16 July 2026

California Air Resources Board
Clean Cars Program

Re: Drive Forward Workshop Comments on Adoption of SAE J1634 APR 2026 for BEV Range Testing and BEV Window Sticker Metrics

Dear CARB Staff,

SAE International, a global voluntary consensus mobility standards development organization, appreciates this opportunity to submit comments to California Air Resources Board June 22, 2026, Drive Forward workshop. These comments were prepared by members from the Light Duty Vehicle Performance and Economy Measure Committee and are representative of the consensus of the committee's subject matter expertise. Their comments reference SAE documents that were developed in an open consensus process in accordance with the National Technology Transfer and Advancement Act 0f 1995.

SAE standards committee members have a long history of developing voluntary consensus standards that have been incorporated by reference into legislation, rulemaking documents, and regulations. SAE ground vehicle standards are cited in the federal, state, local, tribal, and by international government bodies such as the United Nations World Forum for the Harmonization of Motor Vehicle Regulations.

SAE International is submitting two separate letters of comment to the 22 June 2026 Drive Forward Workshop.

Workshop comments pertaining to the recent revision of J1634-2026: Response Comments

The SAE Light Duty Vehicle Performance and Economy Measure Committee appreciates the opportunity to comment on the June 22, 2026, Drive Forward workshop. CARB identified adoption of version 2026 of SAE J1634 for BEV range testing, with amendments, as a topic for stakeholder input.

The Committee supports CARB's adoption of SAE J1634 APR 2026 for BEV range testing. At this stage, the Committee is reserving detailed comments on any CARB-specific amendments until those amendments are further defined.

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SAE J1634 APR 2026 provides meaningful technical improvements that support better repeatability and stronger correlation across BEV range testing options. The 2026 revision is intended to reduce test-to-test variation without introducing bias relative to J1634 2017-07 or J1634 2021-04, while also improving correlation between the short multi-cycle procedures and the multi-cycle test.

In particular, the Committee notes the following advantages of SAE J1634 APR 2026:

- The procedure requires energy measurement from all rechargeable electrical energy storage systems, including both high-voltage and low-voltage batteries. This reduces variation associated with low-voltage battery charging and discharging effects, including the influence of 12V battery starting state of charge.
- The addition of methods to aid automakers to voluntarily reduce label range and/or apply a cap to the UBE was included to commonize the method by which an OEM perform such voluntary reductions, should they choose to. Such commonization is intended to help both automakers and regulators conduct tests and review applications.
- On the MCT test, the soak prior to UDDS3 is narrowed to 10 +/- 1 minutes rather than the previously wider window of 0 to 30 minutes. This change reduces variation in UDDS3 and overall range while maintaining equivalency to the earlier MCT procedure without introducing bias.
- The end-of-test procedure is improved by defining end of test as 4 seconds after the vehicle can no longer maintain 63 mph, with energy integration ending automatically at that point and deceleration to zero occurring within 60 seconds. These changes reduce operator-response variation and avoid aggressive decelerations that can create safety concerns and unnecessary tire wear on the chassis dynamometer.
- The short multi-cycle test (SMCT) procedures were revised to align with the multi-cycle test (MCT) and provide consistency between the two procedures. The US06 cycle was replaced with a fixed CSC_m of 20-minutes at65 mph. This change improves correlation with MCT, reduces the risk of driver violations, reduces the need for higher power dynamometers for high-mass vehicles, and simplifies the method by using the same 20-minute 65 mph steady-state data as the basis for calculating the sMCT battery cycler discharge rate, the sMCT end-of-test criteria, and 70 mph energy consumption and range.
- The SMCT approach offers practical laboratory benefits because all four UDDS cycles and both HWFET cycles are completed within the first three hours, allowing the same driver to complete the core energy-efficiency cycles while reducing fatigue-related variation. This approach can reduce the time required to

collect the energy-efficiency data portion of the test from approximately 10 to 11 hours for MCT to approximately 3 hours for sMCT+.

Taken together, these updates improve repeatability, reduce unnecessary test burden, and strengthen correlation between abbreviated and full test procedures while maintaining continuity with prior SAE practice. For those reasons, the Committee encourages CARB adoption of SAE J1634 APR 2026 for BEV range testing.

BEV Window Sticker proposal: Response comments

The SAE J1634 Committee understands that CARB's proposed BEV window sticker is intended to provide customers with additional information about vehicle performance under different operating conditions, including city driving, freeway driving at 70 mph, cold temperature operation, and hot temperature operation.

