July 13, 2026

Clean Cars Team
Mobile Source Control Division
California Air Resources Board
1001 I Street, Sacramento, CA 95814
Submitted via the Drive Forward Light-Duty Vehicle Standards informal comment submittal form

Re: Comments on the Drive Forward Light-Duty Vehicle Program, June 22, 2026 Public Workshop. Proposal to require on-board fuel and energy consumption data collection and annual manufacturer reporting, modeled on the European Union's OBFCM program, for all new plug-in vehicles first and for the remaining light-duty fleet second.

Dear Clean Cars Team,

Thank you for the opportunity to comment on the Drive Forward Light-Duty Vehicle Program. I direct the Electric Vehicle Research Center at the Institute of Transportation Studies, University of California, Davis, where my research group studies real-world use of plug-in hybrid and battery-electric vehicles, including electric vehicle miles traveled, charging behavior, and the gap between certification values and on-road performance, in ongoing work with CARB and the California Energy Commission. This comment responds to three specific requests in the June 22, 2026 workshop: the request for additional data sources for PHEV electric vehicle miles traveled and for an optional pathway for creating PHEV utility factors utilizing standardized vehicle data or on-board diagnostics parameters (workshop presentation, slide 52); the request for input on ZEV data standardization requirements (slide 35); and the Standardized Regulatory Impact Assessment request for alternatives that achieve the regulation's goals at lower cost (slides 70 and 71).

1. Summary of the proposal

CARB should require, as a condition of California certification under the Drive Forward regulation, that the standardized, non-resettable, lifetime fuel and energy counters new vehicles already store be collected by the manufacturer and reported to CARB annually. The requirement should begin with all new plug-in vehicles, plug-in hybrids and battery-electric vehicles together, and extend to the remaining light-duty fleet in a second phase. The model is the European Union's On-Board Fuel and/or Energy Consumption Monitoring (OBFCM) program: every new car with a combustion engine type-approved in the EU carries the recording capability since 2021 (Annex XXII to Regulation (EU) 2017/1151), and manufacturers collect and report the data annually with the vehicle identification number, over the air or through the OBD port at service, free of charge, unless the owner expressly refuses (Commission Implementing Regulation (EU) 2021/392, Article 9). The EU program spans the whole combustion fleet, conventional gasoline and diesel vehicles, hybrids, and plug-in hybrids alike: of the vehicles first registered in 2021 alone, manufacturers reported real-world data for 391,329 gasoline cars, 301,995 diesel cars, and 220,111 plug-in hybrids (European Commission, 2024, Table 1), and cumulative reporting has since grown to more than 6.5 million vehicles (Plötz & Tal, 2026). Pure battery-electric vehicles are the one group the EU program does not yet cover. California can therefore do what the EU has not: begin with the full plug-in fleet, because section 1962.5 already mandates the complete battery-electric energy ledger for 2026 and subsequent model years.

The proposal is deliberately incremental. Nearly all of the required vehicle capability is already adopted California law: Real Emissions Assessment Logging under 13 CCR 1968.2 has required light-duty vehicles to store real-world fuel-consumption data since model year 2019, section 1968.2(g)(6) contains the charge-depleting and grid-energy tracking architecture for plug-in hybrids, and section 1962.5 requires 2026 and subsequent model year ZEVs and PHEVs to track and report, through a standardized unauthenticated readout, lifetime counters including total distance traveled, total net energy consumed, and total grid energy into the battery. A manufacturer collection-and-reporting pipeline to CARB also already exists in a narrow form: sections 1968.2(g)(8) and 1962.5(c)(5) require manufacturers to collect all stored lifetime values over the air before any over-the-air reprogramming that would erase them and to report averages and standard deviations per test group to the Executive Officer within 75 calendar days (CARB, 2019, section 1968.2(g)(8); CARB, 2022, section 1962.5(c)(5); report format specified in CARB, 2021). What is missing is only regularity: the same collection, on a calendar rather than on reprogramming events, reported annually. The hardware burden of the proposal is therefore zero and the software burden minimal.

