March 9, 2026

California Air Resources Board

1001 I Street

Sacramento, CA 95814

Re: Public Comment on Proposed Amendments to the Regulation for the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms (Cap-and-Invest Regulation) — Request to Close the Methane Slip Compliance Gap and Establish a Methane Slip Abatement Offset Protocol

Dear CARB Staff and Board Members,

We respectfully submit the following comments on the Proposed Amendments to the Regulation for the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms (Cap-and-Invest Regulation), released January 20, 2026. We commend CARB and the Legislature for extending the Cap-and-Invest program through 2045 and for the significant tightening of the allowance budget to align with California's 40% and net-zero GHG targets.

Our comments focus on a specific and consequential gap in the current regulation: methane slip from lean-burn natural gas reciprocating engines. This emission source is growing rapidly, represents a significant fraction of the real-world GHG footprint of covered and near-covered entities, and is not being properly captured in compliance obligations under current regulatory design. As California tightens its cap and extends the program through 2045, closing this gap is essential to program integrity, environmental effectiveness, and fairness among regulated entities.

We also identify a significant opportunity: methane slip abatement represents one of the lowest-cost, highest-impact climate interventions available anywhere on the marginal abatement cost curve, and establishing a compliance offset protocol for methane slip abatement could direct capital toward this highly effective measure while generating verifiable, additional GHG reductions.

I. Background: Methane Slip and Its Climate Significance

Lean-burn natural gas reciprocating engines — including lean-burn spark ignition (LBSI) engines widely used in data centers, combined heat and power (CHP) facilities, stationary power generation, and pipeline compression — emit 1–5% of their fuel input as unburned methane through their exhaust, a phenomenon known as "methane slip." This occurs because the lean-burn combustion regime optimized to minimize NOx produces exhaust temperatures too low for conventional aftertreatment systems to fully oxidize methane.

The climate implications of methane slip are substantial:

- Methane has a global warming potential (GWP) of 86–87 g CO_2e/g CH_4 over 20 years (GWP20) and 36 g CO_2e/g CH_4 over 100 years (GWP100), per IPCC AR5.
- At a 2% slip rate and using GWP100, methane slip adds approximately 25% to the total CO_2e footprint of a lean-burn engine beyond its direct CO_2 combustion emissions. At GWP20, this rises to approximately 50% of total CO_2e.
- At a 5% slip rate — documented in high-slip LBSI engines — methane slip can exceed CO_2 combustion emissions on a GWP20 basis.

These are not marginal or speculative emission rates. They are well-documented in peer-reviewed literature and operational data across multiple engine types and applications. Yet the Cap-and-Invest regulation's compliance obligation calculations — which rely on combustion emission factors calibrated for near-complete combustion — systematically fail to capture them.

II. The Growing Scale of the Problem in California

The deployment of lean-burn natural gas engines in California is accelerating, driven primarily by explosive demand for data center power. As AI workloads drive electricity demand, grid constraints are pushing data center operators toward on-site natural gas generation. Reciprocating lean-burn engine gensets are proliferating because gas turbines have multi-year lead times. This is not a future risk — it is happening today.

Relevant scale considerations for California:

- U.S. data center electricity consumption is projected to grow from 183 TWh in 2024 to over 426 TWh by 2030 — a 133% increase — with significant California capacity in this growth.

- Natural gas is projected to supply over 60% of electricity for U.S. data centers by 2030, much of it from on-site lean-burn reciprocating engines.
- Stationary engine applications beyond data centers — CHP facilities, universities, hospitals, industrial sites, and midstream compression — represent a large installed base of lean-burn engines across the state.
- Nationally, methane slip from lean-burn engines is estimated to total approximately 850 million metric tons CO_2e annually in 2025 and growing.

The scale problem is compounded by the accelerating adoption of renewable natural gas (RNG) as a fuel source for these engines. California policy — through the Low Carbon Fuel Standard, Self-Generation Incentive Program, and utility procurement mandates — is actively encouraging RNG substitution for fossil natural gas in stationary engines on the premise that RNG combustion delivers near-zero or negative lifecycle CO_2e. That premise is only valid if the methane is actually combusted. When lean-burn engines slip 1–5% of fuel as unburned methane, the upstream RNG carbon credit is partially or entirely consumed by downstream exhaust losses. The molecular composition and combustion chemistry of RNG are identical to fossil natural gas once in the pipeline; slip rates are the same regardless of fuel origin. California is therefore deploying growing volumes of RNG into an engine fleet that is silently and systematically negating a material share of RNG's climate value — with no regulatory mechanism to detect or quantify this.

As California tightens its cap for 2027–2030 and beyond, and as the regulation extends through 2045, the failure to capture these emissions in compliance obligations becomes an increasingly significant source of environmental non-integrity and competitive inequity between covered entities that do capture all their GHG emissions and those operating lean-burn engines with unaccounted methane slip.

