March 25, 2008

Ms. Mary Nichols, Chair and Board Members
Mr. James Goldstene
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: 2008 Proposed Amendments to the California Zero Emission Vehicle Program Regulations, Agenda Item 08-3-5

Dear Ms. Nichols, Mr. Goldstene and Board Members:

On behalf of the above named organizations, we are pleased to offer a proposal to strengthen the Zero Emission Program, specifically the **Enhanced AT-PZEV** component as described in the California Air Resources Board (CARB) staff Initial Statement of Reasons (ISOR) released February 8, 2008.

The ZEV Program should promote new innovation in advanced technology by automakers. We strongly recommend that the volumes of Enhanced AT-PZEVs required for 2012 and beyond follow a continuous upward trend. Specifically, we advocate for significantly strengthening the staff proposal by requiring at least the increased **number of plug-in hybrid electric vehicles** shown in the table below (volumes in thousands of vehicles):

Model Year	2012	2013	2014	*Cumulative 2012-2014*	2015	2016	2017	*Cumulative 2012-2017*
CARB ISOR (Enh. AT-PZEV)	25	25	25	*75*	28	28	28	*159*
New Proposal Minimum Plug-in Hybrid Sales	25	35	49	*110*	69	97	136	*411*
Improvement Factor	1.0	1.4	2.0	*1.5*	2.5	3.5	4.8	*2.6*

The report attached with this letter ("**Proposal to Strengthen the ZEV Program's Enhanced AT-PZEV Component**") demonstrates that the plug-in hybrid vehicles volumes required by the ISOR are exceeded by automaker plans, historic sales trajectories for advanced technology vehicles and projections based on national government and financial services firm assessments.

Our proposal results in more than twice the number of plug-ins on the road in 2017 and can be achieved through a gradual reduction in credit values for the Enhanced AT-PZEV and lower technology categories.

We are advocating a significant increase but to put our proposal in perspective consider that the AB 1007 *State Alternative Fuels Plan* adopted by the CARB Board calls for 1.3 million plug-in hybrids on California roads by 2020.

Because of their advanced battery requirements, plug-in hybrid vehicles promote pure zero-emission vehicle technologies. Additionally, plug-in hybrids are a vital solution for reducing global warming pollution from the transportation sector. Plug-in hybrid vehicles can reduce global warming by 50 percent or more compared to similarly-sized conventional vehicles. Additionally, increased volumes of plug-in hybrids recommended by our proposal can help make electricity an important contributor to California's Low Carbon Fuels Standard (LCFS), providing approximately 1.5 percent carbon intensity reduction in 2020 towards the 10 percent LCFS goal.

We urge CARB to institute a much larger Enhanced AT-PZEV requirement. By doing so, CARB can lock-in the plug-in hybrid plans announced by automakers and push these ZEV technologies to mass commercialization. We appreciate your consideration of our proposal.

Sincerely,

Bonnie Holmes-Gen
American Lung Association of California

John Shears
Center for Energy Efficiency and Renewable Technologies

Tim Carmichael
Coalition for Clean Air

Daniel Emmett
Energy Independence Now

Danielle Fugere
Friends of the Earth

Luke Tonachel
Natural Resources Defense Council

Sherry Boschert
Sierra Club California

Spencer Quong
Union of Concerned Scientists

Attachment:

Proposal to Strengthen the ZEV Program's Enhanced AT-PZEV Component

Introduction

The CARB proposal for modification of the ZEV Program should be strengthened to require volumes of advanced technology vehicles that promote new innovation by automakers. At a minimum, the advanced technology vehicle requirements should be in addition to what the automakers would produce without the program. This document provides a basis for improving the requirements for Enhanced AT-PZEVs as described in CARB's ZEV Initial Statement of Reasons (ISOR) released February 8, 2008.

