

**CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD**

STAFF REPORT: INITIAL STATEMENT OF REASONS

ADVANCED CLEAN CARS

**2012 PROPOSED AMENDMENTS TO THE
CALIFORNIA ZERO EMISSION VEHICLE PROGRAM REGULATIONS**

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

Date of Release: December 7, 2011
Scheduled for Consideration: January 26-27, 2012

EXECUTIVE SUMMARY

In 1990, the California Air Resources Board (ARB or the Board) adopted an ambitious program to significantly reduce the environmental impact of light-duty vehicles through the commercial introduction of zero emission vehicles (ZEV) into the California fleet. Since then the requirements of the ZEV program have resulted in several important milestones being achieved. Many gasoline engines now emit at near zero emission levels of smog-forming emissions. Non-plug-in hybrid electric vehicles (HEV) have been commercialized, and the number of models offered for sale is quickly expanding. Recently, battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) have been introduced for sale, and fuel cell electric vehicles (FCV) are expected to be sold beginning in 2015. This movement to commercialize advanced clean cars has occurred in large part because of the ZEV regulation.

The ZEV regulation, which affects passenger cars and light-duty trucks, remains critically important to California's efforts to meet health based air quality goals. More recently, the program's goals have evolved to also include paving the way for achieving California's long term climate change emission reduction goals. For these reasons, California remains committed to the commercialization of ZEV technologies.

At its March 2008 hearing, the Board directed staff to redesign the 2015 and subsequent model year requirements for the ZEV regulation. It directed staff to strengthen the regulation above what is currently required and focus primarily on the zero emission drive, that is BEV, hydrogen FCV, and PHEV technologies. The goal of the Board direction was to ensure California as the central location for moving advanced, low greenhouse gas (GHG) technology vehicles from the demonstration phase to commercialization.

In 2009, staff undertook an analysis of pathways to meeting California's long term 2050 GHG reduction goals in the light duty vehicle subsector.¹ The analysis showed ZEVs will need to reach nearly 100 percent of new vehicle sales between 2040 and 2050, with commercial markets for ZEVs launching in the 2015 to 2020 timeframe. The analysis concluded that even widespread adoption of advanced conventional technologies, like non-plug-in HEVs, will not be enough to meet the 2050 targets. Staff presented its findings at the December 2009 Board hearing.

At the December hearing, the Board adopted Resolution 09-66, reaffirming its commitment to meeting California's long term air quality and climate change reduction goals through commercialization of ZEV technologies. The Board further directed staff to consider shifting the focus of the ZEV regulation to both GHG and criteria pollutant emission reductions, commercializing ZEVs and PHEVs in order to meet the 2050 goals, and to take into consideration the new Low Emission Vehicle (LEV III) fleet standards and propose revisions to the ZEV regulation accordingly.

¹ California Governor Arnold Schwarzenegger enacted Executive Order S-03-05, requiring a reduction in state-wide GHG emissions to 80-percent below 1990 levels by 2050

This rulemaking is an opportunity for the Board to commit to the transformation of California's light-duty vehicle fleet. As the technology-forcing piece of the Advanced Clean Car package, the ZEV regulation along with new LEV III criteria pollutant and GHG standards can be the catalyst to that transformative process. Proposed amendments to the regulation focus on technologies that help meet long term emission reduction goals, simplify the program where needed, and increase requirements for 2018 and subsequent model years.

Proposed Amendments to the Regulations

2009 through 2017 Model Year Amendments

Staff's goal for amendments affecting the current ZEV regulation through 2017 model year is to make minor mid-course corrections and clarifications, and enable manufacturers to successfully meet 2018 and subsequent model year requirements. The amendments include:

- A. *Provide Compliance Flexibility:* Remove carry forward credit limitations for ZEVs, allowing manufacturers to bank ZEV credits indefinitely for use in later years. Slightly reduce the 2015 through 2017 credit requirement for intermediate volume manufacturers (IVM, less than 60,000 vehicles produced each year), to allow them to prepare for requirements in 2018. Extend the provision that allows ZEVs placed in any state that has adopted the California ZEV regulation to count towards the ZEV requirement through 2017 (i.e. extending the "travel provision" for BEVs through 2017).
- B. *Adjust Credits and Allowances:* Increase credits for Type V (300 mile FCV) ZEVs to appropriately incentivize this longer term technology.
- C. *Add New Vehicle Category:* Add Type I.5x and Type IIx vehicles as a compliance option for manufacturers to meet up to half of their minimum ZEV requirement. The proposed vehicle is closer to a BEV than to a PHEV: a vehicle with primarily zero-emission operation equipped with a small non-ZEV fuel auxiliary power unit (APU) for limited range extension.

2018 and Subsequent Model Year Amendments

Staff's goal for the proposed amendments for 2018 and subsequent model years is to achieve ZEV and transitional zero emission vehicle (TZEV; most commonly a PHEV) commercialization through simplifying the regulation and pushing technology to higher volume production in order to achieve cost reductions. The amendments include:

- A. *Increase Requirement for 2018 and Subsequent Model Years.* Increase requirements which push ZEVs and TZEVs to over 15 percent of new sales by 2025. This will ensure production volumes are at a level sufficient to bring

battery and fuel cell technology down the cost curve and reduce incremental ZEV prices.

- B. *Focus Regulation on ZEVs and Transitional Zero Emission Vehicles (TZEV):* Remove partial zero emission allowance vehicle (PZEV, near-zero emitting conventional technologies) and advanced technology partial zero emission allowance vehicle (AT PZEV, typically non-plug-in HEVs) credits as compliance options for manufacturers because these technologies are now commercialized and their emissions are better reflected in the LEV III program. Allow manufacturers to use banked PZEV and AT PZEV credits earned in 2017 and previous model years, but discount the credits, and place a cap on usage in 2018 and subsequent model years. Focus the 2018 and subsequent model year requirements on ZEVs and TZEVs
- C. *Amend Manufacturer Size Definitions, Ownership Requirements, and Transitions.* Amend IVM and large volume manufacturer (LVM) size definitions to bring all but the smallest manufacturers under the full ZEV requirements by model year 2018. Align LEV III and ZEV ownership requirements, so that manufacturers who own more than 33.4 percent of each other are considered as the same manufacturer for determination of size. Modify transition periods for manufacturers switching size categories. These changes result in applying the ZEV regulation to manufacturers that represent 97 percent of the light duty vehicle market.
- D. *Modify Credit System.* Base credits for ZEVs on range, with 50 mile BEVs earning 1 credit each and 350 mile FCVs earning 4 credits each. Allow extended range BEVs (BEVx) which have a limited combustion engine range extender to meet up to half of a manufacturer's minimum ZEV requirement. The range of credits reflects the utility of the vehicle (i.e. the zero emitting miles it may travel) and its expected timing for commercialization. Simplify and streamline TZEV credit based on the vehicle's zero-emission range capability, and ability to perform 10 miles on the more aggressive US06 drive schedule. In addition to simplifying the program, reducing the spread of credits makes the technologies more evenly treated and reduces the variation in compliance outcomes (numbers of vehicles produced to meet the regulation requirements).
- E. *Modify Travel Provision:* End the Travel Provision for BEVs after model year 2017. Extend the Travel Provision for FCVs until sufficient complementary policies are in place in states that have adopted the California ZEV regulation. This will allow FCV technology to continue to mature, and provide time for

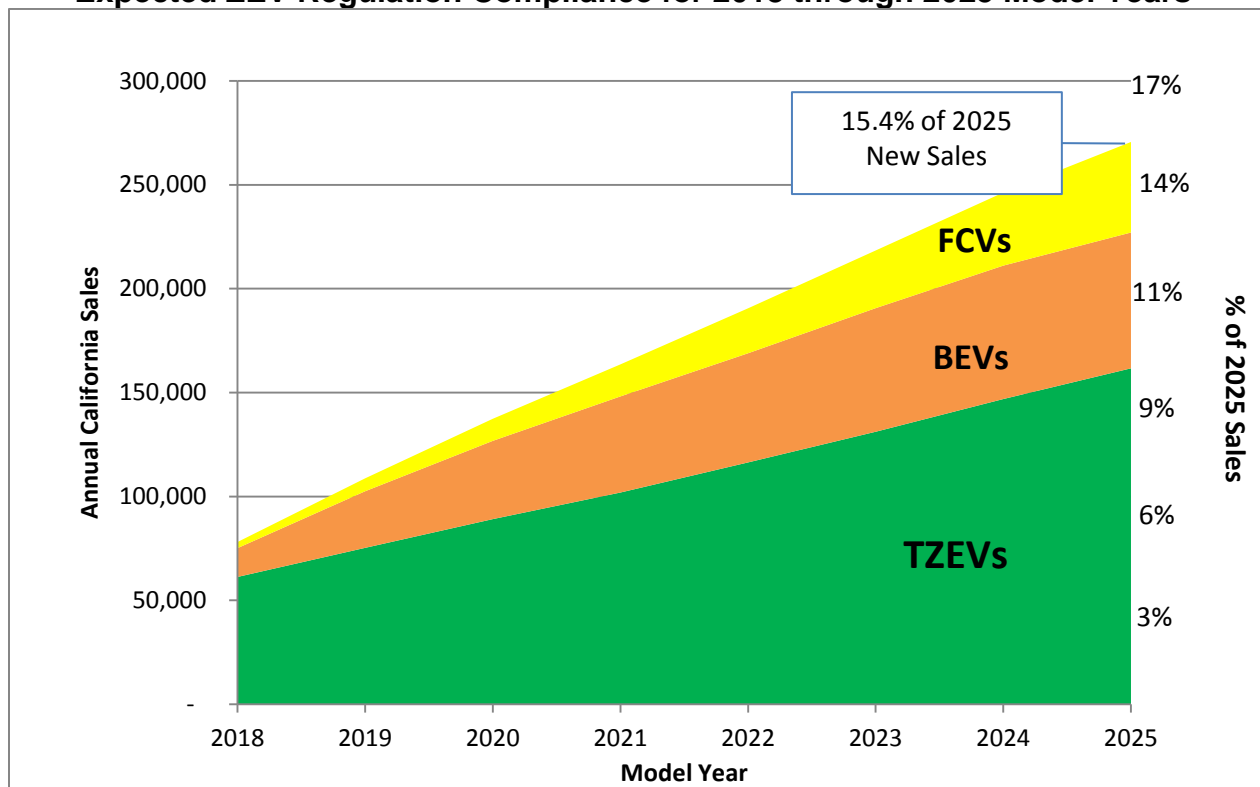
Section 177 States to build infrastructure and put in place incentives to foster FCVs.

- F. *Add GHG-ZEV Over-Compliance Credits:* Allow manufacturers who systematically over comply with the proposed LEV III GHG fleet standard to offset a portion of their ZEV requirement in 2018 through 2021 model years only.

Effect of Proposed Amendments

As a result of staff's proposal, over 1.4 million ZEVs and TZEVs are expected to be produced cumulatively in California by 2025, with 500,000 of those vehicles being pure ZEVs (BEVs and FCVs).

Expected ZEV Regulation Compliance for 2018 through 2025 Model Years



During this time frame, the incremental price of a ZEV or TZEV is expected to rapidly decline, but remain higher than a conventional vehicle, by approximately \$10,000 (high-end estimate).

The proposed amendments will also result in an emissions benefit as compared to the current regulations, and will likely provide benefits beyond that achieved by complying with the LEV III criteria pollutant standard with conventional vehicles only. This is due to increased electricity and hydrogen use, and subsequently decreased gasoline production and refinery emissions.

Advanced Clean Cars

Continuing its leadership role in the development of innovative and ground breaking emission control programs and to achieve California's goals of meeting ambient air quality standards and reducing climate changing GHG emissions, ARB has developed the Advanced Clean Cars (ACC) program. The ACC program combines the control of smog-causing pollutants and GHG emissions into a single coordinated package of requirements for model years 2015 through 2025 and assures the development of environmentally superior cars that will continue to deliver the performance, utility and safety car owners have come to expect. The ZEV regulation (with amendments proposed herein) will act as the technology forcing piece of the ACC program, pushing manufacturers to produce ZEVs and PHEVs in the 2018 through 2025 model years. In addition, the ACC program also includes amendments to the Clean Fuels Outlet (CFO) requirements that will assure that ultra-clean fuels such as hydrogen are available to meet vehicle demands brought on by amendments to the ZEV regulation.

Beyond 2025, the driving force for lower emissions will be climate change. In order to meet our 2050 GHG goal, the new vehicle fleet will need to be primarily composed of advanced technology vehicles such as electric and FCVs by 2035 in order to address fleet turnover. Accordingly, the ACC program coordinates the goals of the LEV, ZEV, and CFO programs in order to lay the foundation for commercialization and support of ultra-clean vehicles.

A more complete description of the impacts and benefits of the ACC can be found in the LEV staff report, including in its Executive Summary.

Staff Recommendation

Staff recommends that the Board adopt the amendments as proposed in this Initial Statement of Reasons (ISOR). The proposed amendments will help support future commercialization of ZEVs and TZEVs through simplification of the regulation and increasing requirements in 2018 and subsequent model years.

TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	ZEV PROGRAM OBJECTIVES (OVERALL SUMMARY).....	2
1.2	AIR QUALITY AND CLIMATE CHANGE IN CALIFORNIA.....	3
1.3	ZEV PROGRAM HISTORY	5
1.4	2008 AMENDMENTS AND 2009 TECHNOLOGY REVIEW.....	6
1.5	THE CURRENT PROGRAM.....	8
2	SUMMARY OF PROPOSED AMENDMENTS.....	13
2.1	PART I: MODEL YEAR 2012 THROUGH 2017 AMENDMENTS.....	13
2.2	PART II: 2018 AND SUBSEQUENT MODEL YEAR AMENDMENTS	25
3	EFFECT OF PROPOSED CHANGES	44
3.1	OVERALL EFFECTS OF MANUFACTURER’S BANKED ZEV CREDITS	44
3.2	EFFECTS OF PROPOSED CHANGES: 2009 THROUGH 2017 MODEL YEARS	46
3.3	EFFECTS OF PROPOSED CHANGES: 2018 AND SUBSEQUENT MODEL YEARS.....	46
3.4	EFFECTS OF PROPOSED CHANGES: TRAVEL PROVISION	51
4	REGULATORY ALTERNATIVES.....	53
4.1	ALTERNATIVE A: LOWER ZEV REQUIREMENTS.....	53
4.2	ALTERNATIVE B: HIGHER ZEV REQUIREMENTS.....	54
4.3	ALTERNATIVE C: DO NOT AMEND PROGRAM.....	54
5	ECONOMIC IMPACTS	55
5.1	LEGAL REQUIREMENT	55
5.2	DIRECTLY AFFECTED BUSINESSES.....	55
5.3	POTENTIAL IMPACTS TO INDIVIDUALS (CAR BUYERS)	64
5.4	POTENTIAL IMPACT ON BUSINESS COMPETITIVENESS	68
5.5	POTENTIAL IMPACT ON BUSINESS CREATION, ELIMINATION OR EXPANSION	68
5.6	POTENTIAL COSTS TO LOCAL AND STATE AGENCIES	70
6	EMISSIONS AND HEALTH IMPACTS.....	72
6.1	CALIFORNIA ENVIRONMENTAL QUALITY ACT	73
6.2	IMPACTS TO MINORITY AND LOW INCOME COMMUNITIES	73
6.3	HEALTH IMPACTS.....	74
6.4	EMISSIONS IMPACTS	75
7	COST-EFFECTIVENESS	80
8	SUMMARY AND STAFF RECOMMENDATION	81
9	SUMMARY AND RATIONALE FOR PROPOSED REGULATIONS	83
10	REFERENCES	107

**APPENDIX A: PROPOSED REGULATION ORDER: AMENDMENTS TO THE
ZERO-EMISSION VEHICLE REGULATION**

Appendix A-1. §1962.1 Zero Emission Vehicle Standards for 2009 through 2017 Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles

Appendix A-2. California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes

Appendix A-3. §1962.2 Zero Emission Vehicle Standards for 2018 and subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles

Appendix A-4. California Exhaust Emission Standards and Test Procedures for 2018 and subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes

Appendix A-5. §1962.3 California Vehicle Charging Requirements

**APPENDIX B: ENVIRONMENTAL ANALYSIS FOR ADVANCE CLEAN CARS
REGULATION PACKAGE**

APPENDIX C: ECONOMIC ANALYSIS INPUTS

Table of Acronyms

AB	Assembly Bill
ACC.....	Advanced Clean Car
APU.....	Auxiliary Power Unit
ARB	California Air Resources Board
AT PZEV	Advanced Technology Partial Zero Emission Allowance Vehicle, typically a non-plug in hybrid such as the Prius
BEV	Battery Electric Vehicle
BEVx	Range Extended Battery Electric Vehicle
CAFE.....	Corporate Average Fuel Economy
CEC.....	California Energy Commission
CEQA	California Environmental Quality Act
CO ₂	Carbon Dioxide
CPUC	California Public Utilities Commission
DC	Direct Current
E-DRAM	Economic Dynamic Revenue Assessment Model
EA	Joint Environmental Assessment for Advanced Clean Car Rulemaking
EAER	Equivalent All Electric Range
EMFAC	ARB's mobile emissions inventory modeling program
Enhanced AT PZEV...	Enhanced Advanced Technology Partial Zero Emission Allowance Vehicle, now called a Transitional Zero Emission Vehicle or TZEV
EPL	Environmental Performance Label
EPRI.....	Electric Power Research Institute
EU	European Union
EVSE.....	Electric Vehicle Supply Equipment
FCV	Fuel Cell Electric Vehicle
FSOR	Final Statement of Reasons
g/mi	grams per mile
gCO ₂ /mi	grams carbon dioxide per mile
GHG	Greenhouse Gas
HEV.....	Hybrid electric vehicle (non plug-in)
HICE.....	Hydrogen Internal Combustion Engine
ICM.....	Indirect Cost Multiplier
ILVM.....	Independent Low Volume Manufacturer
ISOR	Initial Statement of Reasons
IVM.....	Intermediate Vehicle Manufacturer
kW	Kilowatt
LCFS.....	Low Carbon Fuel Standard
LDT	Light- Duty Truck with loaded vehicle weight up to 8500 pounds
LEV I	First generation Low Emission Vehicle program, adopted in a 1990-1991 rulemaking, and generally applicable in the 1994-2003 model years
LEV II	Second generation Low Emission Vehicle program, adopted in a 1998 -1999 rulemaking, and generally applicable in the 2004 and subsequent model years

LEV III Third generation Low Emission Vehicle program (criteria pollutant and greenhouse gas emission fleet standards), proposed as part of the Advanced Clean Cars rulemaking package in 2012, and generally applicable to 2015 and subsequent model years for Criteria Pollutants, and applicable to 2017 and subsequent model years for Greenhouse Gases.

MDV Medium Duty Vehicle

MMT Million Metric Tonnes

MOA Memorandum of Agreement

NAS National Academy of Sciences

NEV Neighborhood Electric Vehicle

NHTSA National Highway Traffic Safety Administration

NMOG Non-Methane Organic Gas

NO_x Oxides of Nitrogen

NMOG+ NO_x...Non-Methane Organic Gas plus Oxides of Nitrogen

PC Passenger Car

PHEV Plug-in Hybrid-Electric Vehicle

PM..... Particulate Matter

ppb parts per billion

PZEV Partial Zero Emission Allowance Vehicle, typically, a conventional gasoline, diesel, or natural gas vehicle that meets the most stringent standards for smog-forming emissions

R_{cda} Charge Depleting Range Actual

RD&D Research, Development, and Demonstration

ROG Reactive Organic Gases

RPS..... Renewable Portfolio Standard

SIP State Implementation Plan

SULEV Super Ultra Low Emission Vehicle

SVM Small Volume Manufacturer

TAR Joint Agency Technical Assessment Report Release September 2010

TTW Tank-To-Wheel (emissions)

Type 0 Utility EV, less than 50 mile range

Type I City EV, range of 50 to less than 100 miles

Type II Full Function EV, range of 100 or more miles

Type III ZEV, range of 100 or more miles plus fast refueling, or 200 miles

Type IV..... ZEV, range of 200 or more miles plus fast refueling

Type V..... ZEV, range of 300 or more miles plus fast refueling

TZEV Transitional Zero Emission Vehicle, typically a plug-in hybrid electric vehicle

UAW United Auto-Workers (union)

UDDS Urban Dynamometer Driving Schedule

US06 US06 drive schedule

U.S. DOE United States Department of Energy

U.S. DOT..... United States Department of Transportation

U.S. EPA United States Environmental Protection Agency

VAC..... Volts Alternative Current

VMT Vehicle Miles Traveled
WTW Well-To-Wheel (emissions)
ZEV Zero Emission Vehicle

1 INTRODUCTION

In 1990, the California Air Resources Board (ARB or the Board) adopted an ambitious program to dramatically reduce the environmental impact of light-duty vehicles (LDV) through the gradual introduction of zero emission vehicles (ZEV) into the California fleet as part of the original Low Emission Vehicle (LEV I) program. The ZEV program, which affects passenger cars (PC) and light-duty trucks (LDT), has been adjusted five times since its inception - in 1996, 1998, 2001, 2003, and 2008, to reflect the pace of ZEV development and the emergence of new ZEV and ZEV-like technologies. Through these adjustments the fundamental goal of the program has not changed: California remains committed to the commercialization of ZEV technologies.

California's strong commitment to the ZEV program reflects the essential need for ZEV technology in order to achieve the State's public health protection goals, including criteria pollutant and long-term climate change emission reductions. Health-based state and federal air quality standards continue to be exceeded in regions throughout California. California's growing population and increasing use of motor vehicles mean continued upward pressure on statewide emissions.

Faced with ever more stringent regulations, vehicle manufacturers have made remarkable progress in advancing vehicle technology. Conventional vehicles meeting ARB's most stringent emission certification standards achieve emission levels that seemed impossible when the ZEV program was adopted in 1990. The relative contribution of PCs and LDTs is expected to decline over time as new standards phase in, but in 2020 such vehicles will still be responsible for approximately 10 percent of total emissions. State and federal law requires implementation of control strategies to attain ambient air quality standards as quickly as practicable.

Due to California's long history in leading the charge for ZEVs and ZEV enabling technologies and the state's need for criteria pollutant and greenhouse gas (GHG) emission reductions, it is essential that California continues to lead in launching the ZEV commercialization effort. California consumers have a history of adopting new and "green" technologies. Manufacturers have targeted California for many of their demonstration programs, research efforts, and early deployment due to California's mild climate and "green" consumer base. For The EV Project, a project run by ECOtality through a grant from the United States Department of Energy (U.S. DOE), nearly half of the Nissan Leafs and Chevrolet Volts for the project were placed in California.² It is important that California continue as the proving grounds and launching point for emerging ZEV technologies.

This rulemaking is an opportunity for the Board to further the transformation of California's light duty vehicle (LDV) fleet to zero emission and low carbon. As the

² ECOtality, 2011. ECOtality. "Quarterly Report: Second Quarter 2011"
<http://www.theevproject.com/downloads/documents/Q2%20EVP%20INL%20Report.pdf>.

technology-forcing piece of the Advanced Clean Car (ACC) package, the ZEV regulation along with staff proposed amendments to the Low Emission Vehicle (LEV III) Criteria Pollutant and LEV III GHG standards can be the catalyst for that transformative process.

Public Process for ZEV Regulation Development

To support development of the ACC package, beginning in May 2010, ARB staff held two public workshops to engage stakeholders and obtain input on the proposed regulations. These stakeholders primarily included representatives from regulated and non-regulated manufacturers, vehicle component suppliers, and environmental advocates.

These workshops were held at ARB offices in Sacramento and El Monte. The announcements and materials for these workshops were posted on ARB's website and distributed through a list serve that included over 14500 recipients. Each workshop attracted over 30 attendees in person. Both meetings were either telecast, webcast or available by teleconference. The dates and materials presented at the workshops are available on ARB's ZEV program website at <http://www.arb.ca.gov/msprog/zevprog/zevprog.htm>.

1.1 ZEV Program Objectives (Overall Summary)

Since its adoption, the ZEV program has pushed the boundaries of ZEV development and emission reduction from cars and trucks, while taking into account the cost, performance, suitability for volume production, and long-term prospects of various technologies. The following are the main objectives of staff's proposed changes:

- Maintain requirements that facilitate and accelerate ZEV technologies needed to meet California's long term GHG and criteria pollutant targets,
- Push technology to higher volume production in order to achieve cost reductions,
- Minor mid-course corrections and clarifications for model years 2012 through 2017,
- Maintain compliance flexibility in meeting the ZEV requirements, and
- Simplify the structure of the ZEV program.

In the wake of the commercial release of General Motor's Volt PHEV and Nissan's battery electric Leaf, it appears ZEVs have successfully entered the market. However, amending and strengthening ZEV regulatory requirements at this time will ensure continued technology development by multiple manufacturers. Two or three manufacturers succeeding in a particular vehicle technology does not guarantee

achieving our air quality or 2050 GHG goals. The key is moving beyond the early adopters and providing viable choices for the everyday consumer.

The most significant amendment in staff's proposal is the increased ZEV volume requirement for 2018 and subsequent model years. Staff's 2009 analysis showed that almost every LDV sold by model year 2040 would need to be a ZEV in order to meet California's long term GHG goals. More recent analyses by various organizations continue to confirm this trend: the need for large-scale electrification of the LDV fleet.^{3,4,5} Staff's proposal helps to get California's fleet on an appropriate trajectory toward meeting this long term GHG goal, while offering compliance flexibility and not placing unnecessary and burdensome requirements on those manufacturers clearly on their way to commercializing ZEV technology.

Staff's proposed amendments also help simplify the regulation in model years 2018 and beyond. ZEV credits are now linear, based only on the vehicle's range. Also, the PHEV⁶ credit calculation has been simplified, allowing manufacturers to do one calculation, as opposed to the old method of adding up various allowances. Another change affecting many manufacturers in both the LEV III proposal and the ZEV regulation proposal is a new manufacturer size definition. This change will bring nearly all manufacturers under the full ZEV requirements by model year 2018. This amendment is important for commercialization of 2050 vehicle technologies, ensuring a portfolio of vehicle models and technologies become available.

1.2 Air Quality and Climate Change in California

There are currently roughly 25 million cars operating in California, and by 2035, will grow to more than 30 million cars. Prior to the establishment of ARB in 1968, photochemical smog pollution was a major health concern that caused acute health impacts to Californians. Much of this smog was formed by automobile emissions. Over the next 40 years, ARB adopted the most stringent automobile emissions standards in the world, requiring use of the catalytic converter that revolutionized emissions control and dramatically reduced emissions from automobiles. Those regulations, in conjunction with regional programs to reduce emissions from refineries, power-plants, and other stationary sources, led to a major improvement in air quality. In 1980, the South Coast Air Basin experienced widespread ozone levels which exceeded air quality standard for 179 days per year⁷. In 2010, that number was reduced to 63 days per year, and those violations occurred in a much smaller portion of the Air Basin. During this same period, peak ozone concentrations in Southern California dropped more than 60 percent - from 273

³ CCST, 2011. California Council on Science and Technology, May 2011. "California's Energy Future: The View to 2050."

⁴ NREL, 2011a. National Renewable Energy Laboratory. February 15, 2011 "Role of Fuel Carbon Intensity in Achieving 2050 GHG Reduction Goals within the LDV Sector."

⁵ IEA, 2011. International Energy Agency. June 2011. "Technology Roadmap: Electric and Plug-in Hybrid Electric Vehicles."

⁶ Plug-in hybrid electric vehicles (PHEV) are also referred to as Transitional Zero Emission Vehicles, or TZEVs. Staff is proposing new terminology to be straighter forward and simple.

⁷ 1997 federal 8-hour ozone standard of 0.08 ppm.

parts per billion (ppb) to 112 ppb. Similar air quality improvements were seen in many other regions of California.

Despite these major improvements, air quality in both the greater Los Angeles region and the San Joaquin Valley are classified by the United States Environmental Protection Agency (U.S. EPA) as “extreme” ozone non-attainment areas. This is the most severe federal non-attainment classification, and these two areas of California are the only two areas in the nation granted this designation. Bringing these regions into attainment requires more significant emission controls than anywhere else in the United States.

In 2007, California adopted State Implementation Plans (SIP) to chart the course to attainment of the 1997 federal 8-hour ozone standard. To achieve the 1997 ozone standard by the attainment date in 2023, oxides of nitrogen (NO_x) emissions in the greater Los Angeles region must be reduced by two thirds, even after considering all of the regulations in place today, with the most significant share of needed emission reductions coming from long-term advanced clean air technologies. In the San Joaquin Valley, the SIP identified the need to reduce NO_x emissions by 80 tons/day in 2023 through the use of long-term and advanced technology strategies. To put this in context, this is equivalent to eliminating the NO_x emissions from all on-road vehicles operating in these regions.

Despite the dramatic emission reductions and air quality improvements achieved to date, most urban areas of California, including Southern California, and the Central Valley continue to exceed the federal ozone standard⁸. ARB, the South Coast Air Quality Management District, and the San Joaquin Valley Air Pollution Control District are beginning to evaluate the emission reductions needed to attain the more health-protective ozone standard U.S. EPA established in 2008. In order to meet these challenges, air quality and land-use agencies in the South Coast and San Joaquin Valley are actively pursuing a coordinated strategy that would result in the widespread use of zero-emission technologies on transportation networks designed to reduce smog-forming emissions from single-occupant vehicle use.

Climate change poses a serious threat to the economic well-being, public health, natural resources, and environment of California. Global warming is projected to have detrimental effects on some of California’s largest industries (including agriculture and tourism), increase the strain on electricity supplies, and contribute to unhealthy air.^{9,10,11}

⁸ 2008 federal 8-hour ozone standard of 0.075 ppm. Designations, classifications, attainment date and planning requirements for the 2008 federal ozone standard have not yet been established by the U.S. Environmental Protection Agency. ARB anticipates that SIPs will be due to U.S. EPA by 2015 with attainment required in the 2031/32 timeframe.

⁹ CNRA, 2009. California Natural Resources Agency. 2009. “2009 California Climate Adaptation Strategy” <http://www.energy.ca.gov/2011publications/CEC-600-2011-007/CEC-600-2011-007-SD.pdf>

¹⁰ UC Berkeley, 2008. University of California, Berkeley. November 2008. “California Climate Risk and Response”

¹¹ ARB 2009a. California Air Resources Board. May 11, 2009 Update. “Climate Change Scoping Plan” http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

A number of state policies directly address climate change emissions. Assembly Bill (AB) 32 (2006) requires that statewide climate change emissions be reduced to 1990 levels by 2020. AB 1007 (2005) indicates a need for electric drive trains as well as other significant actions to meet California's goals. Fleet performance standards outlined by AB 1493 (2002) and the LEV III program provide a foundation for these emission reductions, however, performance standards alone cannot provide reasonable assurance that ZEVs will be produced in necessary volumes to provide a sufficient launch of the technology in the marketplace. The ZEV regulation is the necessary tool to ensure a portfolio of advanced technologies are available to consumers.

In recognizing the potential for large, damaging impacts from climate change, former California Governor Arnold Schwarzenegger enacted Executive Order S-03-05, requiring a reduction in state-wide GHG emissions to 80-percent below 1990 levels by 2050. Staff's 2009 analysis¹² showed widespread adoption of conventional technologies, even conventional mild hybrid electric vehicles (HEV), will not be enough to meet these stringent targets. ZEVs will need to reach nearly 100 percent of new vehicle sales between 2040 and 2050, with commercial markets for ZEVs launching in the 2015 to 2020 timeframe. All ZEV technologies – fuel cell electric vehicle (FCV), battery electric vehicle (BEV), and plug-in hybrid electric vehicle (PHEV) – need to be encouraged and promoted through regulatory and non-regulatory methods.

1.3 ZEV Program History

Manufacturers originally pursued the development of BEVs to meet the ZEV requirements. In 1996, ARB eliminated the requirements for the 1998 through 2002 model years due to cost and performance issues, to allow additional time for battery research and development. ARB entered into memorandums of agreement (MOA) with vehicle manufacturers to place, in California, roughly 1,800 advanced-BEVs between 1998 and 2000. The agreements were designed to provide battery developers with the necessary initial production volumes to meet the cost and performance goals needed for begin early commercial production.

Contrary to expectations, advanced battery costs remained too high for commercial viability. Notwithstanding these costs, several manufacturers continued to place a modest number of BEVs beyond the MOA volumes. These vehicles earned ZEV credits that have been used for compliance with the regulation.

Manufacturers began to look seriously at hydrogen FCVs in the late 1990's as an alternative to BEVs. This interest led to cooperative efforts among ARB, industry and other governmental agencies to create the California Fuel Cell Partnership in 1999.

¹² ARB, 2009b. California Air Resources Board. November 25, 2009. "White Paper: Summary of Staff's Preliminary Assessment of the Need for Revisions to the Zero Emission Vehicle Regulation - Attachment B: 2050 Greenhouse Gas Analysis" http://www.arb.ca.gov/msprog/zevprog/2009zevreview/attachment_b_2050ghg.pdf

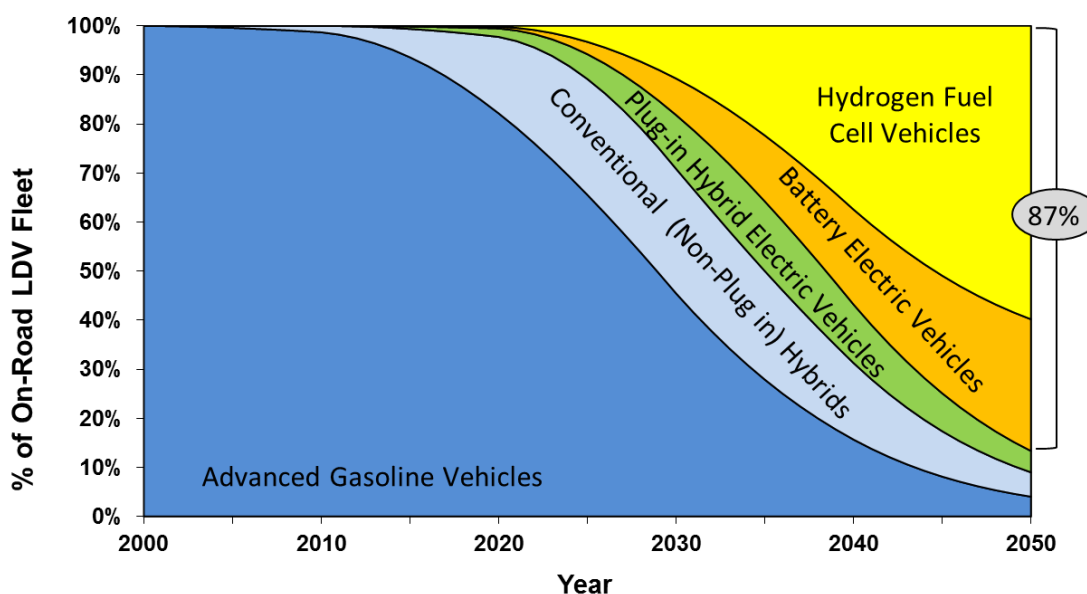
The Partnership demonstrates vehicle technology while exploring the paths to commercialization, including the development of public hydrogen fueling infrastructure. Changes to the ZEV regulation in 2003 provided new incentives for FCVs, resolved legal challenges, and addressed the state of technology at that time.

1.4 2008 Amendments and 2009 Technology Review

The Board adopted Resolution 08-24 at the March 2008 hearing, directing staff to redesign the 2015 and beyond requirements for the ZEV program, strengthen the requirement more than the current program, focus primarily on the zero emission drive, that is BEV, FCV, and PHEV technologies, and ensure California as the central location for advanced, low GHG technology vehicles from the demonstration phase to commercialization.

In 2009, staff undertook an assessment of ZEV technologies, an analysis of pathways to meeting California's long term 2050 GHG reduction goals in the LDV subsector¹³ and a review of current and possible future complementary policies that would be needed to aid in infrastructure development and market pull policies for ZEVs. Based on the U.S. DOE Vision model¹⁴, staff developed a California-specific model for the LDV subsector, relying heavily on model inputs and assumptions from peer-reviewed studies. Figure 1 shows what the cumulative on-road PCs would need to be to reach the 2050 goal.