2. Motivation: regulate real-world performance, starting where the gap is largest

Vehicle emission standards have been based on laboratory tests for decades, and the divergence between laboratory and road is largest precisely for plug-in hybrids. The European Commission's first OBFCM report found that for cars first registered in 2021, real-world CO2 emissions exceeded WLTP type-approval values by 23.7 percent for gasoline cars and 18.1 percent for diesel cars, but by a factor of 3.5 for plug-in hybrids, whose real-world emissions (139.4 g CO2/km) were only 23 percent lower than those of conventional cars (European Commission, 2024). CARB staff's own analysis, presented at the June 2024 ACC II Amendments workshop, reached the same qualitative conclusion for California: real-world emissions from PHEVs disproportionately exceed certification values, and the effect is not an artifact of out-of-state drivers (CARB, 2024, slides 45 to 48). The June 2026 workshop carries this forward, proposing to lower the Fleet Utility Factor because real-world data suggest it overstates PHEV benefits, and developing alternative utility factors based on manufacturer-submitted data (slide 50).

A utility factor built on manufacturer-submitted data is only as credible as the data pipeline behind it. The European experience shows what that pipeline should be: a census rather than a sample; lifetime counters read from the vehicle itself rather than estimates; collected by the manufacturer under a regulatory duty with a defined owner opt-out; audited through VIN-linked de-duplication; and published as anonymized per-manufacturer aggregates. It also shows the payoff: since 2025 the Commission uses the data to recalibrate how plug-in hybrids count toward manufacturers' fleet CO2 targets, the first major emissions framework in which observed data directly shape compliance, a step toward performance-based regulation that rewards manufacturers for how vehicles actually perform on the road (Plötz & Tal, 2026). And it shows the design lesson California should internalize: EU first-year fleet coverage was only 10.6 percent, dominated by the few manufacturers making comprehensive use of over-the-air transmission, because service-visit collection reaches few vehicles in their first year (European Commission, 2024). California should therefore require over-the-air collection wherever the vehicle is so equipped, rather than leaving the channel to manufacturer discretion.

3. Why Smog Check data cannot carry this function

CARB's 2024 analysis used data collected by the Bureau of Automotive Repair through the Smog Check program, and both that analysis and the concept of using routine inspection readouts illustrate

the structural limits of the inspection channel. First, coverage: battery-electric vehicles receive no Smog Check at all, and gasoline, hybrid, and plug-in hybrid vehicles eight model years old and newer are exempt from the biennial renewal inspection, so no renewal data exist for exactly the model years whose behavior must inform utility factors for a forward-looking fleet standard. Second, selection: the newer PHEVs that do appear in BAR data arrive mainly through change-of-ownership inspections and out-of-state entries, a self-selected slice of the fleet; the 2024 staff analysis of model year 2021 and 2022 vehicles rested on 2,375 PHEVs across 17 models (CARB, 2024, slide 46), where a manufacturer-reporting census would cover essentially every plug-in vehicle sold in the state. Third, latency and cadence: inspection readouts arrive at multi-year intervals per vehicle, while lifetime counters reported annually support year-over-year differencing for the whole fleet. Fourth, cost: each inspection observation carries the transaction cost of a station visit, whereas over-the-air manufacturer collection has near-zero marginal cost per vehicle and is already required at every over-the-air reprogramming event. The same logic was examined for Europe before Regulation 2021/392 was adopted: the Commission's preparatory study found the periodic-inspection channel structurally late for light-duty vehicles, because the first inspection falls three to four years after registration, after the highest-mileage years, while the additional effort of inspection readout, where used, is minimal (Ricardo Energy & Environment, 2020). The inspection channel remains valuable as an audit and backstop; it cannot be the primary instrument. This proposal replaces reliance on it with a purpose-built, near-zero-cost channel.