Enhanced AT-PZEVs are a new technology category proposed by CARB to backfill a substantial reduction in pure ZEV requirements starting in 2012. Enhanced AT-PZEVs are an appropriate backfill technology because, as the ISOR states, "Enhanced AT PZEVs, though not gold in terms of zero tailpipe emissions, are extremely clean in terms of both criteria pollutant and climate change fuel cycle emissions and, even more than conventional AT-PZEVs make use of fuels and vehicle systems directly enabling further advancement of ZEVs." Plug-in hybrid electric vehicles are a very promising Enhanced AT-PZEV technology both because of recent advancements in battery technology and because consumers generally have easy access to electricity for charging. CARB's Expert Panel noted that plug-in hybrids are likely to be available in the 10,000's/year in 2012.[1]

Our review of the Expert Panel assessment along with evaluation of automaker announcements and past AT-PZEV performance lead us to conclude that the CARB ISOR requirements for Enhanced AT-PZEVs are insufficient. CARB should strengthen their proposal with significantly larger volumes of Enhanced AT-PZEVs that continue to grow from 2012 through 2017.

CARB's Enhanced AT-PZEV Proposal Falls Short: Three Examples of Deficiency

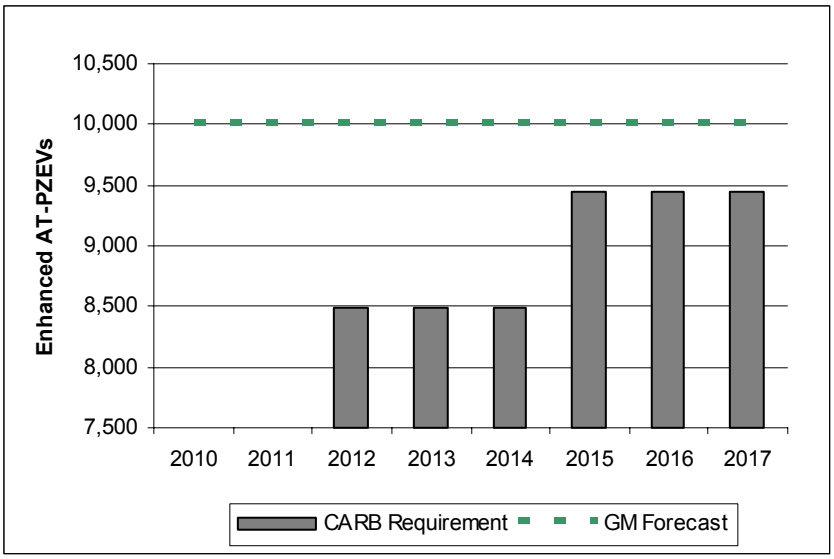
1. Automaker Plans Exceed CARB Requirement

General Motors Vice President of Global Program Management John Lauckner recently commented that GM plans annual production of the Chevrolet Volt in the 10,000's starting in 2010.[2] Comparing this announcement with CARB proposal indicates that

[1] Walsh et al., "Status and Prospects for Zero Emissions Vehicle Technology: Report of the ARB Independent Expert Panel 2007", April 13, 2007, p. 12.
[2] Shepardson, David, "GM plans to build 'tens of thousands' of Chevy Volt plug-ins, official says", *The Detroit News*, January 31, 2008, available at http://www.detnews.com/apps/pbcs.dll/article?AID=/20080131/BIZ/801310505.

CARB has set the bar too low. The bars of Figure 1 estimate the maximum national volumes of the Chevy Volt, an Enhanced AT-PZEV plug-in hybrid with 40 miles of all-electric range (AER), required by the CARB ISOR. The dashed line is set at production volumes that GM is targeting for 2010, two years before CARB starts its lower requirement. Note that in the figure, the GM forecast remains constant at the Volt's first-year volume; actual sales greater than 10,000/year after 2010 would cause the CARB requirement to fall further behind the automaker.

Figure 1: CARB Chevy Volt Requirement for All ZEV States Falls Below Automaker Plans



Assumes Volt receives 2.4 credits/vehicle and the maximum volume of Enhanced AT-PZEVs is used as a backfill for ZEV. GM's obligation under CA ZEV is assumed to be 22 percent and the national volume requirement is 2.4 times the CA requirement.