Figure 1: On Road Passenger Car Scenario to Reach 2050 Goal



¹³ This analysis assumed a 2050 target of 80% below the passenger vehicle portion of 1990's GHG inventory, or 20% of 108.5 MMT of CO₂ equivalent emissions.

¹⁴ DOE, 2008. United States Department of Energy. Vision Model, 2008.
http://www.transportation.anl.gov/modeling_simulation/VISION/

This graph shows the cumulative on-road PC mix for the scenario developed by staff that reaches the Governor's GHG emission reduction goal. The most important trend to highlight is that ZEVs grow to become approximately 87 percent of on-road PCs after ZEV sales reached nearly 100 percent in 2040.

Through modeling various scenarios, including the scenario shown in Figure 1, staff concluded:

- ZEVs are essential to meeting California's long term GHG emission reduction goals.
- A high-volume (100,000s) ZEV market needs to exist by 2020 in order for ZEV sales and fleet turn-over rates to result in enough ZEVs to achieve deep reductions in GHG emissions.
- Any amendments to the ZEV regulation should help keep the LDV subsector on track to reach an 80 percent reduction in GHG emissions by 2050.
- FCVs, BEVs, and PHEVs with low carbon biofuels are the three most viable candidates for near-zero carbon transportation. All three vehicle technologies will be necessary in order to achieve the GHG goal, and to lessen the risk of market failures.

Staff presented its findings at the December 2009 Board Hearing. At the December hearing, the Board adopted Resolution 09-66¹⁵, reaffirming its direction to meet California's long term air quality and climate change reduction goals through commercialization of low-carbon emitting vehicle technologies. The Board directed staff to consider the following in preparing amendments to the ZEV regulation:

- Shift focus from only criteria pollutant emission regulations to GHG emission reductions and criteria pollutants;
- Focus on transforming California's light-duty fleet and commercializing low-carbon emitting technologies, such as ZEVs and PHEV in a timeframe sufficient to meet the 2050 target of 80 percent reduction in GHG emissions compared to 1990 levels;
- Take into consideration new LEV III GHG fleet standards and revise the ZEV regulatory structure, credit values, and stringency of the current requirements accordingly.

In 2010, President Barack Obama directed the U.S. EPA and National Highway Traffic Safety Administration (NHTSA) to work with California to develop GHG fleet standards

¹⁵ ARB 2009c. California Air Resources Board. Resolution 09-66. December 9, 2009. http://www.arb.ca.gov/msprog/zevprog/2009zevreview/res09_66.pdf

for model year 2017 through 2025 LDVs. The Joint Technical Assessment Report (TAR) was released in September 2010. The report concluded “electric drive vehicles including hybrid(s)...battery electric vehicles...plug-in hybrid(s)...and hydrogen fuel cell vehicles...can dramatically reduce petroleum consumption and GHG emissions compared to conventional technologies...The future rate of penetration of these technologies into the vehicle fleet is not only related to future GHG and CAFE standards, but also to future reductions in HEV/PHEV/EV [electric vehicle] battery costs, the overall performance and consumer demand for the advanced technologies...”¹⁶ Manufacturers confirmed in meetings leading up to the release of the TAR, their commitment to develop ZEV technologies. “...[A] number of the firms suggested that in the 2020 timeframe their U.S. sales of HEVs, PHEVs, and EVs [electric vehicle] combined could be on the order of 15-20% of their production.”(EPA, 2010, pp.2-5)

1.5 The Current Program

Table 1.1 below specifies large volume manufacturer credit obligations for 2012 through 2014 and 2015 through 2017 model years.

¹⁶ EPA, 2010. United States Environmental Protection Agency, National Highway Safety and Traffic Administration and California Air Resources Board. September 2010. “Interim Joint Technical Assessment Report: Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2017-2025” (p. vii)

**Table 1.1: Summary of 2012 Through 2017 Model Year Requirements
For Large Volume Manufacturers***

Vehicle Category	Vehicle Technology Descriptions	2012-2014 Annual Credit Requirement	2012-2014 Annual % of Fleet	2015-2017 Annual Credit Requirement	2015-2017 % of Fleet
ZEV	Zero tailpipe emissions: battery electric vehicles, and hydrogen fuel cells.	0.79%	0.2%	3%	0.7%
TZEV	Transitional Zero Emission Vehicles; Vehicles certified to PZEV standards that utilize a ZEV fuel: e.g. plug-in hybrid electric vehicles or hydrogen internal combustion engine vehicles. Proposed terminology replacing "Enhanced AT PZEV"	2.21%	1.5%	3%	2%
AT PZEV	Vehicles certified to PZEV standards and employing ZEV-enabling technologies: e.g. hybrids or compressed natural gas vehicles.	3%	7%	2%	6%
PZEV	Conventional vehicles certified to the most stringent tailpipe emission standards, zero evaporative emissions, and extended warranty.	6%	30%	6%	30%

*The ZEV regulation establishes a credit requirement, shown in shaded columns, for manufacturers each year. Manufacturers earn credits through production of vehicles from different categories. The "Annual % of Fleet" represents the percentage of new vehicle sales expected from each vehicle category due to compliance with the regulations.

The four categories of vehicles used to meet the ZEV regulation are ZEVs, TZEVs (formerly "Enhanced advanced technology partial zero emission allowance vehicles" or "Enhanced AT PZEV"), advanced technology partial zero emission allowance vehicles (AT PZEV), and partial zero emission allowance vehicles (PZEV). To date all manufacturers are fully in compliance, with nearly 5,600 ZEVs demonstrated, and over 1,700,000 PZEVs and 350,000 AT PZEVs commercially introduced, resulting in significant emissions reductions. Examples of PZEVs are the Honda Civic and Mazda 6 while an example of an AT PZEV is the Ford Fusion Hybrid. Table 1.2, below, shows the cumulative number of vehicles placed in compliance with the ZEV regulation.

Table 1.2: Cumulative Vehicle Placement

ZEV Credit Category	Technology Type	Quantity of Vehicles
ZEV	Fuel Cell	350
	Battery Electric	5,200
	Neighborhood Electric	28,800
AT PZEV	Hybrid or Compressed Natural Gas	380,000
PZEV	Conventional Gas	1,750,000

*On-road number is less for FCVs and NEVs.

Manufacturer Compliance Status and Near Term Production Plans

All manufacturers have complied with ZEV regulation requirements. For the 2012 model year, six large volume manufacturers (LVM) are required to comply with the entire regulation, meaning these manufacturers must produce pure ZEVs: Chrysler, Ford Motor Company, General Motors, Honda, Nissan, and Toyota. Ten intermediate volume manufacturers (IVM) have the option to meet their entire requirement with credits from PZEV. These ten manufacturers include: BMW, Hyundai, Jaguar-Land Rover, Kia, Mazda, Mercedes Benz, Subaru, Volkswagen and Volvo. Several other non-regulated manufacturers are actively producing ZEVs and neighborhood electric vehicles (NEV), and earning ZEV credits.

The 2008 amendments provided greater flexibility in the regulation for model years 2012 and beyond, offering more equal treatment of ZEV technologies. Manufacturers have complied by producing the maximum number of PZEVs and AT PZEVs. Half of the LVMs have heavily pursued FCV technology, while the other half have focused predominately on BEV technology.

Fuel Cell Vehicle Technology, Deployment, and Infrastructure Status

Manufacturers have continued to pursue FCV technology, publically committing to early-commercialization in the 2015 to 2020 timeframe. In a joint letter issued in September 2009, manufacturers (Daimler, Ford, General Motors, Honda, Hyundai, Kia, Toyota, alliance Renault SA, and Nissan) strongly supported fuel cell technology, anticipating that from 2015 onwards, FCVs could reach commercialization. Recently, Mercedes Benz announced a three year lease program for its 2011 B-Class F-Cell vehicle.¹⁷

In January 2011, thirteen Japanese companies jointly announced significant cost reductions in manufacturing FCVs, commitment to 100 hydrogen stations in Japan by 2015, and joint support for spreading FCV technology throughout Japan.¹⁸ Such

¹⁷ Autobloggreen, 2010. AutoBlogGreen.com. Eric Loveday. "Mercedes-Benz prices B-Class F-Cell lease at \$849 a month"

<http://www.green.autoblog.com/2010/11/22/mercedes-benz-prices-b-class-f-cell-lease-at-849-a-month/>

¹⁸ Toyota, 2011. Toyota Motor Company. January 13, 2011 "Japanese Companies Eye Smooth Domestic Launch of FCVs" <http://www2.toyota.co.jp/en/news/11/01/0113.html>

worldwide developments help to bring vehicle costs down, advancing FCVs closer towards commercialization.

Hydrogen infrastructure technology is advancing and station performance is improving. As a result, customer experience is progressing toward being comparable to today's gasoline fueling experience. Through ARB and California Energy Commission (CEC) funding, five new stations are currently under construction or will have opened by the end of the year. Also, an existing station has been updated and put back into service with improvements in accessibility. Additionally, eight new hydrogen stations will be opening in the next two years, with three more stations planned to be upgraded with increased capacity and accessibility. In total, over 2000 additional kilograms per day of hydrogen will have been made available to FCVs located in the California's Bay Area and South Coast air quality management districts. The increased capacity will support up to 2500 FCVs total. Confidential submittals auto manufacturers reveal that over 50,000 FCVs are planned to be in operation in California by 2017.

Recently, a number of manufacturers have announced aggressive production plans for PHEVs and BEVs for the next three model years. These announcements reflect technological advancement in lithium ion battery technology and a general shift in customer demand and corporate environmental stewardship. The following table provides a summary of manufacturers' current program commitments, by technology category, as publicly stated.

Table 1.3: Manufacturer ZEV and TZEZ Announcements

Manufacturer	Model	Type	Timeframe	Reference
BMW	ActiveE	BEV	2011	BMW, 2011a
	i3	BEV	2013	BMW, 2011b
	i3 Rex	PHEV		BMW, 2011c
	i8	PHEV	2014	BMW, 2011b
BYD	e6	BEV	2012	BYD, 2010
CODA	(unknown)	BEV	2011	PopularMechanics, 2011
Chrysler	Fiat 500 EV	BEV	2012	Chrysler, 2010
Fisker	Karma	PHEV	2011	Fisker, 2011
Ford	C-MAX Energi	PHEV	2012	Ford, 2011a
	Focus Electric	BEV	2011	Ford, 2011b
	Transit Connect Electric	BEV	in production	n/a
GM	Cadillac ELR	PHEV	(unknown)	GM, 2011a
	Spark	BEV	2012	GM, 2011b
	Volt	PHEV	in production	n/a
	(unknown)	FCV	2015	USA TODAY, 2010
Honda	Fit EV	BEV	2012	Honda, 2011
	(unknown)	PHEV	2012	
	Clarity FCX	FCV	in production	n/a
Hyundai	Tucson IX	FCV	2015	Bloomberg, 2010
Mercedes Benz	(unknown)	BEV	2012	Mercedes, 2011
	F-Cell	FCV	in production	Autobloggreen, 2010
Mitsubishi	i	BEV	in production	n/a
	Outlander	PHEV	2013	Motor Trend, 2011
Nissan	LEAF	BEV	in production	n/a
Smart	fortwo ED	BEV	in production	n/a
Tesla	Model S	BEV	2012	Tesla, 2011
Think	City	BEV	in production	n/a
Toyota	Prius Plug-In	PHEV	2012	Toyota, 2011b
	RAV-4 EV	BEV	2012	Toyota, 2011c
	Scion iQ-EV	BEV	2012	
	(unknown)	FCV	2015	Toyota, 2011d
Volkswagen	e-up!	BEV	2013	Volkswagen, 2011
Wheego	Whip LiFe	BEV	in production	n/a

The table reveals that nearly every manufacturer will be introducing production BEV and PHEV products within the next one to three years, and five manufacturers will commercially introduce FCVs by 2015.

2 SUMMARY OF PROPOSED AMENDMENTS

In response to the Board's direction in 2008 and in 2009, and in consideration of the issues related to technology commercialization and new proposed GHG and criteria pollutant standards, staff proposes amendments to the program that strengthen and simplify the regulation. The amendments are split into two parts: Model year 2012 through 2017 (Part I), and model years 2018 and beyond (Part II). The amendments identified in this section represent the most significant changes being proposed in each "Part." Additional minor proposed amendments and concurrent rationale can be found below in Section 9.

The following sections more fully describe each of the major proposed amendments and the rationale for the proposed change.

2.1 Part I: Model Year 2012 through 2017 Amendments

2.1.1 Type I.5x and Type IIx: Range Extended Battery Electric Vehicles

Some manufacturers have proposed a new class of advanced vehicles for separate treatment as part of the ZEV program: range extended battery electric vehicle (referred to as a "Type I.5x and Type IIx vehicles" or "BEVx" in this proposal). The proposed vehicle is closer to a BEV than to a PHEV: a vehicle with primarily zero-emission operation equipped with a small non-ZEV fuel auxiliary power unit (APU) for limited range extension. Manufacturers proposing this type of vehicle describe it as having reduced performance while operating in APU mode that allows drivers to find a charging location, and discouraging non-zero emission driving. Most of these vehicles are expected to have a zero-emission range of 80 miles or greater. This vehicle has substantially more range than currently announced PHEVs, with electric range comparable to full function BEVs and will probably require ground-up BEV design. Manufacturers believe that the APU will be a relatively high-cost option on top of an existing, full function (100+ mile), BEV.

BEVs are expected to play an important role in ARB's long-term emissions reduction strategy, but the market for current technology BEVs might be limited. The proposed vehicle has the potential to expand the BEV market beyond current market estimates by giving interested BEV customers an extra measure of confidence about range, and if successful, would add substantial zero-emission vehicle miles traveled (VMT) to the overall California fleet. While the APU within the vehicle may evolve during this transition, from gasoline to advanced biofuels to hydrogen, it is reasonable to believe that this proposed vehicle may help meet ARB's long-term GHG and criteria pollutant emissions reduction goals.

Staff expects BEVxs to play a longer-term role than TZEVs because of their improved zero emission mileage potential. These vehicles would be particularly well suited to use of low upstream GHG fuels that might be more expensive, since the predominant operating cost would be offset by relatively low-cost electricity. In addition to potential for emerging alternative fuel use, there is an opportunity to explore engine

technologies that are advantageous but otherwise unsuitable for application in conventional vehicles. Engine technology applied to existing PHEVs is derived from small conventional production gasoline engines, but highly specialized APUs for BEVxs may eventually spin off and evolve in completely different directions. Future BEVxs with highly specialized engine and fuel technologies could be optimized to drive cost, weight, size, and emissions down and make these specialized BEVx APUs suitable for more affordable and therefore more widespread application. Lotus Engineering and other automotive design firms have been developing hybrid-specific APUs and have several unique concepts under development already.¹⁹

There are several reasons to consider equivalent regulatory treatment for BEVxs relative to BEVs with the same range capability. Most BEV drivers must plan their vehicle use with some degree of “reserve” range left in the battery, while BEVx drivers will have the confidence plan trips that consume all, or nearly all, of the energy storage capability of their battery systems. In this way, the BEVx market may appeal to drivers who would not otherwise consider a BEV with the same range. Also, since staff considers these vehicles full function BEVs with short range APUs, it is important that the minimum range for eligibility be equivalent to full function BEVs in the marketplace.

Staff proposes the following criteria to these proposed vehicles:

- (1) the APU range is equal to or less than the all-electric range,
- (2) engine operation cannot occur until the battery charge has been depleted to the charge-sustaining lower limit,
- (3) have a minimum 80 miles electric range, and
- (4) super ultra low emission vehicle (SULEV) and zero evaporative emissions compliant and TZEV warranty requirements on the battery system.

Though not required, manufacturers are expected to incorporate further performance limits on charge sustaining APU mode operation, including speed restrictions. The intent of the backup APU is not to charge the battery, but rather, to enable the vehicle to drive to a charging station. BEVxs will fit the needs of drivers who are looking for an improved regional driving capability, but not for use in long-distance driving.

Because of the potential for strong zero emissions mileage performance potential, staff proposes to treat this emerging class of BEVxs similar to BEVs, similar to current treatment of NEVs. For the 2012 through 2017 model years, BEVxs will be referred to as Type I.5x and Type IIx vehicles, to fit in with the pre-2018 nomenclature for ZEVs. Staff proposes Type I.5x and Type IIx vehicles will receive the same credits as Type I.5 and Type II ZEVs: 2.5 and 3 credits, respectively. Staff proposes that a manufacturer may meet up to 50 percent of the portion of their requirement that must be met with pure ZEVs with these Type I.5x and Type IIx vehicles. Additionally, staff proposes that these vehicles will qualify under the Travel Provision, through 2017, like their ZEV counterparts. Lastly, Type I.5x and Type IIx vehicles will be eligible for

¹⁹ Lotus, 2010. Lotus Engineering. Turner, James, et al., “The Lotus Range Extender Engine.” SAE Int J Engines 3:318-351.

advanced demonstration credit through 2017 model year. See Section 2.2.6, below, for 2018 and subsequent model year treatment.

It is staff's intent to provide equivalent incentives for BEVxs, and to encourage outside stakeholders distributing or controlling incentives normally allocated to ZEVs to also allocate equivalent benefits to vehicles meeting the new BEVx requirements.

2.1.2 Extend Compliance Flexibility Provisions Through Model Year 2017

Advanced Demonstrations

Currently, up to 25²⁰ ZEVs or TZEVs²¹ that are placed in a California advanced technology demonstration program may earn ZEV credits even if they are not "delivered for sale." Instead of being sold or leased, these demonstration vehicles are typically operated by the manufacturer to gain needed experience and information about the technology. In addition, vehicles in these programs are required to be in California for at least one year of a two year placement. The current regulation sunsets advanced demonstration credits after model year 2014.

Even though some manufacturers have seemingly commercialized ZEVs, many manufacturers are still in the research and development phase for zero emission technologies. Staff is proposing to extend advanced demonstrations for ZEVs, but not TZEVs, through model year 2017, allowing advanced demonstrations credits for TZEVs to sunset after model year 2014 as currently written. With staff's proposal to amend the definition for LVMs which causes additional manufacturers to come under the full ZEV requirements in model year 2018, extension of this provision will allow prospective 2018 LVMs to demonstrate technologies needed to meet future requirements, while lessening the burden of placing the vehicles in service.

Travel Provision

Section 177 of the federal Clean Air Act²² allows other states to adopt California motor vehicle emission standards including the ZEV regulation. Currently, there are 11 states which have adopted the California ZEV regulation: Arizona, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, and Vermont (hereafter, referred to as section 177 ZEV states). The current ZEV regulation allows all ZEV "types", except TZEVs, placed in service in Section 177 ZEV states to be counted towards compliance with the California percentage ZEV requirements as if they are placed in service in California. Similarly, a vehicle placed in California counts towards compliance in a Section 177 ZEV state. The effect of travel is the number of ZEVs required to be produced by vehicle manufacturers, regardless of how many states adopt the ZEV program, will not exceed those required by ARB's regulation alone. Typically the number of vehicles that have to be produced for the

²⁰ California Code of Regulation (CCR), title 13, section 1962.1(g)(4) language states 25 vehicles per model, per ZEV state, per year.

²¹ CCR, title 13, section 1962.1(g)(4) language currently states Enhanced AT PZEVs are eligible. Staff is proposing to replace Enhanced AT PZEVs with Transitional Zero Emission Vehicles or TZEVs.

²² United States Code, title 42, section 7507

Section 177 ZEV states is 1.5 to 2 times the number that has to be produced for California (two times is used in this document for simplicity).

There is currently no travel provision for TZEVs, and staff is not proposing to change this provision. This means that manufacturers that choose to comply in California using TZEVs may not use those credits for compliance in the Section 177 ZEV states.

Currently the Travel Provision sunsets after model year 2014 for Type I, Type I.5, and Type II ZEVs, which are typically BEVs. Staff proposes to extend this provision through model year 2017 for these three ZEV types. California markets have matured and are well prepared for increased sales requirements. However, markets in Section 177 ZEV states need additional time to prepare for ZEVs, and some vehicle manufacturers need time to expand their BEV offerings to other states and to different climates.

Staff is also proposing clarifying language within this provision to ensure only manufacturers with a requirement are allowed to use this provision. This is the current intent of the language in this provision, and the proposed language is only for clarification.

2.1.3 Increase Incentives for Fuel Cell Vehicles: Model Years 2015 – 2017

Under the current regulation, travel for BEVs expires after 2014 model year, but FCVs travel through model year 2017. Thus the production of a BEV to meet California's regulation means an additional obligation to produce approximately two more BEVs to comply with the combined requirement of the section 177 ZEV states. If a FCV is produced for compliance in California, there is no further production obligation in the Section 177 ZEV states because the travel provision applies to FCVs.

Due to staff's proposed extension of the travel provision for BEVs for model years 2015 through 2017 described above, production of a BEV satisfies the obligation of both Section 177 ZEV states and California, whereas the current regulation would result in a requirement to produce three BEVs, compared to one FCV. As a result there will be a substantially reduced incentive to produce FCVs in this timeframe.

California is investing heavily to create a publically accessible hydrogen fueling infrastructure which is a necessary prerequisite to manufacturers introducing to the market FCVs. Staff's 2009 fleet-wide GHG analysis showed FCV technology would be the predominate on-road ZEV technology in model year 2050. In development of the 2009 analysis, as well as this rulemaking, many manufacturers stated BEV technology would only be able to fulfill 20 to 30 percent of future fleet sales.²³ Thus decreasing the relative credit derived from producing a FCV, compared to a BEV,

²³ ARB, 2009d. California Air Resources Board. "White Paper: Summary of Staff's Preliminary Assessment of the Need for Revisions to the Zero Emission Vehicle Regulation," <http://www.arb.ca.gov/msprog/zevprog/2009zevreview/>

sends the wrong signal to those five manufacturers planning the introduction of FCVs prior to 2017.

Staff proposes to address this issue by increasing the amount of credit earned by Type V ZEVs, or 300 mile range fast-refueling capable FCVs. Currently, Type V ZEVs earn seven credits each. Staff proposes to increase the credit value to nine credits. This would be three times the amount a Type II ZEV (a 100 mile BEV) would earn in this time frame. Proponents of this change have requested significantly greater credit. However, staff believes the proposed credit level appropriately recognizes and provides an incentive for the technology without greatly reducing the number of vehicles produced in this timeframe for compliance. It also better reflects the current higher cost of producing a FCV, compared to a BEV, at the current state of FCV development and lower production quantities.

2.1.4 Decrease Overall Requirement for IVMs for Model Years 2015 – 2017

IVMs currently are allowed to comply fully with credits from PZEVs to meet their ZEV obligation. Table 2.1 below shows an IVM's credit requirement, and what this means in terms of a percentage of its annual vehicle sales being PZEVs.

Table 2.1: Current IVM Requirement 2012 through 2017

Model Years	Current Credit Percentage Requirement	Percentage of IVM Fleet
2012 through 2014	12%	~60%
2015 through 2017	14%	~80%

Due to staff proposed amendments to manufacturer size definitions, many current IVMs will become LVMs by model year 2018. Staff is not proposing any additional lead time for these manufacturers, and considers the next six model years (up to model year 2018) adequate for ZEV development, considering many of the manufacturers have development programs underway.

For these reasons, staff proposes to reduce the credit percentage for IVMs for model years 2015 through 2017, from 14 percent to 12 percent. This still guarantees 60 percent of each IVM's fleet will be PZEVs, a substantially higher percentage of the manufacturers' fleets than LVM fleets. The change will allow IVMs, especially those becoming LVMs in 2018, to focus on development of ZEV technologies necessary for meeting more stringent ZEV requirements in 2018.

2.1.5 Remove Carry Forward Provisions

Historically, the ZEV regulation allowed the banking and trading of credits earned from early introduction or over-compliance with the regulation. In 2008, staff modified the way banked ZEV credits could be used to meet future requirements. ZEV credits could be used to meet ZEV obligations for the model year in which they were earned and two additional model years. For example, if a manufacturer earns three ZEV

credits from placing a Type II ZEV²⁴ in model year 2010, the manufacturer may bank and use those credits to meet the portion of the regulation that must be met with ZEVs for model years 2011 and 2012 compliance. In 2013, the credits may only satisfy the portion of the requirement that may be met with TZEVS.

Staff proposes to remove this provision, and allow ZEV credits to be banked and used to meet the full requirement in all future model years. The decision to remove this provision is justified based on the substantial increase in ZEV volume proposed for model years 2018 and beyond, and the incentive it provides to produce ZEVs prior to 2018. Currently requirements plateau for three years at a time but hold steady indefinitely at a relatively low level for 2018 through 2025 model years. Because staff is proposing to increase volumetric requirements each year for model years 2018 through 2025, it is unlikely that manufacturers will be able to bank large volumes of credits for later use. Also, some manufacturers will likely need banked credits to assist with compliance in later years. Lastly, this proposed amendment simplifies the regulation in 2018 and subsequent model years.

2.1.6 Minor Amendments

Amend PZEV Calculations

Staff is proposing several minor amendments to the PZEV calculations. First, ARB received several comments regarding the zero-emission VMT PZEV allowance, many of which were received during 2009 rulemaking for PHEV test procedure amendments and aftermarket parts certification requirements.²⁵ The issues concerned the equation for greater than 40 mile PHEVs, in section 1962.1(c)(3)(A), and potential future PHEVs with blended operation. Staff is proposing to correct inconsistencies in the zero-emission VMT allowance equation as indicated in Table 2.2 below.

²⁴ An example of a Type II ZEV is a 100 mile BEV.

²⁵ Rulemaking documents and public comments received during the 45-day and subsequent comment periods for the PHEV test procedure rulemaking can be accessed at the following link:
<http://www.arb.ca.gov/regact/2008/phev09/phev09.htm>

Table 2.2: Proposed Regulatory Language – Zero Emission VMT Allowance

2.1.6.1 Range	Zero-emission VMT Allowance
$EAER_u < 10$ miles	0.0
$EAER_u \geq 10$ miles to 40 miles and $R_{cda} \geq 10$ miles to 40 miles	$EAER_u \times (1 - UF_{R_{cda}})/11.028$
R_{cda} <u>$EAER_u > 40$ miles</u>	$EAER_{u40}/29.63$ $\frac{(EAER_{u40}) \times [1 - (UF_{40} * R_{cda}/EAER_u)]}{11.028}$ <p><u>Where,</u> <u>UF_{40} = utility factor at 40 miles</u> <u>$EAER_{u40}$ = 40 miles</u></p>

*EAER means equivalent all electric range.

* R_{cda} means charge depleting range actual.

Second, staff is providing clarifying language as to the utility factors (UF) to be used in determining a manufacturer's zero emission VMT allowance. Within the update Society of Automotive Engineers J2841 (March 2009), there are multiple UFs. Staff proposes to specify the UF determined to be according to Section 4.5.2 Equation 5 and the "Fleet UF" Utility Factor Equation Coefficients in Section 4.5.2, Table 3, in J2841 (March 2009).

Third, staff is proposing to delete the alternative test procedures for determining a manufacturer's zero emission VMT allowance. The alternative test procedures allowed manufacturers to receive zero emission VMT allowance for vehicles using fuels that produce near-zero, but not zero criteria pollutants. Staff is proposing this amendment because no automakers have included vehicles requiring or requesting such exemptions in any vehicle planned through 2017. This change would most likely impact a manufacturer planning to certify and sell hydrogen internal combustion engine (HICE) vehicles in the near-term, but staff believes that HICE vehicles are not under consideration for sales until the 2020 and beyond timeframe when hydrogen fueling infrastructure may be more commonly available in California.

Also, staff is proposing to eliminate the Type C advanced componentry allowance. In past years, manufacturers produced conventional hybrids with lower system voltages, and there was still some degree of motor system technology transferrable to ZEVs. Since that time, ZEV technology has advanced and staff now believes that the minimum qualifying system should be increased to the higher voltage Type D because (1) AT PZEVs need to make use of systems that more closely represent those that are needed for ZEVs, and (2) no manufacturers have certified, or have disclosed plans to certify, a Type C AT PZEV.

Decrease Value of Transportation System Credits

Transportation system credits were included in the ZEV regulation in 2001 to evaluate the benefits and issues related to the shared use of ZEVs, and the application of new technologies (at that time) such as reservation management, card systems, depot management, etc. Manufacturers earn transportation system credits by placing vehicles (currently PZEVs, AT PZEVs, TZEVs, and ZEVs) in car-sharing programs with automated reservation system technologies, and receive additional credits for linking these car-sharing programs to transit. Car sharing programs may be run by a manufacturer, or by a third party (e.g., Zipcar).

Transportation system credits have been a lucrative compliance strategy for manufacturers. When originally conceived, transportation system credits were thought to give manufacturers a different venue for placing new technologies in multiple consumer hands without requiring vehicle purchase or lease.

In Resolution 09-66, the Board found that the ZEV regulation will help assure the successful launch of commercial ZEVs and TZEVs (enhanced AT PZEV, as stated in Resolution 09-66) in the next decade. Staff believes limiting the number of credits offered for reasons other than vehicle placement is key to ensuring ZEV and TZEV commercial success. For this reason, and in an effort to simplify the regulation, staff proposes to decrease the amount of extra credits for TZEVs and ZEVs placed in transportation systems. The following table 2.3 enumerates the adjusted credit volumes for model year 2012 through 2017.

Table 2.3: Proposed Transportation System Amendments 2012-2017

Type of Vehicle	<i>Current Credit for Shared Use, Intelligence</i>	<u>Proposed Credit</u> for Shared Use, Intelligence	<i>Current Credit for Linkage to Transit</i>	<u>Proposed Credit</u> for Linkage to Transit
TZEV	1.0	0.5	1.0	0.5
ZEV	2.0	1.0	1.0	0.5

End Transportation System Credit Provision after Model Year 2017

Car sharing programs are important for air quality and GHG emission reductions, and have potential to play an important role in land use policies such as SB 375²⁶. However, the proposed amendments for 2018 and subsequent model years are meant to simplify the program and require manufacturers to place large numbers of ZEVs in the hands of customers.

Staff proposes to end the transportation system credit provision after model year 2017. Staff met with interested stakeholders regarding expiration of this provision and

²⁶ SB 375, 2008. Steinberg. September 30, 2008. http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_bill_20080930_chaptered.pdf Accessed September 7, 2011.

learned that monetary incentives for vehicle purchase might have the same effect as earning ZEV credits. Currently, most parties earning transportation system credits are not regulated, and sell those credits to regulated manufacturers. Staff believes ensuring monetary incentives are available for car-sharing programs to purchase advanced technology vehicles, like ZEVs and TZEVs, will work similarly to car sharing programs earning ZEV credits. This policy shift is reflected in the recently approved spending plan for the AB 118 Clean Vehicle Rebate Program which sets aside specific amounts of rebate funds for share car programs.

ZEV Bank Account Conversion

Staff proposes to no longer use non-methane organic gas (NMOG) fleet values when calculating manufacturers' ZEV credit account balances starting for 2015 model year compliance. NMOG values are used in ZEV banking to offer an incentive for early vehicle placement, because grams per mile (g/mi) NMOG fleet requirements decrease each year in LEV II. In the LEV III rulemaking for criteria pollutant emission standards for cars and trucks (see rulemaking documents related to LEV III), staff is proposing to change from an NMOG fleet standard to an NMOG plus NO_x (NMOG + NO_x) fleet standard. A combined NMOG + NO_x value would be higher than the lowest NMOG standard in the LEV II regulation, and would not serve as an early compliance incentive in the ZEV regulation.

Staff proposes to divide each ZEV account holder's bank balances after model year 2014 compliance by the lowest NMOG value, 0.035, to convert the credits from g/mi NMOG to straight ZEV credits. This will enable all banking in 2015 and subsequent model years to be in ZEV credits, simplifying the regulation. Due to this change, staff proposes clarifying language throughout section 1962.1, title 13, CCR to make clear the change over from g/mi NMOG ZEV credit to straight ZEV credits.

PZEV Qualification

Staff is proposing to begin LEV III criteria pollutant fleet standards in model year 2015. These will include new tailpipe NMOG + NO_x standards as well as evaporative emission standards. Staff will also be proposing new emission certification categories that go beyond SULEV standards. Due to these change in LEV III, staff proposes that in order to earn PZEV credit within the ZEV regulation in 2015 and subsequent model years, the vehicle must be certified to the more stringent SULEV 30 or SULEV 20 standards, and meet LEV III zero-evaporative standards. See the LEV III ISOR for more information on these certification categories.

Charging Requirement Specifications

ARB requires a minimum degree of charging connection compatibility amongst all grid-charged electric vehicles. This requirement ensures the use of standard chargers to facilitate ZEV and TZEV commercialization. The requirement for minimal charging commonality does not preclude the installation of additional vehicle charging capabilities such as direct current (DC) fast charge.

Several unanticipated changes in BEV and PHEV designs have occurred since the Board adopted infrastructure requirements in 2001. Low-range BEVs and PHEVs with both 220 and 120 volt charging capability and battery packs small enough to achieve reasonable charge times with chargers of less than the 3.3 kilowatt (kW) minimum capability were not anticipated when the requirements were adopted. Additionally, charging connection capability was never explicitly required of NEVs.

Staff believes the capability of low-range BEVs to charge on both 220 and 120 volts alternating current (VAC) should be encouraged; it enhances the overall compatibility of low-range BEVs that make use of shared charging stations. ARB has provided an exemption from the current requirements for the 2012 Toyota Plug-in Prius because it is both 220 and 120 VAC compatible, but still capable of fully charging its battery in less than 2 hours even though it is equipped with a relatively low-power on-board charger. Staff proposes to delete the exception for BEVs that only charge at 120 VAC and instead allow for lower power on-board chargers on these low-range BEVs, as long as an optional minimum charge time requirement of 4 hours is met.

Since the original charging requirement went into effect, no manufacturer has certified a vehicle with the 120 VAC only exemption, and none have indicated an interest in future vehicles with 120 VAC only charging. Instead, several manufacturers have agreed that an alternative minimum charge time would be a better way to provide an exemption to the 3.3 kW minimum power requirement for small vehicles because a 120 VAC only vehicle would be (1) less attractive to customers, and (2) incompatible with the objectives of this charging requirement because these vehicles would be incompatible with most planned public infrastructure or even stations installed under future building code requirements.

Staff proposes to require NEVs to meet this same charging connection requirement, beginning in model year 2014 to align with charging requirements for other grid-charged electric vehicles.

Modifications for NEVs

NEVs are simple, low cost, speed limited (25 miles per hour) BEV whose profile is often similar to a golf cart. Currently, ZEV credits for producing a NEV are only allowed to be used to meet up to certain amounts of a manufacturer's ZEV requirement. Pre-2006 model year NEV credits are more stringently capped than 2006 and beyond NEV credits. Staff proposes to extend caps for 2012 through 2014, to 2015 through 2017 model years. Table 2.4, below, lists staff proposed caps for pre 2006 NEV credits for 2015 through 2017 model years.

Table 2.4: Proposed Pre-2006 NEV Credit Limits

Model Years	Portion of the Obligation that:	Percentage of the Obligation that may be met with NEV credits
2012 – 2017	Must be met with ZEVs	0%

	May be met with TZEVs, AT PZEVs, or PZEVs	50%
--	---	-----

Table 2.5, below, lists staff proposed caps for post-2006 NEV credits for 2015 through 2017 model years.

Table 2.5: Proposed Post-2006 NEV Credit Limits

Model Years	Portion of the Obligation that:	Percentage of the Obligation that may be met with NEV credits
2012 – 2017	Must be met with ZEVs	0%
	May be met with TZEVs, AT PZEVs, or PZEVs	No Limit

Additionally, staff is proposing to add NEV acceleration, top speed, and constant speed range testing requirements to the “Test Procedures for 2009 through 2017 Model Zero-Emission Vehicle and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck And Medium-Duty Vehicle Classes” to specify testing methods for NEV certification.

