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**SENATE COMMITTEE ON ENVIRONMENTAL QUALITY**

**Senator Allen, Chair**

**2021 - 2022 Regular**

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**Bill No:** AB 2446  
**Author:** Holden  
**Version:** 6/21/2022  
**Urgency:** No  
**Consultant:** Eric Walters

**Hearing Date:** 6/29/2022  
**Fiscal:** Yes

**SUBJECT:** Embodied carbon emissions: construction materials

**DIGEST:** This bill requires the California Air Resources Board (ARB) to develop a framework for measuring and reducing carbon emissions associated with new building construction.

**ANALYSIS:**

Existing law:

- 1) Establishes the California Energy Resources Conservation and Development Commission (CEC) within the California Natural Resources Agency (CNRA), as the state's primary energy policy and planning agency. (Public Resources Code (PRC) §25200 et seq.)
- 2) Establishes the California Air Resources Board (ARB) as the air pollution control agency in California and requires ARB, among other things, to control emissions from a wide array of mobile sources and coordinate, encourage, and review the efforts of all levels of government as they affect greenhouse gas (GHG) emissions. (Health and Safety Code (HSC) §39500 et seq.)
- 3) Requires, under the Buy Clean California Act (BCCA) the Department of General Services (DGS), in consultation with ARB, to establish and publish the maximum acceptable Global Warming Potential (GWP) limit for four eligible materials: structural steel, concrete reinforcing steel, flat glass, and mineral wool board insulation. Further states that when used in public works projects, these eligible materials must have a GWP that does not exceed the limit set by DGS. (Public Contract Code §3500-3505)
- 4) Requires, under the California Environmental Quality Act (CEQA) public lead agencies to impose feasible mitigation measures as part of the approval of a “project” in order to substantially lessen or avoid the significant adverse effects of the project on the physical environment. (PRC § 21000 et seq.)

- 5) Defines, under California Code of Regulations, Title 14 (“CEQA Guidelines”) §15370, “mitigation” as:
  - a) Avoiding the impact altogether,
  - b) Minimizing the impact by limiting its degree or magnitude,
  - c) Rectifying the impact by repairing, rehabilitating, or restoring the impacted environmental resource,
  - d) Reducing or eliminating the impact over time, through actions that preserve or maintain the resource, and
- 6) Compensating for the impact by replacing or providing substitute resources or environmental conditions, including through permanent protection of such resources in the form of conservation easements.
- 7) Requires the California Air Resources Board (ARB) to develop by July 1, 2023, a comprehensive strategy for the state's cement sector to achieve net-zero GHG emissions no later than December 31, 2045. (Health and Safety Code §38561.2)

This bill:

- 1) Requires ARB to develop a framework for measuring and reducing the carbon intensity of new building construction.
- 2) Requires ARB to design the framework to achieve an 80 percent net reduction in the carbon intensity of construction and materials used in new construction by 2045, as compared to 2020 levels. This bill also requires ARB to adopt an interim goal of reducing the carbon intensity of construction 20 percent below 2020 levels by 2030 and 40 percent below 2020 levels by 2035.
- 3) Requires ARB’s framework to include specified life cycle analyses to determine the carbon intensity of residential and non-residential building construction.
- 4) Authorizes ARB to include a tracking and reporting mechanism in the framework and charge a fee for ARB’s costs to administer the reporting mechanism.
- 5) Requires ARB to prioritize actions that leverage applicable state and federal incentives and evaluate measures to support market demand and financial incentives to encourage the production and use of materials used in construction-related projects with low GHG intensity. Specifically, this bill requires ARB to consider measures to expedite the adoption for use in projects undertaken by state agencies and measures to provide incentives for research

and development of technologies to reduce emissions related to building construction.

## Background

- 1) *Embodied carbon*. The term “embodied carbon” refers to the GHG emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of building materials. The majority of a building’s total embodied carbon is released upfront at the beginning of a building’s life. Unlike with operational carbon, there is no chance to decrease embodied carbon with updates in efficiency after the building is constructed.