Toyota has also expressed plans to build plug-in hybrid electric vehicles. In recent testimony before Congress, Toyota commented on the beginning of plug-in hybrid road tests in 2007 in the U.S., Japan and Europe. The Toyota representative continued by underscoring Toyota's commitment to lithium-ion batteries:

> In 2010, we will expand this demonstration phase by delivering a significant fleet of plug-in hybrid vehicles to a variety of global fleet customers, including many in the U.S. These plug-in hybrids will be powered by Toyota's first-generation lithium-ion batteries. To prepare for this expansion, Toyota and its joint-venture battery partner, Panasonic, will add manufacturing capacity to build lithium batteries for automotive applications.[3]

2. Historic Sales Trajectory of Advanced Technology Vehicles Exceeds CARB Requirement

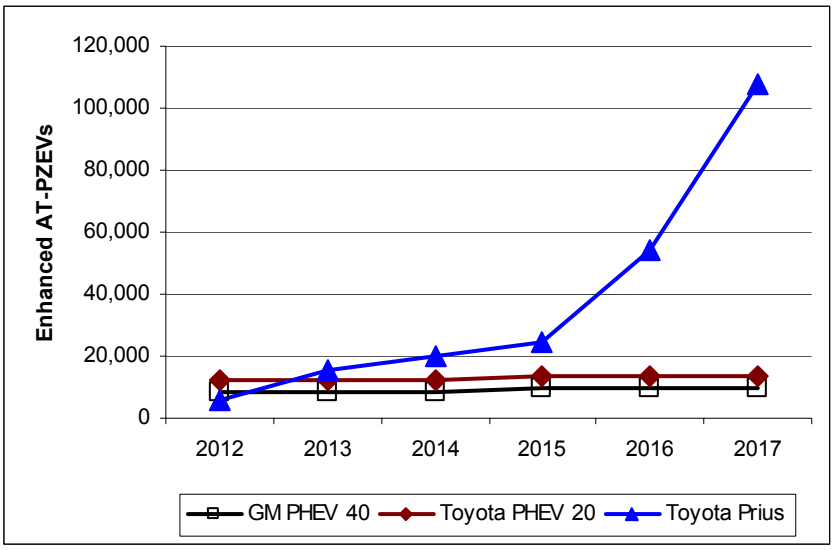
The CARB Enhanced AT-PZEV requirement also falls short of observed sales of advanced technology vehicles. Once introduced into the marketplace, sales of high quality vehicles can grow at an exponential rate. In its summary of the Expert Panel ZEV Technology Review, CARB describes the large jumps in vehicle production volumes as

[3] Stricker, Tom, "Toyota's Hybrid Vehicle Strategy," Testimony before the House Appropriations Committee, Subcommittee on Energy and Water, February 14, 2008.

vehicles progress through pre-commercialization (1,000's/year), commercialization (10,000's/year) and mass commercialization (100,000's/year) stages.[4] The CARB proposal for Enhanced AT-PZEVs, however, fails to keep up with the increased volumes associated with commercialization stages. The proposal also fails to keep up with the historic sales trajectory of a familiar, yet highly complex AT-PZEV, the Toyota Prius. Some Enhanced AT-PZEV architectures involve only the integration of a larger battery into existing AT-PZEV platforms, so it is reasonable to assume that Enhanced AT-PZEV production volumes could follow the sales trajectory of complex AT-PZEV models.

In Figure 2, we compare the national volume requirements under CARB's proposal for two Enhanced AT-PZEVs, the Chevy Volt and a Toyota plug-in hybrid with a 20 mile AER, to the national sales of the Toyota Prius. The Prius reached pre-commercialization volumes of over 5,000 vehicles in 2000; this year 2000 volume is matched with the CARB 2012 requirement for Enhanced AT-PZEVs. Both the Volt and Toyota PHEV 20 start above the Prius with near commercialization volumes (~10,000/year) in 2012. However, the growth trajectory falls short of the Prius trajectory just a year later. By the fourth year (2015), the Prius sales are nearly double that required for the Toyota Enhanced AT-PZEV and the gap grows larger in the following years.

Figure 2: CARB Proposal Lacks Sufficient Growth Beyond 2012:
CARB Requirement for GM Volt and Toyota PHEV 20 vs. Sales Trajectory of Toyota Prius



Same assumptions as Figure 1. Additionally, Toyota's CA ZEV obligation is 27 percent and the Toyota PHEV 20 earns 2.0 credits/vehicle.