4. Manufacturer readiness: the same companies already run this pipeline in Europe

An analysis of a global plug-in vehicle sales database (May 2026 edition) covering U.S. and EU sales from 2021 through May 2026 confirms that the manufacturers this requirement would bind are, with narrow exceptions, the same companies already operating the full OBFCM device and Article 9 reporting pipeline in Europe. Every major PHEV seller in the U.S. market also sells PHEVs, and a full combustion lineup, in the EU including Stellantis, Toyota, BMW, Volvo, Hyundai-Kia, Ford, Mercedes-Benz, Volkswagen Group, Mazda, Nissan-Mitsubishi, Jaguar Land Rover, and Honda. Manufacturers accounting for 99.1 percent of U.S. PHEV sales since 2021 therefore already implement OBFCM recording and annual manufacturer reporting on the European versions of their vehicles. Table 1 summarizes the exceptions, none of which weakens the proposal: General Motors has no EU passenger-car presence but currently sells no PHEVs in the U.S. market either, and its battery-electric vehicles fall under section 1962.5; Subaru's PHEV volumes are small and its EU combustion models carry the base OBFCM device; and the battery-electric-only manufacturers, Tesla, Rivian, and Lucid, with 2.98 million U.S. BEVs since 2021, were never subject to EU OBFCM but certify to section 1962.5 in California, which already mandates their counters.

Manufacturer group	US plug-in sales 2021 to May 2026	EU PHEV sales 2021 to May 2026	OBFCM and reporting status
12 groups selling PHEVs in both markets (Stellantis, Toyota, BMW, Volvo, Hyundai-Kia, Ford, Mercedes-Benz, VW, Mazda, Nissan-Mitsubishi, JLR, Honda)	1,347,291 PHEVs (99.1% of US PHEV total)	4,600,301	Full OBFCM device and Article 9 annual reporting in operation today
General Motors	471,968 (all BEV; no US PHEVs 2021 to date)	0	No EU exposure; BEVs covered by 13 CCR 1962.5

Subaru	5,729 PHEV; 41,141 BEV	0	EU combustion models carry base OBFCM; PHEV parameter set to be certified for California
Tesla, Rivian, Lucid (BEV-only)	2,976,263 BEV	Not in EU OBFCM scope	Counters and readout already required by 13 CCR 1962.5 for MY2026+

Table 1. U.S. plug-in manufacturers and their existing OBFCM exposure. Sales figures from the EV Volumes database, May 2026 edition; EU OBFCM implementation and coverage from European Commission (2024).

5. Proposed vehicle capability specification

Phase 1, all new plug-in vehicles, proposed for the 2031 model year to align with the applicability dates used elsewhere in the Drive Forward proposals, with credit for early voluntary compliance. For plug-in hybrids, each vehicle must record, as non-resettable lifetime counters preserved from the completion of production: total fuel consumed; total distance traveled; total fuel consumed and total distance traveled in charge-depleting operation, distinguishing engine-off from engine-running operation; total fuel consumed and distance traveled in driver-selectable charge-increasing operation; and total grid energy into the battery. Accuracy should follow the Annex XXII convention of plus or minus 0.05 against the certification fuel-consumption value, evaluated on counter differentials. Readout should use the standardized protocols the vehicle already uses for OBD compliance under section 1968.2(g), with parameters stored both as lifetime and recent-operation values following section 1962.5(c)(4)(D)2. For battery-electric vehicles, section 1962.5(c)(4)(D) already mandates the full energy ledger (total distance, total net energy consumed, grid energy split by AC and DC, energy exported off-board, and battery state of health with a verification-testing right for CARB), so Phase 1 adds no BEV vehicle capability at all; it adds only the reporting duty of Section 6. This also directly answers the workshop's request for input on ZEV data standardization (slide 35): the highest-value improvement to section 1962.5 is not another parameter but a routine reporting channel for the parameters it already mandates. Table 2 maps each element to existing provisions; most rows require harmonization rather than new capability.