Clarifications in Penalty Equation

California Health and Safety Code section 43211 applies a penalty to manufacturers of \$5,000 per vehicle not produced in compliance with ARB’s standards. In looking at the penalty equation currently in the ZEV regulation, it is not clear how the penalty is to be applied to manufacturers out of compliance. In the ZEV regulation, manufacturers have a wide array of compliance options, with vehicles earning various amounts of credits. However, a manufacturer’s ZEV requirement is ZEV credit production; all other vehicle credit types are compliance options, not requirements. Therefore, staff interprets the overall penalty for ZEV non-compliance to be \$5,000 per whole credit not produced. Staff proposes to clarify the regulatory language in section 1962.1, title 13, CCR to reflect this intent, and proposes the following equations in Table 2.6 to determine the penalty to be applied to manufacturers not in compliance with the ZEV regulation:

Table 2.6: Proposed ZEV Regulation Penalty Equations

Applicable Model Years	Equation
2009 through 2014	(No. of credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year) / (the fleet average requirement for PCs and LDT1s for the model year)
2015 and Subsequent	(No. of credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year)

Lead Time Provisions

Currently, manufacturers are given five years of lead time when transitioning into a larger size definition. For example, if a manufacturer were to increase in sales, such that their 2011 through 2013 sales average exceeded the current LVM threshold of 60,000 sales, the manufacturer would be subject to the full ZEV requirements in model year 2019. However, due to staff proposed modifications for definition and lead time, to be discussed in subsection 2.2.1 below, staff proposes that manufacturers starting their transition before 2018 will be subject to full ZEV requirements starting in 2018 model year. This means, for example, if a manufacturer's 2013 through 2015 sales average (for the first time) is 61,000 vehicles, then instead of being subject to LVM requirements in 2021, the manufacturer will be subject to LVM requirements in 2018.

There is a group of current IVMs that will become subject to LVM requirements in 2018, due to staff's proposed amendments to the definition thresholds, as discussed below in subsection 2.2.1. Some of these current IVMs are closer to becoming an LVM under the current definition of 60,000 vehicles sold, and others will only become an LVM due to staff proposed definition changes. The purpose of staff's proposed amendments is to bring a larger percentage of manufacturers under the full ZEV requirements. This proposed amendment to the lead time provision ensures a level playing field, making manufacturers close to the current definition thresholds (60,000 vehicles per year), subject to LVM requirements at the same time as manufacturers effected by staff's proposed definition change.

Change of Ownership Provisions

Currently, section 1962.1, title 13, CCR, specifies how to calculate a manufacturer's sales when a change of ownership occurs. Staff proposes to include additional clarifying language to this provision to specify when a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, the basis of determining next model year must be the earlier model year. This amendment ensures additional lead time is not earned in this type of situation.

Vehicle Credit Eligibility

Currently, ZEVs earn one-credit for the ZEV to be "delivered for sale" and the additional credits for the ZEV to be "placed in service". Staff proposes two change regarding vehicle credit eligibility. First, staff proposes that a vehicle must be both delivered for sale and placed in service in California in order to receive the total credit amount. This change is due to some manufacturers having internet based sales, and questions surrounding the location of a vehicle's delivery and placement in service. Staff's proposed change clarifies the original intent of the provision. The vehicle may still receive partial credit if the vehicle is just delivered for sale. Second, staff proposes to place a five year limit on 2012 and prior model year ZEVs to collect "placed in service" credit. Staff is proposing this five year limit to ensure that the ZEVs

offered to consumers are moderately current advanced technology and advanced technology components have not deteriorated.

Rounding Convention

Staff proposes ZEV credit and debits to be rounded to the nearest thousandth of a credit or debit only on the final credit and debit total for a compliance year using the conventional rounding method, for 2009 through 2014 model year. For example all numbers including the vehicle production numbers, the debit requirement, and the credits earned will not be rounded. Only the final total for each compliance year will be rounded to the nearest thousandth. This amendment is meant to provide clarification and to avoid differences in calculating ZEV credits and debits. Staff proposes ZEV credits and debits to be rounded to the nearest thousandth on the final credit and debit total for a compliance year using the conventional rounding method for 2015 and subsequent model years.

2.2 Part II: 2018 and Subsequent Model Year Amendments

2.2.1 Amend Manufacturer Size Definitions

A manufacturer's California sales volume plays an important role in determining a manufacturer's treatment under various LDV regulations. Size is based on a manufacturer's average PC, LDT, and medium duty vehicle (MDV) sales in California. Table 2.7 lists the current manufacturer size definitions, and the regulations that apply to each manufacturer size definition.

Table 2.7: Current Size Definition Categories and Applicable California Regulations

Current Size Category	Current Definition (PC, LDT, MDV Avg Sales)	Applicable Regulations
Small Volume (SVM)	Between 1 and 4,500	Limited LEV II, Limited Pavley
Independent Low Volume (ILVM)	Less than 10,000 (must apply to Executive Officer)	Limited LEV II, Limited Pavley
Intermediate Volume (IVM)	Between 4,501 and 60,000	Full LEV II, Full Pavley Compliance by 2016, Limited ZEV (PZEV Only)
Large Volume (LVM)	60,001 and greater	Manufacturers subject to full regulations

Currently, IVMs (those having more than 4,500 PC, LDT, and MDV, on average, in California) and LVMs (those having more than 60,000 PC, LDT, and MDV sales, on average, in California) are the two groups of manufacturers mandated by the ZEV regulation. LVMs are required to comply with a minimum amount of ZEVs, while IVMs may meet their entire requirement through PZEV production. Small volume manufacturers (SVM) and independent low volume manufacturers (ILVM) are not

required to comply with the ZEV regulation, but may generate, trade, and sell ZEV credits. Table 2.8 below lists current LVMs and IVMs, along with an average of each company's 2008 through 2010 vehicle sales.

**Table 2.8: Current Manufacturer Size Status
(2008 – 2010 MY Sales Averages, Rounded)**

Large Volume Manufacturers (<60,000 PCs, LDTs, MDVs)		Intermediate Volume Manufacturers (<4,500 PCs, LDTs, MDVs)	
Chrysler	89,000	BMW	53,000
Ford	130,000	Daimler	52,000
GM	167,000	Hyundai	34,000
Honda	175,000	Jaguar Land Rover	9,000
Nissan	112,000	Kia	21,000
Toyota	315,000	Mazda	30,000
		Mitsubishi	8,400
		Subaru	14,000
		Volkswagen	52,000
		Volvo	8,000

At the 2008 March hearing, the Board did not adopt staff's proposal to extend the transition time for an IVM becoming an LVM from six years to twelve years. Board members questioned the differing treatment of the two sizes of manufacturers, concluding both sizes should be treated similarly.²⁷ Though sales in California differ between each manufacturer, many current IVMs have similar sales figures as LVMs on a worldwide basis.

Inconsistencies exist between the LEV and ZEV regulations regarding LVM and IVM definitions and ownership. Under the light-duty GHG regulations, two manufacturers are to aggregate their sales when one manufacturer owns more than 10 percent of another manufacturer. Under the ZEV regulation, two manufacturers are to aggregate their sales for size determination when one manufacturer owns greater than 50 percent of another manufacturer. Another discrepancy between the two regulations is lead time for manufacturers changing sizes. A manufacturer who has moved from IVM status to LVM status under the light-duty GHG regulations has 3 years lead time, while under ZEV the manufacturer has 5 years lead time, before having to comply with the full requirements.

As staff began to examine differential treatment of companies under the three regulations, the need to align ownership thresholds, re-examine the cut points for IVM and LVM size definitions, and align lead time provisions became apparent to reduce confusion. Staff proposes to decrease the IVM – LVM threshold from 60,000 PCs, LDTs, and MDVs on average in California to 20,000 on average. Manufacturers will

²⁷ARB, 2008. California Air Resources Board. March 27, 2008 Board Hearing Transcript. <http://www.arb.ca.gov/board/mt/2008/mt032708.txt>

be redefined and will determine their requirement based on their 2015 through 2017 sales average.

Additionally, to align ownership thresholds between the light-duty GHG fleet regulations with the ZEV regulations, staff proposes that two manufacturers' sales will be aggregated for determination of size if one manufacturer owns greater than 33.4 percent of another manufacturer.

Lastly, staff proposes new lead time provisions under the ZEV regulation, as well as provisions for manufacturers decreasing sizes, from LVM to IVM, or IVM to SMV status. A manufacturer with three consecutive averages over a size threshold will be subject to the stepped-up requirement the first model year following the last year of the third consecutive threshold. Below is an example of how this would work:

Manufacturer A Sales Averages

<u>2017-2019</u>	<u>2018-2020</u>	<u>2019-2021</u>	<u>2020-2022</u>
19,000	21,000	25,000	28,000

Manufacturer A, formerly an IVM would be subject to LVM requirements in model year 2023. Similarly, staff proposes manufacturers decreasing in size, and moving from one size category to another would only do so after three consecutive averages below a size threshold. Below is an example for a manufacturer moving from a larger size category to a small size category:

Manufacturer B Sales Averages

<u>2017-2019</u>	<u>2018-2020</u>	<u>2019-2021</u>	<u>2020-2022</u>
6,000	4,200	3,900	4,000

Manufacturer B, formerly an IVM, would be treated as an SVM starting in model year 2023, and no longer subject to the ZEV regulation. Also, staff proposes that manufacturers will no longer be able to qualify as an ILVM for purposes of the ZEV regulation after model year 2017.

The effect of these changes is all the IVMs listed in Table 2.8, except Volvo, Subaru, Jaguar/Land Rover and Mitsubishi, would be expected to become LVMs in 2018, and meet the full ZEV requirements starting that year. This proposed change is needed to assure that major manufacturers compete on a level playing field, and to assure a variety of ZEVs are available to the consumer. Other changes are discussed in Section 2.2.4.

2.2.2 Remove PZEV and AT PZEV Compliance Options

PZEVs and AT PZEVs have been compliance options for manufacturers since 1996. Credit multipliers along with high credit amounts were used to encourage manufacturers to develop ZEV-enabling technologies, and offset manufacturers' overall ZEV requirements. Most manufacturers are currently selling or have near term

plans to sell PZEVs and AT PZEVs (namely conventional HEVs like the Toyota Prius). To date, over 1.7 million PZEVs and 350,000 AT PZEVs have been delivered for sale in California as a result of the ZEV regulation. This leads staff to conclude that PZEV and AT PZEVs have reached commercialization and are no longer appropriate as a compliance option in the ZEV regulation. Additionally, at the 2009 December Board Hearing, the Board adopted Resolution 09-66, which resolves that PZEVs and AT PZEVs, currently a part of the ZEV regulation, are commercial and can be removed from the ZEV regulation as a compliance option.

Therefore, staff proposes to remove new production of PZEVs and AT PZEVs as compliance options under the ZEV regulation for 2018 and subsequent model years. Capitalizing on the successful commercialization of these technologies, it is appropriate that the LEV III Criteria Pollutant and GHG fleet regulations will rely upon these vehicles to aide in compliance with the standards being proposed. The LEV III rulemaking for criteria pollutant standards is proposing to require the PC and truck fleet to meet the SULEV tailpipe NMOG + NO_x fleet standard by 2025. Vehicles will also be required to have virtually zero-evaporative emissions. Additionally, the LEV III rulemaking for GHG standards could result in over 40 percent of hybridization of the PC and truck fleet by 2025, dependent on each manufacturer's compliance method. These regulations will continue to ensure the expansion of volumes of PZEV and AT PZEV-like vehicles, allowing the ZEV regulation to focus on commercialization of zero and near-zero emitting vehicle technologies.

2.2.3 Increase ZEV Requirement for 2018 and Subsequent Model Years

Currently, manufacturers' 2018 and subsequent model year ZEV requirements are held at the same percentage each year, as shown in Table 2.9 below.

Table 2.9: Current 2018 and Subsequent ZEV Credit Requirement

Credit Category	Credit Requirement
Minimum ZEV	5.0%
Maximum TZE ^V *	3.0%
Maximum AT PZE ^V *	2.0%
Maximum PZE ^V	6.0%
Total ZEV Requirement	16.0%

*The regulation does not specify the split between TZE^Vs and AT PZE^Vs. For this analysis, staff assumed AT PZE^V TZE^V credit requirement would remain the same from the 2015 through 2017 requirements . If the PZE^V and AT PZE^Vs (highlighted in grey) are moved to the LEV III program as proposed, the remaining ZEV requirement under the current regulation would be 8%.

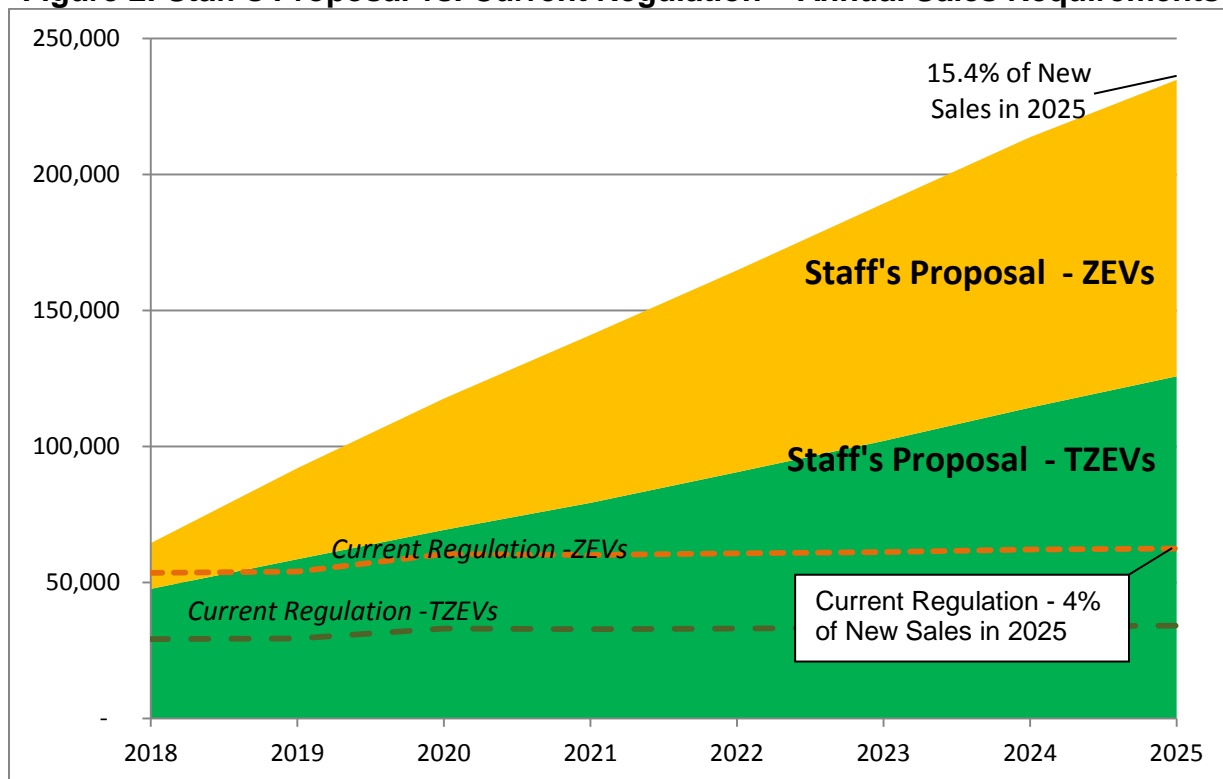
To address one of the program's primary objectives (ZEV technology commercialization and long-term GHG and criteria emission goals), staff proposes to increase each manufacturer's compliance requirements for 2018 and subsequent model years, ultimately reaching credit requirements of 6 percent for TZE^Vs and 16 percent for pure ZEVs in 2025. This increase is outlined in Table 2.10 below.

Table 2.10: Proposed ZEV Credit Requirement for 2018 and Subsequent

Model Year	2018	2019	2020	2021	2022	2023	2024	2025 and Subsequent
Overall ZEV Requirement	4.5%	7.0%	9.5%	12.0%	14.5%	17.0%	19.5%	22.0%
Min. ZEV	2.0%	4.0%	6.0%	8.0%	10.0%	12.0%	14.0%	16.0%
Max. TZEV	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%

As shown in Table 2.10 above, the proposed overall ZEV credit requirement, between model year 2018 and model year 2022, is less than the current program. Because staff is proposing to revise the number of credits earned per vehicle (typically by one half), and PZEVs and AT PZEVs no longer would count towards meeting a manufacturer's ZEV obligation, it is more illustrative to compare the actual number of ZEVs required to be produced given the current and proposed crediting structure. This is shown below in Figure 2.

Figure 2: Staff's Proposal vs. Current Regulation – Annual Sales Requirements



In establishing the proposed requirements above, staff reviewed a range of compliance alternatives to ensure program objectives were met, including work done

in 2009 to examine the LDV sector meeting long term GHG emission reduction goals. (ARB, 2009a) Starting from staff's 2050 analysis, staff considered the appropriate level of ZEVs and TZEVs that should be required in the 2018 through 2025 model year timeframe based on a number of factors: ZEV platforms, technology cost curves, and the future GHG fleet standards.

Staff's 2050 analysis suggests over 35 percent of LVMs' 2025 LDV sales would need to be ZEVs and TZEVs to keep California on a trajectory to meet the 2050 GHG reduction goal. In terms of PC sales that would need to be ZEVs or TZEVs would likely be higher because staff expects that manufacturers will preferentially produce ZEV as PCs rather than LDTs, in order to reduce costs, especially for BEVs. While these sorts of production numbers would likely help the LDV sector reach its long term GHG emission reduction goals, the effect on the PC market in such a short timeframe suggests staff consider less stringent requirements. Staff chose requirements which push ZEVs and TZEVs to 15 percent of new LDV sales by 2025.

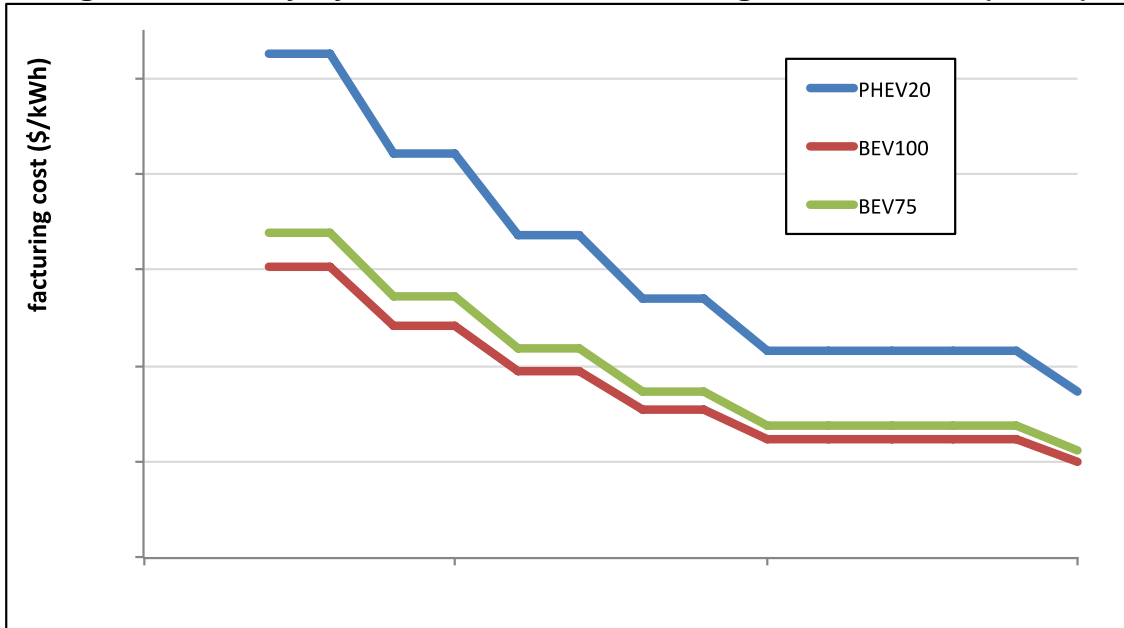
Another important factor staff considered in choosing future requirements was cost. In order to highlight the scale of cost reductions anticipated as a result of high volume production, the following four Figures (3, 4, 5, and 6) show declining production costs, over the period of the regulation, for the advanced batteries and fuel cell systems considered in the analysis. To highlight the most relevant and expensive components of the advanced vehicle platforms, the values shown here assume direct manufacturing.²⁸

Generally, battery and fuel cell costs decline over time due to several factors. As production volumes increase, costs decline due to economies of scale. Additionally, as manufacturers operate production systems for a number of years, costs can decline from the manufacturing process as improvements are identified. Both of these factors (production volume and production experience) are incorporated into the time-based costs presented in Figures 3 and 5.

Figure 3 shows the declining costs of batteries, as assumed in the joint model used in staff's ACC analysis, with time on three platforms: a PHEV with 20 mile electric range (PHEV20), a BEV with 75 mile all-electric range (BEV 75), and a BEV with 100 mile all-electric range (BEV100). Costs for PHEV battery systems are higher than BEVs (on a per kWh basis) primarily because the relative cost of auxiliary systems (battery thermal management and controls) increases with smaller batteries.

²⁸ High volume production is assumed by 2025 on world-wide platforms (greater than 100,000 units/yr).

Figure 3: Battery System Direct Manufacturing Cost vs. Time (2009\$)



As described in the LEVIII ISOR Section III-A-4.3, battery cost projections (above) were developed jointly with the U.S. EPA and NHTSA and leveraged analysis by Argonne National Laboratory (ANL), as well as input from manufacturers. Figure 4 shows battery cost reductions with increasing production of battery packs.²⁹

Figure 4: Battery System Direct Manufacturing Cost vs. Production Scale (2009\$) (ANL, 2010)

²⁹ ANL, 2010. Argonne National Laboratory. D.J.Santini et al, EVS-25, Nov 5-9 2010. "Modeling of Manufacturing Costs of Lithium-Ion Batteries for HEVs, PHEVs, and EVs."

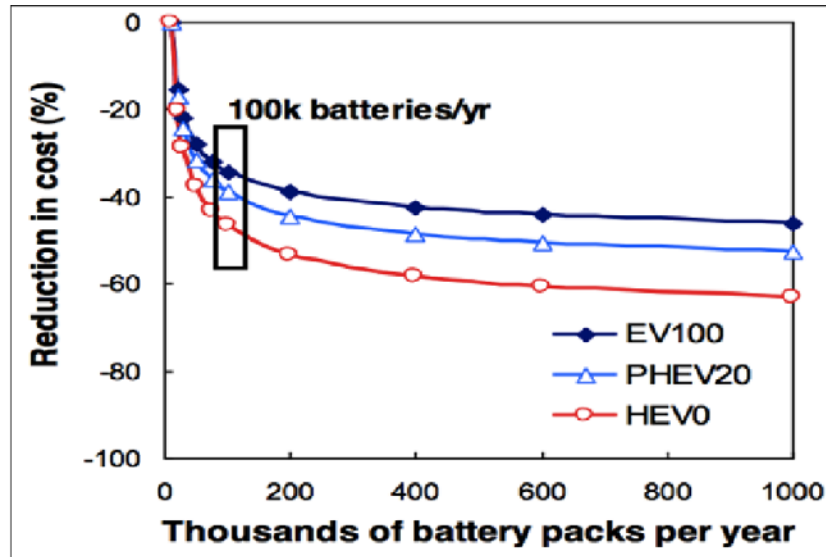
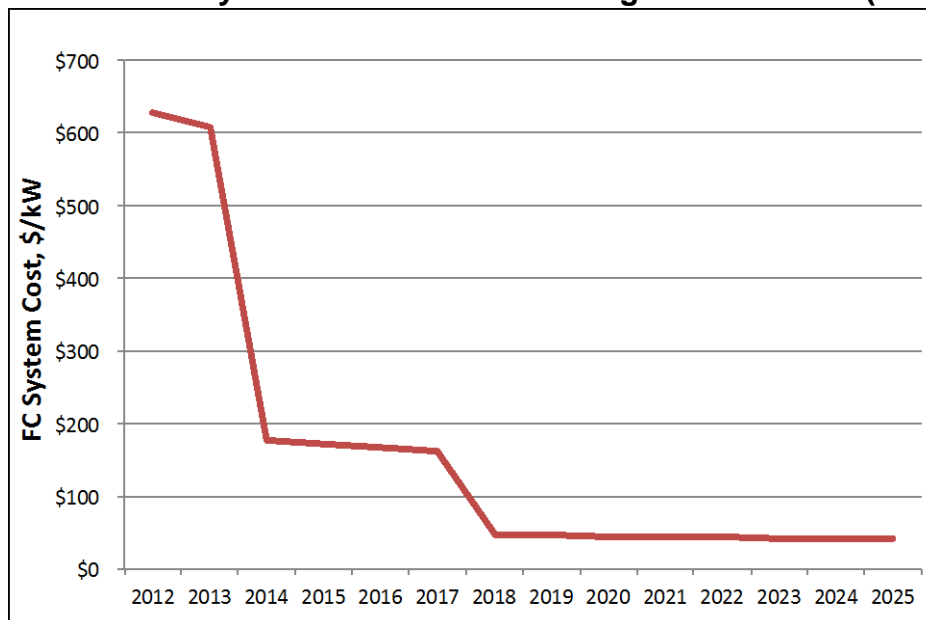


Figure 5 shows the declining cost of fuel cell systems as a function of time, as assumed in the joint model used in staff's ACC analysis.

Figure 5: Fuel Cell System Direct Manufacturing Cost vs. Time (2009\$)*

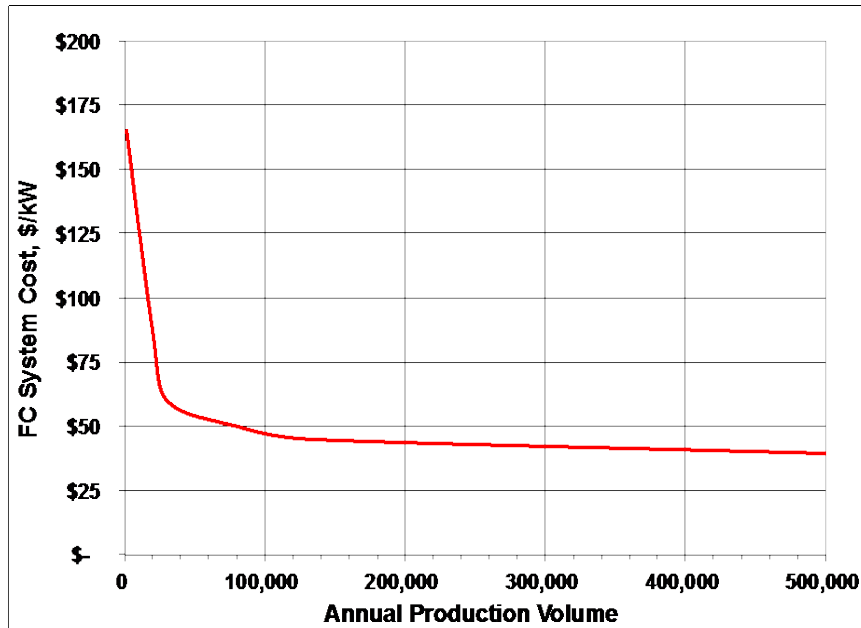


*does not include hydrogen storage

Fuel cell cost projections relied, in part, on high volume cost functions developed by Directed Technologies Incorporated (DTI), one of two long-term contractors evaluating future system costs for the U.S. DOE. Figure 6 below show DTI's fuel cell system costs based on annual production volumes.

Figure 6: Fuel Cell System Direct Manufacturing Costs vs. Production Scale (2009\$)³⁰

³⁰ DTI, 2010. Directed Technologies Inc., 2010 U.S. DOE Merit Review. June 7-11, 2010. "Mass Production Cost Estimation for Automotive Fuel Cell Systems".



Staff's proposed requirements push production volumes to levels that reduce incremental ZEV prices below what would have occurred in the existing regulation. It also encourages multiple platforms, and brings a selection of vehicles to a larger portion of the market (well beyond early adopters).

Lastly, staff considered expected ZEVs under future GHG fleet standards for LDVs. Without a ZEV regulation, the California proposed GHG standards would likely result in approximately 6 percent of annual sales by 2025 would be ZEVs and TZEVs. This level of penetration would not likely achieve the cost reductions needed for commercialization in the timeframe needed to meet long term emission reduction goals.

2.2.4 IVM Treatment

As discussed above, staff is proposing to reduce the sales volume which separates an IVM from an LVM from 60,000 annual sales in California to 20,000 annual sales, starting in 2018. Four manufacturers would remain IVMs (Subaru, Volvo, Jaguar Land Rover, and Mitsubishi). This raises the issue of what should be the ZEV requirements for these smaller manufacturers? Currently, IVMs are allowed to meet their entire ZEV requirement with credits from conventional PZEVs. Due to the proposed removal of PZEVs as a compliance option for ZEV in 2018 and subsequent model years, staff considered what ZEV requirements, if any, should apply to IVMs beginning in 2018.

These manufacturers are significantly smaller than other manufacturers in terms of research and development funds, California sales, and worldwide sales. However, most have displayed ZEV or TZEVs at recent auto shows, and have active ZEV development programs. This is necessary to remain competitive with LVMs. What limits the ability of IVMs is the potential of having to develop multiple technologies given their relatively smaller research, development, and demonstration (RD&D)

budgets. Therefore, staff proposes that IVMs be subject to the ZEV mandate, but have no limits on the type of ZEVs, other than NEVs, they produce. For example, an IVM could fulfill the requirements by producing only TZEVs (e.g. PHEVs). By comparison, a LVM that chooses to produce TZEVs must also produce specified numbers of ZEVs. Further flexibilities for IVMs will be discussed throughout the following subsections.

2.2.5 Excess PZEV and AT PZEV Credits Treatment

Staff's proposal to remove new production of PZEVs and AT PZEVs as compliance options for the ZEV program for model years 2018 and beyond will likely leave manufacturers with banked PZEV and AT PZEV credits. Manufacturers' PZEV and AT PZEV banks reflect over compliance with the ZEV regulation, as well as old multipliers offered for early compliance. In a shift toward requiring manufacturers to place vehicles in order to comply with the regulation rather than use banked credits, staff believes it is appropriate to limit the use of banked ZEV credits in 2018 and subsequent model years. Staff proposes to first discount the banked PZEV and AT PZEV credits, then cap their use at 25 percent of a manufacturer's portion of its overall ZEV requirement that may be fulfilled with credits from TZEVs. Banked PZEV and AT PZEV credits could not be used to comply with any of the portion of the requirement that must be met with ZEVs. Staff's proposed discount for the PZEV and AT PZEV credit banks after model year 2017 compliance may be found in Table 2.11 below.

Table 2.11: Proposed Credit Discounts for PZEV and AT PZEV Credit Banks

	Affected Manufacturer Size	Discount	Equivalency
PZEV	LVM	93.25%	1 TZEV(20 mile) = ~51 PZEVs
PZEV	IVM	75%	1 TZEV(20 mile) = ~14 PZEVs
AT PZEV	IVM and LVM	75%	1 TZEV(20 mile) = ~5 AT PZEVs

The cap on usage of PZEV and AT PZEV credits for 25 percent of the portion of a manufacturer's ZEV requirement that may be met with TZEVs, equals approximately 7 percent to 14 percent of a manufacturer's overall ZEV requirement each year.

For IVMs, for model years 2018 and 2019, staff proposes to not cap the usage of banked PZEV and AT PZEV credits as a way to increase flexibility for these smaller manufacturers as they develop new products. For 2020 and subsequent model years, staff proposes to cap the usage of PZEV and AT PZEV credits to 25 percent of an IVM's overall requirement. Staff also proposes to cap NEV credits in the same manner as banked PZEV and AT PZEV credits. Therefore, all PZEV, AT PZEV, and NEV credits would be under the same cap in 2018 and subsequent model years. The proposed allowed percentages are enumerated in Table 2.12 below.

Table 2.12: Proposed Limits on Banked PZEV and AT PZEV Credits, and NEV Credits for 2018 and Subsequent Model Years:

	2018	2019	2020	2021	2022	2023	2024	2025
--	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Allowed Usage in an LVM's TZEZ portion of Requirement	Up to 25%							
OR								
Allowed Usage in an LVM's overall Requirement	13.9%	10.7%	9.2%	8.3%	7.8%	7.4%	7.1%	6.8%
Allowed Usage in an IVM's overall Requirement	100%	100%	Up to 25%					

Staff's proposal helps to move manufacturers from relying on banked ZEV credits for compliance, and helps to ensure ZEVs and TZEZs will be produced in compliance with the regulations.

2.2.6 ZEV Treatment and Credits

Currently, ZEV credits for Type III, Type IV, and Type V ZEVs are scheduled to decrease for 2018 and subsequent model years. Below, Table 2.13 shows credit levels currently in the regulation for 2018 and subsequent model years.

Table 2.13: Current ZEV Types and Credit Levels

	Definition	2009 through 2017	2018 and Subsequent
NEVs	Low Speed Neighborhood Electric Vehicles	0.30	0.30
Type 0	<50 Mile BEVs	1	1
Type I	>50 - <75 Mile BEVs	2	2
Type I.5	>75 - <100 Mile BEVs	2.5	2.5
Type II	>100 Mile BEVs	3	3
Type III	>100 Mile FCVs (with fast refueling) <u>OR</u> >200 Mile BEVs	4	3
Type IV	>200 Mile FCVs (with fast refueling)	5	3
Type V	>300 Mile FCVs (with fast refueling)	7	3

The current system of tiered credit levels encourages manufacturers to produce a vehicle meeting the range threshold rather than rewarding the actual mileage of the vehicle. Staff considered several ways of amending the current crediting system. Credit factors such as a vehicle's physical size, weight, a manufacturer's monetary investment in the vehicle technology, refueling capabilities, refueling access, long term vehicle cost potential, GHG well-to-wheel (WTW) performance, as well as others were

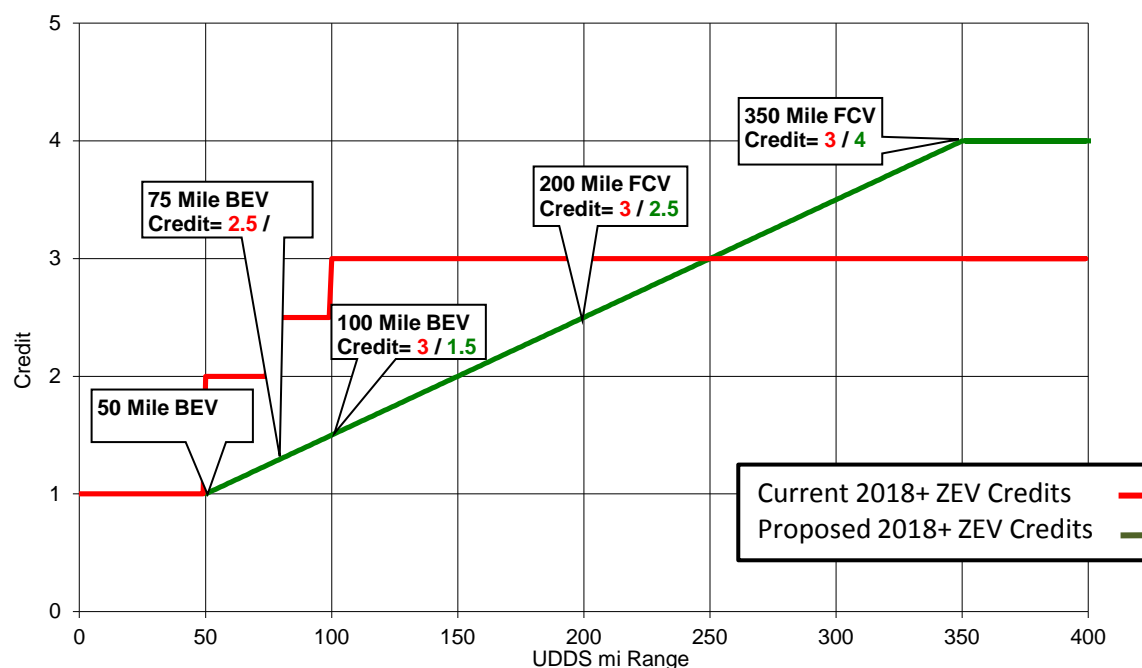
considered and discussed at a May 2010 workshop. In the spirit of simplicity, many factors were discarded due to the subjective nature of the factor, such as a manufacturer's investment in the technology. Other factors had little to do with the vehicle's design and engineering, or the manufacturer would have no control over the amount of credit earned. Staff considered including a vehicle's size in a future credit system, which would encourage ZEV technologies to be placed on larger platform vehicles, and credit based on the vehicle's footprint and range. As staff explored this option, it appeared that longer range vehicles would generally be on larger platforms, which reduced the need to credit the vehicle's footprint as well as its range.