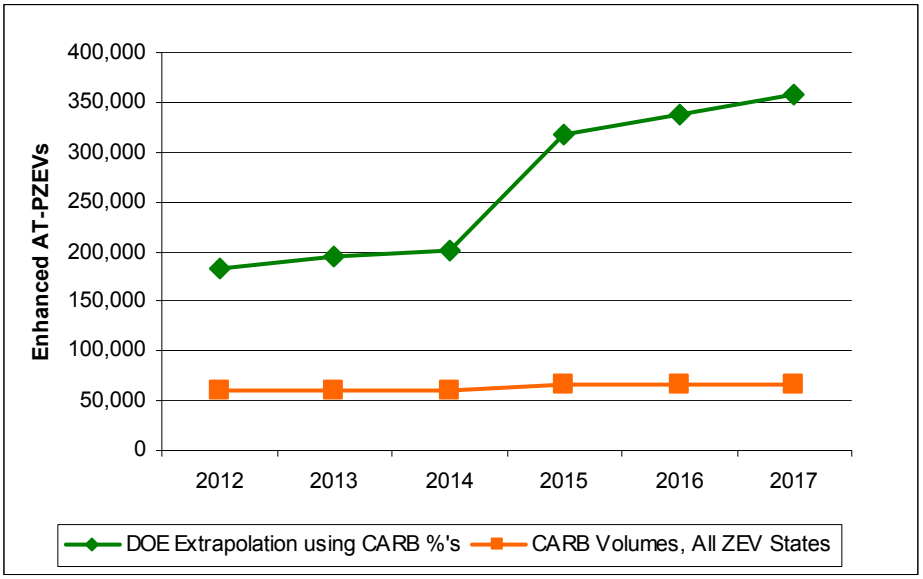
3. Using CARB Methodology, National Enhanced AT-PZEV Sales Exceed CARB Requirement

Comparing the CARB Enhanced AT-PZEV to national projections in the growth of hybrid vehicles reveals that the CARB requirements are too low. We use the relationship between the requirements of Enhanced AT-PZEVs and AT-PZEVs in the CARB

[4] CARB, "Status Report on the California Air Resources Board's Zero Emission Vehicle Program: ZEV Technology Review," April 20, 2007.

proposal as an indicator of how many Enhanced AT-PZEVs the six largest manufacturers can deliver. CARB's Enhanced AT-PZEV requirement is 28 percent of the total AT-PZEV requirement from 2012 to 2014 and 36 percent from 2015 to 2017.[5] These percentages show that manufacturers must shift their hybrid production from predominately AT-PZEVs to a mix that is a third Enhanced AT-PZEVs. Applying these same percentages to a national projection of hybrid sales illustrates that the CARB proposal is far lower than manufacturer capabilities. Figure 3 presents the volume of Enhanced AT-PZEVs that would be expected nationally if the CARB Enhanced AT-PZEV percentages were applied to the Department of Energy's (DOE) projection of hybrid electric sales.[6] In all years, the DOE projection is significantly greater than the CARB requirement implemented in all ZEV states, growing from 67 percent greater in 2012 to 81 percent greater in 2017.

Figure 3: Using CARB Methodology, DOE Projections Exceed CARB Proposal for Big 6 Manufacturers



The examples of CARB ISOR deficiency presented as 1, 2 and 3 above are based on conservative assumptions. Assumptions used in the analyses seek to put the ISOR in its strongest position by minimizing the gap between the ISOR volume requirements, automaker plans and likely vehicle production scenarios. Appendix A describes how less conservative assumptions would show that the ISOR is even more deficient at pushing for greater innovation in the Enhanced AT-PZEV category.

[5] 'Total AT-PZEV' refers to the sum of Enhanced AT-PZEV and AT-PZEV vehicles. Enhanced AT-PZEVs receive 1.5 credits; AT-PZEVs receive 0.65 credits in 2012-2014 and 0.55 credits in 2015-2017. To get national estimate, the CA volumes were multiplied by 2.4.