Phase 2, the remaining light-duty fleet, proposed for the 2033 model year. Conventional gasoline, diesel, and hybrid vehicles have stored REAL fuel-consumption data since model year 2019 under section 1968.2, so the extension consists of the same annual reporting duty applied to counters that are already on board, mirroring the EU program, which has covered the full combustion fleet from its first year. This is the step that converts California's framework, over time, from one that regulates laboratory performance to one that also observes real-world performance fleet-wide.

Element	EU basis	Existing California provision	Action needed
Total fuel consumed (lifetime)	Annex XXII	13 CCR 1968.2, REAL fuel-consumption data, MY2019+	Carry forward; add accuracy tolerance
Total distance traveled (lifetime)	Annex XXII	1968.2(g)(6); 1962.5(c)(4)(D)1.a	None
Charge-depleting fuel and distance, engine off and on	Annex XXII PHEV set	1968.2(g)(6.4) charge-depleting and grid-energy tracking architecture; ACC II test procedures for 2026+	Verify completeness against Annex XXII; codify any missing counters
Driver-selectable charge-increasing operation	Annex XXII PHEV set	Not confirmed	Add
Grid energy into battery (kWh)	Annex XXII PHEV set	1962.5(c)(4)(D)1.n through p (AC and DC split)	Extend to all PHEVs

BEV energy ledger incl. V2G export and battery SOH	Not yet in EU OBFCM	1962.5(c)(4)(D), (c)(4)(A)2	None; California ahead
Standardized unauthenticated readout	OBD at Art. 9 service readout	1962.5(c)(2) through (c)(4); 1968.2(g)	None
Annual manufacturer reporting with owner opt-out	Reg. (EU) 2021/392, Art. 9	Only reprogramming-triggered reports: 1968.2(g)(8), 1962.5(c)(5)	Core of this proposal: make reporting routine and annual

Table 2. Mapping of the proposed OBFCM-equivalent requirement to existing California provisions.

6. Proposed reporting requirement

Modeled on Article 9 of Commission Implementing Regulation (EU) 2021/392, adapted to California's adopted consent architecture and strengthened where the EU's first-year experience exposed a weakness. The manufacturer collects the lifetime counters, over the air wherever the vehicle is so equipped (a requirement, not an option, given that service-visit-only collection produced the EU's thin first-year coverage) and through the OBD port at service visits otherwise, at no charge to the owner, unless the owner has expressly declined; the manufacturer reports to CARB annually, by April 1 for the preceding calendar year, using the same electronic submission channel and the same statistical format (average and standard deviation per certified test group) as the existing reprogramming reports under sections 1968.2(g)(8) and 1962.5(c)(5), extended with the distribution statistics needed for utility factors, in particular the charge-depleting share of distance. Where more than one readout exists for a vehicle in a year, the record with the highest total distance controls, following the EU de-duplication rule. Manufacturers should be required to state reasons for unreported vehicles, as the EU requires from the second reporting year. CARB publishes anonymized per-manufacturer aggregates annually: average fuel consumption, average electric energy consumption, charge-depleting distance share, and the gap against certification values. Both channels should apply to every vehicle rather than being segmented by trim or price. Embedded connectivity is now close to universal in the U.S. new-vehicle market: industry analysts estimate a North American embedded-telematics attach rate of about 93 percent, with 75 to 79 percent of all cars sold globally in 2024 connected and telematics standard across premium brands for more than a decade (Berg Insight, 2025; Counterpoint Research, 2025[1]) The plug-in segment is effectively fully connected, since the battery-electric-only manufacturers ship embedded connectivity on every vehicle and plug-in models depend on it for charging functions; this is the author's assessment rather than a published statistic. The at-service readout will therefore rarely be the primary channel, but it should not be understood as a coverage patch for the least expensive trims. It is the lifetime backstop, because embedded modems go dark over a vehicle's life as cellular networks are retired, a failure mode the Commission's preparatory study flagged explicitly (Ricardo Energy & Environment, 2020). It is the audit path, because the standardized, unauthenticated readout lets CARB verify independently, at any service or inspection visit, the values a manufacturer reported over the air, answering the accuracy concern that manufacturer-implemented counters raise. And it is what keeps the census a census: a connectivity-only design would systematically exclude the buyers of the least expensive vehicles from the data that will set utility factors and, eventually, any real-world-based compliance measure.