For the reasons stated above, and in an effort to simplify the regulation, staff is proposing to base the amount of credits earned by each ZEV exclusively on the vehicle's urban dynamometer driving schedule (UDDS) range. Credits for ZEVs would range from 1 and 4 credits each, with a minimum 50 mile range ZEV earning 1 credit and a 350 mile range ZEV earning 4 credits. Below is the staff's proposed credit equation for ZEVs:

$$\text{ZEV Credit} = (0.01) * (\text{UDDS range}) + 0.5$$

Figure 7 below shows the amount of credit various vehicles would receive using staff's proposed ZEV credit equation, along with the current credit structure.

Figure 7: Proposed ZEV Credits As Compared to Current ZEV Credits (2018 and Subsequent Model Years)



Essentially, a ZEV will receive half as much credit in 2018 and subsequent model years as was earned in 2017 and earlier model years. To align credits earned by

NEVs in 2018 and later model years, staff proposes to reduce NEV credits by 50percent as well, from 0.30 to 0.15 credits each.

Additionally, staff proposes BEVx credit will be equivalent to that received by BEVs, based on range. Like in 2012 through 2017 model years, manufacturers will be allowed to meet up to 50 percent of the portion of their requirement that must be met with pure ZEVs with credits from BEVxs.

2.2.7 TZEV Treatment and Credits

AT PZEVs were included as a compliance option in the ZEV regulation to accelerate the development and manufacturing capacity of the component technologies that are also necessary to build ZEVs. These components include traction motors, power electronics, batteries, battery management systems, and hydrogen storage tanks. About 350,000 AT PZEVs have been placed in California since 2004. ZEV technologies have improved at a faster pace than normal market forces would have otherwise expected due to commercialization of AT PZEVs. As a result, the industry is now progressing to a “transition” phase where ZEV component production is increasing, and the resulting component costs are decreasing.

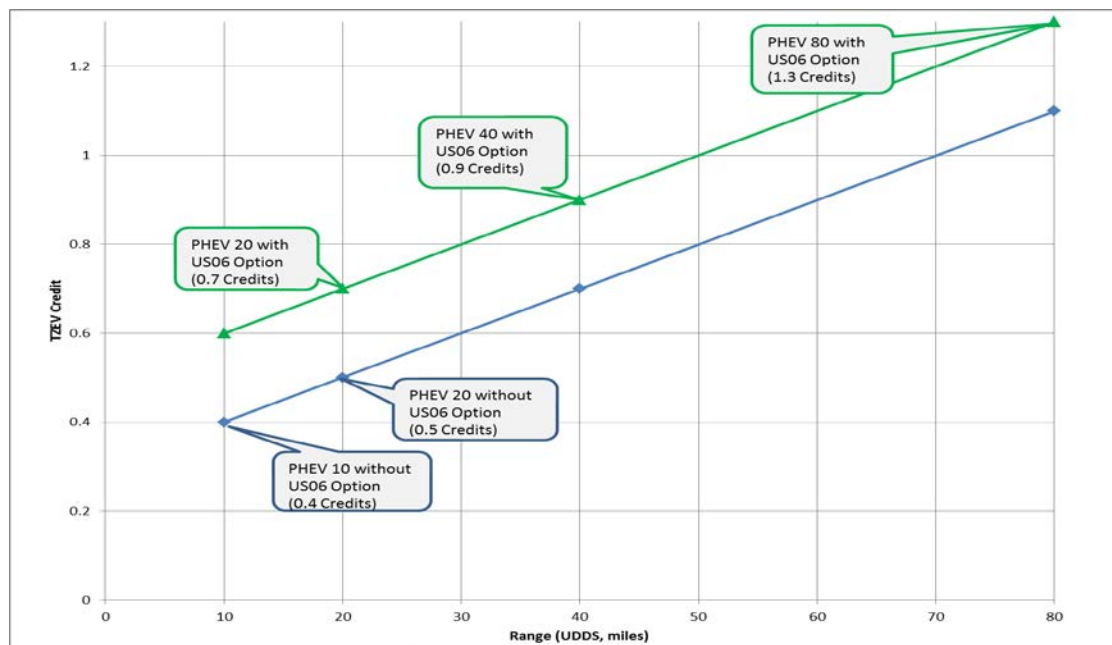
The emphasis of the AT PZEV compliance option within the ZEV regulation was the initial introduction of these component technologies into production vehicles. TZEVs will encourage further evolution of these ZEV components and technologies by significantly “raising the bar” for qualifying vehicles. In this way, staff believes the overall California fleet will incorporate more ZEV-component intensive vehicles, and will provide more significant emissions reduction benefits from actual zero-emission VMT and zero-emissions fuel use. For this reason, staff is proposing a simplified TZEV credit system for 2018 and subsequent model years based primarily on zero emission VMT capability. Table 2.14 below shows staff’s proposed equation for TZEV zero emission VMT allowance.

Table 2.14: TZEV Zero-Emission VMT Allowance

UDDS Test Cycle Range (R_{cda})	Credit
<10 miles	0.0
≥10 miles range	$\text{TZEV Credit} = [(0.01) * \text{EAER} + 0.3]$
>80 miles (credit cap)	1.3

TZEVs with at least 10 miles all electric UDDS range will be eligible for zero emission VMT allowance. Manufacturers may earn an extra allowance of 0.2 if the vehicle is capable of driving 10 miles all electric on the US06. Figure 8 below shows the total credit amount manufacturers would be eligible for in 2018 and subsequent model years.

Figure 8: Proposed TZEV Credits - PHEVs



Staff also proposes a fixed allowance for HICE vehicles of 0.75. HICE vehicles that also have all-electric range would also be eligible for a zero emission VMT allowance, but subject to an overall credit cap of 1.25.

New technologies, performance features, and vehicle types have recently emerged that are challenging to assess under the current ZEV regulatory structure. A key example of such a development is the range-extended BEV explained earlier in this staff report: a BEV with an APU range extender. This is particularly challenging when many of these vehicles are only just now being announced or introduced into the market and little is known about them. PHEV driver behavior is still relatively unknown and staff cannot predict performance results based on vehicle attributes. Over the next two to three years, staff commits to studying PHEV and BEVx user-behavior to find a more refined attribute-based methodology that can better correlate with desirable zero-emission VMT and emissions reductions.

2.2.8 Travel Provision

During the development of the TAR, the involved agencies jointly met with states that have adopted California's air quality regulations through the Clean Air Act, often referred to as Section 177 ZEV states. "Several states mentioned activities they have underway to develop the infrastructure needed to support electrified vehicles." (EPA, 2010, pp.2-11) As proposed above, staff believes it is appropriate to extend the travel provision for Type I, Type I.5, and Type II ZEVs (BEVs) through 2017. However, for 2018 and subsequent model years, staff believes BEVs will be reaching commercial levels, and be available in most states. Nissan has announced that the Leaf will be available for model year 2012 in over half of the United States.³¹ From that

³¹ Nissan, 2011. Press Release, July 19, 2011. "Nissan To Launch All-Electric Leaf As Upgraded 2012 Model In New U.S. Markets" <http://www.nissannews.com/pressrelease/2682/185/nissan-launch-all-electric-leaf-upgraded-2012-model>.

perspective, staff believes it is not appropriate to extend the travel provision for BEV credits past the 2017 model year.

Commercialization of FCVs lags commercialization of BEVs by several years. BEVs have entered the marketplace this year, while the first FCVs in volume production are not expected until 2015 or later, and then only in those regions such as California and New York that are preparing the necessary hydrogen fueling infrastructure. Thus staff proposes to extend travel for FCV credits. Travel would be extended for FCVs until there are clear plans for sufficient hydrogen infrastructure in Section 177 ZEV states to support these vehicles.

2.2.9 GHG Over-Compliance Credits

On July 29, 2011, President Barack Obama announced a joint agreement between the U.S. EPA, NHTSA, the state of California, the United Auto Workers (UAW) and thirteen manufacturers to improve GHG emission performance of all PCs by 2025.³² California submitted a letter to U.S. EPA Administrator Lisa Jackson and United States Department of Transportation (U.S. DOT) Secretary Ray LaHood on July 28, 2011 affirming its commitment to a one-national GHG tailpipe standard. The following statement was included in the July 28, 2011 commitment letter:

“California commits to propose that its revised ZEV program for the 2018-2021 MYs include a provision providing that over-compliance with the federal GHG standards in the prior model year may be used to reduce in part a manufacturer’s ZEV obligation in the next model year.”³³

Staff proposes to allow a manufacturer that complies with its national light-duty fleet GHG standard to use those over-compliance credits to offset a portion of its ZEV requirement in 2018 through 2021 model years. Table 2.15, below, enumerates the percentage of ZEV credits a manufacturer may off-set with GHG over-compliance credits.

Table 2.15: Maximum Percentage of ZEV Credit Offset Each Model Year

2018	2019	2020	2021
50%	50%	40%	30%

The percentages in Table 2.15 represent two caps: 1) the total percentage of a manufacturer’s requirement able to be met with GHG-ZEV over-compliance credits, and 2) the maximum percentage allowed to be met within the portion of the regulations that must be met with ZEVs. Manufacturers will not be limited (other than by the cap on the total requirement) on use of GHG-ZEV over-compliance credits within the TZEV category.

³² White House, 2011. United States White House. Press Release. July 29, 2011. “President Obama Announces Historic 54.5 MPG Fuel Efficiency Standards.” <http://www.whitehouse.gov/the-press-office/2011/07/29/president-obama-announces-historic-545-mpg-fuel-efficiency-standard>. Accessed September 9, 2011

³³ ARB, 2011a. California Air Resources Board. Commitment Letter. July 28, 2011. <http://www.epa.gov/oms/climate/letters/carb-commitment-ltr.pdf>.

Based on historical compliance with the ARB LEV II regulation and from NHTSA's Corporate Average Fuel Economy (CAFE) program, manufacturers often run debits and credits in alternating model years that balance out due to carry-back and carry-forward provisions. Staff projects that fully compliant manufacturers will typically operate with 1 to 4 grams carbon dioxide per mile (gCO₂/mile) of credits or debits GHG credits as a normal course of action as part of the GHG program. It is not the intent of the ZEV-GHG over-compliance provisions to reward this small fluctuation in g/mi credits that naturally occur from program compliance or to reward accumulated GHG emission reductions that occurred before model year 2018.

To award consistent and planned over-compliance with the GHG fleet standard, staff proposes that manufacturers be eligible to utilize the ZEV-GHG over-compliance provisions only if particular conditions are met before the regulation start date and in each model year (i.e., between 2018-2021) of the program. First, staff proposes that the following two preconditions must be met in order for manufacturers to qualify for use of the ZEV-GHG over-compliance provision:

1. Model year 2017 GHG precondition: A company must have no GHG program debits in model year 2017 and no outstanding debits from previous model years.
2. Model year 2017 ZEV precondition: A company must have no ZEV program debits in model year 2017 and no outstanding debits from previous model years.

Staff proposes a manufacturer must submit an application to ARB by May 1, 2018 documenting the company's intent to use the ZEV-GHG over-compliance provision. The application must include test model, vehicle sales, and GHG standard data for documenting federal compliance model year 2017 data for the GHG program. The application must also declare any existing credits or debits from the 2012-2016 GHG fleet regulations. Lastly, a manufacturer must submit its projected product plan information for model years 2018-2021 that documents its expected GHG program over-compliance by at least 2 gCO₂/mile in each model year through the entire period without receiving GHG program credits from any other automaker for model years 2018 through 2021.

To lessen reporting issues and allow manufacturers adequate planning time, staff proposes ZEV-GHG over-compliance credits be based on the manufacturer's previous model year compliance. For example, a manufacturer generating ZEV-GHG over-compliance credits to meet ZEV requirements in model year 2019 would calculate GHG over-compliance based on model year 2018. Annually, manufacturers would be required to report credits/debits from the model year, any remaining credits/debits from previous model years, and projected credits/debits for future years through 2021. Also, staff proposes at a minimum, the manufacturer must over-comply

by at least 2 gCO₂/mile each year, and must not include the following credits and multipliers in calculating a manufacturer's GHG fleet standard over-compliance:

1. Additional credit earned from additional incentive multipliers greater than 1.0 (i.e. truck technology credit multipliers), and
2. Banked GHG gCO₂/mile credits from previous model years or from other manufacturers.

Note, that California is not proposing to include advanced electric-drive vehicle technology multiplier incentives in the 2017 and subsequent GHG standards. However, manufacturers will have the option of directly complying with California's standards or complying with the federal standards. In the event of a given manufacturer selecting the federal compliance option, the manufacturer will also not be allowed to include the multiplier received for advanced electric drive vehicle technologies in their ZEV-GHG over-compliance calculation.

Staff proposes the following equation be used to calculate a manufacturer's ZEV-GHG over-compliance credits for use in California and Section 177 ZEV states:

ZEV Credit Calculation (for given model year):

**(Manufacturer U.S. Sales of PC & LDT) * (gCO₂/mile
below manufacturer GHG standard)**

(manufacturer GHG standard)

Manufacturers will be required to remove the gCO₂/mile credits used to calculate ZEV offset credits from their GHG fleet standard banks.

In the event that a manufacturer is not generating a GHG compliance credit or receives GHG credit from any other automaker for any model year from 2018 through 2021, the company would no longer be eligible for the ZEV-GHG over-compliance program, and would be subject to the full requirements and penalties of the ZEV regulation.

2.2.10 Minor Amendments

Counting ZEVs in Applicable Sales Volume

Each model year, manufacturers calculate their applicable vehicle sales volume to which their ZEV requirement is applied. In 2003, staff modified the regulation to not count a manufacturer's ZEVs produced in the manufacturer's applicable sales volume. This was to prevent NEV manufacturers from generating a larger requirement than could be met, due to NEVs earning less than one ZEV credit. When considering the

effect of this provision on developing future requirements, staff concluded removing this provision for manufacturers would simplify the program and not have an adverse effect on manufacturers.

Staff proposes to end this provision for ZEVs for 2018 and subsequent model years, and include all ZEVs produced in the manufacturer's applicable sales volume. However, staff proposes that NEV manufacturers would not include NEVs in their applicable sales volumes to prevent manufacturers from facing a larger requirement than could be fulfilled.

Amendment to Applicable Sales Volume Determination "Previous Years Method"

Since 2003, staff has allowed each manufacturer to choose its applicable sales volume determination method. As stated previously, a manufacturer's applicable sales volume is the number of vehicles a manufacturer's requirement is applied to for a model year. Manufacturers may choose to use their current year sales, or an average of previous year sales, from the fourth, fifth, and sixth model years prior to the model year with which they are complying. For example, for the 2011 model year, manufacturers may choose their applicable sales volume based on 2011 sales, or on an average of 2005, 2006 and 2007 model year sales. Manufacturers are allowed to switch methods each year. This provision causes uncertainty for ARB when trying to determine how many ZEVs and TZEVs will be made each year. Also, manufacturers are able to take advantage of a low sales volume year to reduce their obligation for up to nine years, which greatly impacts the number of ZEVs required.

Staff proposes a manufacturer's applicable sales volume to be based on an average of the second, third, and fourth years back. For example, for 2019, a manufacturer's applicable sales volume would be based on an average of 2016, 2017, and 2018 model year sales. This change would make the applicable average more contemporaneous and helps even out the sales bumps year to year. However, staff understands unforeseen circumstances cannot be planned for, and should be considered in regards to a manufacturer's ZEV requirement. An example of an unforeseen circumstance could be a severe economic downturn or a natural disaster. Staff proposes that manufacturers could apply to the Executive Officer to use a current model year for their applicable sales volume, for a maximum of two model years. Manufacturers applying to the Executive Officer would need to do so by January 1 of the year following the compliance model year. For example, a manufacturer applying to use a current model year for their applicable sales volume for model year 2020, would need to apply to the Executive Officer no later than January 1, 2021. If a manufacturer does switch to the same year method, then switch back, it only continues to benefit from a bad year for four years, as it is included into its previous second, third, and fourth year average.

Amendments to Carry Back Provision

Currently, manufacturers are allowed to carry a ZEV credit deficit for up to three model years. For example, a manufacturer who does not meet its ZEV requirement in model year 2016 would not be subject to penalties for non-compliance until after model year

2018 compliance, and would be allowed to make up deficits with credits from ZEVs in model years 2017 and 2018. Up to this point, all manufacturers have been in full compliance with the ZEV regulation, and have not had to make use of this provision. However, this provision creates uncertainty in the number of ZEVs to be delivered for sale each year.

In an effort to strengthen and provide more certainty of the number of ZEVs to be delivered to California for a given model year, staff proposes to shorten a manufacturer's allowed deficit to one year. This means, for example, a manufacturer could fail to submit the required amount of ZEV credits in 2019, and proceed to make up the credit deficit in 2020 model year compliance. After model year 2020 compliance, the manufacturer would be subject to ZEV penalties.

Removing Placed In Service Requirement

Currently, for manufacturers to receive full credit for ZEVs, each ZEV must be placed in service.³⁴ This requirement was added in 2001 to encourage manufacturers to place ZEVs, particularly NEVs, with end-users and further ZEV commercialization and markets. Manufacturers currently receive one credit for each vehicle delivered for sale, and earn the rest of the credits for each vehicle when it is placed in service (i.e. sold or leased to an end user). Staff believes this requirement will no longer be necessary for BEVs in 2018 and subsequent model years as requirements increase. This greatly simplifies tracking and acknowledges the maturing market for BEVs. However, staff will continue to require all FCVs and NEVs to be placed in service in order to earn credit through the regulation. FCVs need to be tracked by vehicle identification number (VIN) for purposes of the travel provision, and accounting across states. The regulation will also retain ARB's authority to request VINs of delivered ZEVs to verify the vehicles have been delivered to California.

Additional minor modifications are discussed in Section 9 of this ISOR.

³⁴ CCR 1962.1(h)(7) states "placed in service" means "having been sold or leased to an end-user and not to a dealer or other distribution chain entity, and having been individually registered for on-road use by the California Department of Motor Vehicles."

3 EFFECT OF PROPOSED CHANGES

This section provides an assessment of the industry wide number of vehicles that may be produced due to the proposed changes. Sections 5, 6 and 7 then use these estimates to project the economic and environmental impacts of the proposed changes. Staff is proposing limited amendments to the 2012 through 2017 timeframe which have little impact on the numbers of vehicles produced in compliance with the ZEV requirements. Staff's analysis of manufacturer's current ZEV credit banks is in subsection 3.1. Staff's analysis of the effects of the proposed changes to Type V credits, and decreased IVM requirement is presented below in subsection 3.2. The bulk of staff's analysis focuses on the 2018 through 2025 timeframe, and can be found below in subsection 3.3.

3.1 Overall Effects of Manufacturer's Banked ZEV Credits

Manufacturers have over complied with the ZEV regulation, which has caused them to have banks of excess ZEV credits. A manufacturer may bank an unlimited amount of credits from each vehicle category. Table 3.1 below shows manufacturer's ZEV bank balances as of September 30, 2011.

Table 3.1: Manufacturer Current Bank Balances (g/mi NMOG)*

Manufacturer	ZEVs (excluding NEVs)	NEVs	Enhanced AT PZEVs	AT PZEVs	PZEVs
BMW	106.000	0.000	0.000	0.000	209.547
Chrysler Group	55.611	665.316	0.000	0.000	0.000
Ford	274.687	1,069.090	0.000	596.272	1,135.289
FUJI Heavy Industries/Subaru	0.000	0.000	0.000	0.000	65.662
General Motors	408.156	787.166	0.000	454.352	120.388
Honda	404.105	804.666	0.000	946.318	62.655
Hyundai	31.360	0.000	0.000	0.000	22.378
KIA	22.647	0.000	0.000	0.000	0.000
Land Rover	0.000	0.000	0.000	0.000	10.139
Mazda	0.000	0.000	0.000	0.000	246.998
Mercedes Benz	28.520	193.066	0.000	9.849	6.278
Mitsubishi	1.400	0.000	0.000	0.000	53.432
Nissan	189.321	0.000	0.000	0.000	1,523.912
Tesla	0.000	0.000	0.000	0.000	0.000
Toyota	1,116.293	0.000	7.721	6,723.705	734.941
Volkswagen	35.558	0.000	0.000	17.130	11.929
Volvo	0.000	0.000	0.000	0.000	108.493

Zipcar	0.000	0.000	0.000	0.000	17.083
TOTALS	2,673.657	3,519.305	7.721	8,747.627	4,329.126

*Manufacturer ZEV bank balances are posted each year, on September 30, on the following website: <http://www.arb.ca.gov/msprog/zevprog/zevcredits/2010zevcredits.htm>

Manufacturers can comply in innumerable ways with the regulation. Manufacturers may fulfill their entire requirement with credits from ZEVs, or produce more AT PZEVs to fulfill the portion of the requirement that may be met with PZEVs. The regulation defines the upper limits of how the various credit categories can be used to fulfill a manufacturer's requirement.

Taking the manufacturer's current credit banks into account, staff analyzed potential credit usage in the 2012 through 2017 timeframe, and in the 2018 through 2025 timeframe.

For 2012 through 2017 model year, it is difficult to determine the impact of banked PZEV and AT PZEVs credits on actual PZEV and AT PZEV production. PZEVs and AT PZEVs are a compliance option within the regulation. For example, some manufacturers use NEV credits in lieu of producing AT PZEVs. Staff is proposing to allow manufacturers to use their banked PZEV and AT PZEV credits to meet up to 25 percent of the TZEZ portion of their requirement in 2018 and subsequent model years. This could incentivize manufacturers to continue producing PZEV and AT PZEVs through model year 2017, as discussed below.

As shown above in Table 3.1, manufacturers currently have no banked TZEZ (referred to in the table as Enhanced AT PZEV) credits, except for one manufacturer. It is possible that LVMs might use ZEV credits, and NEV credits, as allowed, to meet some of the TZEZ portion of their requirement. Still, staff predicts most LVMs will produce TZEZs to fulfill this portion of their 2012 through 2017 requirement.

Looking at LVM's minimum ZEV requirement, and assuming manufacturers only used banked credits to comply with the regulation in 2012 through 2017, most LVMs would be able to comply through model year 2014 using only banked ZEV credits. Four out of six LVMs would be able to comply through model year 2015, and one LVM would likely be able to meet their 2016 minimum ZEV obligation with banked credits.

In order to complete an analysis of possible credit usage in 2018 and subsequent model years, multiple assumptions must be made. Though many manufacturers have announced plans to produce ZEV program vehicles (see Section 1), few shed light on expected volumes. For the purposes of this analysis, staff did not assume an increase in manufacturer's banked ZEV credits. It is clear that most manufacturers will likely need to produce TZEZs, since there are few TZEZ credits currently in manufacturer's ZEV banks.

Assuming LVMs keep their current credit banks constant through model year 2017, meaning they are meeting their yearly obligations through model year 2017 by

producing vehicles and not using banked credits, most manufacturers would be able to comply only with their model year 2018 minimum ZEV requirement.

This credit analysis leads to two conclusions: 1) most manufacturers will likely need to produce TZEVs to meet a portion of their 2012 and subsequent model year requirements, and 2) manufacturers will run out of pure ZEV credits, and will need to produce ZEVs in order to meet their future requirements.³⁵

3.2 Effects of Proposed Changes: 2009 through 2017 Model Years

Decreased IVM Requirements: 2015 through 2017 Model Years

Staff is proposing to decrease the overall requirement that applies to IVMs from 14 percent to 12 percent credits each year for model years 2015 through 2017. Table 3.2 shows the differential in expected PZEVs due to staff's proposed change.

Table 3.2: Effect of Decreased IVM Requirements in 2015 through 2017

	<i>Existing IVM Requirement</i>	<i>Proposed IVM Requirement</i>	<i>Differential</i>
Annual Credit Percentage	14%	12%	2% less per year
Annual Percentage of IVM Sales That Are PZEV	70%	60%	10% less per year
Cumulative PZEV Sales	617,000	530,000	87,000 fewer cumulatively

The proposed decreased PZEV requirements for IVMs will likely result in a cost savings over existing requirements. Because IVMs will be required to start complying with TZEVs in 2018, IVMs will likely use cost savings from decreased PZEV production to invest in research, development, and demonstration (RD&D) in TZEV technologies (the reason for the proposed change).

3.3 Effects of Proposed Changes: 2018 and Subsequent Model Years

2018 – 2025 Model Year Likely Compliance Scenario Development

Manufacturers are offered much flexibility in complying with the ZEV regulation. As explained above, LVMs must comply with a minimum amount of credit from producing ZEVs. Staff proposes that LVMs be allowed to meet the rest of their requirement with credits from producing TZEVs. Thus LVMs may fulfill their entire requirement with credits from ZEVs, but may not fulfill their entire requirement with credits from TZEVs. However, IVMs are allowed to fulfill their entire requirement with credits from TZEVs, although they may use ZEV credits if desired. Due to these uncertainties, and the wide array of ZEVs and TZEVs that could be produced to comply with staff's proposed ZEV requirements, staff developed a likely compliance scenario to be used for its analyses.

³⁵ Confidential information, regarding historical credit usage patterns, was used to determine the effects of manufacturer's banked credits.

First, staff made the broad assumption that LVMs would fulfill their obligation with the maximum allowed percentage of TZEV credits. This is based on a belief that initial the market for TZEVs may be greater than for BEVs due to the latter's range limitations. Most LVMs have announced TZEV demonstration or production programs set to start prior to model year 2018.

Second, staff assumed a combination of BEVs and FCVs would be produced to comply with the ZEV requirements. Table 3.3 provides the assumed fraction of the total ZEVs produced that would be BEVs or FCVs.

**Table 3.3: Fraction of ZEV Technologies
2018 and Subsequent Model Years**

	2018	2019	2020	2021	2022	2023	2024	2025
FCVs	17.5%	18.6%	22.0%	25.0%	29.2%	31.8%	35.4%	40.0%
BEVs	82.5%	81.4%	78.0%	75.0%	70.8%	68.2%	64.6%	60.0%

Staff developed an average weighted credit using the above percentages in Table 3.3 to establish the minimum number of ZEVs produced each year. Each regulated manufacturer has a ZEV credit requirement. To translate the number of credits into a number of vehicles, a credit per vehicle must be assumed. Staff assumed all FCVs produced would have a 350 mile range, earning 4 credits each, and all BEVs produced would, on average, have a 100 mile range, earning 1.5 credits each. The average weighted credit used each year is enumerated in Table 3.4 below:

Table 3.4: Average Weight Credits Used in Likely Compliance Scenario

	2018	2019	2020	2021	2022	2023	2024	2025 and beyond
Average Weighted Credit	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5

Using these base assumptions, a number of analyses were run to determine the effect of staff's proposed amendments.

3.3.1 Manufacturer Size Definition Amendments

Staff's proposed amendments to manufacturer size definitions will affect most IVMs, bringing nearly 97% of manufacturers' vehicle sales in California subject to the full LVM ZEV requirements. Table 3.5 shows the size classifications for LVMs and IVMs under staff's proposed amendments

Table 3.5: Proposed Size Classifications for Manufacturers 2018 and Beyond

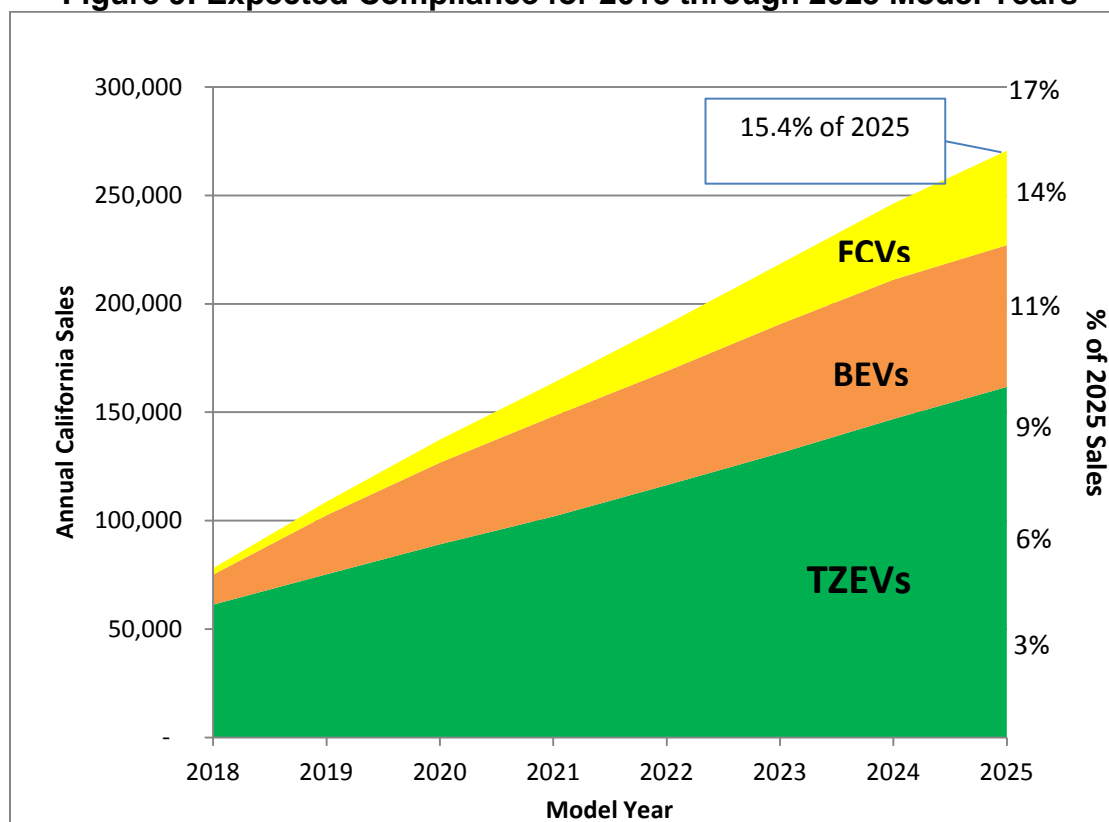
LVMs (>20,000 CA Sales)	IVMs (<20,000 CA Sales – >4,500 CA Sales)
<ul style="list-style-type: none"> • BMW • Chrysler • Daimler • Ford • General Motors • Honda • Hyundai • Kia • Mazda • Nissan • Toyota • Volkswagen <div data-bbox="537 541 792 730"> 96.9% of California Sales </div>	<ul style="list-style-type: none"> • Jaguar Land Rover • Mitsubishi • Subaru • Volvo <div data-bbox="1052 541 1300 730"> 2.8% of California Sales </div>

These size definitions greatly affect the overall number of ZEVs expected to be produced in compliance with the ZEV regulations. Additionally, IVMs previously allowed to meet their entire requirement with PZEVs will now be allowed to produce TZEVs. This is important for setting future standards and ensuring that most manufacturers will have some level of electric drive technology in their fleet. In 2025, if all IVMs take advantage of the flexibilities provided, over 30 percent of their annual sales will be TZEVs.

3.3.2 ZEV and TZEV Credit Calculations and Increased 2018 and Subsequent ZEV requirement

Putting all of the factors and assumptions discussed above together, staff has developed the following expected compliance scenario. As a result of staff's proposal, over 1.4 million ZEVs and TZEVs are expected to be produced cumulatively in California by 2025, which represents a 200 percent increase over the current ZEV requirements. Over 500,000 ZEVs (excluding TZEVs) are expected to be produced cumulatively in California by 2025. Figure 9, below, shows the total number of vehicles expected to be produced each year in compliance with staff's proposal. By model year 2025, staff expects 15.4 percent of new sales will be ZEVs and TZEVs.

Figure 9: Expected Compliance for 2018 through 2025 Model Years



The expected numbers for each model year are enumerated in Table 3.6 below. These numbers are based on future sales projections from ARB's Emissions Inventory Model, (EMFAC) 2011³⁶.

Table 3.6: Number of Vehicles Expected Annually – 2018 through 2025 Model Year (Expected Compliance Scenario - Rounded to Nearest 100)

	2018	2019	2020	2021	2022	2023	2024	2025	Cumulative TOTAL
FCVs	2,900	6,200	10,600	15,400	21,600	27,800	35,200	43,600	163,300
BEVs	13,900	27,300	37,700	46,300	52,600	59,500	64,200	65,400	366,900
TZEVs	61,300	75,300	89,100	101,900	116,300	131,200	146,900	161,700	883,700
Total Vehicles	78,100	108,800	137,400	163,600	190,500	218,500	246,300	270,700	1,413,900

There are an innumerable number of compliance scenarios. As explained above, manufacturers are not required to make each technology stated in Table 3.6. LVMs

³⁶ ARB 2011b. California Air Resources Board. Emission Inventory Model, EMFAC 2011.
<http://www.arb.ca.gov/msei/msei.htm>

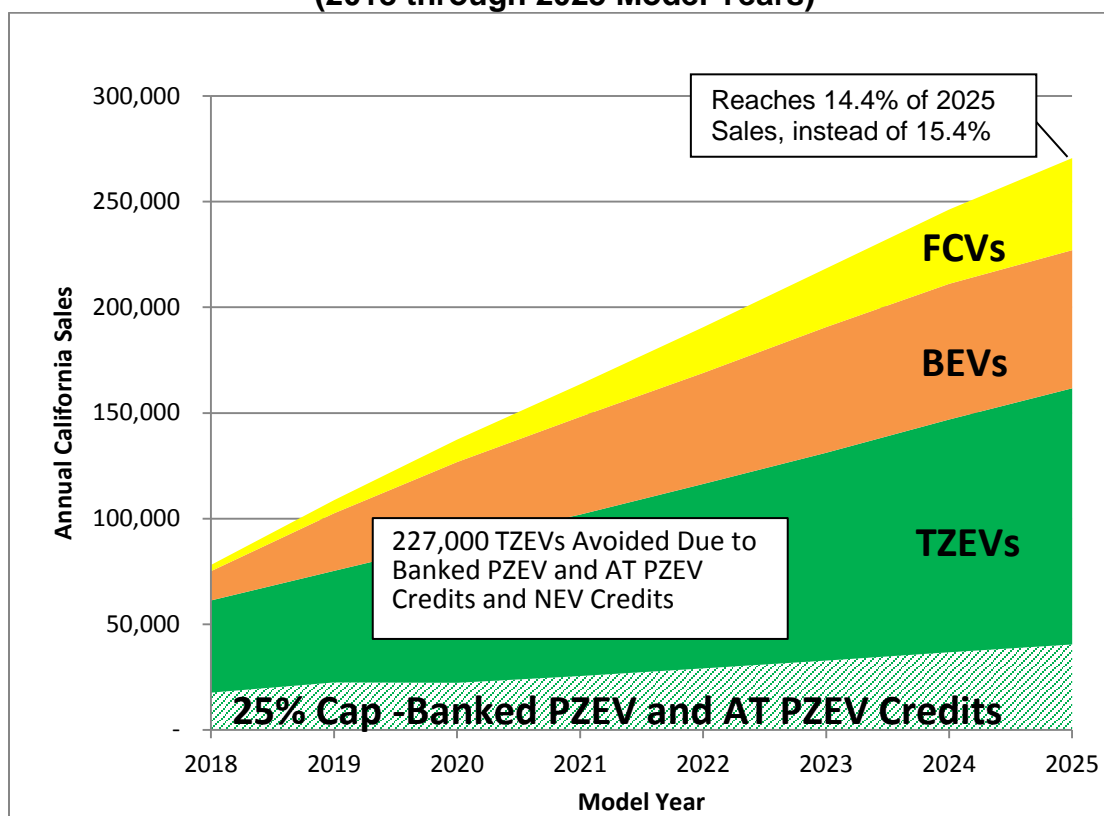
may fulfill their entire requirement with credits from ZEVs, either BEVs or FCVs, or a mixture of both. If LVMs were to only pursue BEV technology to meet their minimum ZEV requirement, the number of ZEVs would nearly double each year; if only FCVs were used to meet their minimum ZEV requirements, the total number of ZEVs would be reduced by one third compared to numbers shown in Table 3.6.

3.3.3 Compliance Flexibility: Use of Banked PZEV and AT PZEV Credits

Staff is proposing to allow manufacturers to use PZEV and AT PZEV credits banked up to 2017 model year for 2018 through 2025 model year compliance, even though PZEV and AT PZEVs will be removed as compliance options. NEV credits, banked or new, would also be under the same cap as banked PZEV and AT PZEV credits.

Figure 10 shows the amount of the 2018 through 2025 model year ZEV requirements that could be met with historical banked PZEV and AT PZEV credits, and NEV credits.