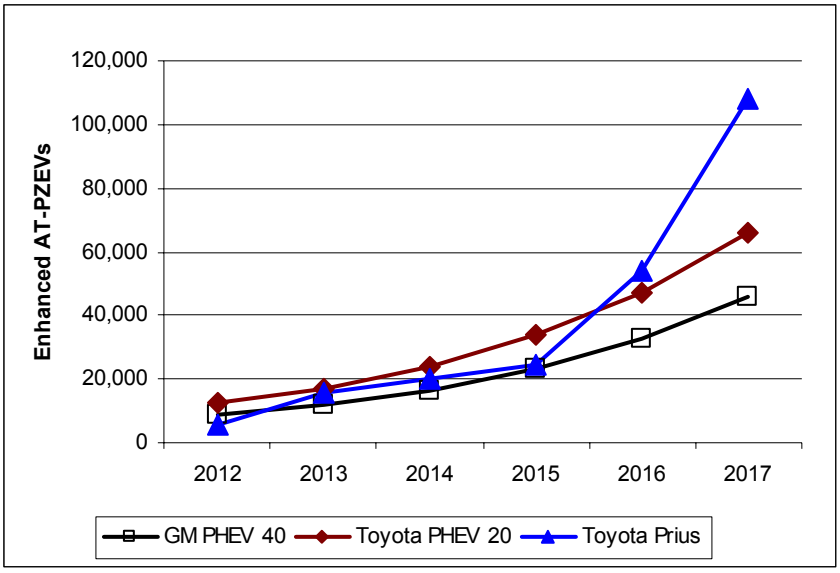
[6] National hybrid sales from Department of Energy, Energy Information Administration, *Annual Energy Outlook* 2007, Table 47. DOE sales are multiplied by 80 percent to conservatively estimate volumes from six largest manufacturers. Volumes of Enhanced AT-PZEV are determined so that Enhanced AT-PZEVs achieve the CARB percentages (28 percent for 2012-2014, 36 percent for 2015-2017) of the sum of Enhanced AT-PZEVs and conventional hybrids.

Proposal to Strengthen the Enhanced AT-PZEV Requirement: CARB Should Require Higher Enhanced AT-PZEV Volumes and Increase Requirements on an Annual Basis

CARB should strengthen the Enhanced AT-PZEV requirement through an annual increase of at least 40 percent per year to ensure a rapid commercialization of Enhanced AT-PZEVs from 2012 and through 2017. As explained above, the CARB ISOR fails to aggressively push vehicle manufacturers to mass commercialization of Enhanced AT-PZEVs, namely plug-in hybrid electric vehicles. The ISOR requirements fall below planned volumes from GM, fail to keep pace with observed sales of the Prius AT-PZEV and are misaligned with national projections of hybrid penetration. The annual percentage increase structure is an improvement over the CARB ISOR because it more closely follows the exponential rise seen in successful market launches, such as for the Prius. Starting with a 40 percent/year increase is conservative: it is just over half of the 74 percent/year average annual growth rate for new sales of the Prius from 2000 to 2007 and it is set lower in recognition that not all manufacturers are equally positioned to deliver Enhanced AT-PZEVs.

