

California Air Resources Board

Oct 11, 2024

Attn:

Pamela Gupta, Branch Chief, Building Decarbonization

Hanjiro Ambrose, Lead Staff, Building Embodied Carbon Policy

Letter of Public Comment on the Sept 19th Embodied Carbon in Buildings Workshop 1

Dear Ms. Gupta and Mr. Ambrose,

On behalf of the Carbon Leadership Forum (CLF), I am writing to offer comments for your consideration in the development of programs under AB 2446 and AB43. CLF is highly supportive of CARB's program efforts and commends CARB staff for kicking off a collaborative and transparent public process that will undoubtedly result in better program outcomes. This is critical work for California that has the potential to influence policy more broadly as we've already seen with the Buy Clean California policy of 2017. We support continued program resources to address embodied carbon since there are solutions to reduce embodied carbon along the entire supply chain of actors in the built environment. Additionally, there's national and international momentum on this topic right now. CLF looks forward to continued engagement in CARB's process.

Below we offer specific responses to some of the questions listed in the workshop [slidedeck](#).

[slide 30] Data that will be reported to CARB?

1. *Who else should report?*

- a. The scope of the policy is broad and covers all building materials consumed in CA in any given year. However, the statutory reporting requirements will likely fall short of tracking the entire scope of the policy and focus on a subset of new construction activities. To fill reporting gaps of those materials produced out of state or consumed during renovation projects, consider additional voluntary or mandatory reporting for:
 - i. Building material retailers and distributors (product type/quantities/EPDs). Are there lessons learned from the Clean Fuel Standard reporting requirements about the value of capturing upstream supplier/distributors that can be brought to this program?
 - ii. Designer of record. CalGreen already requires embodied carbon measures that could aid reporting of reuse (renovated) buildings, whole building LCAs (although quantities aren't required in Calgreen reporting), and EPD/GWP limit compliance.

2. *What else should be reported?*

- a. For the building life cycle cycle assessments, there seems to be a statutory focus on only reporting A1-A3. As outlined in response to the questions below, we recommend

reviewing the [Project Life Cycle Assessment Requirements: ECHO Recommendations for Alignment, Version 1.0](#), which summarizes ECHO’s findings and recommendations around project LCA requirements to drive alignment in the modeling and reporting of project LCAs. The ECHO project recommends a bare minimum of reporting A1-A5 and we strongly recommend full reporting of life cycle stages A-C.

- b. For material manufacturers, it’s unclear if this statute gives CARB the authority to require any building material sold into the state to report on production quantity, cost data, EPDs, and background data. Additionally, CARB mentioned reporting of additional “background” data. A focus on high-quality facility-specific EPDs could reduce the reporting burden of other “background” data, thereby reducing costs and increasing feasibility.
- c. The scope of which products covered by the reporting policy is unclear. We saw an initial focus on data collection using the CA and Federal Buy Clean materials. We encourage an expansion of scope to include the following materials: concrete (ready mix, CMU, precast), cement, glass, steel, re-bar steel, insulation, aluminum, wood, gypsum board, acoustic ceiling panels, paint, and flooring, which are supported by the following studies:

- i. Tilak, Usry, C. & Victor, O. (2022). *Roadmap to Reaching Zero Embodied Carbon in US Federal Building Projects*. RMI. [Link](#)
- ii. Bowick, M. & O’Connor, J. (2017). *Carbon Footprint Benchmarking of BC Multi-Unit Residential Buildings*. Athena Sustainable Materials Institute. [Link](#)
- iii. One Click LCA. (2021). *Embodied Carbon Benchmarks for European Buildings*: [Link](#)
- iv. Magwood et al (2022). *Emissions of Materials Benchmark Assessment for Residential Construction*. [Link](#)
- v. Benke, B., Roberts, M., Shen, Y., Carlisle, S., Chafart, M., and Simonen, K. (2024). *The California Carbon Report: An Analysis of the Embodied and Operational Carbon Impacts of 30 Buildings*. Carbon Leadership Forum, University of Washington. Seattle, WA. [Link](#)

3. *What local, state, or federal reporting could be leveraged?*

- a. CARB should review the reporting requirements for compliance with CALGreen Section 5.409.2 Whole Building Life Cycle Assessment. In particular, Worksheet WS-9, which was added for optional use by design professionals, and for required use if invoked by the enforcement entity.