Figure 10: Impact of Banked PZEV AT PZEV Credits, and NEV Credits (2018 through 2025 Model Years)

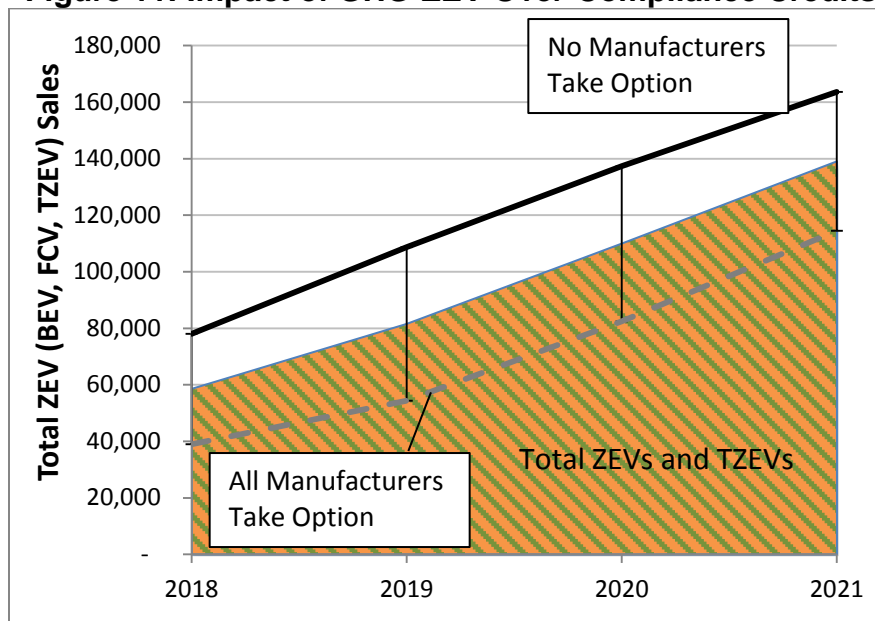


If all manufacturers use banked PZEV and AT PZEV credits to the maximum extent allowed in 2018 through 2025 model years, they will avoid up to 227,000 TZEVs cumulatively. This is about a 25 percent reduction in TZEVs from the values shown above in Table 3.6.

3.3.4 Compliance Flexibility: GHG-ZEV Over-Compliance Credits

Staff does not know which manufacturers will take advantage of the GHG-ZEV over-compliance provisions in model years 2018 through 2021, the only four model years these credits will be available. In Figure 11 below, the minimum (if zero manufacturers use this option) and maximum (if all manufacturers use this option) cases are shown.

Figure 11: Impact of GHG-ZEV Over-Compliance Credits

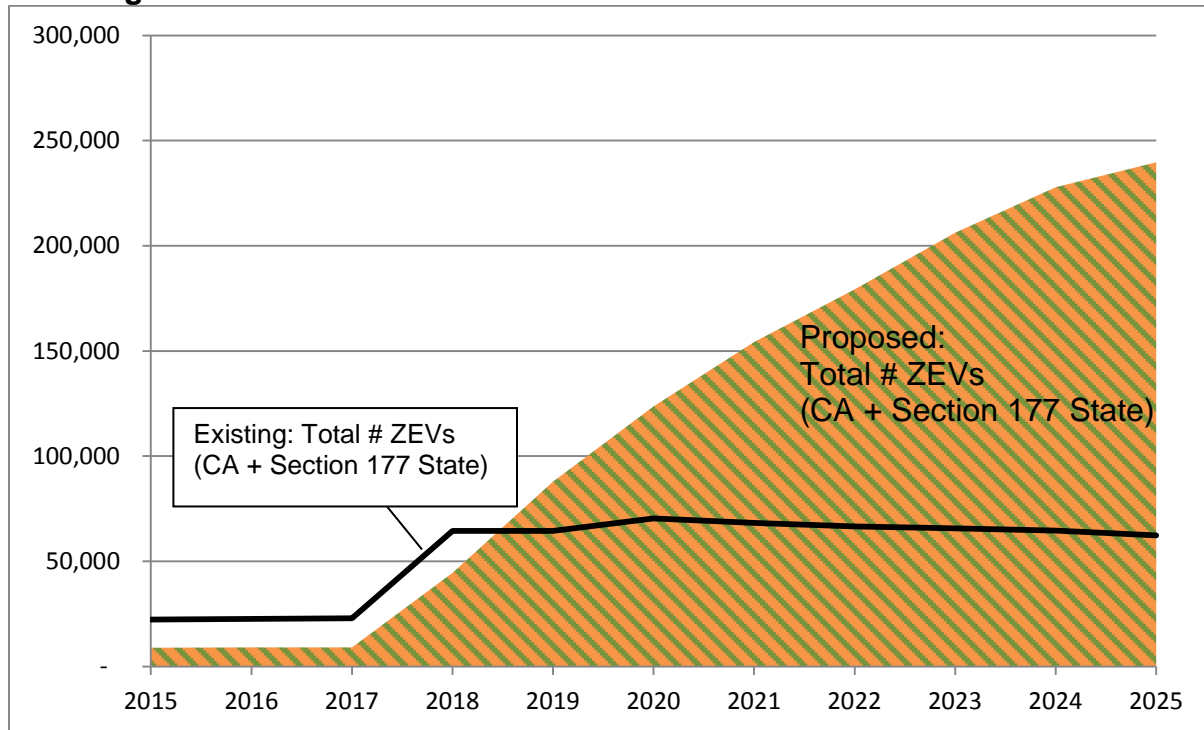


The hash marked area in Figure 11 represents total ZEV and TZE sales if manufacturers responsible for half of vehicle sales take advantage of the GHG-ZEV over-compliance provision. The error bars indicate the impact if all manufacturers use this provision, or if no manufacturers use this provision. Staff's best guess at this point of time is manufacturers accounting for sales between 15 percent and 50 percent of total sales may be able to use the over compliance provision.

3.4 Effects of Proposed Changes: Travel Provision

Staff is proposing to extend the travel provision for BEVs through 2017 model year. This will likely result over 40,000 fewer BEVs placed in the Section 177 ZEV states, assuming the volume of vehicles sold in Section 177 ZEV states was twice as much as the volume of vehicles sold in California. This provision will be sunset for BEVs after 2017 model year. Due to this sunset, there will be a dramatic increase the total amount of ZEVs a manufacturer must produce in compliance with California and the Section 177 ZEV state regulations. Figure 12, below, shows the likely increase in the total number of BEVs placed in compliance with the ZEV regulation in California and in the Section 177 ZEV states.

Figure 12: Effect of BEV Travel Provision Sunset in 2017 Model Year



As shown above, the existing regulation requires manufacturers to place more BEVs than staff's proposal during 2015 to 2017 model years. However, due to staff's proposed extension of travel for BEVs, manufacturers are allowed to produce fewer BEVs in compliance with the regulation, and required to significantly ramp up their volumes in later years.

During the development of this ISOR, manufacturers and Section 177 ZEV states have discussed options regarding amendments to the travel provision. Some states have indicated that they would like to have ZEVs in their states prior to model year 2018, while others continue to prepare for increased volumes starting in 2018. Manufacturers have indicated the need for TZEVs to travel, which is not currently permitted under the regulation, and is not being proposed. Some manufacturers have also requested a reduction in the required volumes of ZEVs and TZEVs in the Section 177 ZEV states in model years 2018 and beyond. At the time of release of this ISOR, manufacturers and Section 177 ZEV states were still discussing these various issues.

4 REGULATORY ALTERNATIVES

As part of the regulatory development process, staff considered four alternatives regarding the number of vehicles required to be produced in 2018 and subsequent model years. A consistently calculated scenario of expected ZEV and TZEV sales used to comply for each of the four alternatives is presented below in Table 4.1. The options were then evaluated in the context of two of staff's primary objectives: commercialization of ZEV technology to ensure reduced incremental costs and addressing long-term GHG and criteria emission goals.

Table 4.1: Alternatives – Annual Combined ZEV and TZEVs (Rounded)

	2018	2019	2020	2021	2022	2023	2024	2025
Staff Proposal	78,000	109,000	137,000	164,000	191,000	218,000	246,000	271,000
Alt A (Lower)	44,000	56,000	83,000	122,000	157,000	195,000	229,000	261,000
Alt B (Higher)	120,000	161,000	191,000	218,000	246,000	274,000	302,000	325,000
Alt C* (Existing Program)	54,000	54,000	60,000	60,000	61,000	61,000	62,000	62,000

*Assumes PZEVs and AT PZEVs are removed and covered in LEV III.

4.1 Alternative A: Lower ZEV Requirements

Alternative A combines aspects of a proposal from a subset of auto manufacturers with staff's assumptions on amendments to the travel provision. This alternative includes a gradual phasing in (reduction) of the ZEV and TZEV credit values, increasing the fraction of the ZEV requirement that may be met with credits from TZEVs, and lower overall requirements.³⁷ Compared to staff's proposal, the number of ZEVs required is much lower in the early years, consists of a much higher portion of TZEVs relative to ZEVs, but gets closer to the staff proposal in terms of annual volume by 2025.

Staff rejected Alternative A because it could undercut the launch of and resultant commercialization of pure ZEVs (BEVs and FCVs). To achieve full commercialization and place the industry on a pathway consistent with meeting long term goals, volume sales of ZEVs need to ramp up quickly. Alternative A delays the ramp up. While lower numbers of ZEVs would result in lower compliance costs to manufacturers, progress toward lowering unit costs through increased volume is also delayed, pushing out the date at which a sustainable market is reached. Although TZEVs are an important bridging technology, too much uncertainty surrounds the availability of

³⁷ Manufacturers proposed reducing the number of ZEVs and TZEVs required to be placed in the Section 177 ZEV states. Staff modified the manufacturer's original proposal to reflect a one-third reduction in vehicle requirements in California as well as the Section 177 ZEV states for purposes of analyzing Alternative A.

low-carbon biofuels and understanding of how much zero emission VMT is achieved with TZEVs to depend fully on TZEVs to achieve long term emission reductions.

4.2 Alternative B: Higher ZEV Requirements

Alternative B represents a proposal from a group of non-governmental organizations, the California Clean Car Coalition. This alternative is similar to the staff proposal, except the jump in volume requirement between 2017 and 2018 is much greater (more than a doubling), and requirements for subsequent years are higher by 20 to 50 percent compared to staff's proposal.

Staff rejected this proposal due to the steep jump in volume requirement between the model year 2017 and 2018 requirements and increased overall compliance costs.

4.3 Alternative C: Do Not Amend Program

Staff also considered not recommending any amendments to the ZEV regulation. In this case, PZEVs and AT PZEVs would continue to be an option for compliance through model year 2018 and require no more than 1.7 percent of manufacturer's new vehicles to be ZEVs in 2018 and subsequent model years. Additionally, manufacturers would be required to produce more ZEVs in the Section 177 ZEV states, due to the travel provision expiring for Type I, I.5, and II ZEVs (BEVs) following model year 2014, and expiring for Type III, IV, and V ZEVs (FCVs) following model year 2017. Staff rejected this alternative because it is not consistent with achieving a commercial market for ZEVs or TZEVs.

5 ECONOMIC IMPACTS

This section discusses the economic impacts of the ZEV requirements on regulated manufacturers inside and outside California, individual consumers, and local and State government. For the manufacturers, the impact is from higher manufacturing costs, which is expressed as an incremental price above a baseline 2016 gasoline vehicle, and the total compliance costs (calculated as the sales multiplied by the individual incremental prices for any given year). The economic impacts to consumers are presented in a variety of ways, including the impact of the incremental price they would see when purchasing a ZEV (assuming the manufacturer passes all of the costs of compliance to the ZEV compliance vehicles), juxtaposed with the cost savings they would recover when operating the vehicle, the incremental costs to all vehicles if the compliance costs of the ZEV program were spread across the entire new vehicle fleet and a discussion of other factors influencing the price of ZEVs in the marketplace. For local and State government, impacts are presented qualitatively.

5.1 Legal Requirement

Sections 11346.3 and 11346.5 of the Government Code require state agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include consideration of the impact of the proposed regulation on California jobs, business expansion, elimination, or creation, and the ability of California businesses to compete. State agencies are also required to estimate the cost or savings to any state or local agency and school districts in accordance with instruction adopted by the Department of Finance. This estimate is to include any nondiscretionary costs or savings to local agencies and the costs or savings in federal funding to the state.

5.2 Directly Affected Businesses

At present, there are no companies in California whose sales volumes are high enough for them to be considered IVMs to make them subject to the existing ZEV requirements or the proposed amendments. There are three California-based businesses that could be subject to this regulation in the future. Three motor vehicle manufacturing plants are located in California: a Fremont facility and Palo Alto facility owned by Tesla Motor Company, and an assembly facility in Benicia owned by Coda. Due to staff's proposed amendment to count ZEVs in a manufacturer's applicable sales volume (as discussed in section 2.2.10, above), these three California manufacturers could become subject to the ZEV regulation if their individual California sales volume each exceed 4,500 vehicles per year.

Outside of California, LVMs and IVMs subject to the ZEV regulation are directly affected by the proposed amendments. As described in Section 2.2.1, nearly all manufacturers are required to comply with the current ZEV regulation. The largest six vehicle manufacturers, which account for nearly 80 percent of California's LDV

market, are currently required to make ZEVs, which results in a greater economic impact. The eight IVMs are allowed to comply with PZEVs, which are nearer to conventional technology, and are usually less financially impacted. However, due to staff's proposed amendments which redefine the size of the IVM and LVMs (discussed in Section 2.2.1), it is projected that 12 manufacturers, accounting for approximately 97 percent of all LDV PC and LDT sales, will be directly regulated to make ZEVs starting in 2018 model year.

5.2.1 Potential Impact on Manufacturers

Manufacturers may take many different paths to comply with the ZEV regulation. In general, as a result of staff's proposed amendments, regulated manufacturers are likely to adjust their future vehicle product portfolios and accelerate development and production of advanced technology vehicles. This will have a direct impact on research, development, and production programs, and a secondary impact on the suppliers of components and infrastructure. A manufacturer's involvement in advanced technologies for global markets and the manufacturer's quantity of banked ZEV credits, will also affect the impact from the regulation. The impact of the proposed amendments will affect manufacturers differently depending on the size of their California sales, company resources, and technology expertise.

Technology Choice

In general, manufacturers with larger market shares, like Toyota and General Motors, sell a larger variety of cars and trucks. Though staff predicts most ZEVs and TZEVs will be primarily PCs, manufacturers' compliance strategies for the ZEV regulation may take into account a specific technology best suited for varying platform sizes. For example, manufacturers with a broad mix of cars and trucks may pursue multiple technologies to apply across their varied platforms. However, manufacturers with fewer and more consistent platforms may pursue a single technology that applies well to their model mix. Examples of platform specific considerations for the various technologies follow:

- BEVs may predominantly be on small car platforms given the relationship between vehicle weight, range and cost associated with batteries. Namely, to minimize cost and maximize range, batteries are applied to the smallest or lightest vehicles. Additionally, smaller platforms are a better match with vehicles limited to 100 to 150 miles electric range that may be predominantly used in urban areas.
- FCVs may predominantly be on mid-sized car and light truck platforms given their longer-range performance and the capability to scale up powertrain output with less additional weight compared to batteries (adding range is a function of adding hydrogen storage capacity which can be done more cost effectively than adding batteries on a BEV in larger vehicle platforms).

- PHEVs may be developed on a wide range of platforms depending on the size of the battery used. The more battery dominant the drive-train, the smaller the platform that will likely be used.

5.2.2 Incremental Direct Manufacturing System Costs Estimates

For manufacturers, incremental cost represents the added cost to manufacture advanced vehicle components and higher material costs (e.g. lithium for batteries and platinum for fuel cells). In some cases, specific advanced vehicles are more complex than conventional cars (e.g. PHEVs have both combustion engines and batteries). Determining incremental costs is important to evaluate the impact to manufacturers when coupled with total sales.

For this analysis, staff estimated incremental direct manufacturing system costs for each model year of the regulation and compared them to a 2008 baseline gasoline vehicle.³⁸ Model year 2008 is used as a technology reference for the GHG-reduction effectiveness calculations because it is the year with the most comprehensive dataset (e.g., for sales, footprint, technology, CO₂ emissions for every model), and it closely matches the vehicle simulation modeling baseline. As a result, incremental technology costs are also indexed to the 2008 technology level. Subsequent calculations of incremental compliance costs for new proposed regulations are relative to the technology required to comply with existing regulations, including model year 2016 GHG standards. A description of cost impacts for each technology follows:

Plug-in Hybrid Electric Vehicles

The variation in the incremental costs for PHEVs between vehicle classes is smaller than the BEV technology given the smaller battery pack size. However, PHEVs will remain inherently more complex than BEVs because of the combustion engine.

Battery Electric Vehicles

The incremental costs are particularly sensitive to the vehicle's electric range given its direct relationship to the size of the battery pack.

Fuel Cell Vehicles

FCVs are expected to have higher incremental costs when first introduced into the market compared to BEVs, but will decline rapidly with production volumes (2012 vs. 2025 system costs shown in Table 5.1).

The most expensive components of ZEVs are the battery modules and fuel cell systems. To better understand the declining costs of these advanced components, Table 5.1, below shows the direct manufacturing costs of the battery packs and fuel

³⁸ As described in the LEV III ISOR, staff developed a comprehensive model for projecting the incremental costs of advanced vehicle technologies in future years. This modeling effort was conducted jointly with the U.S. EPA and NHTSA in support of the Federal rulemaking, and was first presented in the Technical Assessment Report (EPA, 2010). This analysis was revised in 2011 and is outlined in the LEV III ISOR Section III-A-4.3.

cell systems³⁹ for midsize platforms. Because, as shown in the table below, incremental system costs decrease with increased volume, staff's proposal will have the effect of decreasing per vehicle direct manufacturing system costs as compared to the existing requirements. Incremental system costs are shown for multiple years between 2012 and 2025, revealing the declining cost of batteries and fuel cells over time as production volumes rise.

Table 5.1: Incremental Direct System Manufacturing Costs* (2009\$)

	2012	2015	2020	2025
System per-vehicle costs (\$) ^a				
PHEV20 battery pack	8,078	6,462	3,309	2,647
BEV100 battery pack	21,367	17,094	8,752	7,002
FCV fuel cell system	18,908	10,208	5,220	4,756
System per-unit costs				
PHEV20 battery pack (\$/kWh)	1053	842	431	345
BEV100 battery pack (\$/kWh)	605	484	248	198
FCV fuel cell system (\$/kW)	163	88	45	41

*Based on midsize car / small multipurpose vehicle class, as compared to a 2008 baseline; Figures 3 and 4, in Section 2.2.3, show the system costs graphically.

Battery packs and fuel cell stacks are assumed to last the life of the vehicle (no replacement). As compared to BEVs where the system cost is predominantly the battery pack, FCVs include three major sub-systems in addition to the electric drive components shared by both technologies. The three sub-systems include the fuel cell system (fuel cell stack and auxiliary equipment), the hydrogen storage assembly, and the hybrid battery pack (similar size to existing conventional hybrids).

The table above shows that incremental system costs decline with volume production – an important reason that the ZEV requirements ramp up through the program years. It is also important to point out that the incremental system costs of FCVs drop below the incremental system costs of BEVs in the later years of the program. This factor was used in the staff's estimates of vehicle technology mix in the expected compliance scenario.

5.2.3 Vehicle Package Incremental Prices

To determine the total impact to manufacturers, staff analyzed incremental vehicle prices for each ZEV technology. Incremental vehicle prices include the direct manufacturer costs, as shown above, as well as an indirect cost multiplier (ICM). As described the LEVIII ISOR Section III-A-4.3, the ICM markup includes a number of indirect cost components, including overhead, warranty, RD&D, depreciation, marketing, and dealer profit. Table 5.2 below shows the ICM values used in the full ACC analysis. The "High 2" complexity category was used for the BEV and PHEV platforms, whereas "High 1" was used for FCV platforms (and non-battery components for PHEVs).

³⁹ These costs differ from those in Table 6.1 as they do not include all other package components such as electric motors, power electronics, or small combustion engines for PHEVs, and are compared to a 2008 baseline rather than a 2016 baseline vehicle.

Table 5.2: (Un-Modified) Indirect Cost Multipliers

Tech Complexity Level	Near term (2017-2021)	Long term (2022-2025)
High 1	1.56	1.35
High 2	1.77	1.50

Note: ICM factors shown are approximate; mark-up factors involve separate components for warranty and non-warranty related indirect costs

These ICM factors for advanced vehicles are conservative estimates about how these advanced technology cost factors (by battery and fuel cell stack developers, in-house or at supplier companies) may ultimately affect automakers' indirect costs. Hereafter, the ICM values in Table 5.2, above, will be referred to as "un-modified ICMs".

For comparison, an alternate ICM value of 1.33 (modified ICM) was also analyzed to represent the scenario where the auto industry better manages the associated complexity and indirect costs associated with the emerging advanced technologies. Staff believes that this lower ICM is of higher likelihood as ZEVs are commercialized and automakers work in-house and with suppliers to minimize the cost factors inherent to the ICM framework. The National Academy of Sciences (NAS) similarly suggests lower ICM values in its 2011 technology assessment for hybrid and plug-in vehicles due to the likelihood that many of the indirect costs (e.g., engineering, labor, overhead, and integration costs) would otherwise be double counted.⁴⁰

Table 5.3 below, shows the sensitivity of incremental vehicle prices to the ICM assumption. All values are referenced to a MY2016 average baseline technology.

Table 5.3: ICM Sensitivity Analysis of Incremental Vehicle Price

	<i>Un-Modified ICM</i>		<i>Modified ICM</i>	
	2020	2025	2020	2025
PHEV20 (6.6 kWh)	10,249	8,448	7,969	7,312
BEV100 (30 kWh)	14,593	10,829	11,428	9,406
FCV (3.3 kg H ₂)	9,811	7,513	8,224	7,387

All technologies on subcompact platforms.

As shown, the use of a 1.33 ICM factor would bring down BEV and PHEV costs by \$1000 to \$3000 per vehicle; the lower ICM would reduce FCV costs by \$200 to \$1500. Staff believes that the 1.33 is likely to be a maximum ICM for the cost multiplier for the indirect costs of conventional hybrids and PHEVs and that BEV technology is likely to have a lower cost multiplier (though higher gross per-vehicle indirect cost) due their reduced OEM integration complexity (i.e., without combustion engine and associated integration issues). Nonetheless, the un-modified, more conservative ICMs were utilized for consistency with the LEV III analysis (and related joint-agency technology cost analysis).

Table 5.4, below, shows incremental ZEV technology prices for model years 2016 and 2025. Model year 2016 was chosen as the reference vehicle technology for this

⁴⁰ NAS, 2011. National Academy of Sciences. 2010. Committee on the Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy; National Research Council "Assessment of Fuel Economy Technologies Light Duty Vehicles".

analysis, as it is the final model year of the currently adopted GHG regulations.⁴¹ So for example, for the 2025 model year comparison, a 2025 model year vehicle with 2016 technology was compared with a 2025 model year vehicle equipped with technology necessary for meeting the new proposed standards in 2025.

Table 5.4: Incremental technology package prices above average MY2016 baseline technology (2009\$)¹

Vehicle Class	Technology Package (energy capacity) ²	Incremental Vehicle Price in 2016	Incremental Vehicle Price in 2025
Subcompact	PHEV20 ³ (6.6 kWh)	13,233	8,448
	PHEV40 (13.4 kWh)	16,580	10,259
	BEV75 ⁴ (23 kWh)	17,010	9,405
	BEV100 (30 kWh)	19,655	10,829
	FCV ⁵ (3.3 kg H ₂)	19,060	7,513
Midsize car / Small MPV	PHEV20 (7.7 kWh)	13,807	8,876
	PHEV40 (15.5 kWh)	17,818	11,043
	BEV75 (27 kWh)	17,562	9,794
	BEV100 (35 kWh)	20,785	11,551
	FCV (3.8 kg H ₂)	23,472	9,334
Large Car	PHEV20 (9.1 kWh)	17,280	11,205
	PHEV40 (18.7 kWh)	23,134	14,390
	BEV75 (30 kWh)	20,820	11,628
	BEV100 (40 kWh)	23,959	13,363
	FCV (4.3 kg H ₂)	33,238	13,406

¹ Refer to the LEVIII ISOR Section III-A-4.3 and Appendix R for additional vehicle packages

² Energy capacity for BEV/PHEV is kWh rated battery pack capacity, kg H₂ for FCV

³ EPA and NHTSA designation for a PHEV is a "range extended electric vehicle" or REEV.

⁴ For BEVs and PHEVs, the residential charging equipment costs are included in these technology packages.

⁵ FCV costs include the fuel cell system (as shown in later figures), the hydrogen storage system, the hybrid battery module, and other EV components and power electronics similar to the BEV technology package.

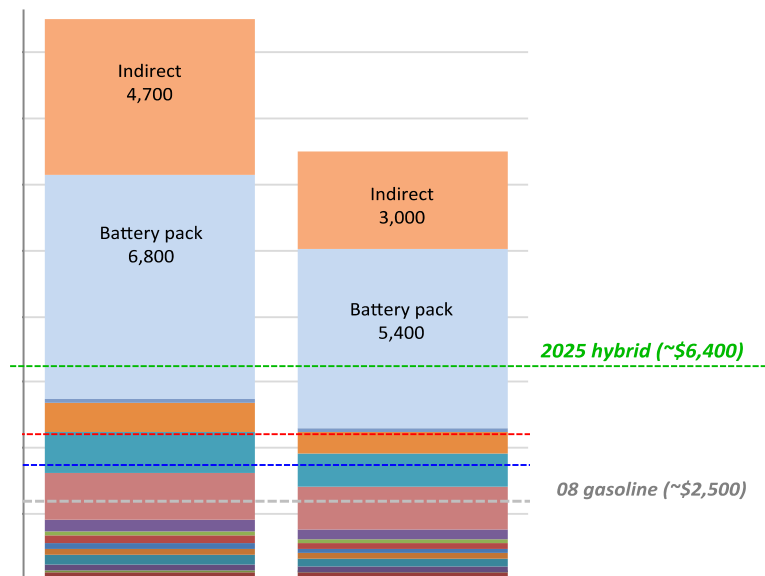
5.2.4 Component Costs and Baseline Comparisons

Figures 13 and 14, below, show the individual component costs of BEVs and FCVs, along with the ICM, above reference 2016 model year technology. The figures show the break-out for various components within the vehicle, displaying the relative difference in cost between individual parts and the projected cost reduction from learning effects between 2020 and 2025. Several gasoline vehicle reference points are shown for context. Note that these two figures show a baseline 2008 powertrain (i.e., engine and transmission) at \$2500, and a model year 2016 vehicle would represent about \$1000 per vehicle in additional cost. Also note that several of the BEV and FCV components that are shown (aerodynamics, low rolling resistance tires, improved accessories) in the figures are also likely to be deployed widespread on future gasoline vehicles. As described in Section 5, the battery costs are the dominant

⁴¹ Staff notes that model year 2008 is the technology level from which vehicle attributes are well characterized and is the fundamental reference for technology, cost, and emission-reduction effectiveness in ARB staff's joint work with the federal agencies on LEV III assessment. The average projected incremental price for model year 2016 non-ZEV vehicle modifications related to the LEVIII GHG program is \$951 per vehicle over the model year 2008 reference.

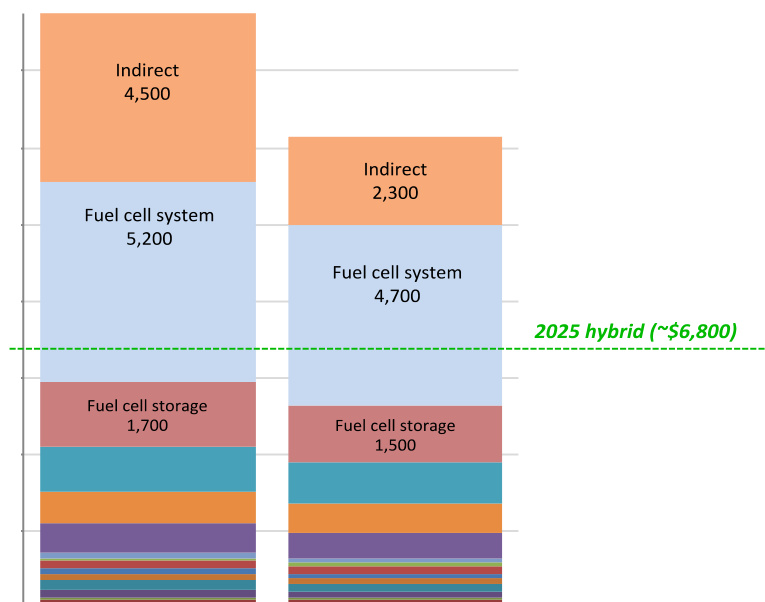
factor for BEVs, and the fuel cell system coupled with the hydrogen storage assembly dominate the costs for FCVs.

Figure 13: BEV Component Costs and ICE Comparisons (2009\$) *



*Component costs reflect subcompact 100 mile BEV

Figure 14: FCV Component Costs and ICE Comparisons (2009\$)*



*Component costs reflect mid-size 350 mile FCV

5.2.5 Annual Manufacturer Costs

For manufacturers, an annual compliance cost is calculated by multiplying the total advanced vehicles required due to staff's proposal by the incremental prices for each vehicle type and size. Due to staff's proposal to increase the 2018 and subsequent model year ZEV requirement, regulated manufacturers will experience an increase in compliance costs as compared to current ZEV requirements. Table 5.5 shows the annual impact to manufacturers (for two model years: 2020 and 2025) due to staff's proposed changes, and the difference in impact as compared to the existing regulation.

The compliance costs in Table 5.5, below, include the un-modified ICM mark-up. It was important to directly capture all of these cost components in the estimated compliance cost. The small fraction associated with assumed profit would represent future expenditures on required RD&D or costs to supplier systems.

Table 5.5: Estimated Annual Compliance Costs for 2020 and 2025* (2009\$)

	2020			2025		
	Sales - Rounded (vehicles)	Average Incremental Vehicle Price	Total Cost (millions)	Sales – Rounded (vehicles)	Average Incremental Vehicle Price	Total Cost (millions)
Staff Proposal						
BEV	39,000	12,900	\$502	65,000	9,500	\$618
FCV	11,000	12,400	\$136	44,000	9,300	\$411
PHEV	93,000	10,900	\$1,017	164,000	8,900	\$1,465
Total	143,000	11,600	\$1,655	272,000	9,200	\$2,494
Existing Regulation						
BEV	22,000	13,000	\$287	16,997	9,700	\$164
FCV	6,000	10,800	\$65	11,331	8,000	\$90
PHEV	35,000	10,400	\$363	33,993	8,700	\$295
Total	63,000	11,400	\$715	62,321	8,800	\$550
Total Incremental Costs			\$940			\$1,983

* Costs are based on incremental ZEV technology vehicle prices above non-ZEV model year 2016 technology

The incremental costs in Table 5.5 above represent an average of incremental prices amongst various platforms, found in Table 5.4. Lower incremental costs in the "Existing Regulation" case are due to lower volumes being assumed on smaller platforms with lower incremental prices. The higher volumes required by staff's proposal result in ZEV technologies moving into larger platforms, and therefore have a higher incremental price per vehicle.

Staff estimates the entire incremental compliance cost for the ZEV proposal alone, above the existing regulation for the years 2018-2025, to be approximately \$10.5 billion. However, subsection 5.2.6 will discuss the cost of the proposed amendments to the ZEV regulation in context with compliance with LEV III fleet average standards.

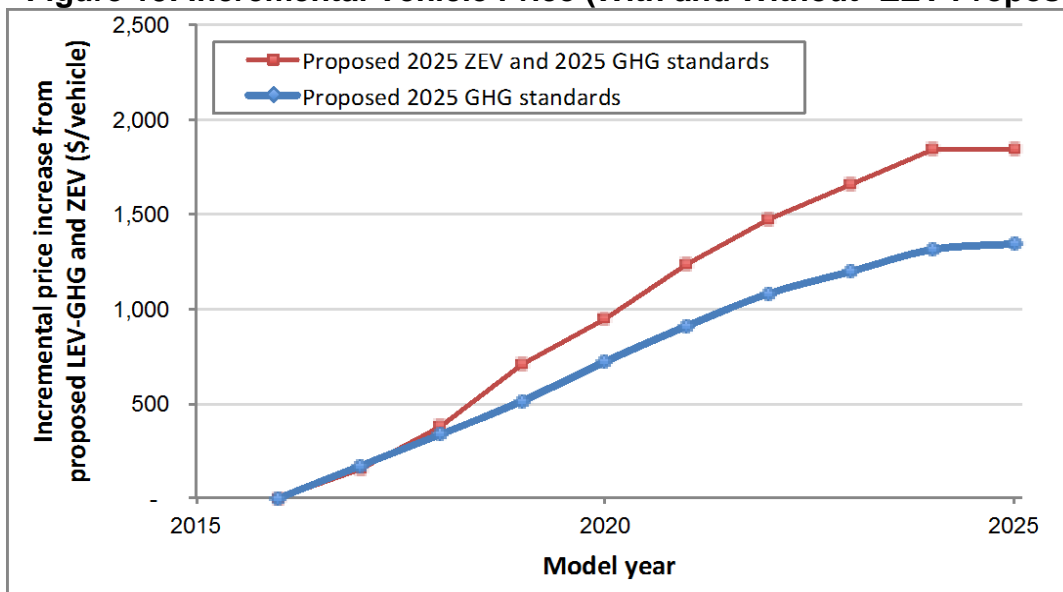
5.2.6 Incremental Price Increase in the Context of Advanced Clean Cars

The ZEV regulation must be considered in conjunction with the proposed LEV III amendments. Vehicles produced as a result of the ZEV regulation are part of a

manufacturer's light-duty fleet and are therefore included when calculating fleet averages for compliance with the LEV III GHG amendments. Because the ZEVs have ultra-low GHG emission levels that are far lower than non-ZEV technology, they are a critical component of automakers' LEV III GHG standard compliance strategies. As such the ZEV program cost is considered as the difference in complying with the LEV III GHG fleet standard without the proposed amendments to the ZEV regulation versus with the proposed amendments to the ZEV regulation.

Assuming that all of the associated direct manufacturing and ICMs are passed on to consumers, the average incremental price increase that results from the proposed LEV III GHG fleet standards and proposed ZEV regulation over the 2017 through 2025 timeframe will differ from the average increase resulting from compliance with only the LEV III GHG amendments. The average incremental vehicle price due to proposed LEV III GHG standards, but with no amendments to the current ZEV regulation, in 2025 is expected to be \$1,340. The average incremental vehicle price considering the proposed LEV III GHG fleet standards and the proposed ZEV requirements in 2025 model year increases to \$1,840, a \$500 incremental increase. Using the modified ICM, the incremental price increase due to the proposed ZEV requirements would be \$370 instead of \$500. Figure 15 below shows the incremental vehicle prices, with and without staff's proposed amendments to the ZEV regulation. In the broader context of the overall fleet, the ultra-low GHG ZEV technology is a major component of compliance with the LEV III GHG fleet standards for the overall light duty fleet. In that fleet context, the overall cost of the ZEV program is the difference in costs between the "GHG-plus-ZEV" and the "GHG only" scenarios.

Figure 15: Incremental Vehicle Price (With and Without* ZEV Proposal)



*Proposed 2025 GHG Standards means 2025 GHG standards with no change to the current ZEV requirements.

Table 5.6 summarizes the total incremental cumulative cost of the ZEV program in two different contexts. First, the incremental cost of the expected deployment of ZEV technology is summed versus the reference model year 2025 as if the current

requirements for the ZEV regulation remained unchanged. This cumulative ZEV incremental technology cost is equivalent to \$10.5 billion over 2018 through 2025 model years. In the second context, the amended ZEV program vehicle cost is compared in combination with compliance with the LEV III amendments. As illustrated above in Figure 15, the difference between LEV III GHG with the existing ZEV regulation and GHG with the proposed ZEV regulation in each model year (times the number of total vehicles sales) is the equivalent cost premium of the ZEV program. In this overall fleet context where the ZEV technology produces substantial GHG reductions in the LEV III program, the additional cost of the amended ZEV program is \$4.6 billion over 2018-2025 model years.