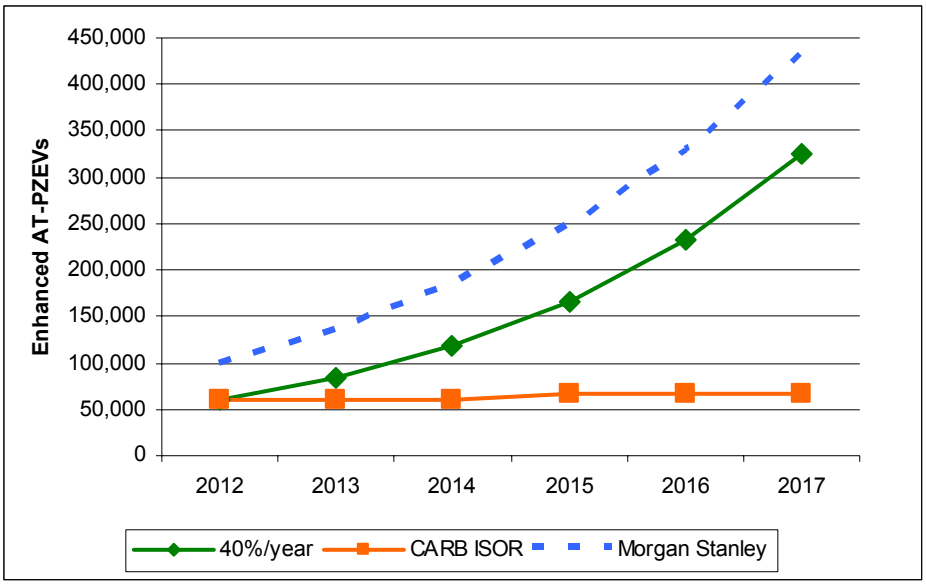
Figure 4 illustrates the impact of the annual percentage increase for the GM Volt and Toyota PHEV 20 and can be compared to the CARB ISOR requirements for those vehicles in Figure 2 above. Figure 5 illustrates the potential Enhanced AT-PZEV volumes in all ZEV states under the annual percentage increase proposal as compared to the CARB ISOR. While still not keeping pace with the later-year Prius trajectory, the 40 percent/year annual increase provides a reasonable match to the trajectory in the earlier years. Nationally, the 40 percent/year proposal forces more innovation from vehicle manufactures than the CARB ISOR by requiring nearly twice the ISOR volume in 2014 and 4.8 times the ISOR volume in 2017.

Figure 4: Strengthened CARB Requirements through Annual 40 Percent/Year Increase in Enhanced AT-PZEVs: Select Vehicle Comparison, All ZEV States



Also included in Figure 5 is a recent projection of US plug-in hybrid sales by Morgan Stanley, a global financial services firm. Morgan Stanley estimates that plug-in hybrids will reach greater volumes in 2012 than the ISOR but then increase on similar trajectory to our strengthening proposal, growing from national sales of 100,000 in 2012 to 250,000 in 2015 and over 435,000 in 2017.[7]

Figure 5: Strengthened Proposal for All ZEV States: Enhanced AT-PZEV Requirement Increases by 40 Percent/Year



Assumes an Enhanced AT-PZEV credit of 1.5/vehicle and a multiplier of 2.4 to translate CA requirements to all ZEV states.

The comparisons shown in Figures 4 and 5 for Enhanced AT-PZEV volumes are analogous to expected volumes in California. Table 1 displays the volume of Enhanced AT-PZEVs required for California for both the ISOR and strengthened proposal at 40 percent/year annual increase.

Table 1: California Enhanced AT-PZEV Volumes

Enhanced AT-PZEV Type		2012	2013	2014	2015	2016	2017
GM PHEV 40	ISOR	8,494	8,494	8,494	9,438	9,438	9,438
	40%/yr	8,494	11,892	16,649	23,309	32,632	45,685
Toyota PHEV 20	ISOR	12,293	12,293	12,293	13,659	13,659	13,659
	40%/yr	12,293	17,211	24,095	33,733	47,226	66,117
Big 6 Total PHEVs (1.5 credits/vehicle)	ISOR	25,200	25,200	25,200	28,000	28,000	28,000
	40%/yr	25,200	35,280	49,392	69,149	96,808	135,532

[7] Steinmetz, Jonathan and Shanker, Ravi, "Plug-in Hybrids: The Next Automotive Revolution", Morgan Stanley Research North America, March 11, 2008.

With Strengthening Proposal, Plug-in Hybrids Contribute Significantly to 2020 Low Carbon Fuels Standard, But Further Growth Needed for 2050 Global Warming Targets

University of California researchers, led by Professors Alexander Farrell and Daniel Sperling, analyzed multiple advanced vehicle and alternative fuel paths for achieving the 10 percent carbon intensity target of the California Low Carbon Fuel Standard (LCFS).[8] Included in their analysis is a plug-in hybrid scenario with vehicle volumes similar to those that can be achieved with the 40 percent/year strengthening proposal for Enhanced AT-PZEVs. Continuing the 40 percent/year ramp beyond 2017 to 2020, could result in sales of new Enhanced AT-PZEVs of 370,000 in 2020 and on-road vehicle population of 1.1 million.[9] Assuming that the Enhanced AT-PZEVs are predominantly plug-in hybrid vehicles, the researchers found that these volumes, and their associated displacement of gasoline with grid electricity, could produce a 1.5 percent reduction in carbon intensity in 2020, or 15% of LCFS requirement.[10]