Two privacy design points deserve emphasis. First, the default proposed here is aggregate, test-group-level reporting, which supports utility factors, fleet-average compliance analysis, and gap

[1] both figures are drawn from the firms' published summaries rather than the underlying proprietary reports

tracking without transmitting any VIN-linked record to the State; this keeps the program fully consistent with section 1962.5(c)(4)(D)3., under which CARB may not collect data from privately owned vehicles without the operator's voluntary and informed consent. Second, if CARB later determines that VIN-linked records are needed, the EU governance model supplies the template: de-duplication and retention limits, publication only in aggregate, owner opt-out at every readout, and re-identification capability confined to the manufacturer and the registration authority. No location data are collected under either variant; nothing in the parameter set records where a vehicle has been.

7. Response to the SRIA request for alternatives: same benefit, lower cost

As an alternative for the Standardized Regulatory Impact Assessment, this proposal delivers the data foundation for the utility-factor and in-use provisions of the draft regulation at a cost materially lower than the alternatives CARB has used or contemplated, and the cost basis is documented rather than asserted. Vehicle hardware: zero incremental cost, because every counter in Table 2 is either already required by adopted California regulation or already implemented on the European versions of the same vehicle models sold by the manufacturers covering 99.1 percent of U.S. PHEV sales (Section 4). Data transmission: the European Commission's preparatory study for Regulation 2021/392 concluded that over-the-air transfer of the OBFCM record is small and annual, with 'expected data transmission costs low and able to be subsumed into existing OTA cellular data contracts,' and that in-vehicle software updates to enable it are 'mostly a straightforward process' (Ricardo Energy & Environment, 2020). Reporting infrastructure: manufacturers already operate the collection and CARB submission pipeline for reprogramming events under 1968.2(g)(8) and 1962.5(c)(5); the incremental cost of running it annually is administrative. Against this, the Smog Check channel embeds the cost of a station transaction per observation and structurally cannot observe BEVs or vehicles in their first eight model years, and dedicated research data loggers cost hundreds of dollars per vehicle-year and reach thousands, not millions, of vehicles.

8. The longer-term goal: performance-based regulation for all vehicles

Starting with the plug-in fleet targets the largest laboratory-to-road gap and the regulatory use CARB has already identified, while Phase 2 generalizes the architecture to the whole light-duty fleet, which the EU has covered from the start and for which California vehicles have stored the necessary counters since model year 2019. Fleet-wide annual reporting converts California's compliance framework, over time, from one that regulates laboratory performance to one that also observes and eventually regulates real-world performance, with laboratory tests retained for type approval of new technologies. That is the trajectory Plötz and Tal (2026) argue is now feasible and necessary, and it aligns California with EU practice while preserving California's lead on battery-electric data, where section 1962.5 already goes beyond the European parameter set. A voluntary early-start variant is available immediately: CARB could add annual real-world data reporting to the criteria for the Drive Forward Leaders list, using the aggregate format of Section 6, allowing willing manufacturers to begin building the California time series before the regulation takes effect.

9. Conclusion

California already mandates the counters, already mandates the standardized readout, and already operates a narrow version of the reporting pipeline; the manufacturers that would carry the duty already run the full version of it in Europe. Requiring annual manufacturer reporting of on-board fuel and energy consumption data for all new plug-in vehicles, and then for the light-duty fleet as a whole,

completes an architecture that is largely built, answers the specific data needs staff identified at the June 22 workshop, replaces a structurally limited inspection-based data channel at very low to no cost, and positions the Drive Forward program at the frontier of performance-based vehicle regulation. I would welcome the opportunity to discuss the proposal, the supporting research, or the cost analysis with staff.

Respectfully submitted,

Dr. Gil Tal
Director, The Electric Vehicle Research Center
Adj. Professor, Department of Environmental Science and Policy
University of California Davis
gtal@ucdavis.edu

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