Table 5.6: Estimated Compliance Costs for ZEV regulation in two contexts

	Program cost, MY2018-2025
ZEV technology - Incremental compliance cost from proposed ZEV amendments to current ZEV program	\$10.5 billion
Incremental compliance - Incremental cost to comply with GHG program with new ZEV program (versus without new ZEV program) through each model year	\$4.6 billion

5.3 Potential Impacts to Individuals (Car Buyers)

For individual consumers, incremental price represents the added price they would pay for a ZEV compliant car over a baseline vehicle, creating a higher “initial” or “up front” cost. For this analysis, staff estimated incremental prices for each model year of the regulation and compared them to 2016 baseline vehicle technology. Determining incremental prices is important to evaluate the potential upper bounds impact to individual consumers, and is later coupled with operating cost savings to determine payback periods.

Staff’s proposed amendments will likely decrease the per-vehicle initial cost to consumers compared to the existing regulation because of the impact of higher production volume reducing incremental costs, but costs will remain \$7,500 to \$14,500 higher than the 2016 vehicle technology in 2025. The incremental price per vehicle can be found in subsection 5.2.3 above.

5.3.1 Lifetime Costs and Consumer Payback⁴²

With significant changes in technology and in alternative fuels, car buyers have the opportunity to think about the cost of their personal transportation choices differently by considering both initial purchase prices and in-use costs such as fuel, maintenance and other factors. As shown below in Table 5.7⁴³, ZEVs’ incremental price increase is paid back over the life of the car. Table 5.7 below outlines the lifetime costs and consumer savings resulting from staff’s proposed amendments. Lifetime costs include varying fuel costs due to improved efficiency and using an alternative fuel, electric

⁴² See Appendix C for cost inputs and assumptions.

⁴³ A further explanation on lifetime costs can be found in the LEV VIII ISOR Section III-A-4.4.

charging equipment purchases, and vehicle and equipment purchase incentives. The table shows the incremental prices for vehicles purchased in 2025 and then shows lifetime consumer savings.

Table 5.7: Lifetime Costs and Consumer Payback^a (2009\$)

Technology Package ^b	Incremental Vehicle Price in 2025 ^c	Lifetime Consumer Savings ^d
PHEV20 (7.7 kWh)	8,876	10,382
PHEV40 (15.5 kWh)	11,043	10,565
BEV75 (27 kWh)	9,794	10,594
BEV100 (35 kWh)	11,551	10,594
FCV (3.8 kg H ₂)	9,334	6,067

^a Costs based on incremental vehicle prices above a 2016 baseline technology

^b Based on mid-size car / small multipurpose vehicle

^c Vehicle prices, including residential charging equipment/installation costs for plug-in vehicles

^d Average car lifetime in California is 14 years, 186,000 miles; Future fuel savings discounted by 5%.

Fuel prices from CEC (e.g., for 2025, gasoline = \$4.02/gal); electricity = \$0.15/kWh; Hydrogen = \$6/kg

ARB estimates the median life in California for PCs is 14 years, or approximately 186,000 miles. For two vehicle types shown, the consumer payback occurs within the median life of the vehicle. The “consumer payback period” is the year at which the cumulative fuel savings equals the incremental purchase price. Though the payback period will not occur within the life of the vehicle for the three other vehicle types, consumers will still experience \$6,000 to \$10,000 in lifetime savings. Note that these savings are based on average annual VMT; to the extent that consumers travel more or less than average or own their vehicles for longer or shorter than the median life, savings could be higher or lower.

As discussed further in this subsection 5.2.4, manufacturers may also spread some or all of the compliance cost of ZEVs across their whole vehicle fleet, which would reduce the incremental cost per ZEV vehicle, as well as the consumer payback period. The LEV III ISOR shows when costs for LEV and ZEV compliance are considered in a join context, the average payback period is 3 years for model year 2025 vehicles. Other factors that impact the actual cost of ZEVs to consumers are discussed below in subsection 5.3.2.

5.3.2 Other Cost Factors

This section has so far laid out the incremental price of ZEVs compared to conventional cars as well as the incremental impact of the ZEV amendments in the context of the entire ACC program. But there are other factors that may influence the price, operating cost savings and operational benefits of ZEVs. Some of these are discussed below.

These additional economic factors are not quantified as a part of staff’s analysis of the proposed amendments, but can be evaluated at a future time when they are better understood.

- International Factors: If a manufacturer is developing ZEVs for other markets outside of the United States, it will be better prepared to meet staff’s proposed

ZEV requirements in 2018 and subsequent model years. Coupled with the production plans for BEVs and PHEVs from manufacturers, substantial international investments are being made into advanced battery production and development. These trends are outlined in several studies, including Roland Berger^{44,45} and the International Energy Agency's recent EV Roadmap⁴⁶. As global markets grow, the production capacity is growing rapidly which helps to bring costs down.

National government support for battery manufacturing, vehicle development, and incentives are also influential factors in international market costs (e.g. China, Japan, United States).⁴⁷ The European Union (EU), particularly France and Germany, have strong policies and incentives supporting FCVs, BEVs, and PHEVs. China has substantial vehicle incentives, infrastructure funding, and manufacturing subsidies in place. South Korea has national support for hydrogen infrastructure. Japan has infrastructure support for both electricity and hydrogen. In addition to centralized financial support, national emission regulation targets will also influence advanced vehicle programs. The EU, China, and Japan all have aggressive gCO₂/kilometer targets for the 2020-2025 timeframe.⁴⁸

- Vehicle Maintenance – Although BEVs and FCVs still have some moving parts, the number of components and fluids that need to be serviced is likely to be lower than conventional vehicles. Although this is difficult to estimate today, it is expected that BEVs and FCVs will have lower maintenance costs over the life of the vehicles. As an example, Ford has recently stated that maintenance costs of its upcoming Focus BEV could be \$1,200 lower than the conventional Focus over 10 years.⁴⁹
- Low Carbon Fuel Standard (LCFS) credit value – Depending on policy decisions by ARB and the California Public Utilities Commission (CPUC), LCFS credit value for electricity may be returned to electricity providers and ultimately ZEV drivers. A recent research study identified the potential revenue this would provide for BEV users. With California's 2020 grid, the value could range from \$75 per vehicle per year (at \$25 per tonne CO₂ equivalent) to \$300 per vehicle

⁴⁴ Roland Berger, 2010a. Roland Berger Strategy Consultants "Powertrain 2020: Li-Ion Batteries – The Next Bubble Ahead"

⁴⁵ Roland Berger, 2011. Roland Berger Strategy Consultants. "Automotive Landscape 2025: Opportunities and Challenges Ahead"

⁴⁶ IEA, 2011. International Energy Agency, June 2011. "Technology Roadmap – Electric and Plug-in Hybrid Electric Vehicles"

⁴⁷ PRTM, 2011. PRTM and World Bank, April 2011 "The China New Energy Vehicles Program – Challenges and Opportunities"

⁴⁸ ICCT, 2011. International Council on Clean Transportation, April 2011 Update. "Global Light-Duty Vehicles: Fuel Economy and Greenhouse Gas Emissions Standards"

⁴⁹ PluginCars, 2011. PluginCars.com. Zach McDonald. February 9, 2011. "Ford Pushes Key Marketing Message: Lower Maintenance Costs." <http://www.plugincars.com/ford-pushes-key-marketing-message-electric-cars-lower-maintenance-costs-106793.html> Accessed September 26, 2011.

per year (at \$100 per tonne CO₂ equivalent).⁵⁰ This could result in a fueling rebate, or discount on electricity rates for PHEVs and BEVs.

- Fuel tax change – The current state and national gasoline taxes are no longer sufficient as the LDV fleet becomes more efficient and as alternative fuels are introduced. Several national studies have identified the scale of the funding gap and potential solutions Congress could consider.^{51,52} This may change into a VMT-based tax, which would treat all fuels equally, or may become an energy-based tax which would favor alternative fuels with lower WTW energy usage. Currently, hydrogen and electricity for transportation do not pay road taxes, though their contribution to the funding shortfall is small.
- Feebates – A revenue neutral feebate policy on new vehicles would increase purchase costs for vehicles with higher carbon emissions while reducing costs for vehicles with lower carbon emissions. A recent study prepared for ARB analyzed a California specific feebate policy and the potential benefits and challenges.⁵³ As financial purchase incentives are discontinued in the next few years, a feebate policy could create a permanent cost offset for efficient advanced vehicles without relying on government funds.
- Battery grid services - For BEVs and PHEVs, there may be additional revenue opportunities in the future for battery second-life usage^{54,55} and vehicle-to-grid services. However, these factors are speculative at this point and would require a number of barriers to be addressed. California stakeholders, such as the CEC, CPUC, and Electric Power Research Institute (EPRI), are studying these concepts.
- Non-Monetary Factors affecting Purchase Behavior – It is important to note that initial purchase price, lifetime costs, and payback estimations are not the dominant factors to all buyers; a certain fraction of consumers will consider non-monetary factors when purchasing their vehicle. The convenience of charging a vehicle at home and work, the synergies of integrating vehicles with the electric grid, the attractiveness of electric drive characteristics (reduced noise, low speed torque from FCVs and BEVs), energy security benefits (reduced oil consumption), making a “green” purchasing decision (reducing emissions), access to high-occupancy vehicle lanes, and even the ability to

⁵⁰ UC Davis, 2011a. University of California, Davis. Chris Yang. June 23, 2011. “Fuel Electricity and Plug-in Electric Vehicles in an LCFS.”

⁵¹ Carnegie, 2011. Carnegie Endowment, 2011. “Road To Recovery – Transforming America’s Transportation” http://carnegieendowment.org/files/road_to_recovery.pdf

⁵² Greene, 2011. David Greene, Transportation Research Part D, 2011. “What is greener than a VMT tax? The case for an indexed energy user fee to finance U.S. surface transportation”

⁵³ UC Davis, 2011b. University of California, Davis. D. Bunch and D. Greene, February 2011. “Potential Design, Implementation, and Benefits of a Feebate Program for New Passenger Vehicles in California: Final Report.”

⁵⁴ NREL, 2011b. National Renewable Energy Laboratory. J. Neubauer and A. Pesaran. June 2011. “*The ability of battery second use strategies to impact plug-in electric vehicle prices and serve utility energy storage applications.*”

⁵⁵ UC Berkeley, 2011. University of California, Berkeley. B.Williams and T.Lipman. April 2011. “*Analysis of the combined vehicle and post vehicle use value of lithium ion plug-in vehicle propulsion batteries.*” (Draft Final)

directly connect renewable power to BEVs and PHEVs at home may influence the value customers consider in purchasing these vehicles.^{56,57}

5.4 Potential Impact on Business Competitiveness

Automobile manufacturing in California represents a small fraction of the State's economy, less than 0.5 percent. The California businesses impacted by this regulation are largely indirectly affected as affiliated businesses such as gasoline service stations, automobile dealers, and automobile repair shops. Affiliated businesses are mostly local businesses. These businesses compete within the State and generally are not subject to competition from out-of-state businesses. Therefore, the proposed regulations are not expected to impose significant competitive disadvantages on affiliated businesses.

5.5 Potential Impact on Business Creation, Elimination or Expansion

California businesses that purchase the same LDVs as consumers would, like consumers, pay higher prices for the vehicles but save on operating costs, as is discussed in Section 5.3 above.

It is very likely that savings from reduced vehicle operating costs would end up as expenditures for other goods and services. These expenditures would flow through the economy, causing expansion or creation of new businesses in several sectors. Staff's economic analysis shows that as the expenditures occur, jobs and personal income increase. As discussed in the LEV III ISOR, the Environmental Revenue Dynamic Assessment Model (E-DRAM) was used to assess the overall impact of the regulation on California's economy. Specifically, E-DRAM was used to estimate impacts on California's output of goods and services, personal income, and employment. In the analysis for the full ACC program which includes the proposed amendments to the ZEV regulation, jobs increase by 0.1 percent in 2025, and 0.2 percent in 2030 compared to the baseline economy that excludes the proposed ACC program. Similarly, personal income grows by \$1 billion in 2020, by \$3 billion in 2025, and \$6 billion 2030. The estimates of the regulation's impact on these economic factors are used to assess the potential impacts on business creation, elimination, or expansion in California.

Staff's proposed amendments will likely increase benefits to companies specializing in ZEVs and ZEV infrastructure. The creation of these businesses cannot be fully attributed to staff's proposed amendments. Business and job creation from advanced vehicle technologies is part of the clean technology sector, which is currently experiencing higher than average job growth in California and nationally.⁵⁸ However,

⁵⁶ UC Davis, 2010. University of California, Davis. J.Axsen and K.Kurani. July 2010. *"Reflexive Layers of Influence (RFI): A model of social influence, vehicle purchase behavior, and pro-societal values."*

⁵⁷ UC Davis, 2011c. University of California, Davis. T.Turrentine et al. May 2011. *"The UC Davis MINI E Consumer Study."*

⁵⁸ Brookings, 2011. The Brookings Institution. M. Muro, J. Rothwell, and D. Saha. "Sizing the Clean Economy: A National and Regional Green Jobs Report"

staff's proposal will likely increase opportunities for California-based manufacturers to generate credits through production of ZEVs and TZEVs to increase flexibility for regulated manufacturers who may purchase credits for ZEV regulation compliance. Some specific sectors are discussed below.

5.5.1 Manufacturing

Staff's proposed amendments will require increased manufacturing of ZEV and PHEV componentry. There is very little vehicle component and final assembly in California, most of it occurring in other parts of the United States and internationally. However, as the ZEV amendments are expected to increase demand for these components and vehicles, these businesses would likely expand, which could offset any reductions experienced in the conventional vehicle segment.

In California, smaller manufacturers not currently mandated to build ZEVs under the regulation do have plans to increase ZEV and ZEV component production. One vehicle assembly plant in the state, formerly a joint venture between General Motors and Toyota that produced conventional vehicles, was recently purchased by Tesla, a California company developing BEVs. Tesla intends to use the facility to manufacture the Model S BEV due to arrive on the market in mid-2012. At one time, the Fremont facility employed approximately 4,000 people. Under Tesla's plans, it may employ nearly 1,000 people. Coda Automotive, another California BEV company has announced plans to assemble vehicles in Benicia, California.⁵⁹

5.5.2 Infrastructure

Staff's proposed amendments will increase demand for fueling infrastructure in California. There are several California-based companies developing electric vehicle charging equipment, including Coulomb, AeroVironment, Better Place, Clipper Creek, and 350Green. Additional non-California based electric vehicle supply equipment (EVSE) providers are installing equipment in the state to support the growing BEV and PHEV markets – including ECotality, Leviton, and General Electric. Many of these companies are leveraging external grants, for example U.S. DOE awards, and marketing and installing chargers in California.⁶⁰

Several major companies are entering the EVSE market and using traditional large retail outlets. General Electric is planning to distribute its EVSE, the WattStation, through Lowes home improvement stores.⁶¹ Ford and its EVSE supplier, Leviton, are partnering with Best Buy and its Geek Squad for retail and distribution of their equipment to homes.⁶² Over time, it is expected that partnerships will grow and innovative business models will emerge for servicing and installing EVSE.

⁵⁹ BusinessTimes, 2011. San Francisco Business Times, September 12, 2011. "Coda to assemble electric cars in Benicia" <http://www.bizjournals.com/sanfrancisco/news/2011/09/12/coda-to-assemble-evs-in-benicia.html>

⁶⁰ Coulomb, 2011. Coulomb ChargePoint America. Website. <http://chargepointamerica.com/>. Accessed September 20, 2011

⁶¹ Green Car Congress, 2011a. Green Car Congress.com, July 18, 2011. "GE Energy partners with Lowe's to provide EV chargers for home and commercial use; Siemens Energy providing chargers to Town of Cary, NC" <http://www.greencarcongress.com/2011/07/gesiemens-20110718.html> Accessed September 9, 2011.

⁶² Green Car Congress, 2011b. Green Car Congress.com, January 13, 2011 "Ford developed home charging station for the Focus with Leviton" <http://www.greencarcongress.com/2011/01/ford-20110113.html>

Staff's proposal will also create a demand for hydrogen fueling stations⁶³. Several companies are already active in developing these stations, including Air Products, Praxair, and Linde. Most of the hydrogen dispensed at these stations is expected to be produced within the state, primarily from central production facilities and then transported by truck to retail outlets. The Clean Fuels Outlet (CFO) ISOR provides more information regarding future hydrogen fueling demand, and infrastructure development.

5.6 Potential Costs to Local and State Agencies

The proposed amendments are not expected to result in an increase in costs for local and state agencies in the next three to five years. However, as advanced vehicles enter the fleet in larger numbers (10-15 years from now), there will likely be an impact to state and local revenue from vehicle and fuel sales taxes.

As a result of the projected fleet from the proposed ACC program, large revenue losses could occur in later years unless fuel tax policy changes occur. The vast majority of the fuel tax loss will result from gasoline vehicles given that the existing tax structure applies only to gasoline and diesel fuel and has not changed over the years to adjust for inflation or changes in consumption levels. Although a small portion of the funding shortfall, ZEVs will result in a loss of fuel taxes because there are currently no road taxes on hydrogen and electricity sold for vehicles. Between 2017 and 2025, if gasoline taxation rates remain the same, California fuel tax revenue losses would be approximately \$3.8 billion⁶⁴, only a small portion of which would be associated with the ZEV population. These state revenue losses will partially be offset by higher vehicle sales tax revenues given the higher incremental vehicle prices.

Although not a direct effect of the ZEV regulation, local governments will need to devote resources to planning and implementing electric charging and hydrogen infrastructure. These impacts are becoming clear as the Nissan Leaf and General Motors Volt are entering California communities, and as new hydrogen stations are being constructed today. These impacts can include the need to prepare city inspectors and permitting officials to approve residential charging equipment; the need for city planning officials to identify appropriate public and workplace charging; and the need for local officials to help evaluate and permit hydrogen stations.

To reduce the impact on local agencies, there are a number of programs designed to help communities implement planning programs for alternative fuels.^{65,66,67} For

⁶³ CaFCP, 2009. California Fuel Cell Partnership. CaFCP Action Plan, February 2009. "Hydrogen Fuel Cell Vehicle and Station Deployment Plan: A Strategy for Meeting the Challenge Ahead"
http://www.caftp.org/sites/files/Action_Plan_FINAL.pdf

⁶⁴ See Appendix C for more information.

⁶⁵ Sonoma, 2011. County of Sonoma (CA), General Services Department, July 2011. "Electric Vehicle Charging Station Program and Installation Guidelines"

⁶⁶ Rocky Mountain Institute, 2009. Rocky Mountain Institute, February 24, 2009. "Project Get Ready: Helping Communities Become Electrified Vehicle Pioneers"

electric charging infrastructure, the U.S. DOE and the CEC are both providing grants directly to local governments for planning purposes. To augment this resource, several partnerships are preparing guidance documents with best practices for local governments to aid in their implementation. For electric charging, one partnership is the California Plug-Electric Vehicle (PEV) Collaborative. For hydrogen, the California Fuel Cell Partnership has been working for a number of years to help local governments become prepared in planning, siting, and safety review of new stations. The U.S. DOE's Clean Cities coalitions (California has 13 of these cities) also are instrumental in helping local governments become prepared for a number of alternative fuels.

Implementation of the ZEV regulation requires staff resources to oversee annual compliance by manufacturers with ZEV program credits. As the regulation compliance requirements increase in future years, and more manufacturers are classified as LVMs, this state oversight role may require additional resources.

⁶⁷ RolandBerger, 2010b. Roland Berger Strategy Consultants in collaboration with Rocky Mountain Institute, 2010. "PEV Readiness Study."

6 EMISSIONS AND HEALTH IMPACTS

Staff's proposed ZEV amendments will result in an emissions benefit as compared to current ZEV regulations, as will the entire ACC program as compared to no ACC program. Staff performed a combined LEV, ZEV, and CFO emissions analysis, which can be found in Section V of the LEV ISOR. For the purposes of the ZEV regulation analysis, staff's emissions assessment includes both criteria pollutant, particulate matter (PM) and GHG emissions, accounting for both tailpipe emissions in PHEVs, and upstream emissions from all advanced technologies considered. As illustrated below, the ZEV requirements provide benefits beyond that achieved by using a fleet NMOG + NOx average as proposed in the LEV III criteria emission regulation. This is primarily because upstream criteria and PM emissions will be reduced after accounting for higher electricity and hydrogen production and lower gasoline production at refineries. However, because vehicles produced for the ZEV regulation are counted in the LEV III GHG fleet average standard, and because the GHG fleet average standard accounts for differences in upstream emissions for electricity and hydrogen, the ZEV regulation does not result in further GHG emission improvements beyond the LEV III GHG program.

The recently updated EMFAC 2011 was used to assess the vehicle emission impacts of staff's proposal. Using EMFAC, staff modeled the proposed requirements and compared these results to a vehicle fleet under the current ZEV regulation (ARB, 2011b). A separate model was used to estimate upstream emissions, including production and delivery of electricity and hydrogen and vehicle manufacturing emissions.⁶⁸ Emission impacts from the Regulatory Alternatives A (lower case) and B (higher case) are not presented here, although impacts from Alternative C (existing regulation) are shown.

As stated in Section 1, climate change poses a serious threat to the economic well-being, public health, natural resources, and environment of California. According to staff's 2009 analysis, ZEVs are the most important technology for the LDV to achieve long-term GHG emission reductions. As for criteria pollutant emissions, NOx emissions in the greater Los Angeles region must be reduced by two thirds to meet the current ozone attainment goal, even after considering all of the regulations in place today, with the most significant share of needed emission reductions coming from long-term advanced clean air technologies. In the San Joaquin Valley, the SIP identified the need to reduce NOx emissions by 80 tons/day in 2023 through the use of long-term and advanced technology strategies. To put this in context, this is equivalent to eliminating the NOx emissions from all on-road vehicles operating in these regions. This implies ZEVs are needed as a critical part of the future California fleet to achieve climate change goals and critical criteria pollutant emission reductions.

⁶⁸ See Section V LEV III ISOR for more information.

6.1 California Environmental Quality Act

ARB is the lead agency for the proposed regulation and has prepared an environmental analysis pursuant to its certified regulatory program. The California Environmental Quality Act (CEQA) at Public Resources Code section 21080.5 allows public agencies with regulatory programs to prepare a plan or other written document in lieu of an environmental impact report or negative declaration once the Secretary of the Resources Agency has certified the regulatory program. ARB's regulatory program has been certified by the Secretary of the Resources Agency.⁶⁹ As required by ARB's certified regulatory program for the proposed regulations, the environmental analysis is included as Appendix B to this ISOR for the rulemaking.⁷⁰

Appendix B to the ISOR is an Environmental Analysis (EA) that provides an evaluation of the potential for environmental impacts associated with the proposed ACC Program. The proposed ACC program consists of amendments to the following regulations: LEV III, the E-10 Fuels Certification, Environmental Performance Label (EPL), ZEV, and the CFO. Four separate Regulatory Notices and Staff Reports have been prepared for these proposed amendments. A single coordinated analysis of the potential environmental impacts can be found in Appendix B. The EA assesses the potential for significant long or short term adverse environmental impacts associated with the proposed actions and an analysis of those impacts.⁷¹ In accordance with ARB's regulations, the EA also describes any beneficial impacts.⁷² The resource areas from the state CEQA Guidelines environmental checklist were used as a framework for assessing potentially significant impacts.⁷³

If comments that are received during the public review period raise significant environmental issues, staff will summarize and respond to the comments in writing. The written responses will be included in the Final Statement of Reasons (FSOR) for the regulation. In accordance with ARB certified regulatory program, prior to taking final action on the proposed regulation, the decision maker will approve the written responses.⁷⁴ If the regulation is adopted, a Notice of Decision will be posted on ARB's website and filed with the Secretary of the Natural Resources Agency for public inspection.⁷⁵

6.2 Impacts to Minority and Low Income Communities

This section provides information on the ARB's activities to reach out to minority and low-income communities in the development of the ACC regulations.

⁶⁹ State CEQA Guidelines section 15251 (d); CCR, title 17, sections 60005-60008.)

⁷⁰ CCR, title 17, section 60005.

⁷¹ CCR, title 17, section 60005, subd (b).

⁷² CCR, title 17, section 60005, subd. (d).

⁷³ State CEQA Guidelines, Appendix G.

⁷⁴ CCR, title 17, section 60007, subd (a).

⁷⁵ CCR, title 17, section 60007, subd. (b).

ARB Environmental Justice Policy

ARB has made inclusion of environmental justice an integral part of its activities. State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

The Board approved Environmental Justice Policies and Actions (Policies) on December 13, 2001. These Policies establish a framework for incorporating environmental justice into the ARB's programs consistent with the directives of State law. The Policies apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities.

Outreach to Minority and Low Income Communities

Staff conducted workshops in communities with environmental justice concerns. The dates of all the workshops were as follows:

Date	Location
July 12, 2011	Fresno
July 19, 2011	Pacoima
July 26, 2011	Oakland

Each of the three workshops included an expert panel with opening remarks from a local community leader. The panels included one expert that focused on background information and environmental impacts of air pollution, one expert in the medical field that focused on the health impacts of air pollution, one expert from the American Lung Association of California that discussed its report titled "The Road to Clean Air," and in some workshops also had an expert speak about local concerns. For instance, in Fresno, one speaker addressed agriculture impacts of climate change. Having local community members and leaders participate in the workshops was greatly appreciated and added value and a local context to ARB's presence in these communities. After community members heard from the panel members, staff presented information about the ACC regulations and the CEQA scoping process.

There were a number of different comments and concerns expressed at each workshop and staff was able to engage in a constructive dialogue with attendees about many air quality and climate change related issues. In general, community leaders and community members were very supportive of the work ARB is doing to take steps to reduce emissions from PCs and LDTs.

6.3 Health Impacts

Staff estimates that, statewide, implementation of the ACC regulations from 2010 through 2025 will eliminate approximately 1,400 tons of PM_{2.5} and 40,000 tons of NO_x emissions from passenger vehicles. The estimate of the reduction of premature deaths associated with these emission reductions for both primary PM and secondary

PM (produced in the atmosphere from the precursor NO_x) are between 330 and 530. See the LEV III ISOR, subsection V.F for more details on this assessment of health impacts.

6.4 Emissions Impacts

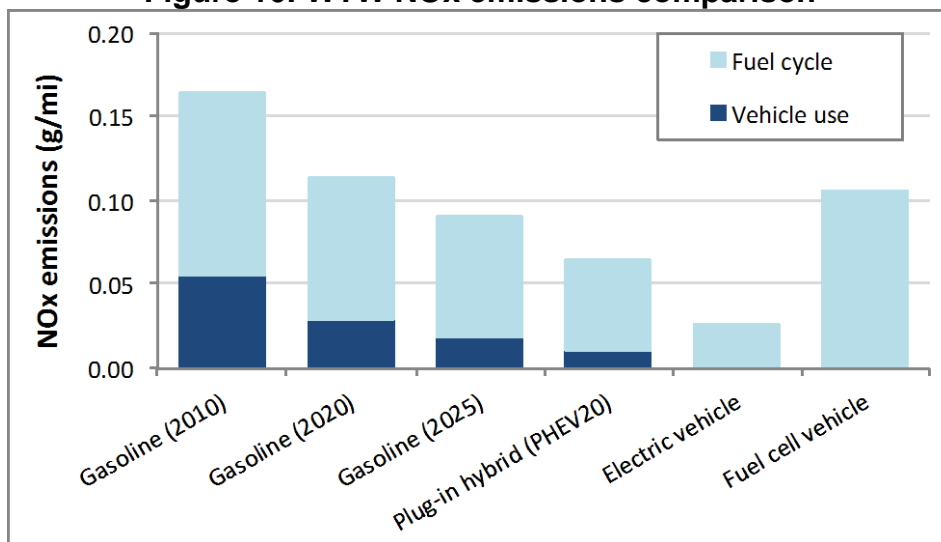
Staff analyzed the emissions impacts resulting from the ZEV proposal compared to the existing regulation. Similar to the cost analysis, this was done assuming manufacturers also complied with proposed LEV III fleet standard. Several scenarios were created to evaluate a LEV III fleet with and without the new ZEV proposal.⁷⁶

WTW emissions profiles were derived from the upstream emissions factors and the LEV III fleet vehicle efficiency attributes. This information is summarized in Section V.E of the LEV III Staff Report.

6.4.1 Emissions Comparisons: Vehicle Technologies

BEVs, FCVs, and PHEVs are all ultra-low criteria pollutant and GHG emitting technologies, even on a WTW basis. WTW emissions include upstream emissions from fuel production and vehicle manufacturing, as well as vehicle emissions from PHEVs. Three categories of conventional vehicles are shown to emphasize that their emissions profiles are improving over time as a result of the proposed LEV III Criteria Pollutant and GHG regulations.

Figure 16: WTW NO_x emissions comparison



⁷⁶ In developing this new analysis, it was not accurate to compare this to the ZEV emissions impacts from the 2008 staff analysis for two reasons. The proposed LEV III emissions regulations mean that the entire fleet will become cleaner with or without the ZEV regulation. Additionally, the 2008 staff analysis only included the South Coast air basin emission inventory.

Figure 17: WTW PM emissions comparison

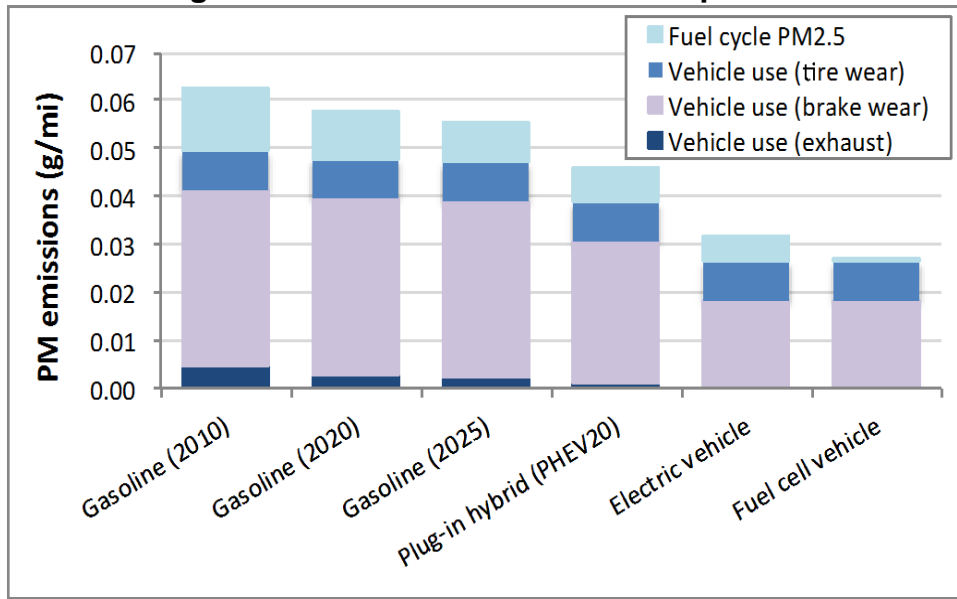
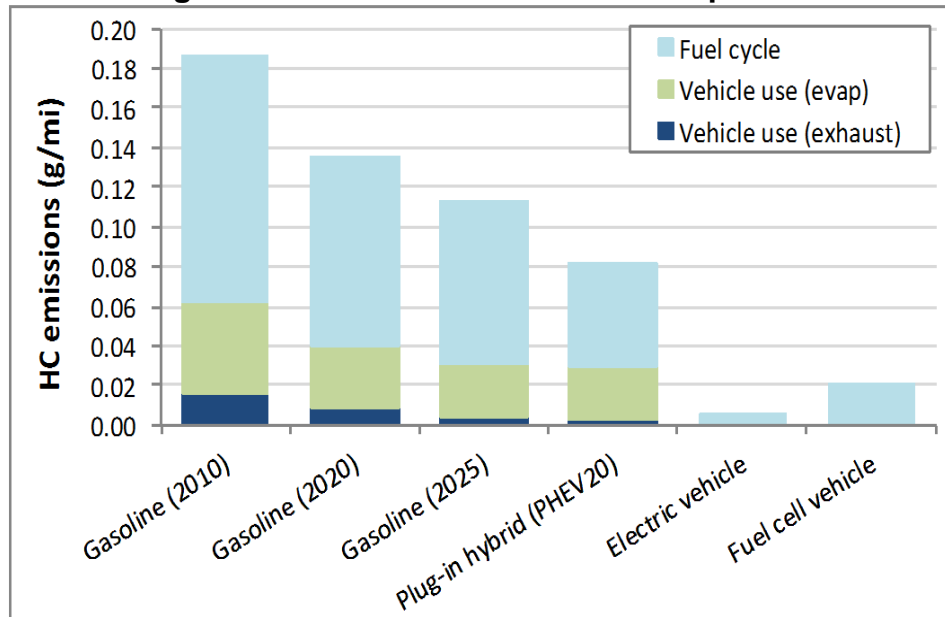
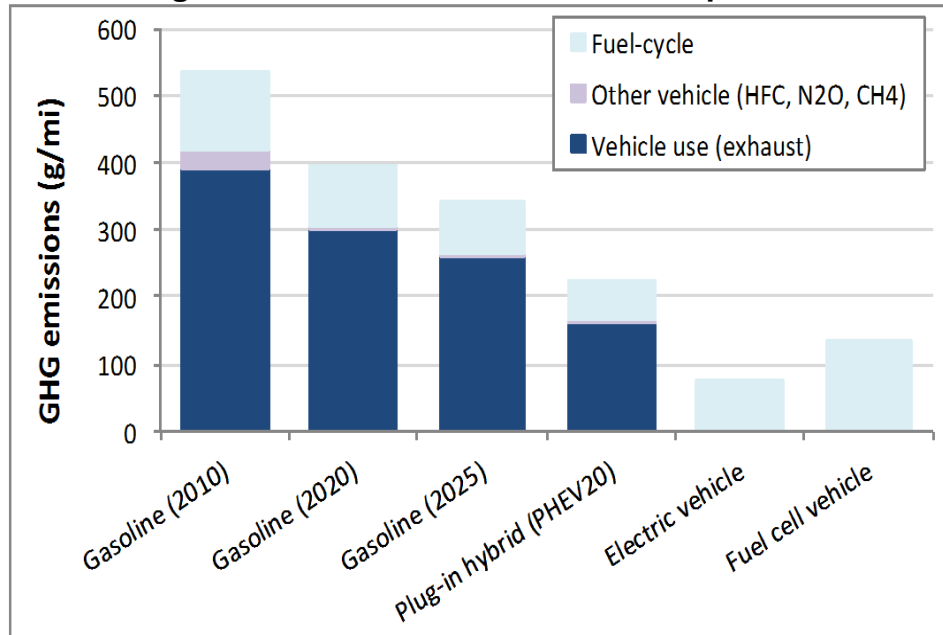


Figure 18: WTW ROG emissions comparison



*ROG means reactive organic gas

Figure 19: WTW GHG emissions comparison



6.4.2 Total Emissions – Criteria and PM

Overall, there will be a reduction in criteria pollutants as a result of the proposed ACC program standards. Criteria pollutant emission benefits for the ACC program are fully realized in the 2035-2040 timeframe when nearly all vehicles operating in the fleet are expected to be compliant with the proposed standards. By 2035 reactive organic gas (ROG) emissions would be reduced by an additional 34 percent, and NOx emissions, by an additional 37 percent, compared to 2035 without the proposed ACC rules.

Under the proposed rule, the new PM2.5 standard is reduced to 3 mg/mi in 2020 and 1 mg/mi in 2028. With these standards, PM2.5 emissions will be essentially unchanged between 2010 and 2040 as growth in VMT offsets the tightening of the standard.

There is no benefit from including the ZEV proposal in terms of vehicle (tank-to-wheel or TTW) emissions. The LEV III criteria pollutant fleet standard is responsible for those emission reductions in the fleet; the fleet would become cleaner regardless of the ZEV regulation because manufacturers would adjust their compliance response to the standard by making cleaner conventional vehicles. However, upstream criteria and PM emissions are not captured in the LEV III criteria pollutant standard, so additional electricity and fuel production in the fleet results in increased upstream criteria pollutant emissions.

Table 6.1 presents the emissions impacts in WTW criteria pollutant and PM emissions in 2030 due to staff's proposal. 2030 was chosen as a reference year to account for a significant amount of fleet turn-over.