While the strengthening proposal produces large enough plug-in hybrid volumes that meaningfully contribute to the LCFS, greater growth in plug-in hybrids will be necessary to meet California's 2050 goal of an 80 percent reduction in global warming pollution from 1990 levels. In the recent *State Alternative Fuels Plan*, the California Energy Commission and CARB examined a "Moderate Case Example" of plug-in hybrid penetration which included 1.3 million plug-ins on the road in 2020, which is about 200,000 more than the strengthening proposal extended to that year.[11] The State Plan notes that the plug-in hybrid example (Example 2 in the report) is insufficient for meeting the state's 2050 global warming pollution target. Therefore, the vehicle volumes achieved with the 40 percent/year ramp-up can be viewed as only a first step; CARB must continue to ramp up plug-in hybrids beyond the 40 percent/year penetration rate to meet long-term goals.

Greater Enhanced AT-PZEV Volumes Achieved through Future Credit Reductions

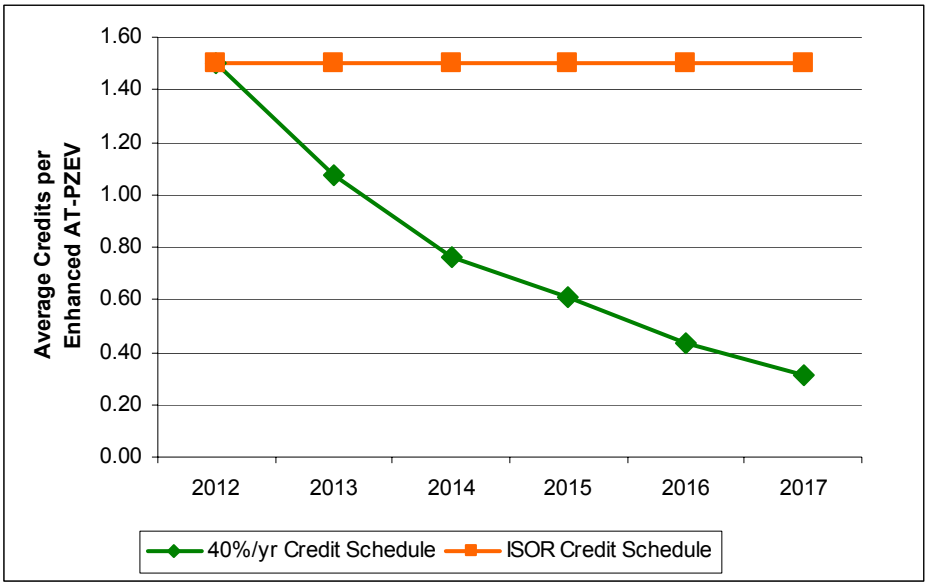
Increasing the volume of Enhanced AT-PZEV volumes as compared to the ISOR can be accomplished by annually reducing the credits awarded to each Enhanced AT-PZEV (and correspondingly reducing credits for lower technology AT-PZEVs and PZEVs). This methodology preserves CARB's ability to increase the pure ZEV requirements over time while staying within the current regulatory constraints of new vehicle fleet sales allocated to ZEVs (i.e. the General Percentage ZEV Requirement of 12 percent of model years 2012 through 2014 and 14 percent of model years 2015 through 2017) and the percentage splits between each vehicle category proposed in the ISOR (i.e. Enhanced AT-PZEVs comprise 2.7 percent of the model years 2012 through 2014 and 3.0 percent of model years 2015 through 2017). The method can also serve to increase the volumes of other

[8] Farrell, Alexander E. and Sperling, Daniel, "A Low Carbon Fuels Standard for California, Part 1: Technical Analysis", May 29, 2007.
[9] Assumes a 5 percent/year scrappage rate.
[10] Farrell and Sperling, op. cit., Scenario C5, Assumption 'Introduce PHEVs'.
[11] California Energy Commission, California Air Resources Board, *State Alternative Fuels Plan*, Commission Report CEC-600-2007-011-CMF, December 2007.

lower-cost technologies in the AT-PZEV and PZEV categories that are essential for meeting the state's near-term global warming and air quality goals.