Note: The committee recommendations are presented in italic for emphasis

Core Concern: Adjusted vs. Unadjusted Basis

The Committee's fundamental concern is the use of CARB window sticker values based on unadjusted data alongside the EPA label. Adjusted values have been used in vehicle labeling for decades to help reconcile the testing conditions of a dynamometer lab with real-world conditions and to calibrate consumer expectations. The EPA label uses a 5-cycle adjusted range to align consumer expectations in that way and is typically 20 to 30% lower than the unadjusted data. As a result, the CARB combined and hot weather range values will appear materially higher than the EPA (combined) label range for the same vehicle, while the cold weather range value will also over predict. It is expected that the use of unadjusted numbers will set an unrealistic and unachievable expectation of driving range. Because CARB is seeking to support customer acceptance and adoption of electric vehicles, a label that increases customer dissatisfaction will not advance that objective.

For example, for a vehicle with an EPA adjusted range label of 300 miles, the corresponding unadjusted combined hot range will be approximately 390 miles. Presenting a higher, less real-world-achievable value next to the EPA label may create customer confusion and lead to dissatisfaction when those ranges are not achieved in normal use.

This concern applies equally to all values displayed on the CARB supplemental window sticker - not only the hot and cold temperature range values, but also the city and Cruise 70mph range values to the extent they are derived from unadjusted dynamometer data.

The Committee therefore strongly recommends that all CARB window sticker *values be expressed on an adjusted basis, consistent with the EPA* fuel economy *label framework, as described in the recommendations below.*

The committee also recommends adding text similar to the EPA fuel economy label's statement of "Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle." to clarify that all the values on the CARB supplemental window sticker are estimates.

Recommendation: Remove Combined Range from CARB Window Sticker

The Committee recommends that the "Combined" range metric be removed from the CARB supplemental window sticker entirely. The range on the EPA label is already an adjusted, combined range value, and is already displayed on the federally mandated EPA Fuel Economy label, which is affixed to the same vehicle. Duplicating this value on the CARB window sticker - particularly if expressed on an unadjusted basis -creates a risk of consumer confusion when two different numerical values appear for the same metric on labels affixed side by side, or at a minimum is redundant. Removing the combined range from the CARB window sticker eliminates this risk and positions the CARB window sticker as clearly complementary to, rather than competing with, the federal EPA fuel economy label.

The Committee therefore recommends that the CARB supplemental window sticker *displays four metrics only: City range, Cruise* (70 mph) range, Cold temperature range, and Hot temperature range - all expressed on an adjusted basis as described below.*

**" Cruise (70mph)" is the recommended renaming of the CARB Highway (70mph) range and is used throughout this document. Details will be presented below.*

Recommendation: Adjustment Factors Applied to Adjusted Basis for Environmental Factors

The Committee is supportive of the approach to using two base adjustment factors, one each for hot and cold range, but strongly believe it should be applied to the EPA adjusted (5-cycle or default 0.7 Adj Factor) values for the reasons set forth above. No label value - whether Combined, City, Cruise (70mph), Cold, or Hot - should be derived from or displayed as an unadjusted dynamometer result. Unadjusted values systematically overstate achievable range and undermine the consumer trust that the CARB window sticker is intended to build.

The Committee recommends adopting the adjustment factors such~~:~~ that they are applied to the adjusted 5-cycle combined range: Hot Factor = 0.8, and Cold Factor = 0.6. The committee also recommends a periodic update of these factors via MAC letters. The committee's intent is to continue to validate these factors in the near term.

The committee agrees that individual adjustment factors obtained through testing should be allowed. The testing is discussed below.

The hot and cold ranges will represent a combined city/highway driving pattern.

These factors are based on results of existing studies such as Argonne National Lab's Downloadable Dynamometer Database and the AAA Temperature Effects On Electric And Hybrid Vehicle Efficiency Study of 2026, as well as other studies about the impact of HVAC loads on energy consumption. These recommended factors represent the lower end of performance, which leave room for vehicle-specific test procedures, described below, through which individual automakers can demonstrate superior technology that reduces energy consumption, through both current state-of-the-art as well as future unknown innovations.

Recommendation: City Range - Adjusted Basis

The Committee recommends that the CARB City range value be derived from the EPA adjusted (5-cycle or default 0.7 Adj Factor) city fuel economy result, consistent with the city value already established under the federal label framework. The applicable adjustment methodology is set forth in 40 CFR 600.210-12. This ensures that the CARB City range value is directly reconcilable with the federal label and test procedures and reflects real-world driving expectations.