Table 6.1: Statewide Criteria and PM Emissions in 2030 (tons per day)¹

2030	ROG	NMOG+ NOx	PM
LEVIII fleet WTW emissions <u>without</u> new ZEV proposal	231	233	56.4
LEVIII fleet WTW emissions <u>with</u> new ZEV proposal	225	229.5	56.2

¹ Refer to the LEVIII ISOR Section V and Appendix Q for additional details. Includes reduced petroleum upstream emissions and increased hydrogen and electricity production emissions

The upstream emissions from the production of hydrogen and electricity represents a very small fraction of the combined vehicle and upstream emissions impacts of the fleet, and is far outweighed by the reduction in gasoline production emissions, creating the net benefit shown in Table 6.1 and 6.2. Additionally, a portion of these upstream emissions are in non-urban areas.⁷⁷

Table 6.2 below provides expanded details on the emission impacts shown in Table 6.1, and shows the WTW impacts for these emissions types.⁷⁸

Table 6.2: Detailed Statewide Criteria and PM Emission Inputs in 2030 (tons per day)

2030	ROG	NOx	PM
LEVIII fleet vehicle emissions (TTW) ¹	126	116	26
Upstream emissions from LEVIII fleet <u>without</u> ZEV proposal (WTT)	105	117	30.4
LEVIII fleet WTW emissions benefits <u>without</u> new ZEV proposal	231	233	56.4
Increased upstream emissions from hydrogen	0.22	1.11	0.27
Increased upstream emissions from electricity	0.24	1.00	0.22
Reduced upstream refinery emissions due to ZEVs	-6.4	-5.6	-0.66
LEVIII fleet WTW emissions benefits <u>with</u> new ZEV proposal	225	229.5	56.2

Criteria and PM emissions benefits will vary by region throughout the state depending on the location of emission sources. Refinery emission reductions will occur primarily in the east Bay Area and South Coast region where existing refinery facilities operate. As refinery operations reduce production and emissions, the input and output activities, such as truck and ship deliveries, will also decline. This includes crude oil imported through the Los Angeles and Oakland ports, as well as pipeline and local gasoline truck distribution in all regions of the state.

The small increase in upstream emissions associated with new electricity and hydrogen transportation fuel production will occur in various regions. Hydrogen production will predominantly occur from existing centralized hydrogen facilities already operating to supply refinery and industrial applications. These facilities are primarily located in the large metropolitan areas near gasoline refinery operations. The majority of early FCV sales are expected to occur in the South Coast region, the hydrogen facilities in this region will likely be used to produce the fuel for the market.

⁷⁷ For details on how these emissions are incorporated into the full fleet, refer to the LEVIII ISOR Section V.E.

⁷⁸ Refer to the LEVIII ISOR Appendix Q for additional details and a graphical representation of the upstream portion of this analysis.

Electricity production increases will occur throughout the state at power facilities that supply regions where BEV and PHEV sales and use occur. Staff assumes that by 2020, emissions associated with plug-in vehicle charging will be characterized by new power facilities added to the grid between now and 2020. This is assumed to be cleaner natural gas facilities as well as new renewables to comply with California's 33 percent renewable portfolio standard (RPS).

The upstream emissions impacts are quantified in the LEV III ISOR in Appendix V.E, and include an estimation of the split between urban and non-urban source locations.

6.4.3 Total Emissions - Climate Change

Overall, the ACC program would provide major reductions in GHG emissions. By 2025, CO₂ emissions would be reduced by almost 14 million metric tonnes (MMT) per year, which is 12 percent from baseline levels. In reduction increases in 2035 to 32 MMT which is a 27 percent reduction from baseline levels. By 2050, the proposed regulation will reduce emissions by more than 42MMT per year, which is a reduction of 33 percent from baseline levels.

The ZEV regulation does not provide GHG emission reductions in addition to the LEV III GHG regulation given that ZEV emissions are included in determining compliance with the GHG standard. Specifically, because the GHG standard includes upstream emissions, in addition to the vehicle emissions, there is no difference in GHG emissions under varying ZEV scenarios.

Given that climate change emissions remain in the upper atmosphere for long periods of time (50-100 years), climate impacts are a function of the cumulative emissions. As a result, early reduction in annual climate emission rates is important to ultimately stabilize the atmosphere. For the 2050 emission projections from this proposal, emission rates were assumed to remain fixed at the levels in this analysis: 2020 emission rates for upstream factors and 2025 emission rates for vehicle performance.

6.4.4 Energy Diversity and Energy Demand

The vehicle technologies expected to be used in compliance with the regulation typically use fuel more efficiently and/or use alternative fuels, and thus when fully commercialized will reduce demand for petroleum fuels. Reduced demand for gasoline and diesel alleviates the reliance on a single fuel source, creating a more robust fuel supply. Additionally, the erratic and increasing price trends of oil create economic losses for California. Reducing gasoline demand will also reduce the need for additional refining, transportation and distribution facilities, thus preventing additional air and water pollution as noted above.

Moreover, because electricity and hydrogen can be produced from renewable resources such as solar, wind, or hydropower, or biomass feedstock, the staff's proposed amendments would increase the number of vehicles using these fuels and help pave the way towards a sustainable energy future.

7 COST-EFFECTIVENESS

Cost-effectiveness is a measure of the cost incurred to achieve a specific outcome, and is a metric that is used to compare alternatives to achieve the same outcome. In ARB regulations, the specific outcome measured is vehicle emissions. Although a cost-effectiveness value with emissions is determined here, the ZEV regulation does not have explicit emission reduction targets given that the measure of compliance is the number of advanced vehicles sold. As a result, the cost effectiveness value is not the primary factor used to determine the proposed requirement. However, looking at the both the LEV III Criteria Pollutant and GHG regulations and ZEV regulation together, there will likely be a \$290 savings per ton of CO₂ reduced in 2025 and \$320 savings per ton CO₂ reduced in 2035. For criteria pollutants, the cost effectiveness of the three regulations will be \$4 per ton of ROG plus NOx reduced.

8 SUMMARY AND STAFF RECOMMENDATION

Adoption of staff's proposed amendments to the ZEV regulation will begin a transformation of California's LDV fleet to one that uses a portfolio of fuels most of which will sustainable and exhibit low carbon emissions. As the technology-forcing piece of the ACC package, the ZEV regulation is the catalyst to this transformative process. Proposed amendments to the regulation focus on technologies that help meet mid- and long-term climate goals, while simplifying the program where needed as much as possible. By requiring increased numbers of ZEVs and TZEVs in the 2018 through 2025 model year timeframe, vehicle costs will decrease due increased production volumes driving down battery and fuel cell costs, which will help these advanced technologies achieve commercial success in the California LDV market. The following table is a summary of staff proposed changes:

Timeframe	Purpose of Proposed Amendment	Proposed Amendment
2009 – 2017 Model Year	<i>Compliance Flexibility</i>	Extend travel provision for BEVs
		Extend advanced demonstration provision
		Remove carry forward provision
		Reduce 2015 through 2017 requirement for IVMs
	<i>Adjust Credits and Allowances</i>	Increase credits for Type V ZEVs to 9 credits per vehicle
		Add Type I.5x and Type IIx vehicles
2018 and Subsequent Model Years	<i>Adjust Manufacturer Size Definitions</i>	Modify IVM and LVM size definitions
		Modify transitions for manufacturers changing size categories
	<i>Focus Requirements on ZEVs and TZEVs</i>	Remove PZEV and AT PZEVs from 2018 and beyond compliance
		Allow manufacturers to use banked PZEV and AT PZEVs, under a cap
	<i>Increase 2018 + Requirements</i>	Increase overall credit requirements and reduce the amount of credits earned per vehicle
	<i>Provide Flexibility for IVMs</i>	Allow IVMs to meet requirement with credits from TZEVs
		Continue Advanced Demonstration credits for non-LVMs
	<i>Simplify Credit Calculations</i>	Calculate ZEV and TZEV credits based on range
	<i>Modify Travel Provision</i>	Extend Travel Provision for FCVs only
	<i>Encourage GHG Over Compliance</i>	Allow manufacturers to offset part of the 2018 through 2021 ZEV requirement through over-compliance with GHG fleet standard
	<i>Add New Vehicle</i>	Add range extended BEVs as compliance option

Staff recommends that the Board amend sections 1962.1 and 1962.3(renumbered from 1962.2), Title 13, California Code of Regulations, and the incorporated test procedures and related regulations, and adopt section 1962.2, and the incorporated test procedures. The proposed amendments and adoptions are set forth in the Proposed Regulation Order in Appendix A.

9 SUMMARY AND RATIONALE FOR PROPOSED REGULATIONS

The need and rationale for the proposed amendments were discussed extensively in Chapter 2. In addition, in this chapter, staff provides a plain English description of the proposed amendments to the ZEV regulation.

Pursuant to Government Code section 11349.1, Government Code section 11346.2(b)(1), and title 1, California Code of Regulations, section 10, staff is providing a brief summary below that identifies each section in the regulation where amendments are proposed and describes the rationale for each proposed amendment.

§1962.1 Zero-Emission Vehicle Standards for 2009 through 2017 Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

Previously, section 1962.1 and incorporated test procedures applied to 2009 and subsequent model years. Section 1962.1 and its incorporated test procedures now apply to 2009 through 2017 model years, and a new section (section 1962.2) and its incorporated test procedures apply to 2018 and subsequent model years. Language is being changed throughout section 1962.1 to clarify the applicable model years. Also, the word “section” was changed to “subdivision” for clarification purposes. Also, the word “Transitional Zero Emission Vehicle” or “TZE” has replaced the word “Enhanced Advanced Technology Partial Zero Emission Allowance Vehicle” or “Enhanced AT PZEV”. Throughout, spelling and grammatical changes have also been made.

(a) The purpose of this subdivision is to define ZEV certification standards. This subdivision was amended to clarify that the standards apply to 2009 through 2017 model years, rather than just models.

(b)(1)(A) The purpose of this subdivision is to describe manufacturer’s minimum percentage ZEV credit requirement. This subdivision was modified to clarify the origin of the production number that a manufacturer’s requirement is to be based on, which is in the annual NMOG production report. The NMOG production report submitted by a regulated manufacturer to ARB indicates the number of vehicles delivered for sale in California, and to which standard each vehicle is certified. A sentence was added to ensure there were no discrepancies as to which production number is used to determine a manufacturer’s requirement.

(b)(1)(B) The purpose of this subdivision is to calculate the number of vehicles to which the percentage ZEV requirement is applied. This subdivision was amended to organize the methods by applicable model years and to clarify the original intent of the language. This subdivision allows a manufacturer to switch production determination methods, explains that production averaging has no effect on a manufacturer’s size determination, and clarifies how a manufacturer should treat vehicles delivered for sale by other manufacturers in their production determination.

(b)(1)(B)1. A clarifying sentence was added to explain that a manufacturer could base its ZEV obligation on the number of vehicles produced and delivered for sale in the same year, rather than on a three year average method.

(b)(1)(B)2. A sentence was added to clarify an example of how the prior year method works.

(b)(2)(D)1. The purpose of this subdivision is to describe the ZEV requirements for LVMs for model years 2012 through 2014. The language was amended to clarify the intent of the subdivision, which is that credits are required for compliance and are generated from manufacturers delivering ZEVs for sale.

(b)(2)(D)2. The purpose of this subdivision is to describe the ZEV requirements for LVMs for model years 2015 through 2017. The language was amended to clarify the intent of the subdivision, which is that credits are required for compliance and are generated from manufacturers delivering ZEVs for sale.

(b)(2)(D)4. The purpose of this subdivision is to describe how additional credits for ZEVs placed in transportation systems can be used to meet a manufacturer's ZEV requirement. The language was modified to clarify that the limit described applies to credits earned by ZEVs placed in transportation systems.

(b)(2)(E) This subdivision is being deleted because requirements for 2018 and subsequent model years have been moved to section 1962.2.

(b)(3) This subdivision allows IVMs to meet their entire ZEV requirement through delivering for sale PZEVs. This subdivision was amended to reduce the IVM's overall credit requirement in model years 2015 through 2017 to allow them more time to transition into more stringent requirements starting in model year 2018.

(b)(4) This subdivision describes how SVMs and ILVMs are not mandated to produce ZEVs by the ZEV regulation, but may earn and market ZEV credits. This subdivision was clarified to ensure SVMs and ILVMs are able to earn and market TZEV and AT PZEV credits.

(b)(5) This subdivision is being deleted because it is not necessary to clarify how a manufacturer is to count ZEVs and PZEV in a manufacturer's fleet average NMOG calculations. Section 1961 clearly explains how a PZEV and ZEV should be counted in a manufacturer's NMOG calculations.

(b)(7)(A) This subdivision explains how a manufacturer applies the ZEV regulation as the manufacturer increases its California production volume and is redefined as a differently sized manufacturer. Currently, manufacturers are given five years of lead time when transitioning into a larger size definition. For example, if a manufacturer were to increase in sales, such that its 2011 through 2013 sales average exceeded the current large volume manufacturer threshold of 60,000 sales, the

manufacturer would be subject to the full ZEV requirements in model year 2019. However, due to staff proposed modifications for definition and lead time, the language is being modified to reflect that manufacturers starting their transition before 2018 will be subject to full ZEV requirements starting in model year 2018. This means, for example, if a manufacturer's 2013 through 2015 sales average (for the first time) is 61,000 vehicles, then instead of being subject to large volume manufacturer requirements in 2021, the manufacturer will be subject to large volume manufacturer requirements in 2018. Similar language is being added to reflect that when aggregation affects a manufacturer's size, the manufacturer will be subject to the stepped up requirements starting in the fourth model year or in 2018, whichever occurs first.

(b)(7)(C) This subdivision explains how to calculate California production volume in change of ownership situations. This subdivision was modified to explain how to determine the model year when a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, which is to be based on the earlier model year. Additionally, an example was added to clarify the application of the model year determination.

(c)(2)(A) This subdivision establishes which tailpipe emission standards a PZEV is to certify to in section 1961. This subdivision is being amended to separate the 2009 through 2014 model years standards from the 2015 through 2017 model year standards. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015. These will include new tailpipe standards for NMOG + NO_x. Staff will also be proposing new emission certification categories that go beyond SULEV standards. Due to these change in LEV III, the language is being modified so that for a PZEV to earn credit within the ZEV regulation in 2015 and subsequent model years, the vehicle must be certified to the more stringent SULEV 30 or SULEV 20 standards, and meet LEV III zero-evaporative standards.

(c)(2)(B) This subdivision establishes which evaporative emission standards a PZEV is to certify to in section 1976, which is the zero evaporative standard. This subdivision is being amended to separate 2009 through 2014 model year standards from the 2015 through 2017 model year standards. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015. There will be two options for meeting the zero evaporative emissions requirement in model year 2015 and beyond. Option 1 is identical to the current "optional zero evaporative" requirement in that manufacturers must demonstrate a zero evaporative fuel system using a rig test and also meet a whole vehicle test value of 350 mg. Option 2 allows manufacturers to demonstrate a zero evaporative system by doing a "mini rig test" and by meeting a whole vehicle test value of 300 mg. In addition, if a manufacturer chooses this second option, they can average among the vehicles within a standard category. Option 1 and Option 2 are equivalent. Due to these change in LEV III, the language is being modified so that for a PZEV to earn credit within the ZEV regulation in 2015 and subsequent model years, the vehicle must be certified to LEV III zero evaporative standards, but can use either option.

(c)(3)(A) The purpose of this subdivision is to show the equation for determining a vehicle's zero emission VMT allowance. The table within this subdivision is being corrected to resolve inconsistencies in the zero emission VMT allowance equation. The language has also been clarified as to the UF to be used in determining a manufacturer's zero emission VMT allowance, which is according to Section 4.5.2 Equation 5 and the "Fleet UF" Utility Factor Equation Coefficients in Section 4.5.2, Table 3, in J2841 (March 2009). Also the language is being clarified that a vehicle may not earn more than 1.39 zero emission VMT PZEV allowances.

(c)(3)(B) This subdivision is being deleted because no automakers have included vehicles requiring or requesting such exemptions in any vehicle planned through 2017 model year.

(c)(4)(B)1. The purpose of this subdivision is to describe the varying types of advanced componentry allowances for which a manufacturer may qualify. This subdivision is being amended to remove Type C advanced componentry allowance. ZEV technology has advanced and staff now believes that the minimum qualifying system should be increased to the higher voltage Type D because (1) AT PZEVs need to make use of systems that more closely represent those that are needed for ZEVs, and (2) no manufacturers have certified, or have disclosed plans to certify, a Type C AT PZEV. The language prior to the table explaining the various advanced componentry types is being amended to reflect that there are four rather than five types of advanced componentry allowances. Additionally, the table is being updated with new language to reflect the intent of the electric drive system peak power output for Type F and Type G advanced componentry allowances and that the vehicle must travel 10 miles all electrically on either the UDDS or the US06 drive schedule.

(c)(4)(B)4. This subdivision is being deleted to remove Type C advanced componentry allowance. ZEV technology has advanced and staff now believes that the minimum qualifying system should be increased to the higher voltage Type D because AT PZEVs need to make use of systems that more closely represent those that are needed for ZEVs, and no manufacturers have certified, or have disclosed plans to certify, a Type C AT PZEV.

(c)(4)(B)9. The purpose of this subdivision is to establish severability, which allows that if any of 1962.1(c)(4)(B)1. – 8. is found, that the remainder of section 1962.1 remains in full force and effect. The text in this subdivision is being simplified to reflect the intent of the language.

(c)(7)(B) The purpose of this subdivision is to allow a PZEV which earns a zero emission VMT allowance to earn an additional credit multiplier if the vehicle is purchased or offered for an extended lease. This subdivision is being clarified to reflect the intent that the multiplier will no longer be available after model year 2011.

(d)(5)(A) The purpose of this subdivision is to define the various ZEV tiers for determining a vehicle's credit. This subdivision is being modified to define Type

I.5x and Type IIx vehicles (range extended BEVs), vehicles are referenced in two other places in section 1962.1.

(d)(5)(C) The purpose of this subdivision is to explain how a manufacturer earns ZEV credits, and how delivered for sale and placed in service is credited for each ZEV. The language is being modified to reflect that a vehicle must be delivered for sale and placed in service in the same state in order to earn the total credit amount. This change is due to some manufacturers having internet based sales, and questions surrounding the location of a vehicle's delivery and placement in service. Staff's proposed change clarifies the original intent of the provision. The language has also been modified to place a five year limit on 2012 and prior model year ZEVs to collect "placed in service" credit. This five year limit to ensure that the ZEVs offered to consumers are moderately current advanced technology and advanced technology components have not deteriorated. Additionally, the language and table have been modified to reflect the new Type I.5x and Type IIx category, and the amount of credits earned in the 2012 through 2017 timeframe. The table has also been amended to reflect that Type V ZEVs, which are 300 mile range FCVs, earn 9 credits each in the 2015 through 2017 timeframe. This modification gives FCVs additional incentives as compared to BEVs, which have been affected due to other modifications in this timeframe.

(d)(5)(D) The purpose of this subdivision is to allow a ZEV to earn an additional credit multiplier if the vehicle is purchased or offered for an extended lease. This subdivision is being clarified to reflect the intent that the multiplier will no longer be available after model year 2011.

(d)(5)(E) The purpose of this subdivision is allow manufacturers to count a ZEV delivered for sale and placed in service in California as if it were also delivered for sale and placed in service in a Section 177 ZEV state.

(d)(5)(E)1.a. This subdivision is being clarified to apply to manufacturers with a ZEV requirement only, which is the original intent of the text.

(d)(5)(E)1.b. This subdivision is being clarified to apply to manufacturers with a ZEV requirement only, which is the original intent of the text.

(d)(5)(E)2. This subdivision is being clarified to apply to manufacturers with a ZEV requirement only, which is the original intent of the text. This subdivision has also been clarified to allow Type I.5x and Type IIx vehicles under this provision, through 2017 model year. Additionally, this subdivision is being changed to reflect that both intermediate volume and LVMs may use this provision, not just LVMs. Also, manufacturers producing Type I, I.5, and II ZEVs, which are BEVs, may use this provision for those vehicles through 2017 model year, rather than just 2014 model year. California markets have matured and are well prepared for increased sales requirements. However, markets in Section 177 ZEV states need additional time to

prepare for ZEVs, and some vehicle manufacturers need time to expand their BEV offerings to other states and to different climates.

(d)(5)(F) The purpose of this subdivision is to describe the specifications and requirements that a NEV must meet in order to received ZEV credit.

(d)(5)(F)3. The purpose of this section is to describe the warranty that must be offered for NEVs that qualify for credits under the ZEV regulation. The language is being simplified and clarified to better explain rules regarding prorated NEV warranties.

(d)(5)(F)5. This subdivision is being added to require that NEVs must meet the charging connection standard starting in model year 2014 to ensure all electric vehicles, including NEVs meet the same standard.

(d)(5)(G) This subdivision is being added to describe how Type I.5x and Type IIx vehicles earn ZEV credit. Type I.5x and Type IIx vehicles are BEVs equipped with an APU.

(d)(5)(G)1. This subdivision is being added to require Type I.5x and Type IIx vehicles to meet PZEV requirements, ensuring the vehicles are low emitting under all operation.

(d)(5)(G)2. This subdivision is being added to require Type I.5x and Type IIx vehicles to meet Type G advanced componentry requirements, that is, the vehicles must at least be able to run 10 all electric US06 miles before the APU turns on.

(d)(5)(G)3. This subdivision is being added to require the vehicle's UDDS range after the APU first starts is less than or equal to the vehicle's all electric UDDS test range prior to the APU start. The subdivision also clarifies that the APU may not start until the battery is being full depleted. These requirements ensure that the APU functionality is limited and that the unit is not relied upon instead of the battery electric power.

(d)(5)(G)4. This subdivision is being added to require that Type I.5x vehicles must have at least 75 miles electric urban dynamometer range and that Type IIx vehicles must have at least 100 miles electric urban dynamometer range. Staff established a minimum range of 80 miles for Type I.5x and Type IIx vehicles because the examples of "full function" BEVs coming to market all have at least 80 miles range. It is important that the minimum range for eligibility be equivalent to full function BEVs in the marketplace.

(g)(2)(A) This subdivision explains how the credits earned by a manufacturer are expressed in the ZEV bank. This subdivision is being amended to separate the 2009 through 2014 model years standards from the 2015 through 2017 model year standards. Up to model year 2014, ZEV credits are expressed in terms of

g/mi NMOG. After model year 2015, the language is being modified to reflect that ZEV credits will now be expressed in terms of whole ZEV credits. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015.

(g)(2)(B) This subdivision explains how the credits earned by a manufacturer are expressed in the ZEV bank. This subdivision is being amended to separate the 2009 through 2014 model years standards from the 2015 through 2017 model year standards. Up to model year 2014, PZEV credits are expressed in terms of g/mi NMOG. After model year 2015, the language is being modified to reflect that PZEV credits will now be expressed in terms of whole ZEV credits. This is due to new LEV III criteria pollutant fleet standards beginning in model year 2015.

(g)(2)(C) This subdivision explains that various credit types are held in separate accounts within the ZEV bank. This subdivision is being amended to include a separate account for Type I.5x and Type IIx vehicles, since those credits are treated differently.

(g)(2)(D) This subdivision is being added to clarify how ZEV credits and debits are to be rounded. This amendment is meant to provide clarification and to avoid differences in calculating ZEV credits and debits.

(g)(2)(E) This subdivision is being added to explain how g/mi NMOG ZEV credits will be converted into ZEV credits after 2014 model year. This will be accomplished by dividing each manufacturer's 2014 model year g/mi NMOG ZEV credit balance by 0.035. This is due to ZEV credits being expressed in terms of whole ZEV credits starting in model year 2015.

(g)(2)(F) This subdivision is being added to explain how a manufacturer is to convert its PZEV and AT PZEV credits for use after model year 2017. Due to staff's proposed change no longer allowing a manufacturer to meet part of its ZEV requirement with PZEV and AT PZEV credits, manufacturers will be left with banks of PZEV and AT PZEV credits. In a shift toward requiring manufacturers to place vehicles rather than use banked credits in order to comply with the regulation, it is appropriate to discount and limit the use of banked PZEV and AT PZEV credits in 2018 and subsequent model years. This provision allows manufacturers to convert those credits through discounting the value of the credits after model year 2017 model year compliance.

(g)(4) The purpose of this subdivision is to allow manufacturers to earn full credit for TZEVs and ZEVs placed in advanced demonstration programs, even if the vehicle is not delivered for sale or placed in service. This subdivision is being reorganized into two subdivisions: (A) TZEVs and (B) ZEVs. This is due to advanced demonstration programs expiring for TZEVs in 2014 model year, and continuing for ZEVs through model year 2017. New text in subdivision (B) is duplicative, only extending the availability of advanced demonstration credits for

ZEVs, and describes guidelines for ZEVs placed in advanced demonstration programs.

(g)(5)(A) The purpose of this subdivision is to explain transportation system credits and the general guidelines for manufacturers placing ZEV program vehicles into transportation systems. This subdivision is being amended to explicitly restrict manufacturers from being able to use subdivision 1962.1(d)(5)(E) – the travel provision- for transportation system credits. This language is being added to clarify the original intent of the language: manufacturers are only allowed to travel vehicle credits, not additional credits earned by vehicles placed in specific applications.

(g)(5)(B) The purpose of this subdivision is to describe how manufacturers earn transportation system credits. This subdivision is being amended to allow Type I.5x and Type IIx vehicles to earn transportation system credits. This is because Type I.5x and Type IIx vehicles are a new vehicle category and are to be treated the same as ZEVs under most circumstances. The table in this subdivision is also being amended to award fewer credits for TZEVS and ZEVs placed in transportation system credits. Limiting the number of credits offered for reasons other than vehicle placement is to ensure ZEV and TZEVS commercial success, and simplifies the regulation.

(g)(5)(C)1. The purpose of this subdivision is to describe the caps on the use of credits earned by manufacturers placing ZEVs in a transportation system. This subdivision is being amended to include Type I.5x and Type IIx vehicles. This is because Type I.5x and Type IIx vehicles are a new vehicle category and are to be treated the same as ZEVs under most circumstances.

(g)(5)(D) The purpose of this subdivision is to explain how ARB Executive Officer is to allocate transportation system credits to manufacturers. The intent of the language is being clarified to specify that vehicles must be placed in a transportation system for at least two years, as stated in 1962.1(g)(5)(A). This subdivision is also being amended to sunset after model year 2017 compliance. It is not necessary to continue these car sharing programs, when mostly third parties are running transportation system programs, and earning credit, rather than the manufacturers themselves. After meeting with the third parties responsible for transportation systems, staff believes it is more important to establish incentive programs for transportation system, rather than allow third parties to earn credit through transportation systems, and sell their credits to regulated manufacturers.

(g)(6) The purpose of this subdivision is to explain how a manufacturer submits credits for compliance with the regulation to ARB's Executive Officer, and how ZEV credits can be used to meet a manufacturer's obligation. This subdivision is being amended to separate 2009 through 2014 model years from the 2015 through 2017 model years. This is due to ZEV credits being expressed in terms of ZEV credits, instead of in g/mi NMOG ZEV credits, starting in model year 2015.

(g)(6)(A) The purpose of this subdivision is to explain how manufacturers are allowed to use NEV credits to meet its obligation. The table in this subdivision is being amended to extend the caps for NEV credits through 2017. The caps through 2014 were sufficient, and it is appropriate to extend the same caps through model year 2017.

(g)(6)(B) The purpose of this subdivision is to limit a large volume manufacturer's ability to bank a ZEV credit after it is earned. After the time limit is reached, the manufacturer may only use the banked ZEV credit to meet the portion of its requirement that can be met with TZEVs, AT PZEVs, or PZEVs. This subdivision is being amended to clarify the intent of the text: credits from ZEVs but not from NEVs are limited under this provision. Additionally, this subdivision is being amended to sunset the carry forward provisions for ZEVs after 2011 model year. Currently requirements plateau for three years at a time but hold steady indefinitely at a relatively low level for 2018 through 2025 model years. Because staff is proposing to increase volumetric requirements each year for model years 2018 through 2025, it is unlikely that manufacturers will be able to bank large volumes of credits for later use.

(g)(6)(C) The purpose of this subdivision is to limit to two years how long manufacturers other than LVMs are able to bank a ZEV credit after it is earned. This subdivision is being amended to clarify the intent of the text: credits from ZEVs but not from NEVs are limited under this provision. Additionally, this subdivision is being amended to sunset the carry forward provisions for ZEVs after 2011 model year. Currently requirements plateau for three years at a time but hold steady at a relatively low level for 2018 through 2025 model years. Because staff is proposing to increase volumetric requirements each year for model years 2018 through 2025, it is unlikely that manufacturers will be able to bank large volumes of credits for later use.

(g)(6)(D) This subdivision is being added to specify that manufacturers may use Type I.5x and Type IIx vehicles to meet up to 50 percent of the portion of a manufacturer's requirement that must be met with credits from ZEVs. Type I.5x and Type IIx vehicle credits are limited to ensure LVMs still produce pure ZEVs in the 2012 through 2017 timeframe.

(g)(7)(A) This subdivision describes the amount of time a manufacturer has to fulfill a ZEV obligation deficit. This subdivision is being amended to separate 2009 through 2014 model years from the 2015 through 2017 model years. This is due to ZEV credits being expressed in terms of whole ZEV credits, instead of in g/mi NMOG ZEV credits, starting in model year 2015. Additionally, the word "credits" is added throughout to clarify that a manufacturer is required to submit credits in compliance with the requirement, rather than vehicles. This subdivision is also being amended to clarify the intent that only credits from ZEVs are allowed to fulfill a ZEV deficit.

(g)(8) The purpose of this subdivision is to explain that a manufacturer will be subject to penalties if it fails to make up a ZEV deficit, and gives the equation for calculating the resulting ZEV penalty. This subdivision is being amended to

separate 2009 through 2014 model years from the 2015 through 2017 model years. This is due to ZEV credits being expressed in terms of whole ZEV credits, instead of in g/mi NMOG ZEV credits, starting in model year 2015. Staff interprets the overall penalty for ZEV non-compliance to be \$5,000 per whole credit not produced. The language in this subdivision is being amended to reflect this intent

(i)(2) This subdivision is being added to define “auxiliary power unit” because range extended BEVs are equipped with an auxiliary power unit.

(i)(3) This subdivision is being renumbered due to the addition of other definitions.

(i)(4) This subdivision is being renumbered due to the addition of other definitions.

(i)(5) This subdivision is being renumbered due to the addition of other definitions.

(i)(6) This subdivision defines Enhanced AT PZEVs. This subdivision is being amended to indicate that Enhanced AT PZEV is nomenclature used through 2011 model year, and that Transitional Zero Emission Vehicle or TZEVE is interchangeable for Enhanced AT PZEV. This subdivision is being renumbered due to the addition of other definitions.

(i)(7) This subdivision is being renumbered due to the addition of other definitions.

(i)(8) This subdivision is being renumbered due to the addition of other definitions.

(i)(9) This subdivision is being added to define “proportional value” because this value is used to calculate the ratio applied to credits earned in Section 177 ZEV states for subdivision 1962.1(d)(5)(E).

(i)(10) This subdivision is being added to define “Range Extended Battery Electric Vehicle” because manufacturers are allowed to meet a portion of their obligation with this new type of vehicle.

(i)(11) This subdivision is being renumbered due to the addition of other definitions.

(i)(12) This subdivision is being renumbered due to the addition of other definitions.

(i)(13) This subdivision is being added to define “Transitional Zero Emission Vehicle” to redefine Enhanced AT PZEVs, and is the new nomenclature for these types of vehicles for 2012 and subsequent model years.

(i)(14) This subdivision is being renumbered due to the addition of other definitions.

(i)(15) This subdivision is being renumbered due to the addition of other definitions.

(j) The purpose of this subdivision is to define abbreviations used throughout section 1962.1. New abbreviations are being added as appropriate.

(l)(1)(A) The purpose of this subdivision is to clarify that credit balances for each type of ZEV regulation vehicle is required to be disclosed annually. This subdivision is being amended to include Type I.5x and Type IIx vehicles. This is because Type I.5x and Type IIx vehicles are a new vehicle category and are to be treated the same as ZEVs under most circumstances.

Health & Safety Code sections 38562 and 43018.5 are being added as references to reflect the contribution of those sections towards the GHG emission reductions referenced in sections 38562 and 43018.5. Health and Safety Code section 43204 was added as a reference because subdivisions 1962.1(c)(2)(D) and 1962.2(c)(2)(D) reference the warranty requirements of California Code of Regulations subdivisions 2037(b)(2) and 2038(b)(2) and, in turn, those subdivisions reference the requirements of Health and Safety Code section 43204.

List of Changes to “California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles in the Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicle Classes”

The test procedures are included by reference in section 1962.1, and contain an exact copy of the regulatory text, including the amendments being proposed in section 1962.1 in Section C. Previously, section 1962.1 and incorporated test procedures applied to 2009 and subsequent model years. Section 1962.1 and its incorporated test procedure now apply to 2009 through 2017 model years, and a new section (section 1962.2) and its incorporated test procedures apply to 2018 and subsequent model years. Language is being changed throughout the test procedures to clarify the applicable model years. Additionally, due to the addition of a new Section E, existing Sections E through I have been renumbered accordingly.

Section B. Definitions and Terminology

“All-Electric Range” – This definition is being amended to remove language that applies to blended off vehicle charge capable hybrid electric vehicles because equivalent all electric range does not mean all electric range.

“Auxiliary power unit” – This definition is being amended to add language that specifies what auxiliary power unit means for the purposes of range extended BEVs. This definition conforms with the definition found in section 1962.1.

“Enhanced AT PZEV” – This definition is being amended to apply only to model year 2009 through 2011 vehicles, due to new nomenclature used in model year 2012 and subsequent model years. Additionally, clarification is being added to the definition that Transitional Zero Emission Vehicle or TZEV means Enhanced AT PZEV.

“Proportional value” – This definition is being added to define the value used to calculate the ratio applied to credits earned in Section 177 ZEV states for subdivision 1962.1 (d)(5)(E) (subdivision C.4.5(e) of test procedures).

“Range extended battery electric vehicle” – This definition is being added to define a new vehicle category with which manufacturers are allowed to meet a portion of their obligation.

“Transitional zero emission vehicle” – This definition is being added to redefine Enhanced AT PZEVs, and is the new nomenclature for these types of vehicles in 2012 and subsequent model years.

“Type I.5x” - This definition is being added to define a new vehicle category with which manufacturers are allowed to meet a portion of their obligation.

“Type IIx” - This definition is being added to define a new vehicle category with which manufacturers are allowed to meet a portion of their obligation.

“Zero Emission Vehicle Miles Traveled” – This definition is being amended to clarify that “VMT” means vehicle miles traveled.

Section C. Zero Emission Vehicle Standards

The amendments made throughout section 1962.1 have been duplicated in this section of the test procedure.

Section D. Certification Requirements

D.1. This subdivision exempts ZEVs from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing, because ZEVs do not emit. This subdivision is being amended to ensure Type I.5x and Type IIx vehicles are not

exempt from such requirements because these vehicles have tailpipe and evaporative emissions.

Section E. Determination of NEV Acceleration, Top Speed, and Constant Speed Range

This new subdivision is being added to specify testing methods for NEV certification.

Section G. Test Procedures for 2012 and Subsequent Model Off-Vehicle Charge Capable Hybrid Electric Vehicles.

G.12 This new subdivision is needed to establish the calculations that must be used to determine the GHG emissions values attributable to off vehicle charge capable hybrid electric vehicles for the 2017 and subsequent model years.

G.12.1 This subdivision is needed to calculate the combined city/highway GHG emissions value for an off-vehicle charge capable hybrid electric vehicle.

G.12.2 This subdivision is needed to calculate the city (urban) GHG emissions value for off-vehicle charge capable hybrid electric vehicles.

G.12.2.1 This subdivision is needed to provide the equation used to calculate the urban GHG emissions value for off vehicle charge capable hybrid electric vehicles.

G.12.2.2 This subdivision is needed to define the “Charge-Depleting to Charge-Sustaining Range” that is used in the calculations in subsections G.12.2.5 and G.12.3.

G.12.2.3 This subdivision is needed to provide the utility factors for urban and highway cycles that are used in the calculations in subsections G.12.2.1 and G.12.3.

G.12.2.4 This subdivision is needed to provide the equation used to calculate the charge-depleting GHG rate from electricity use in each test cycle used in the calculation in subsection G.12.2.1.