To reach the volumes of Table 1 for the 40 percent/year proposal, an average 1.5 credits per vehicle in 2012 would have to be reduced to 0.3 credits in 2017, as shown in Figure 6.

Figure 6: Average Vehicle Credit Schedules for Meeting Enhanced AT-PZEV Requirements



ISOR Cost Savings Should Be Allocated to Greater Plug-in Hybrid Volumes

Since CARB's proposal significantly reduces the number of pure ZEVs required, automaker costs of compliance are reduced. CARB should require that these savings are put back into vehicle technologies, such as plug-in hybrids. According to the ISOR, automakers save $6.6 billion over the 2012 to 2017 timeframe. The ISOR also claims that the incremental cost of plug-in hybrid technology is $25,000 per vehicle. If just over half ($3.8 billion) was reinvested in plug-in hybrids—using the CARB vehicle cost assumption—an additional 152,000 plug-ins could be produced, resulting in total volumes three times larger than the ISOR requirement for 2012 to 2014.

Conclusion

CARB should strengthen the ISOR by significantly increasing the required numbers of Enhanced AT-PZEVs in the 2012 to 2017 timeframe. CARB should adjust the program to achieve at least the Enhanced AT-PZEVs volumes under the 40 percent/year proposal of Table 1. Based on automaker plans and observed rates of penetration from advanced technologies, the ISOR volumes are insufficient. Typical new technology introduction follows a continuous ramp-up that should be reflected in the CARB requirements.

Annually increasing plug-in hybrid volumes starting in 2012 provides an important opportunity for electricity to meaningfully contribute to the LCFS and helps put California on a path to address global warming pollution from vehicles.

Appendix A: Assumptions of Analysis are Conservative

The three examples illustrated in Figures 1, 2 and 3 are based on conservative assumptions in that they seek to minimize the gap between the CARB ISOR volume requirements, automaker plans and likely vehicle production scenarios. The following list highlights how this difference could be even larger.

- *GM plug-in hybrid production is likely to be higher, which widens the gap between automaker plans and the CARB ISOR.* Figure 1 compares the CARB proposal to a static and minimum level of Chevy Volt production espoused by GM managers for 2010. A more likely scenario of a successful plug-in hybrid launch would result in larger future volumes and a larger gap between the CARB proposal and the GM plans. GM's intention to build the Volt is also included in contractual obligations to their primary labor union, UAW; GM committed the Volt production to the Hamtramck, MI UAW plant.[12] Along with Volt, GM is pursuing another plug-in hybrid architecture with the Saturn Vue and has announced intentions to bring it to production in a similar time frame to the Volt.[13]
- *Extending the CARB proposal to all ZEV states may require fewer vehicles nationally, thus reducing the overall impact of the program.* Figures 1-3 above assume that the national requirement for Enhanced AT-PZEVs is 2.4 times the CA requirement. The CARB ISOR estimates that it is "more than double". The 2.4 factor is calculated from the relationship of fuel use in CA as compared to the other ten ZEV states.[14] However, CA has a relatively large percentage of cars compared to other states. If the fleets of other states are less efficient (using more fuel per vehicle) then CA then calculation methodology would overestimate the number of vehicles sold each year in the state and therefore the number of vehicles needed to comply with ZEV.
- *Early introduction multiplier credits would reduce CARB ISOR volumes.* This analysis assumes that no early introduction multiplier credits are taken for Enhanced AT-PZEVs produced from 2009 to 2011. If manufacturers take advantage of early introduction credit multipliers, their requirements for vehicle production in the 2012 – 2017 timeframe will be lower.

[12] Plant commitments available at http://www.uaw.org/contracts/07/gm/gm08b.php.
[13] Bauza, Margarita and Phelan, Mark, "Saturn turns up the volume with hybrids", Detroit Free Press, January 14, 2008.
[14] Methodology and data is from CARB, "Addendum to January 2 Technical Assessment: Comparison of Greenhouse Gas Reductions for All Fifty United States under CAFE Standards and ARB Regulations Adopted Pursuant to AB1493", January 23, 2008.