In California, according to the latest GHG Emission Inventory from ARB, residential and commercial buildings account for 10.5% of the state’s total GHG emissions. However, residential and commercial buildings are responsible for roughly 25% of California’s GHG emissions when accounting for fossil fuels consumed onsite and electricity demand. It is unclear what the exact breakdown is between embodied and operating emissions, but due to California’s mild climate, increasing renewable electricity supply, and relatively efficient building stock, our state’s operational emissions may be a smaller percentage of total building energy use, compared to the embodied carbon in new construction.

In order to determine the emissions associated with building materials, the entire life cycle of those products must be considered. Life cycle analysis (LCA) is a method of quantifying the environmental impacts associated with a given product. In LCA, researchers create an inventory of resources used and pollutants generated in product production and use. LCAs can vary depending on the assumptions made and the extent of the life cycle considered. Notably, for LCAs of building materials, assessments are usually either cradle-to-gate or cradle-to-grave. Cradle-to-gate LCAs consider the emissions associated from extraction up until arrival at the project site, while cradle-to-grave continues further to consider any emissions associated with the product’s use within the project and building and, ultimately, its end of life.

The CEC is required (by SB 1389, Bowen and Sher, Chapter 568, Statutes of 2002) to regularly produce an Integrated Energy Policy Report (IEPR) to assess and forecast all aspects of energy industry supply, production, transportation, delivery and distribution, demand, and prices.

The latest IEPR from 2021, within its volume on building decarbonization, had a section on embodied carbon. Most relevant to AB 2446, there was a

subsection on embodied carbon in building materials. It reported that in new building projects, on average, up to 50 percent of total GHG emissions, considered over a 30-year building life, are from the embodied carbon associated with the initial construction, and nearly 70 percent of that is from just six materials — concrete and steel (by far the most significant), flat glass, insulation, masonry, and wood products. There are, however, significant variations in estimations of the contribution of embodied carbon to the lifetime emissions from a building that warrant further analysis and contextualization for California.

Ultimately, the IEPR concluded that, “...there is enormous potential for innovation and use of low-carbon products in the built environment. Further research and development are needed, as well as collaboration with other jurisdictions, to develop best practices for reducing embodied carbon in buildings. Also, city planners, designers, and architects could benefit from greater clarity around low-carbon label claims and material-neutral embodied carbon standards.”

- 2) *Buy Clean California Act*. A first in the nation and widely emulated, the Buy Clean California Act (BCCA) is an innovative program establishing limits on embodied carbon emissions and construction materials procured by the state for public construction projects. The law requires the California Department of General Services (DGS) to publish, by January 1, 2022, acceptable maximum Global Warming Potential (GWP) limits for the following eligible materials: structural steel, concrete reinforcing steel (rebar), flat glass, and mineral wool board insulation. In order to determine and compare the GWPs of different products and materials, DGS relies on Environmental Product Declarations (EPDs).

An EPD tells the life cycle story of a product in a single, comprehensive report. The EPD provides information about a product’s impact upon the environment, such as global warming potential, smog creation, ozone depletion and water pollution. With an EPD, manufacturers report comparable, objective, and third-party verified data that helps purchasers better understand a product’s sustainable qualities and environmental repercussions so they can make more informed product selections. EPDs are typically cradle-to-gate analyses, which makes sense since they are used partly to determine which products to acquire for a given project.

## Comments

- 1) *Purpose of Bill.* According to the author, “It is no surprise that housing is an issue in California, and it is our duty as the state to provide solutions to guide key sectors to becoming more sustainable. My hope is to work together across sectors to reach our carbon emission goals and to secure better practices for the people and the planet.”
- 2) *Recent author’s amendments.* The author recently committed to amendments that would address and remove opposition from the California Building Industry Association (CBIA). The amendments are extensive and expected to be in print, should the committee choose to pass the bill out today, in the Senate Appropriations Committee.