Recommendation: Cruise (70 mph) Range - Adjusted Basis via 0.92 Factor (SAE J1634, Appendix B)

With respect to the highway metric, the Committee supports using the SAE J1634 APR 2026 method to calculate Cruise Range (70 mph) energy consumption and range as the laboratory basis for this metric. The revised J1634 procedure derives steady-state range at 70 mph from existing 65 ±2 mph steady-state data and road-load coefficients, reducing laboratory test burden while providing a technically sound laboratory basis.

However, the J1634-derived result is a laboratory value generated under ideal conditions and does not reflect real-world variation. *The Committee therefore recommends that the J1634 result be adjusted by applying a factor of 0.92,* derived from EPA's empirical

highway real-world adjustment analysis and formalized for BEV application in SAE J1634 APR 2017 by removing the fuel/ethanol correction variable applicable to ICE vehicles:

Cruise (70 mph) Adjusted Range = J1634 Unadjusted 70 mph Calculated Range × 0.92 Factor

This approach ensures consistency across all range metrics 0.92 factor reflects the modest but real gap between ideal laboratory conditions and produces real-world 70 mph cruise driving - a gap demonstrably smaller than the city cycle gap.

The differential adjustment treatment between City range and Cruise Range (70 mph) is technically justified by the fundamentally different relationship each test cycle bears to real-world consumer driving experience. The UDDS-based city test cycle, which underlies the City range value metric, operates at an average speed of approximately 21 mph with a maximum speed of 56.7 mph and includes significant idle time - conditions that are materially less demanding than real-world urban driving, which involves higher average speeds, more aggressive acceleration and other factors. EPA recognized this gap explicitly: in 1984, the city adjustment factor was 10%, which the 2006 5-cycle final rule (Federal Register, December 27, 2006, 71 FR 77880) significantly expanded by incorporating additional test cycles - precisely because the UDDS alone was insufficient to capture real-world urban driving conditions.

The Cruise Range (70 mph) metric, by contrast, is derived from the J1634 constant-speed test at 70 mph - a steady-state condition that closely approximates real-world sustained highway cruise driving. The primary real-world deviations from this test condition involve wind variation, road grade, and minor HVAC loading, which EPA's own empirical analysis quantified as approximately an 8% gap between the HFEDS laboratory result and real-world highway performance. SAE J1634 APR 2017 formalized this finding for BEV application by removing the fuel/ethanol correction variable applicable to ICE vehicles from EPA's original 0.905 factor, yielding a BEV-specific real-world adjustment factor of 0.92. This factor is an empirically derived, standard-embedded correction that is appropriate to reflect the modest but real gap between the J1634 laboratory result and consumer 70 mph cruise driving experience.

The Committee recommends renaming "Highway (70 mph)" to "Cruise Range (70 mph)" throughout the CARB window sticker to avoid consumer confusion with the commonly understood "highway" fuel economy values displayed on the federal EPA fuel economy label. This rename should be reflected consistently across all CARB window sticker documentation and rulemaking text.