[slide 31] Help inform CARB's reporting tools and templates

1. Are there standardized ways that firms already collect, share, or report relevant data?
2. How can CARB best design data-reporting systems to leverage data collection already being done?
 - a. For EPDs, align with Buy Clean California and the material section of CALGreen. California could encourage the use of EC3 for streamlined reporting, which is an option that New York State is pursuing.
 - b. For building LCAs, we recommend reviewing the work of the ECHO Project, which is a group of certification bodies, voluntary commitments, and nonprofits that collect project LCA data for buildings and infrastructure. *Project Life Cycle Assessment Requirements: ECHO Recommendations for Alignment, Version 1.0* summarizes ECHO's findings and recommendations around project LCA requirements to drive alignment in the modeling and reporting of project LCAs submitted to the commitment and certification programs included in ECHO. Appendix A provides an extensive summary of existing requirements that will help CARB identify relevant efforts, including other policies. Additionally, the ECHO Reporting Schema v1.0 (summarized in *An Introduction to the ECHO Reporting Schema*) is designed to streamline data reporting, reduce inconsistencies, and support seamless data exchange across various LCA tools, platforms, and databases. Both are available here: <https://www.echo-project.info/publications>
 - c. As noted above, we also recommend reviewing Worksheet Ws-9 for compliance with CALGreen Section 5.409.2 Whole Building Life Cycle Assessment.

3. What sorts of data are most difficult to track and report?

- a. For reporting, establishing a naming and classification system for material quantities is more complex than one may think, as different professions (architects, structural, engineers, etc.) group or name materials differently, and different LCA tools also have different nomenclatures. We strongly recommend leveraging the work of other organizations and standards to prevent creating another competing system for material quantity tracking. For example, using Omniclass Table 21 for categorizing materials.

Tracking quantities is key to tracking reductions in resource use and should not be left out of CARB's efforts. While reducing the emissions per unit of material (which can be tracked through collecting data on EPDs) is a critical strategy, data collection on EPDs alone is not enough to capture the importance of using less of high impact materials. This is part of why building LCAs and material quantity tracking is a critical complement to EPDs alone. We were pleased to see material quantity tracking at the building level included in the scope of reporting. This will allow a reduction of the carbon intensity of building materials (kgCO₂e/unit) and the material intensity (units/m²) to both contribute toward the State's 40% reduction from baseline policy

goal. Additionally, we encourage CARB to consider how reuse of materials in considered in both carbon and material intensity tracking. Applying “credit” for more reuse in future compliance frameworks can help proliferate the material reuse market.

[slide 32] Statute requires the evaluation of the cost impact and feasibility of implementation of the strategy.

1. *What approaches should CARB use to collect cost data from manufacturers and builders?*
2. *What methodologies should CARB consider for evaluating cost impacts?*
 - a. We encourage CARB to consider the social cost of carbon in any cost and feasibility evaluations.