III. Specific Concerns with the Proposed Amendments

A. Section 95852 — Compliance Obligation Calculation: Default Emission Factors Undercount Methane Slip

Compliance obligations for natural gas combustion under Section 95852 are calculated using emission factors that assume substantially complete combustion. These factors are derived from approaches aligned with EPA's GHG Reporting Program (40 CFR Part 98, Subpart C), which similarly apply general combustion emission factors to stationary natural gas combustion without distinguishing lean-burn engine architectures.

For lean-burn engines, this approach systematically and materially undercounts actual methane emissions. A covered entity operating a fleet of LBSI engines may report CO_2 from combustion accurately while effectively zeroing out 1–5% of the fuel's methane content from its compliance calculation. This is not a rounding error — it is a structural gap that can represent 25–50% of actual CO_2e emissions going unaccounted.

This compliance gap is most acute — and most consequential for program integrity — for entities burning renewable natural gas (RNG). A covered entity fueling lean-burn engines with RNG currently faces little or no compliance obligation for those engines: the combustion emission factors produce near-zero CO_2e on a lifecycle basis (reflecting the upstream carbon credit), and the exhaust methane slip is not captured at all. The result is that an entity burning RNG in lean-burn engines may report a compliance obligation that is effectively zero or even negative for those assets, when the actual point-of-use CO_2e footprint — counting the unburned methane slipping through the exhaust at GWP100 — is 50–100% higher than combustion CO_2 alone. This is not merely a theoretical concern: it means that RNG-fueled lean-burn engine operators may be among the most significantly undercounting entities in the covered sector, while simultaneously appearing to be the most climate-responsible. The Cap-and-Invest program cannot credibly claim to price carbon accurately if its compliance obligation calculations produce this outcome. We urge CARB to ensure that the Section 95852 amendments explicitly address this dynamic by requiring point-of-use methane slip measurement as a condition of applying reduced lifecycle emission factors for RNG combustion in lean-burn engines.

We recommend that CARB amend Section 95852 to:

- Explicitly require that covered entities operating lean-burn natural gas reciprocating engines calculate methane slip as a separate emission category, using either (a) measurement-based quantification from stack testing or continuous exhaust monitoring, or (b) engine model- and load-specific emission factors verified against representative measurement data.
- Prohibit reliance on general stationary combustion emission factors for lean-burn engine methane emissions, as these factors were not designed to capture methane slip and materially understate actual emissions.
- Define “lean-burn natural gas reciprocating engine” as a distinct equipment subcategory within the regulation for purposes of both compliance obligation calculation and reporting, consistent with amendments we recommend to MRR.

B. Section 95852.2 — Emissions Without a Compliance Obligation: Risk of Inadvertent Methane Slip Exemption

Section 95852.2 and the proposed amendments to limited emissions exemptions (ISOR Section M) include provisions covering vented and fugitive methane emissions associated with natural gas suppliers (NGS). We are concerned that methane slip from lean-burn engine exhaust could be characterized or treated as falling within these or related exemption categories, either inadvertently or through regulatory ambiguity.

Methane slip from exhaust is neither a vented emission nor a fugitive emission in the traditional sense — it is an incomplete combustion byproduct emitted through a point source. It should be unambiguously subject to a compliance obligation as a combustion emission. We recommend that CARB:

- Explicitly clarify in Section 95852.2 that methane slip from engine exhaust is classified as a combustion emission subject to a full compliance obligation, and is

not eligible for treatment as a vented or fugitive emission or any other exemption category.

- Add a definition or cross-reference in the definitions section (Section 95802) that distinguishes combustion methane slip from vented and fugitive methane, ensuring consistent treatment across the regulation.

C. GWP Values Applied to Methane Compliance Obligations

The Cap-and-Invest regulation currently uses GWP100 values from IPCC AR4 (GWP = 25 for methane, including climate-carbon feedbacks and oxidation) to convert methane emissions to CO_2 equivalents for compliance purposes. While GWP100 is the established standard for cap-and-trade programs globally, we recommend that CARB take two complementary steps:

- Update the GWP values used in the regulation to reflect the most current IPCC science. The IPCC AR6 (2021) values for methane are higher: GWP100 of approximately 29.8 (fossil methane, without climate-carbon feedback) to 82.5 (with feedbacks over 20 years). CARB should evaluate whether updated AR6 values should be incorporated, particularly as the program extends through 2045.
- Require or encourage reporting of methane emissions under both GWP20 and GWP100 to ensure transparency about near-term climate forcing. As CARB's own 2022 Scoping Plan Update emphasizes near-term methane reductions as a critical pathway to meeting 2030 targets, reporting under GWP20 provides the regulatory signal most aligned with those near-term goals.