Recommendation: Vehicle-Specific Environmental Consumption Factors - SAE Work

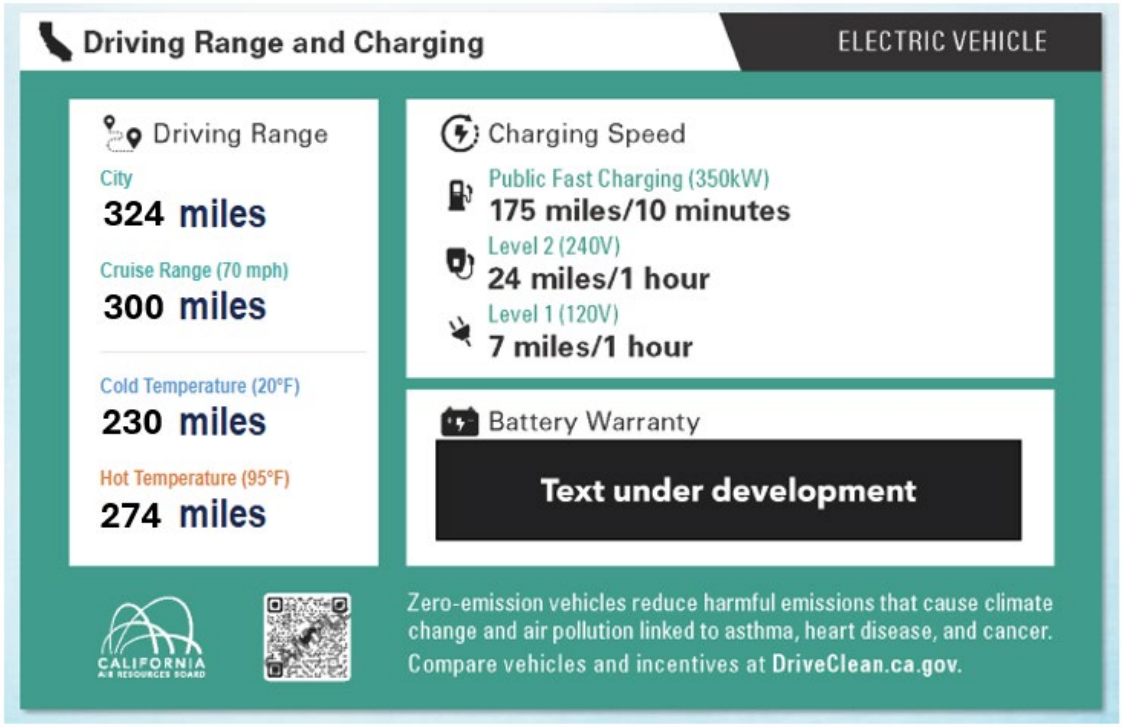
Note that the suggested cold and hot factors are for "combined" 2-cycle ranges as opposed to 1-cycle city or 1-cycle highway range. This distinction is important because of the strong inverse relationship of average speed vs. HVAC and thermal management energy consumption on a per mile basis in a vehicle. Due to that, the use of a single 1-cycle test such as the standalone SC03 (for hot) or the standalone Cold UDDS (for cold) to generate an individual vehicle hot or cold factor that is then compared to a combined range value is insufficient.

The Committee is actively investigating test procedures to enable individual vehicle Hot and Cold Factors. The Committee has identified options for 2-cycle testing that could provide the necessary data to generate vehicle-specific factors and will be evaluating these options against criteria of technical rigor, fairness across all current and future BEV technologies, and practical test burden. The Committee intends to bring forward a vehicle-specific factor methodology for CARB consideration as part of its ongoing work, with the fleet-averaged factors of Hot = 0.8 and Cold = 0.6 serving as the interim regulatory baseline until vehicle-specific procedures are established. OEMs demonstrating superior thermal management performance through the forthcoming SAE test procedure should be permitted to use vehicle-specific factors in lieu of the fleet-averaged baseline.

Summary and Examples

In summary, the Committee recommends that CARB adopt the adjusted-basis framework described above for all four CARB supplemental window sticker metrics - City, Cruise Range (70 mph), Cold, and Hot - ensuring that each value is derived from or reconcilable with the EPA adjusted basis. The Committee further recommends that CARB explicitly remove the Combined range metric from the proposed window sticker, as this value is already presented on the federal EPA fuel economy label and its duplication - particularly on an unadjusted basis - creates an unnecessary risk of consumer confusion. The Committee stands ready to engage with CARB on the technical details of this framework and to propose vehicle-specific thermal factor test procedures as that methodology development work progresses.

Proposed CARB BEV Window Sticker - Recommended Format



Federal v CARB Proposed Window Sticker - Recommended



Metrics, Location and Source

Range Metric	Location	Calculation Detail
City	CARB Window Sticker	J1634 MCT City Range * 0.7 or Custom Adjustment Factor per 1634 Appendix B (40 CFR 600.210-12(d)(3)(ii))
Cruise Range (70 mph)	CARB Window Sticker	J1634 70mph Range * 0.92 (per SAE J1634 Appendix B)
Cold Temperature (20 F)	CARB Window Sticker	Adjusted Combined Range * 0.6 (Baseline Factor) or SAE-developed vehicle-specific factors as future pathway)
Hot Temperature (95 F)	CARB Window Sticker	Adjusted Combined Range * 0.8 (Baseline Factor) or SAE-developed vehicle-specific factors as future pathway)
Combined / "Driving Range"	EPA Label	J1634 MCT Combined Range * 0.7 or Custom Adjustment Factor per 1634 Appendix B (40 CFR 600.210-12(d)(3)(ii))

Thank you in advance for consideration of these comments from members of the SAE International Light Duty Vehicle Performance and Economy Measure Committee and we look forward to discussing this submission with CARB.

Sincerely,



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