[slide 40] Establishing a Baseline

1. *How might CARB address data limitations for bottom- up and top-down approaches to assess GHG emissions?*
 - a. Recognize that there isn’t going to be representative data (quantity and/or GWP intensity) for a number of product types when setting the initial baseline. If you really want a 40% reduction in emissions (and not just a 40% reduction compared to the 2026-calculated value), you might want to reserve the option to adjust the baseline in the future, when more data is available. For example, in 2030: “we first estimated the 2026 baseline value to be X, but now that we have more accurate data on [MEP systems, precast concrete, etc.], we’re revising the 2026 baseline to be Y.”
2. *Is one baseline-development approach preferable?*
 - a. Yes, bottom-up makes more sense then top-down. The top-down approach would use EIO data (gCO₂e/\$-product-produced) that is usually not reconcilable with process LCA data (i.e. EPDs, building LCA background data). If the top down approach is used, the main concern is that the reporting data (process LCA) doesn’t align well with the baseline data (EIO LCA).
 - b. However, pursuing a hybrid approach or analyzing the top down approach to gain a sense of the magnitude of missing data from the bottom up approach may be helpful.
 - c. Just today (Oct 11), the EPA published state-specific EEIO factors, which is an exciting development that’s been anticipated for many years. We encourage CARB to explore this new dataset ([found here](#)) to better understand its utility. In particular, the new EEIO dataset may help CARB better understand the trading of products into and out of California.
 - d. For the bottom-up approach, CARB could consider developing or adapting a representative set of material quantities and types per new construction building type, multiplying by the emissions intensity factors per material, use proxies for missing quantities and/or carbon intensities, and scale the results based on construction

activity. Material quantity data on renovations may be more difficult to obtain, but CLF would be happy to discuss potential approaches.

- e. CLF is interested in supporting CARB's effort to develop a baseline. In particular, we can offer material quantities per building type from the [California Carbon Report](#) and the upcoming [N. American WBLCA Building Benchmarks Study v2](#).
 - f. For the carbon intensity of materials, we publish a [CLF Material Baselines report](#) every two years. The 2023 CLF Baseline values represent an estimate of industry-average GHG emissions for construction materials manufactured in North America. We are currently scoping and beginning work on the 2025 Baselines and would be happy to speak with CARB to see how the 2025 Baselines could best support your efforts.
3. *What additional factors for baseline development should CARB consider?*
- a. CARB needs to clarify the scope of what's being measured/estimated for the baseline and for subsequent years.
 - i. What types of projects? All buildings (including single family homes)? Infrastructure projects not conventionally considered buildings (roadways, sidewalks, sewers, bridges, tunnels, dams, parking garages, transit infrastructure, etc.)?
 - ii. What materials/ types of products? I assume structure and enclosure materials. What about finishes? MEP equipment (HVAC systems, lighting, electronics, data cable, plumbing, etc.)? Elevators?
 - iii. What life cycle stages? A1:A3 only? A1:A5? Beyond A5? (For example, when calculating the embodied carbon emissions due to new construction in a given year, do you also include projected future impacts for maintenance, replacement, and end-of-life related to the building constructed during the year in question?)
 - b. One potential approach is consider a larger scope when interpreting the 40% reduction.
 - i. For example, perhaps the scope for the 40% reduction includes structure, enclosure, finishes, and MEP. But, recognizing the practicality of data availability and collection, the scope of what's tracked (quantities and GWP intensity) is structure, enclosure, and finishes only. Estimate the proportion of total emissions to tracked emissions. And then figure in the (untracked) portion using a simplified approach (e.g., assume static emissions-per-sf-building for the untracked).
 - c. Our understanding (from slide #35, the statutory language, and some of the CARB team's responses to questions during the workshop) is that the goal is estimate the TOTAL emissions due to building materials – both for the baseline and presumably for any given subsequent year. Is this correct?