G.12.2.5 This subdivision is needed to provide the equation used to calculate the urban or highway charge-depleting electricity use used in the calculation in subsection G.12.2.4.

G.12.2.6 This subdivision is needed to provide the equation used to calculate the weighted CO₂ mass emissions of the charge-sustaining test used in the calculation in subsection G.12.2.1.

G.12.3 This subdivision is needed to calculate the highway GHG emissions value for off vehicle charge capable hybrid electric vehicles.

Section K. Advanced Technology Demonstration Program Data Requirements

This new subdivision is being added to specify what is required of manufacturers to submit to ARB's Executive Officer for approval of credits earned in an advanced technology demonstration program, according to subdivision 1962.1(g)(4) (subdivision C.7.4 of test procedures). These data requirements have been available in Manufacturers Advisory Correspondence 06-02, and have now been added to these test procedures.

K.1. The purpose of this subdivision is to request a project description, including a general description, goal, objectives, and location of the advanced demonstration project.

K.2. The purpose of this subdivision is to request vehicle data, including the vehicle's model, model year, date placed in program, and vehicle identification number of the vehicle being demonstrated.

K.3. The purpose of this subdivision is to request the vehicle specifications including its class, curb weight, payload, electric range, fuel economy, fuel type, refueling time, electric motor output, hybrid energy storage, and fuel cell stack type, if applicable. This information is necessary for staff to gain more knowledge regarding the vehicle's technology.

Section L. Fast Refueling Capability

This new subdivision is being added to outline the criterion to verify a Type III, Type IV, and Type V ZEV's fast refueling capability. These criterion for fast refueling capability have been available in Manufacturers Advisory Correspondence 06-02, and have now been added to these test procedures.

§1962.2 Zero-Emission Vehicle Standards for 2018 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

This new section 1962.2, CCR, title 13 is being added to describe the ZEV requirements for 2018 and subsequent model years, and is similar in style and structure to section 1962.1.

(a) The purpose of this subdivision explains the ZEV emission standard, and allows ARB's Executive Officer to certify vehicles as ZEVs that meet the definition of the standard.

(b) The purpose of this subdivision is to outline the percentage ZEV requirements for manufacturers.

(b)(1) The purpose of this subdivision is to describe the percentage ZEV requirement, and how to calculate the number of vehicle to which the percentage ZEV requirements applies.

(b)(1)(A) The purpose of this subdivision is to describe the basic credit percentage requirement for each year that must be ZEVs, and that the ZEV requirement is to be based on the manufacturer's annual NMOG production report. This is a report submitted by a regulated manufacturer to ARB that indicates the number of vehicles delivered for sale in California, and to which standard each vehicle is certified.

(b)(1)(B) The purpose of this subdivision is to calculate the number of vehicles to which the percentage ZEV requirement is applied. This subdivision also describes that production averaging has no effect on a manufacturer's size determination and clarifies how a manufacturer should treat vehicles delivered for sale by other manufacturers in their production determination.

(b)(1)(B)3. The purpose of this subdivision is to allow manufacturers to elect a same year calculation method if the manufacturer applies to ARB's Executive Officer under the circumstances if the manufacturer's volume of PCs and LDTs produced and delivered for sale in California has decreased by 40 percent from the previous year due to circumstances that were unforeseeable and beyond its control. A manufacturer may only elect this option for 2 years.

(b)(1)(D) The purpose of this subdivision is to exclude NEVs produced by the manufacturer itself or by a subsidiary from a manufacturer's applicable sales volume to which the ZEV requirement is applied. This prevents manufacturers producing only NEVs from generating a larger requirement than can be fulfilled, since each NEV is worth less than one ZEV credit.

(b)(2) The purpose of this subdivision is to describe the ZEV requirements for LVMs.

(b)(2)(E) The purpose of this subdivision is to describe the requirements and allowed usage of credits from TZEVs for model year 2018 through 2025. The table describes the portion of the requirement that must be met with credits from ZEVs and the portion of the requirement that is allowed to be met with credits from TZEVs.

(b)(2)(F) The purpose of this subdivision is to describe the requirements and allowed usage of credits from TZEVs for 2026 and subsequent model years.

(b)(3) The purpose of this subdivision is to describe how IVMs are allowed to meet their 2018 and subsequent model year requirements, which is with credits from TZEVs.

(b)(4) The purpose of this subdivision is to exempt SVMs from meeting ZEV percentage credit requirements, but to allow a SVM to earn, bank, market, and trade credits for the ZEVs and TZEVs it produces.

(b)(7) The purpose of this subdivision is to describe the lead time and method for determining when and how a manufacturer is subject to requirements as it increases and decreases in size definition.

(b)(7)(A) The purpose of this subdivision is to describe that a manufacturer increasing in size, either due to aggregation or through increase in the manufacturer's sales, will become subject to more stringent requirements after the manufacturer has three consecutive sales averages above the intermediate or large volume thresholds.

(b)(7)(B) The purpose of this subdivision is to describe that a manufacturer decreasing in size will become subject to less stringent requirements after the manufacturer has three consecutive sales averages below the intermediate or small volume thresholds.

(b)(7)(C) This subdivision explains how to calculate California production volume in change of ownership situations.

(c) This subdivision describes the requirements and credits for TZEVs.

(c)(1) This subdivision introduces the rest of the subdivision.

(c)(2) This subdivision outlines the requirements that a vehicle must meet in order to be eligible for credit through the ZEV regulation.

(c)(2)(A) This subdivision describes that a manufacturer must certify to SULEV tailpipe standards, even if the vehicle is bi-fuel, fuel flexible and dual-fuel capable.

(c)(2)(B) This subdivision describes the evaporative emissions standards a TZEVE must certify to in order to receive credit.

(c)(2)(C) This subdivision describes the on-board diagnostic requirements for 150,000 miles that a TZEVE must meet in order to receive credit.

(c)(2)(D) This subdivision describes the warranty a manufacturer must provide for each TZEVE in order to receive credit.

(c)(3) This subdivision describes the allowances a TZEVE can earn.

(c)(3)(A) This subdivision describes how a manufacturer is to calculate its zero emission VMT allowance. The table in this subdivision describes equations

manufacturers must use to determine their zero emission VMT allowance and that TZEVs with less than 10 all electric UDDS does not qualify for this allowance.

(c)(3)(A)1. This subdivision allows TZEVs with 10 miles all electric range on the US06 drive schedule to receive additional credits.

(c)(3)(E) This subdivision describes the minimum requirements for HICE vehicles and the amount of credit each HICE vehicle is to earn.

(d) This subdivision describes the requirements and credits for ZEVs.

(d)(5) This subdivision describes the various types of credits for 2018 and subsequent model year ZEVs.

(d)(5)(A) This subdivision describes how a manufacturer is to calculate the amount of credit earned by each ZEV, which is based on range, according to the equation in this subdivision.

(d)(5)(A)1. This subdivision requires all ZEVs to have greater than 50 UDDS all electric miles in order to receive credit.

(d)(5)(A)2. This subdivision caps the amount of credit that may be received through the equation in subdivision 1962.2(d)(5)(A) for each ZEV.

(d)(5)(E) This subdivision allows manufacturers to count hydrogen FCVs delivered for sale and placed in service in California to be counted toward meeting the manufacturer's requirement in the Section 177 ZEV states that have adopted the ZEV regulation. This is due to hydrogen FCVs being dependent on hydrogen infrastructure, which is less robust in the Section 177 ZEV states.

(d)(5)(F) This subdivision describes how NEVs are eligible to receive 0.15 credits.

(d)(5)(F)1. This subdivision describes the technical specifications that NEVs must meet in order to receive credit. These specifications guarantee only the most advanced NEVs are eligible to receive credit.

(d)(5)(F)1.a. This subdivision describes the acceleration requirements that a NEV must meet in order to receive credits.

(d)(5)(F)1.b. This subdivision describes the top speed requirements that a NEV must meet in order to receive credits.

(d)(5)(F)1.c. This subdivision describes the constant speed range requirements that a NEV must meet in order to receive credits.

(d)(5)(F)2.. This subdivision describes the battery requirements that a NEV must meet in order to receive credits.

(d)(5)(F)3. This subdivision describes the warranty requirements that a NEV must meet in order to receive credits.

(d)(5)(F)4. This subdivision describes the charging requirements that a NEV must meet in order to receive credits.

(d)(5)(G) This subdivision describes the requirements manufacturers must meet in order for BEVxs, which is a BEV with an APU for back-up power to be eligible to receive credit.

(d)(5)(G)1. This subdivision describes the emissions requirements a BEVx must meet in order to receive credit to ensure the vehicle is low-emitting under all circumstances.

(d)(5)(G)2. This subdivision requires the vehicle's UDDS all electric range after the APU first starts is less than or equal to the vehicle's all electric UDDS test range prior to the APU start. The subdivision also clarifies that the APU may not start until the battery is being full depleted. These requirements ensure that the APU functionality is limited and that the unit is not relied upon instead of the battery electric power.

(d)(5)(G)3. This subdivision requires that in order to receive credit, BEVxs must have at least 80 miles UDDS all electric range.

(g) The purpose of this subdivision it to describe the generation and use of credits, as well as the calculations of penalties if the manufacturer is unable to make up a deficit in meeting its ZEV obligation.

(g)(1) This subdivision allows manufacturers to bank ZEV credits produced in excess of its requirement.

(g)(2) This subdivision describes how manufacturers are to calculate and maintain credits earned under this regulation.

(g)(2)(A) This subdivision describes that credits from ZEVs shall be expressed in terms of credits, and that those credits may be applied toward meeting a manufacturer's ZEV requirement.

(g)(2)(B) This subdivision describes that credits from TZEVs shall be expressed in terms of credits, and that those credits may be applied toward meeting a manufacturer's ZEV requirement.

(g)(2)(C) This subdivision describes that a manufacturer's various credits will be maintained in separate accounts within the ZEV bank.

(g)(2)(D) This subdivision describes how ZEV credits and debits are to be rounded. The language is meant to provide clarification and to avoid differences in calculating ZEV credits and debits.

(g)(3) This subdivision allows manufacturers to earn credit for MDVs produced as ZEVs or TZEVs, and apply those credits towards its ZEV obligation.

(g)(4) This subdivision outlines how manufacturers other than LVMs are to earn advanced demonstration credits for ZEVs and BEVxs.

(g)(4)(B) This subdivision describes the requirements and limits for manufacturers other than LVMs that place ZEVs in advance demonstration programs, and earn credit as if the vehicle was delivered for sale.

(g)(5) This subdivision describes how ZEV credits earned by vehicle placed in transportation systems may be used in 2018 and subsequent model years.

(g)(5)(C) This subdivision describes the limits on the use of transportation system credits for meeting a manufacturer's requirement.

(g)(5)(C)1. This subdivision describes the treatment and limits on the use of transportation system credits earned by ZEVs and BEVxs for meeting a manufacturer's requirement.

(g)(5)(C)2. This subdivision describes the treatment and limits on the use of transportation system credits earned by TZEVs for meeting a manufacturer's requirement.

(g)(6) This subdivision describes how a manufacturer submits credits for compliance with the regulation to ARB's Executive Officer, and how ZEV credits can be used to meet a manufacturer's obligation.

(g)(6)(A) This subdivision describes how discounted PZEV and AT PZEV credits and NEV credits may be used to meet a portion of a manufacturer's obligation, and that these credits expire after model year 2025.

(g)(6)(B) This subdivision describes how BEVx credits may be used to meet a portion of a manufacturer's obligation.

(g)(6)(C) This subdivision describes how a manufacturer applies for, generates, calculates, and uses GHG-ZEV over compliance credits.

(g)(6)(C)1. This subdivision allows a manufacturer to apply to ARB's Executive Officer to be eligible to generate GHG-ZEV over-compliance credits, no later than May 1, 2018.

(g)(6)(C)1.a. This subdivision disqualifies a manufacturer with any outstanding 2017 and previous model year debits from compliance with the GHG fleet standards, according to sections 1961.1 and 1961.3.

(g)(6)(C)1.b. This subdivision disqualifies a manufacturer with any outstanding 2017 and previous model year debits from compliance with the ZEV regulations, according to sections 1962.1.

(g)(6)(C)1.c. This subdivision requires a manufacturer to submit documentation of its projected product plan to show systematic over compliance by at least 2.0 gCO₂/mi of its section 1961.3 requirements for 2018 through 2021 model year, and commitment to do so in each year.

(g)(6)(C)2. This subdivision describes how a manufacturer is to calculate its over compliance with section 1961.3, which will be based on the previous model year.

(g)(6)(C)2.a. This subdivision requires that a manufacturer must over comply with section 1961.3 by at least 2.0 gCO₂/mi and describes the equation used for calculating GHG-ZEV over compliance credits for use towards meeting a manufacturer's ZEV requirement.

(g)(6)(C)2.b. This subdivision prohibits the use of multipliers earned under subdivision 1961.3(b)(9) to calculate a manufacturer's GHG-ZEV over compliance credits.

(g)(6)(C)2.c. This subdivision prohibits the use of banked gCO₂/mi credits to be used in the GHG-ZEV over compliance credit calculation.

(g)(6)(C)3. The purpose of this subdivision to limit the way GHG-ZEV over compliance credits may be used to meet a manufacturer's requirement in model years 2018 through 2021, as well as the limits on how the GHG-ZEV over compliance credits may be used towards meeting the minimum portion of a manufacturer's requirement that must be met with ZEVs. This subdivision also prohibits a manufacturer from banking these credits for use in subsequent model years, and requires a manufacturer to remove the gCO₂/mi used to calculate the GHG-ZEV over compliance credits from its GHG compliance bank, and cannot bank for future compliance toward 1961.3.

(g)(6)(C)4. This subdivision describes what is required of a manufacturer when submitting GHG-ZEV over compliance credits.

(g)(6)(C)4.a. This subdivision provides that a manufacturer who is granted the ability to generate GHG-ZEV over compliance credits and fails to over-comply by at least 2.0 gCO₂/mi will be subject to the full ZEV requirements for the model year and future model year, and will no longer be eligible to receive GHG-ZEV over compliance credits.

(g)(7) This subdivision describes the requirement and time limit to fulfill a ZEV deficit, as well as the penalties a manufacturer would be subject to if the manufacturer failed to make up a ZEV deficit.

(g)(7)(A) This subdivision describes the amount of time – one year – a manufacturer has to fulfill a ZEV obligation deficit, and that only credits from ZEVs may be used to fulfill a manufacturer's deficit.

(g)(8) This subdivision describes the penalties for failure to comply with the ZEV regulation, and the equation used to calculate a manufacturer's penalty because a manufacturer incurs a penalty if out of compliance with the regulation.

(h) This subdivision describes the documents used to certify and determine compliance with the ZEV regulation.

(h)(1) This subdivision names the test procedures used for certification to determine compliance with the ZEV regulation: "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

(h)(2) This subdivision names the test procedures for determining compliance with NEV requirements.

(i) This subdivision holds the definitions for section 1962.2.

(i)(1) This subdivision defines "auxiliary power unit" because range extended BEVs are equipped with an auxiliary power unit.

(i)(2) This subdivision defines "charge depletion range actual" because a TZEVs charge depletion range actual is used to calculate its zero emission VMT allowance.

(i)(3) This subdivision defines "discounted PZEV and AT PZEV credits" because manufacturers are allowed to use discounted PZEV and AT PZEV credits in meeting a portion of their overall requirement.

(i)(4) This subdivision defines "energy storage device" because a TZEV's extended warranty covers the vehicle's energy storage device.

(i)(5) This subdivision defines “hydrogen fuel cell vehicle” because manufacturers are allowed to meet a portion of their obligation with hydrogen fuel cell vehicles, and these vehicles are eligible for subdivision 1962.2(d)(5)(E).

(i)(6) This subdivision defines “hydrogen internal combustion engine vehicle” because manufacturers are allowed to meet a portion of their obligation with hydrogen internal combustion engine vehicles.

(i)(7) This subdivision defines “majority ownership situations” because manufacturers are to aggregate their sales with another manufacturer for determination of size definition in majority ownership situations.

(i)(8) This subdivision defines “manufacturer US PC and LDT Sales” because manufacturer’s US PC and LDT sales are used to calculate a manufacturer GHG-ZEV over compliance credits.

(i)(9) This subdivision defines “neighborhood electric vehicles” because manufacturers are allowed to meet a portion of their obligation with neighborhood electric vehicles.

(i)(10) This subdivision defines “placed in service” because in order for hydrogen FCVs to be eligible for subdivision 1962.2(d)(5)(E), the vehicles must be placed in service.

(i)(11) This subdivision defines “proportional value” because this value is used to calculate the ratio applied to credits earned in Section 177 ZEV states for subdivision 1962.2(d)(5)(E).

(i)(11) This subdivision defines “range extended battery electric vehicle” because manufacturers are allowed to meet a portion of their obligation with range extended BEVs.

(i)(12) This subdivision defines “section 177 state” because the federal Clean Air Act allows other states to adopt this ZEV regulation and the term is used throughout subdivision 1962.2(d)(5)(E) .

(i)(13) This subdivision defines “transitional zero emission vehicle” because manufacturers are allowed to meet a portion of their obligation with transitional zero emission vehicles.

(i)(14) This subdivision defines “zero emission vehicle” because manufacturers are required to comply with the regulation with zero emission vehicles.

(i)(15) This subdivision defines “zero emission vehicle fuel” because this phrase is used in the definition for transitional zero emission vehicle.

(j) This subdivision lists the abbreviations used throughout section 1962.2.

(k) This subdivision ensures that each section of 1962.2 is severable, meaning that if a section is to be deemed unenforceable, the remainder of the section remains in full force and effect.

(l) This subdivision requires that records for the vehicles subject to the ZEV regulation be subject to public disclosure.

(l)(1) This subdivision requires that a manufacturer's annual production data and credits per ZEVs and TZEV produces are subject to public disclosure.

(l)(2) This subdivision outlines the details for a manufacturer's annual credit balance.

(l)(2)(A) This subdivision requires individual ZEV credit balances from each vehicle category be subject to public disclosure.

(l)(2)(B) This subdivision requires credits earned for vehicles placed in advanced demonstration programs be subject to public disclosure.

(l)(2)(C) This subdivision requires credits earned for vehicles placed in transportation systems be subject to public disclosure.

(l)(2)(D) This subdivision requires credits earned, including credits purchased or traded with another party, including the parties themselves be subject to public disclosure.

List of Changes to “California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles in the Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicle Classes”

This test procedure is included by reference in section 1962.2, and contains an exact copy of the regulatory text, including the amendments being proposed in section 1962.1 in Section C. Sections A, B, D, E, F, G, H, I, J, K, and L are identical to those in the “California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles in the Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicle Classes,” as amended in this rulemaking.

§1962.3 Electric Vehicle Charging Requirements

(a) This subdivision describes the vehicles subject to the requirements of section 1962.3. This subdivision is being amended to include range extended BEVs,

to make this section applicable to NEVs starting in model year 2014, to delete the requirement that only ZEVs earning more than one credit must comply with these requirements, and to remove hybrids only capable of Level 1 charging from the requirement, because these vehicles are not anticipated in the future.

(b)(1) This subsection specifies the definitions applicable to section 1962.3. This subdivision is being amended to include the definitions from 1962.2 because this part of the CCR holds requirements for 2018 and subsequent model years.

(b)(2) This subsection defines Level 1 charging. This subdivision is being deleted because vehicles only capable of Level 1 charge are not anticipated in the future.

(c)(1) This subdivision specifies the requirements for an applicable vehicle's on board charger. This subdivision is being clarified to reflect the original intent that a vehicle's charging port and system is also required to meet the specific AC Level 1 and Level 2 charging contained in Society of Automotive Engineers J1772, JAN2010, titled "SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler". This subdivision has also been clarified from 3.3 kilovolt amps to kW to be more precise, and an alternative is being added to allow vehicles with smaller battery packs to comply with the section 1962.3 requirements if the vehicle is able to fully charge in less than 4 hours.

Health & Safety Code sections 38562 and 43018.5 are being added as references to reflect the contribution of those sections towards the GHG emission reductions referenced in sections 38562 and 43018.5.

10 REFERENCES

ANL, 2010. Argonne National Laboratory. D.J.Santini et al, EVS-25, Nov 5-9 2010. "Modeling of Manufacturing Costs of Lithium-Ion Batteries for HEVs, PHEVs, and EVs."

ARB, 2008. California Air Resources Board. March 27, 2008 Board Hearing Transcript. <http://www.arb.ca.gov/board/mt/2008/mt032708.txt>

ARB 2009a. California Air Resources Board. May 11, 2009 Update. "Climate Change Scoping Plan" http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

ARB, 2009b. California Air Resources Board. November 25, 2009. "White Paper: Summary of Staff's Preliminary Assessment of the Need for Revisions to the Zero Emission Vehicle Regulation - Attachment B: 2050 Greenhouse Gas Analysis" http://www.arb.ca.gov/msprog/zevprog/2009zevreview/attachment_b_2050_ghg.pdf

ARB, 2009c. California Air Resources Board. December 9, 2009. Resolution 09-66. http://www.arb.ca.gov/msprog/zevprog/2009zevreview/res09_66.pdf

ARB, 2009d. California Air Resources Board. "White Paper: Summary of Staff's Preliminary Assessment of the Need for Revisions to the Zero Emission Vehicle Regulation," <http://www.arb.ca.gov/msprog/zevprog/2009zevreview/>

ARB. 2010. California Air Resources Board. October 28, 2010. "Rulemaking To Consider The Adoption Of Proposed Amendments To The Regulation To Reduce Emissions Of Diesel Particulate Matter, Oxides Of Nitrogen And Other Criteria Pollutants From In-Use On-Road Diesel-Fueled Vehicles, The Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Measure, And The Regulation To Control Emissions From In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks At Ports And Intermodal Rail Yard Facilities, Appendix J" <http://www.arb.ca.gov/regact/2010/truckbus10/correctedappj.pdf>.

ARB, 2011a. California Air Resources Board. Commitment Letter. July 28, 2011. <http://www.epa.gov/oms/climate/letters/carb-commitment-ltr.pdf>.

ARB 2011b. California Air Resources Board. 2011. EMFAC 2011. <http://www.arb.ca.gov/msei/msei.htm>

Autobloggreen, 2010. AutoBlogGreen.com. Eric Loveday. "Mercedes-Benz prices B-Class F-Cell lease at \$849 a month" <http://www.green.autoblog.com/2010/11/22/mercedes-benz-prices-b-class-f-cell-lease-at-849-a-month/>

BMW, 2011a. Bayerische Motoren Werke AG. Press Release, February 10, 2011. "BMW ActiveE Electric Vehicle" https://www.press.bmwgroup.com/pressclub/p/us/pressDetail.html?outputChannelId=9&id=T0097313EN_US&left_menu_item=node_2253

BMW, 2011b. Bayerische Motoren Werke AG. Press Release, July 29, 2011. "World premiere of the BMW i3 Concept and BMW i8 Concept" https://www.press.bmwgroup.com/pressclub/p/us/pressDetail.html?outputChannelId=9&id=T0118603EN_US&left_menu_item=node_6729

BMW, 2011c. Bayerische Motoren Werke AG. 2011. "BMW i3" http://www.bmw-usa.com/en_us/bmw-i3/

BYD, 2010. Build Your Dreams. Press Release, December 14, 2010. "BYD to supply 50 e6 models to California" <http://bydit.com/doce/news/press/1367.html>

Bloomberg, 2010. Sookyung Seo, Bloomberg.com. December 18, 2010. "Hyundai Targets Commercial Production of Fuel-Cell Cars in 2015" <http://www.bloomberg.com/news/2010-12-19/hyundai-targets-commercial-production-of-fuel-cell-cars-in-2015.html>

Brookings, 2011. The Brookings Institution. M. Muro, J. Rothwell, and D. Saha. "Sizing the Clean Economy: A National and Regional Green Jobs Report"

BusinessTimes, 2011. San Francisco Business Times, September 12, 2011. "Coda to assemble electric cars in Benicia" <http://www.bizjournals.com/sanfrancisco/news/2011/09/12/coda-to-assemble-evs-in-benicia.html>

CCST, 2011. California Council on Science and Technology, May 2011. "California's Energy Future: The View to 2050."

CaFCP, 2009. California Fuel Cell Partnership. CaFCP Action Plan, February 2009. "Hydrogen Fuel Cell Vehicle and Station Deployment Plan: A Strategy for Meeting the Challenge Ahead" <http://www.cafcp.org/sites/files/Action%20Plan%20FINAL.pdf>

Carnegie, 2011. Carnegie Endowment, 2011. "Road To Recovery – Transforming America's Transportation" http://carnegieendowment.org/files/road_to_recovery.pdf

Chrysler, 2010. Chrysler Group LLC. Press Release, March 22, 2010. "Chrysler Group LLC to Develop New Fiat 500 Electric Vehicle for the United States" <http://media.chrysler.com/newsrelease.do?id=9673&mid=&searchresult>

Citi, 2011. Citi Investment Research & Analysis. February 23, 2011 "*Electric Vehicles: Perspectives on a Growing Investment Theme*"

CNRA, 2009. California Natural Resources Agency. 2009. "2009 California Climate Adaptation Strategy" <http://www.energy.ca.gov/2011publications/CEC-600-2011-007/CEC-600-2011-007-SD.pdf>

Coulomb, 2011. Coulomb ChargePoint America.
Website. <http://chargepointamerica.com/>. Accessed September 20, 2011

DOE, 2008. United States Department of Energy. Vision Model, 2008. http://www.transportation.anl.gov/modeling_simulation/VISION/

DTI, 2010. Directed Technologies Inc., 2010 U.S. DOE Merit Review. June 7-11, 2010. "Mass Production Cost Estimation for Automotive Fuel Cell Systems".

ECotality, 2011. ECotality. "Quarterly Report: Second Quarter 2011"
<http://www.theevproject.com/downloads/documents/Q2%20EVP%20INL%20Report.pdf>.

EPA, 2010a. United States Environmental Protection Agency, National Highway Safety and Traffic Administration and California Air Resources Board. September 2010. "Interim Joint Technical Assessment Report: Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2017-2025"

EPA. 2010b. United States Environmental Protection Agency. June 2010. "Quantitative Health Risk Assessment for Particulate Matter" http://www.epa.gov/ttn/naaqs/standards/pm/data/PM_RA_FINAL_June_2010.pdf

Fisker, 2011. Fisker Automotive. Press Release, October 18, 2011. "Fisker Automotive Records First Sales of its Karma Sedan"
<http://media.fiskerautomotive.com/global/en-us/Media/PressRelease.aspx?mediaid=557&title=fisker-automotive-records-first-sales-of-its-karma-sedan>

Ford, 2011a. Ford Motor Company. Press Release, January 10, 2011. "Ford supercharges electric vehicle plan, unveiling new C-MAX Energi and C-MAX Hybrid products" http://media.ford.com/article_display.cfm?article_id=33792

Ford, 2011b. Ford Motor Company. Press Release, June 9, 2011. "Ford to Triple Production Capacity of Electrified Vehicles in North America by 2013, Led by C-MAX Hybrid, C-MAX Energi" http://media.ford.com/article_display.cfm?article_id=34759

GM, 2011a. General Motors Company. Press Release, August 17, 2011. "Electric Concept Car Comes to Life as Cadillac ELR" http://media.gm.com/content/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2011/Aug/0817_cadillac

GM, 2011b. General Motors Company. Press Release, October 12, 2011. "Spark Joins Chevrolet's U.S. Small Car Lineup in 2012" http://media.gm.com/content/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2011/Oct/1012_SparkMCE

Green Car Congress, 2011a. Green Car Congress.com, July 18, 2011. "GE Energy partners with Lowe's to provide EV chargers for home and commercial use; Siemens Energy providing chargers to Town of Cary, NC" <http://www.greencarcongress.com/2011/07/gesiemens-20110718.html> Accessed September 9, 2011.

Green Car Congress, 2011b. Green Car Congress.com, January 13, 2011 "Ford developed home charging station for the Focus with Leviton" <http://www.greencarcongress.com/2011/01/ford-20110113.html>

Greene, 2011. David Greene, Transportation Research Part D, 2011. "What is greener than a VMT tax? The case for an indexed energy user fee to finance US surface transportation"

Honda, 2011. Honda Motor Company, LTD. Press Release, November 17, 2010. "World Debut of Honda Fit EV Concept Electric Vehicle and Plug-in Hybrid Platform at Los Angeles Auto Show" <http://www.hondanews.com/channels/honda-automobiles-concepts/releases/honda-at-the-los-angeles-auto-show-fact-sheet>

ICCT, 2011a. The International Council on Clean Transportation. "Vehicle Electrification Policy Study – Task 2 Report: Metrics" , February 2011

ICCT, 2011b. International Council on Clean Transportation, April 2011 Update. "Global Light-Duty Vehicles: Fuel Economy and Greenhouse Gas Emissions Standards"

IEA, 2011. International Energy Agency, June 2011. "Technology Roadmap – Electric and Plug-in Hybrid Electric Vehicles"

Lotus, 2010. Lotus Engineering. James Turner, et al. "The Lotus Range Extender Engine." SAE Int J Engines 3:318-351

McKinsey, 2010. McKinsey & Company, 2010. "*The Role of BEVs, PHEVs, and FCEVs: A portfolio of power-trains for Europe.*"

Mercedes, 2011. Mercedes-Benz. Press Release, April 12, 2011. "Daimler and Bosch to establish joint venture for electric motors" <http://media.daimler.com/dcmedia/0-921-656186-1-1382859-1-0-0-0-0-1-12759-614216-0-0-0-0-0-0-0-0.html?TS=1319729886930>

Motor Trend, 2011. Motor Trend.com. Michael Floyd. July 12, 2011. "Next-Gen Mitsubishi Outlander to Be Brand's First Plug-In Hybrid" <http://wot.motortrend.com/next-gen-mitsubishi-outlander-to-be-brands-first-plug-in-hybrid-95745.html>

NAS, 2011. National Academy of Sciences. 2010. Committee on the Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy; National Research Council "Assessment of Fuel Economy Technologies Light Duty Vehicles".

NREL, 2011a. National Renewable Energy Laboratory. February 15, 2011 "Role of Fuel Carbon Intensity in Achieving 2050 GHG Reduction Goals within the LDV Sector."

NREL, 2011b. National Renewable Energy Laboratory. Neubauer, J. and A. Pesaran. June 2011. *"The ability of battery second use strategies to impact plug-in electric vehicle prices and serve utility energy storage applications."*

Nissan, 2011. Press Release, July 19, 2011. "Nissan To Launch All-Electric Leaf As Upgraded 2012 Model In New U.S. Markets" <http://www.nissannews.com/pressrelease/2682/185/nissan-launch-all-electric-leaf-upgraded-2012-model>. Accessed October 15, 2011.

PRTM, 2011. PRTM and World Bank, April 2011 "The China New Energy Vehicles Program – Challenges and Opportunities".

PluginCars, 2011. PluginCars.com. Zach McDonald. February 9, 2011. "Ford Pushes Key Marketing Message: Lower Maintenance Costs." <http://www.pluginCars.com/ford-pushes-key-marketing-message-electric-cars-lower-maintenance-costs-106793.html> Accessed September 26, 2011.

PopularMechanics, 2011. Basem Wasef, Popular Mechanics.com. September 30, 2011. "2012 Coda Sedan Test Drive." <http://www.popularmechanics.com/cars/reviews/drives/2012-coda-sedan-test-drive>. Accessed October 15, 2011.

Rocky Mountain Institute, 2009. Rocky Mountain Institute, February 24, 2009. "Project Get Ready: Helping Communities Become Electrified Vehicle Pioneers"

Roland Berger, 2010a. Roland Berger Strategy Consultants "Powertrain 2020: Li-Ion Batteries – The Next Bubble Ahead"

RolandBerger, 2010b. Roland Berger Strategy Consultants in collaboration with Rocky Mountain Institute, 2010. *"PEV Readiness Study."*

Roland Berger, 2011. Roland Berger Strategy Consultants. "Automotive Landscape 2025: Opportunities and Challenges Ahead"

SB 375, 2008. Steinberg. September 30, 2008. http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_bill_20080930_chaptered.pdf Accessed September 7, 2011.

Tesla, 2011. Tesla Motors. Webpage. "Model S Facts". <http://www.teslamotors.com/models/facts>

Toyota, 2011a. Toyota Motor Company. January 13, 2011 "Japanese Companies Eye Smooth Domestic Launch of FCVs" <http://www2.toyota.co.jp/en/news/11/01/0113.html>

Toyota, 2011b. Toyota Motor Company. Press Release, September 16, 2011. "2012 Toyota Prius PHV Media Preview – Bob Carter" <http://pressroom.toyota.com/releases/2012+toyota+prius+phv+preview.htm>

Toyota, 2011c. Toyota Motor Company. Press Release, July 19, 2011. "Toyota RAV4 EV Coming to Market in 2012" <http://pressroom.toyota.com/releases/toyota+rav4+ev+coming+to+market+in+2012.htm>

Toyota, 2011d. Toyota Motor Company. Press Release, May 10, 2011. "Toyota Announces Opening of First Pipeline-Fed Hydrogen Station in the United States" <http://pressroom.toyota.com/releases/toyota+hydrogen+fueling+station+may+2011.htm>

UC Berkeley, 2008. University of California, Berkeley. November 2008. "*California Climate Risk and Response*"

UC Berkeley, 2011. University of California, Berkeley. B.Williams and T.Lipman. April 2011. "*Analysis of the combined vehicle and post vehicle use value of lithium ion plug-in vehicle propulsion batteries.*" (Draft Final)

UC Davis, 2010. University of California, Davis. J.Axsen and K.Kurani. July 2010. "*Reflexive Layers of Influence (RFI): A model of social influence, vehicle purchase behavior, and pro-societal values.*"

UC Davis, 2011a. University of California, Davis. Chris Yang. June 23, 2011. "Fuel Electricity and Plug-in Electric Vehicles in an LCFS."

UC Davis, 2011b. University of California, Davis. David Bunch and David Greene, February 2011. "Potential Design, Implementation, and Benefits of a Feebate Program for New Passenger Vehicles in California: Final Report."

UC Davis, 2011c. University of California, Davis. T.Turrentine et al. Mary 2011. *"The UC Davis MINI E Consumer Study."*

USA TODAY, 2010. Chris Woodyard, USA TODAY. March 18, 2010. "GM vows production-ready hydrogen fuel cell by 2015" <http://content.usatoday.com/communities/driveon/post/2010/03/gm-vows-production-ready-hydrogen-fuel-cell-by-2015/1>. Accessed November 5, 2011

Volkswagen, 2011. Volkswagen Group. Press Release, September 13, 2011. "AN UP!DATE TO THE NEW VOLKSWAGEN SMALL CAR: THE WORLD PREMIER OF SIX CONCEPT CARS, ALL RELATED TO THE UP!" <http://media.vw.com/pressrelease/909/138/up-date-new-volkswagen-small-car-world-premier>

White House, 2011. United States White House. Press Release. July 29, 2011. "President Obama Announces Historic 54.5 MPG Fuel Efficiency Standards." <http://www.whitehouse.gov/the-press-office/2011/07/29/president-obama-announces-historic-545-mpg-fuel-efficiency-standard>. Accessed September 9, 2011

Documents Incorporated By Reference in §1962.1, 1962.2, and the incorporated test procedures, and 1962.3, Title 13, California Code of Regulations

- SAE J2841: "Utility Factor Definitions for Plug-In Hybrid Electric Vehicles Using Travel Survey Data" (March 2009)
- SAE J1772: "SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler" (January 2010)
- SAE J2572: "Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fueled by Compressed Gaseous Hydrogen" (October 2008)
- ETA-NTP002: "Implementation of SAE Standard J1666 May 93: Electric Vehicle Acceleration, Gradeability, and Deceleration Test Procedure" (February 2008)
- ETA-NTP004: "Electric Vehicle Constant Speed Range Tests" (February 2008)

Spreadsheets Used for Tables and Figures

On October 11, 2009, AB 1085 was signed into law and became effective on January 1, 2010. The legislation was subsequently amended by SB 855, which was signed into law and became effective on October 19, 2010, and is intended to provide all of the information relied on by ARB staff in proposing the adoption, amendment, or repeal of a regulation, including all information related to, but not limited to, air emissions, public health impacts, and economic impacts. The information will be posted on the following

website: http://www.arb.ca.gov/msprog/clean_cars/clean_cars_ab1085/clean_cars_ab1085.htm