Briefly, the author’s amendments make the following changes to the bill:

- a) Add the Building Standards Commission, the Department of Housing and Community Development, and other relevant stakeholders to those who must be consulted to develop the measuring and reduction framework;
- b) Clarify that the framework is for the average carbon intensity of the materials used in the construction of new buildings;
- c) Remove the GHG emission reduction targets that currently exist in the bill;
- d) Specify that a target of 40% net reduction in GHG emissions from building materials should be achieved as soon as possible, but no later than December 31, 2035;
- e) State that the baseline is to be established based on industry averages of EPDs reported during 2024 and 2025;
- f) Permit the department to use industry-wide EPDs based on domestic production data if it determines that the facility-specific EPDs available do not adequately represent the industry as a whole;
- g) Set an interim target of 20% net reduction of GHG emissions by December 31, 2030;
- h) Require the commission to, by July 1, 2029, evaluate the feasibility and cost impact of achieving the 2030 target and permit them to adjust the target up- or downward;
- i) Specify findings that must be document in order to adjust the interim target downward;
- j) Require CEC to determine a process in case insufficient LCA or EPDs exist, or in the event of significant supply chain issues;
- k) Require CEC to assess the cost impact and feasibility of implementation, and establish a system for consideration of cost impacts and feasibility issues, as defined;
- l) Define “feasibility” to mean “that new materials are capable of being installed in a successful manner within a reasonable period of time, taking

- into account economic, environmental, legal, social and technological factors”;
- m) Define “cost impact” to include new materials that do not harm the health or safety of installers, and the building design can reasonably incorporate the material without significantly (i.e. greater than 5%) increasing material cost, schedule, energy cost, or operational cost;
  - n) Provide that the incorporation of lower carbon materials shall be limited or excluded to the extent that it has a cost impact;
  - o) Require other conditions for the material, including but not limited to providing the same function, useful life, and durability, the material being commercially available in the local region, the material not being involved in a specified defect or other issue, and the material provides the same function and performance;
  - p) Require the Office of Planning and Research (OPR) to evaluate the circumstances in which the use of low-embodied carbon building materials or carbon sequestration in building materials is an acceptable mitigation measure pursuant to CEQA;
  - q) State that the targets established by this section shall apply no earlier than January 1, 2027, and dictate how targets apply to multi-home projects;
  - r) State that if a project developer cannot achieve the applicable GHG emission reduction target, and if there are no available alternatives that would let the project meet the target, then the project shall be deemed compliant with the target, and the project developer is required to report to ARB on the steps they took to meet the target and why they were unable to;
  - s) Require ARB to form a technical advisory committee, as specified, to make recommendations to developers who cannot achieve the GHG emission reduction target;
  - t) Exempt appliances from this chapter; and
  - u) Prevent adverse environmental impacts associated with the manufacture of building materials from being attributed to the project using the materials.

Due to timeline constraints between the two Senate policy committees, those amendments have not yet been incorporated into the bill in print. As such, questions regarding the purpose or impacts of those amendments may be best directed towards the author and stakeholders.

The committee may wish to confirm with the author that, given these amendments, the bill will still in fact push developers to reduce the carbon intensity of their building materials faster than they otherwise would. Evaluating the market availability of materials that meet these amendments’ numerous requirements is beyond the scope of this committee’s jurisdiction.

- 3) *Senate Energy, Utilities, and Communications (SEUC) Committee amendments.* This bill was heard in the SEUC committee on June 15, 2022. As a condition of the bill's passage, the author committed to amending the bill to 1) rehouse the bill's requirements within ARB instead of CEC, and 2) remove reference to, "a system of credits that can be traded among private entities," which could be used to measure and reduce the carbon intensity of the construction of new buildings.

These changes are reflected in the bill in print.

- 4) *Low carbon product standard.* AB 2446 requires ARB, in consultation with CEC, to develop a framework for measuring and then reducing the carbon intensity of the construction of new buildings, including those for residential uses. This framework will then be used to achieve carbon intensity reduction goals (compared to a 2020 baseline) of 20% by 2030, 40% by 2035, and 80% by 2045 (though these targets will be changed by the author's proposed amendments).

The bill previously authorized the use of a system of credits that can be traded among private entities to facilitate that carbon intensity measurement and reduction. However, this provision was removed in the previous committee in order to be more fully considered here.

This credit concept is similar to that of the Low Carbon Fuel Standard (LCFS), though when applied to construction materials it may be more accurately referred to as a Low Carbon Product Standard (LCPS). While an LCPS does not exist in California, it has been suggested before. SB 596 (Becker, Chapter 246, Statutes of 2021) originally permitted (but did not require) ARB to consider the use of an LCPS in reducing the carbon intensity of cement and concrete, although the provision was ultimately struck from the bill.