The scientific literature is clear that the choice of time horizon has large implications for the apparent climate impact of methane (Balcombe et al., 2018, Environmental Science: Processes & Impacts). For a program extending to 2045 with interim 2030 targets, using only GWP100 may understate the near-term urgency of methane mitigation and create perverse incentives to defer action.

California would not be breaking new ground in adopting GWP20 for methane compliance purposes — it would be joining New York, which has already taken this step under a statutory mandate. The New York Climate Leadership and Community Protection Act (CLCPA), enacted in 2019, requires that New York's statewide greenhouse gas emission limits and reporting be expressed using GWP integrated over a 20-year time horizon. New York's Department of Environmental Conservation codified GWP20 values from IPCC AR5 into 6 NYCRR Part 496 in 2020, and all subsequent New York State GHG inventory reports, cap-and-invest program design documents, and compliance regulations have applied GWP20 as the primary metric for methane. New York's rationale, as stated in its regulatory impact statement, is that GWP20 is necessary to assess GHG emissions over the near-term time frame relevant to its 2030 and 2050 emissions targets — precisely the same logic that applies to California's 2030 and 2045 targets under AB 1207 and SB 840.

California and New York together represent the two most significant state-level carbon pricing programs in the United States. If both programs adopt GWP20 as the primary or co-primary metric for methane compliance, they would collectively establish a national

standard for near-term methane accountability — one grounded in science, aligned with near-term climate targets, and consistent across the two largest subnational carbon markets. We urge CARB to formally evaluate GWP20 adoption in the 2026 amendments and, at minimum, require dual-horizon (GWP20 and GWP100) reporting for methane so that the compliance record reflects both the near-term and long-term climate significance of methane slip emissions from lean-burn engines.

D. Data Centers and On-Site Generation: Coverage Threshold Concerns

Data centers operating lean-burn natural gas engines for prime or backup power may fall below or near the 25,000 MT CO_2e threshold for covered entity status under the regulation, particularly if methane slip is not counted in their compliance obligation calculation. This creates a problematic interaction: the fastest-growing source of lean-burn engine deployment may be systematically undercounting its emissions in a way that places it below the coverage threshold.

We recommend that CARB:

- Review the coverage threshold analysis for data center on-site generation to ensure that methane slip is included in the emissions calculation used to determine threshold applicability.
- Consider whether a sector-specific provision or lower inclusion threshold is warranted for facilities whose primary GHG source is lean-burn natural gas engines, given the documented gap between reported and actual emissions.

We also urge CARB to recognize that these compliance gaps collectively undermine California's net-zero trajectory in a way that is not recoverable by tightening the cap alone. The program's net-zero credibility depends on the accuracy of the emissions it prices. Where a large and growing category of GHG emissions is systematically absent from compliance obligations — and where entities burning RNG in lean-burn engines can present a compliance footprint of near zero while their actual point-of-use CO_2e footprint is materially positive — the cap does not reflect reality. California's 2045 net-zero target requires that the lean-burn engine sector actually reach net zero, not that it appear to reach net zero on the basis of incomplete accounting. Closing the methane slip compliance gap is therefore not a technical correction to the regulation; it is a prerequisite for the regulation to function as a net-zero instrument.

IV. Request to Prioritize a Methane Slip Abatement Compliance Offset Protocol

AB 1207 directs CARB to conduct a study of the Compliance Offsets Program by December 2026 and to update all offset protocols by January 2029 to reflect best available science. The proposed amendments initiate related process changes to offset project listing, monitoring, verification, and registry requirements. We urge CARB to use the protocol review process to develop a new compliance offset protocol specifically for methane slip abatement from lean-burn natural gas engines.

The rationale for this protocol rests on the program's own established criteria for offset eligibility — not on the merits of any particular abatement technology — and we believe methane slip abatement satisfies each criterion clearly.

Real and additional. Methane slip from lean-burn engines is a real, ongoing atmospheric emission. No existing California regulation requires its abatement for the source categories discussed in this comment — data centers, CHP, industrial stationary engines, and pipeline compression. Voluntary abatement is not occurring at meaningful scale absent a regulatory or financial incentive. A well-designed protocol would therefore generate reductions that are unambiguously additional under CARB's existing additionality framework.

Quantifiable and verifiable. Methane slip is a point-source exhaust emission from defined equipment. Baseline and post-abatement emission rates are measurable through standard stack testing protocols (e.g., EPA Method 25A) and continuous exhaust monitoring. The emission reduction from an abatement system is directly quantifiable as the difference between a verified baseline slip rate and measured post-installation exhaust methane, applied to metered fuel consumption or engine operating hours. This is no more complex than existing offset protocols for landfill gas or coal mine methane.