- i. If so, this means the quantity of construction will be enormously significant.
 - ii. There is a lot of focus in the statutory language and in the workshop about EPDs and industry-average emissions intensity, but much less about material quantities. This seems like a hugely important piece of the equation. How well can CARB estimate the quantities of construction materials used in a given year?
 - iii. I assume the amount of construction activity varies from year to year. When estimating the baseline(and any subsequent year’s emissions), it would likely be helpful to – instead of using one year of data – use a three-year (or similar) rolling average in order to iron out bumps and dips of construction activity.
4. *Is there existing information we could rely on for baseline setting?*
- a. There are two main variables for baseline setting: (a) material quantities and (b) GWP intensity per unit material. For GWP intensity of materials, we recommend the CLF Material Baselines. The most recent version available now is from 2023, and we expect to publish the 2025 CLF Material Baselines by spring of 2025.
 - i. The CLF Material Baselines report aims to provide industry-average GWP intensity values for construction product types. CARB could use the CLF’s baseline GWP values directly and/or use the methods (which we plan to document more clearly for v2025) to develop its own baseline GWP values.
 - 1. We draw primarily from industry-average EPDs, as these tend to (a) cover a representative sample of the market and (b) provide production-weighted results.
 - 2. Some cases where the CLF Baseline values do not correspond 1:1 with industry-average EPD results:
 - a. Multiple industry-average EPDs that each cover a subtype of a broader set of product types that are functionally equivalent. (For example, CMU with ordinary portland cement vs CMU with portland limestone cement.) In these cases, we performed a straight average. (A weighted average would be preferred, but we do not have access to that production volume data.)
 - b. An industry-average EPD that is not sufficiently representative or granular/specific in its scope. In these cases, we did not use the industry-average EPD to set a baseline.
 - c. Where there is no industry-average EPD for a given product type. We provide the mean and median GWP values from the collection of applicable product EPDs. (Again, a weighted average would be preferred, but we do not have access to that production volume data.)

- b. Additionally, and as noted above, CLF’s WBLCA benchmarking studies for both California and N. America could provide material quantity intensities per building type.
- 5. *What is the appropriate level of data for this program to track progress towards the target (e.g. facility level, product specific, industry average)?*
 - a. Material quantities
 - i. The material quantities are likely the most difficult but critical piece in tracking progress toward the goal. Reporting by projects and by manufacturers will be important but there will likely be gaps in both pathways. We will think more about this and look forward to speaking with you further!
 - b. GWP intensities
 - i. This depends on the material/product type, and there’s no significant reason why it couldn’t be a combination of sources to inform the GWP intensity of products.
 1. Facility-level data (with varying degrees of specific upstream data) are the most preferable source. Consider tracking product- or company-specific GWP intensity only for a handful of product types. Choose which product types based on a combination of GWP contribution and data availability/robustness of PCR/EPDs, perhaps aligning with EPA’s label program, e.g., PCRs that meet the EPA’s PCR criteria.
 2. Even if the PCR does not meet EPAs criteria, it should always be encouraged to submit facility specific data.
 3. For everything else, assume industry-average GWP intensity (though this industry-average will hopefully decrease over time). It’s also important that we continue to produce high quality industry wide EPDs to evaluate how much progress we’re making towards decarbonizing industry as a whole. Considering the broad scope of this program, CARB could consider how their policy could support both facility specific and industry wide measurement of embodied carbon.
 - ii. One approach could include collecting material quantity data for all materials on any given project that’s subject to reporting. Then collect EPD data for the GWP-tracked materials only. When calculating emissions, multiply the GWP-tracked materials by their associated EPD-derived GWP intensities, and multiply non-GWP-tracked materials by CARB’s default industry-average GWP intensities. (These defaults could be based on industry-average EPDs or other data; see response to previous question.)

[slide 42] Core Requests for Information from Interested Parties

1. *Input on approaches to data reporting*
 - a. Yes, we'd be interested to discuss further.
2. *Are you interested in working early with CARB to help define key aspects of reporting tool development?*
 - a. Yes, we'd be interested to discuss further.
3. *Input to help inform the methodology used for baseline development?*
 - a. Yes, we'd be interested to discuss further. See responses above for specific datasets we can provide.
4. *Input data robustness necessary for implementation of this policy*
 - a. Yes, we'd be interested to discuss further.

Summary

We look forward to tracking and supporting CARB's important work to develop and implement these embodied carbon programs in California. We're encouraged by your practical approach to gathering input and keeping the GHG reduction goals of the program centered in the conversations. Thank you for the opportunity to offer comments.



Jordan Palmeri
Senior Manager, Low Carbon Products
Carbon Leadership Forum