Although AB 2446 no longer permits ARB to establish an LCPS for construction materials, the author has stated his intent to investigate this idea further and pursue future legislation. The concept may ultimately prove useful for the implementation of this bill (among others), so it is evaluated here briefly.

The LCFS generally works by setting a carbon intensity (CI) standard (reported in grams of carbon dioxide equivalent per megajoule of energy provided by the fuel) which declines over time towards set performance targets—20% by 2030 and 80% by 2050. Fuels (namely gasoline and diesel) which have a CI greater than the current target generate "deficits," which must in turn be counteracted

through the purchase of “credits” generated by fuels whose CI is lower than the target. CI is determined through the careful LCA of specific “pathways,” which are submitted to and assessed by ARB, as well as subject to public comment.

The trade of credits between market participants allows low-carbon transportation fuel producers to earn extra revenue, which is provided by high-carbon fuel producers seeking compliance with the program. The balance between credit supply and demand largely dictates the value of a credit. LCFS credits have traded at roughly \$200 a piece for the last several years, but have recently fallen sharply, likely due to an abundance of generated and banked credits. There are other sources of LCFS credit generation—as well as myriad market design elements—which affect the LCFS market, but the above general description of the system and market are instructive for considering an LCPS.

Considering the general framework of the LCFS, there are many substantial questions to be considered in designing an LCPS for building materials. What products would be covered by the standard? Would credits be fungible between different products? What unit of carbon intensity would permit cross-product comparisons? Would certain materials generate “deficits” and be associated with increased compliance costs? Would other materials generate “credits” and thus revenue for their producers? Would the compliance obligations fall upon material producers, or project developers? If the former, how might LCPS compliance interact with cap-and-trade obligations for large producers? If the latter, how might LCPS compliance interact with BCCA? How would the transport or origin of materials be evaluated? How would an LCPS address leakage and competitiveness of domestic producers?

Owing to the tremendous complexity of a potential LCPS, the importance of the Legislature providing thoughtful guidance for the development and implementation of one, and the paucity of details included in previous versions of this bill, this is best addressed in future legislation.

***However, given that the author has expressed a sincere interest in pursuing this topic further, and the great number of stakeholders across industry, academia, public policy that should be consulted, the committee may wish to include intent language in AB 2446 clearly stating the Legislature’s intent to pursue an LCPS through subsequent legislation.***

- 5) *CEQA mitigation.* As part of the author’s amendments described in comment 2 above, OPR would be required to evaluate the circumstances in which the use of low-embodied carbon building materials or carbon sequestration in building materials qualifies as an acceptable mitigation measure pursuant to CEQA.



Under CEQA, lead agencies are required to impose feasible mitigation measures as part of the approval of a project in order to substantially lessen or avoid the significant adverse effects of the project on the physical environment. As stated above, sequestering carbon in building materials and using low-embodied carbon materials do make sense as ways to reduce the GHG emissions associated with a project. However, beyond the scope of GHG emissions, the impacts of these materials is less clear.

*In the interest of clarity and ensuring the applications to CEQA align with the author's intent, the committee should consider amending this provision to refer to mitigation of GHG emissions specifically.*

- 6) *Committee amendments. Staff recommends the committee adopt the bolded amendments contained in comments 4 and 5 above.*

It should also be noted that if approved today, these two committee amendments would be made concurrently with the extensive author's amendments described above.

### **Related/Prior Legislation**

SB 1297 (Cortese, 2022) would require the CEC to consider embodied carbon and carbon sequestration in buildings in the 2023 integrated energy policy report. The bill would also require ARB to develop an accounting methodology to quantify embodied carbon and carbon sequestration in building materials. The bill is currently pending in the Assembly Appropriation Committee.

SB 596 (Becker, Chapter 246, Statutes of 2021) required ARB to develop a comprehensive strategy for the state's cement sector to achieve net-zero GHG emissions no later than December 31, 2045.

AB 3232 (Friedman, Chapter 373, Statutes of 2018) required the CEC to assess the potential for reducing GHG emissions from the state's residential and commercial building stock by at least 40 percent below 1990 levels by January 1, 2030.

**SOURCE:** Author

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**OPPOSITION:**

None received

**-- END --**