Permanent. Unlike forestry offsets, which face reversal risk from fire and land-use change, methane slip abatement from an operating engine system produces reductions that are permanent on any relevant atmospheric timescale. Once methane is oxidized to CO_2 in the exhaust stream, the climate forcing from that methane molecule is permanently eliminated relative to the slip baseline. There is no reversal mechanism.

Scale and program value. California's lean-burn engine fleet is substantial and well-documented in existing regulatory databases. The state's CHP base alone includes over 3.1 GW of industrial capacity and more than 2.1 GW of commercial and institutional capacity, the majority fueled by natural gas reciprocating engines. The pipeline compression sector adds further capacity across hundreds of compressor stations serving California's transmission and distribution network. Layered on top of this existing fleet is a rapidly growing data center sector: by 2030, California's data centers are projected to consume electricity equivalent to adding a city the size of Los Angeles to the grid, with a significant share served by on-site natural gas generation. The combination of a large, well-characterized existing fleet and substantial new capacity entering service over the next decade makes California an ideal jurisdiction for an in-state methane slip offset protocol — directly responsive to AB 1207's direction to expand in-state offset supply and reduce leakage risk.

Co-benefits consistent with environmental justice priorities. Lean-burn engine exhaust contains not only methane but also non-methane volatile organic compounds (NMVOCs) and carbon monoxide, both of which are ozone precursors with documented local health impacts. Abatement systems that oxidize methane in the exhaust stream also reduce these co-pollutants, delivering local air quality benefits in communities near data centers, industrial facilities, and pipeline compressor stations — facilities that are disproportionately sited in environmental justice communities. This directly satisfies the

DEBS (direct environmental benefits in the state) requirement for at least 50% of offset credits used for compliance.

We recommend that CARB include methane slip abatement from lean-burn natural gas engines in the compliance offset protocol study required by AB 1207 and target protocol adoption no later than 2028. Given the rapid growth of the lean-burn engine fleet and the accumulating unmitigated emissions, earlier protocol availability is strongly preferred.

V. Consistency with Cap-and-Invest Program Goals

The recommended actions are directly consistent with the core objectives of the Cap-and-Invest program and the authorizing legislation:

- AB 1207 directs CARB to ensure that covered sector emissions align with the 40% below 1990 levels by 2030 target and net zero by 2045. Including methane slip in compliance obligations is necessary to ensure that the cap reflects actual GHG emissions, not an understated accounting artifact.
- The Proposed Amendments tighten the allowance budget by approximately 118 million allowances for 2027–2030. Ensuring compliance obligation accuracy for a growing, high-GWP emission source is essential to the integrity of this tightened budget.
- The program's goals of cost-effectiveness and real, permanent, quantifiable reductions are best served by capturing all significant emission streams in the cap and enabling the lowest-cost abatement options — including methane slip catalytic oxidation — to compete in the compliance market.
- Environmental justice: Lean-burn engine exhaust contains methane and co-pollutants (NMVOCs, CO) that have local air quality impacts in communities near data centers, CHP plants, and pipeline compressor stations. Closing the methane slip compliance gap and incentivizing abatement reduces these co-pollutant exposures in communities that disproportionately host these facilities.

VI. Summary of Recommendations

We respectfully urge CARB to incorporate the following changes into the Final Regulation Order for the Cap-and-Invest 2026 Amendments:

- Amend Section 95852 to require measurement-based or engine-specific quantification of methane slip from lean-burn natural gas reciprocating engines as a separate compliance emission category, prohibiting reliance on general combustion default factors for these sources.
- Amend Section 95852.2 to explicitly classify methane slip from engine exhaust as a combustion emission subject to full compliance obligations, not eligible for vented/fugitive or other exemptions.

- Add a definition of “lean-burn natural gas reciprocating engine” in Section 95802 to ensure consistent regulatory treatment.
- Review data center on-site generation coverage thresholds to ensure methane slip is included in emissions used to determine covered entity status.
- Evaluate updating GWP values to IPCC AR6 and require dual-horizon (GWP20 and GWP100) reporting of methane emissions for transparency.
- Prioritize development of a new compliance offset protocol for methane slip abatement from lean-burn natural gas engines, with adoption targeted by 2028.

As California's Cap-and-Invest program enters its most consequential phase — extended through 2045, aligned with net-zero targets, and operating with a tightened cap — program integrity requires that all significant emission streams be accurately captured in compliance obligations. Methane slip from lean-burn engines is a growing, measurable, and currently under accounted emission stream that deserves urgent attention. The opportunity to both close this compliance gap and catalyze a low-cost abatement market through a new offset protocol is one that California should not miss.

Thank you for the opportunity to submit these comments. We welcome engagement with CARB staff on any of the recommendations above.

Respectfully submitted,

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