

Review of CARB Staff's ZEV Population Forecasts

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Summary

As part of the midterm review of the Advanced Clean Cars (ACC) regulation, the staff of the California Air Resources Board (CARB) developed forecasts of the number of zero-emission vehicles (ZEVs) expected to be in operation in the state by 2025. In developing these forecasts, CARB staff defined three scenarios representing what it considers to be “slow,” “mid-range,” or “high” advancement of ZEV technology during the period ending in 2025. CARB staff's 2025 ZEV population forecasts across the three scenarios range from 1.1 to 1.2 million vehicles. Of this total, CARB forecasts that about 350,000 will be vehicles sold through the 2017 model year and the remainder will be sold between the 2018 and 2025 model years. Although the ACC regulation itself sets no targets for ZEV sales, the staff's forecasts will undoubtedly be compared to the 2025 target of 1.5 million ZEVs set by Governor Brown through Executive Order B-16-2012.

Given the above, Sierra Research, at the request of the Alliance of Automobile Manufacturers (Alliance), has reviewed the CARB staff's ZEV population forecasts. This review focused on an assessment of the assumptions made by CARB staff in forecasting the 2025 ZEV population under the “mid-range” scenario. Of the assumptions made by CARB staff, two were selected for sensitivity analysis. The first was staff's assumption that in order to ensure compliance with the ZEV requirements, vehicle manufacturers would maintain a reserve of ZEV credits equal to the amount needed for one year of compliance. Our analysis extended this assumption to two years, as was already modeled for the “high” case. The second was staff's assumption that there would be “perfect” trading between manufacturers of credits generated by NEVs/AT PZEVs/PZEVs that will be converted to TZEVE credits for the 2018 model-year. Instead, we assumed that these vehicle manufacturers would retain all of these credits for their own use. As a result of changing only these two assumptions, the number of ZEVs forecast in 2025 using the CARB staff methodology and their updated 2017 ZEV Calculator spreadsheet increases to 1.4 million.

Background

CARB staff's ZEV population forecasts are found in Appendix A¹ of California's Advanced Clean Cars Midterm Review. The assumptions used by the staff are partially summarized in Table 7 of Appendix A. Several factors are used to define the slow, mid-range, and high ZEV technology scenarios, with the assumptions for each differing across the three scenarios. These factors include the following:

¹ www.arb.ca.gov/msprog/acc/mtr/appendix_a.pdf

- The range of battery electric vehicles;
- The range of plug-in hybrid electric vehicles;
- The percentage of plug-in hybrid electric vehicles receiving credit for being fully capable of electric-only operation (i.e., being able to operate in all-electric mode over the US06 driving cycle);
- The percentage of OEMs relying on the use of ZEV credit resulting from over-compliance with CARB's tailpipe GHG standards;
- Compliance pathways chosen by vehicle manufacturers with respect to production of different types of ZEV program vehicles (pure ZEV vs. TZEV; BEV vs. FCEV); and
- The amount of ZEV credits manufacturers would hold in reserve to help ensure compliance with the CARB regulatory requirements.

In addition to the above assumptions, CARB staff made a number of assumptions that are consistent across each scenario. These assumptions address the following:

- The ZEV credit balance that is forecast for each manufacturer at the end of 2017;
- The NEV/AT PZEV/PZEV credit balances that are to be converted to TZEV credits at the end of the 2017 model year as those vehicles leave the ZEV program; and the
- The annual level of vehicle sales forecast for the period from 2018 and 2025.

Although there is significant uncertainty associated with the assumptions made by CARB staff in each of the above areas, our review identified two assumptions that were highly uncertain and were therefore selected for sensitivity analysis: (1) the amount of credits that vehicle manufacturers will hold in reserve to assure future compliance with the ZEV requirements and (2) the use of TZEV credits generated from the conversion of credits originally generated by NEVs, AT PZEVs, and PZEVs. Here, we assumed that manufacturers would maintain a two-year reserve rather than a one-year reserve of ZEV credits and that manufacturers would not trade the TZEV credits resulting from conversion of NEV/AT PZEV/PZEV credits with other manufacturers.

Credit Reserve

In the three scenarios modeled in the Midterm Review, CARB assumes that manufacturers will reserve three months of credits for the slow ZEV technology advancement case, one year of credits for the mid-range case, and two years of credits for the high case. Combining the high technology advancement assumption that manufacturers retain a two-year credit reserve with the remaining assumptions for the mid-range scenario, and using CARB staff's methodology, the number of ZEVs forecast to be sold between 2018 and 2025 increases from just under 800,000 vehicles to just under 1,000,000 vehicles. Given the staff's assumption of approximately 350,000 ZEVs being sold before 2018, the total ZEV population forecast for 2025 increases from 1.15 to 1.35 million vehicles.

Conversion of Historical NEV, AT PZEV, and PZEV (NAP) Credits

The CARB model currently estimates that the conversion of NAP credits generated by NEVs, AT PZEVs, and PZEVs at the end of the 2017 model year will result in the availability of approximately 200,000 TZEV credits. However, the potential TZEV credit available from NAP credits at the end of the 2015 model year² was only about 121,000 credits, and that value is less than the availability at the end of the 2014 model year.³ In addition, because these converted credits are not subject to discounting or expiration over time, the basis for CARB staff's assumption that 75% of these credits will be used by 2025 and that they will be freely traded among manufacturers is highly uncertain. Finally, examination of NAP credit balances for individual manufacturers indicates that only Ford, General Motors, Toyota, Honda, Subaru, and Mazda currently have sufficient credits to satisfy CARB staff's assumption regarding credit usage.

To estimate the impact of this assumption, we modeled four scenarios for the usage of NAP credits:

1. NAP credit balances increase to the levels forecast by CARB, and each manufacturer's usage is capped at 75%;
2. NAP credits remain at the 2015 levels, and each manufacturer's usage is capped at 75%;
3. NAP credits increase to the levels forecast by CARB, and each manufacturer's usage is capped at 100%; and
4. The NAP credits remain at the 2015 levels, and each manufacturer's usage is capped at 100%.

The impact of each of these adjustments is shown in Table 1.

Table 1.
Impact of Assumption Regarding NEV/AT PZEV/PZEV Credits (TZEVs)

NAP Balance	Maximum Usage	TZEVs
2017	75%	61,000
2017	100%	33,000
2015	75%	69,000
2015	100%	49,000

Thus, substituting more reasonable assumptions for CARB staff's assumptions regarding NAP credits increased the number of ZEVs forecast to be sold between 2018 and 2025 by about 50,000 vehicles, or from about 800,000 ZEVs to 850,000 ZEVs. Given the staff's assumption of approximately 350,000 ZEVs being in operation before 2018, the total ZEV population forecast for 2025 increases from 1.15 to 1.2 million vehicles.

² www.arb.ca.gov/msprog/zevprog/zevcredits/2015zevcredits.htm

³ www.arb.ca.gov/msprog/zevprog/zevcredits/2014zevcredits.htm

Conclusion

Substituting what appear to be more reasonable assumptions for two factors while retaining all other CARB staff assumptions for the mid-range ZEV technology advancement case results in a 2025 ZEV population forecast of 1.4 million vehicles, which is in agreement with the CARB staff's original 2012 forecast.