

Setting the Record Straight

A Response to the Sierra Club's Inaccurate and Misleading Paper on the California Cement Industry

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Executive Summary

A recent paper commissioned by Sierra Club California and authored by Global Efficiency Intelligence paints an inaccurate and intentionally misleading picture of the California cement industry. The paper's sensational claims that the California cement industry is "failing the climate challenge" and is "substantially dirtier" than cement industries in other nations, including China, are absurd and incompatible with the facts, including many of those presented in the paper itself.

The truth is that:

The California cement industry has significantly reduced its carbon footprint, while greenhouse gas (GHG) emissions from other cement industries, especially China's, have grown exponentially.

According to the authors, the California cement industry *decreased* its GHG emissions by 20% between 2000 and 2015 through a combination of increased energy efficiency, greater use of lower-carbon fuels, and changes in output. In contrast, the Chinese cement industry *increased* its GHG emissions by more than 200% over the same timeframe, which the paper neglects to mention as it presents the Chinese cement industry as a model of environmental performance.

The California cement industry is just as carbon efficient as other high-performing cement industries when measured on an apples-to-apples basis.

By measuring CO₂ intensity on a per ton of cement basis, the authors manufacture an "apples-to-oranges" comparison with an extreme bias against the California cement industry. The authors should have measured CO₂ intensity on a per ton of *clinker* basis, which provides a more objective and unbiased measure of carbon efficiency. CSCME is confident that an apples-to-apples comparison would show that the analysis presented in the Sierra Club paper is highly misleading and that the California cement industry is just as carbon efficient as other high-performing cement industries around the world.

Locally produced cement is the most environmentally responsible option for meeting California's needs for durable and resilient infrastructure.

The Sierra Club paper neglects to point out that locally produced cement is the cleanest and most carbon efficient option for meeting California's infrastructure needs. The California cement industry is subject to some of the most stringent local, state, and federal regulations in the world with respect to toxic and criteria air emissions (e.g., mercury, particulate matter, NO_x, SO₂). Furthermore, if California does not source its cement locally then it will most likely import it from distant locations, particularly China, which will result in additional transportation-related emissions that are likely to outweigh any insignificant differences in production-related emissions.

There is more work to do, and policymakers have real opportunities to unlock and accelerate further GHG savings throughout the cement-concrete supply chain.

Unlike other cement industries, the California cement industry has limited ability to reduce GHG emissions through the blending of supplementary cementitious materials. However, it could significantly reduce GHG emissions if the state adopts standards that permit the use of Portland-Limestone Cement (PLC), which allow an additional 10% of limestone to be added to the final product. Used in Europe for more than 40 years and in Canada for more than a decade, PLC provides the quickest and most cost-effective path to significantly reducing GHG emissions in the California cement industry.

The California cement industry remains committed to reducing its GHG footprint and advancing the state's climate change goals.

The California cement industry is proud of the progress that it has made in decreasing its GHG emissions, and we look forward to engaging with policymakers, regulators, and other interested stakeholders to find new ways to reduce the industry's carbon footprint while minimizing the risk of emissions leakage. However, a constructive conversation about how the industry can continue to contribute to California's climate change goals cannot be based on sensational claims and intentionally misleading analysis. Rather, it must be rooted in a complete, accurate, and even-handed accounting of the facts, as well as full consideration of the industry's unique circumstances.

Introduction

A recent paper commissioned by Sierra Club California and authored by Global Efficiency Intelligence paints an inaccurate and intentionally misleading picture of the California cement industry. The paper's sensational claims that the California cement industry is "failing the climate challenge" and is "substantially dirtier" than cement industries in other nations, including China, are absurd and incompatible with the facts, including many of those presented in the paper itself.

The truth is that:

- The California cement industry has significantly reduced its carbon footprint, while greenhouse gas (GHG) emissions from other cement industries, such as China's, have grown exponentially.
- The California cement industry is just as carbon efficient as other high-performing cement industries when measured on an apples-to-apples basis.
- Locally produced cement is the most environmentally responsible option for meeting California's needs for durable and resilient infrastructure.
- There is more work to do, and policymakers have real opportunities to unlock and accelerate further GHG savings throughout the cement-concrete supply chain.

In their brazen attempt to paint a distorted picture of the industry, the authors of the Sierra Club paper ignore these facts and commit a series of flagrant errors, including but not limited to making logically inconsistent arguments, manufacturing apples-to-oranges comparisons, failing to provide a description of their methodology, and suppressing data that provides essential context.¹

The purpose of this document is to set the record straight and create a forthright and constructive conversation about how policymakers can assist the industry with further reducing its carbon footprint.

Evident Contradictions: Who Said It Better?

"There are a lot of things the cement industry can do to reduce its energy and process emissions, but few, if any, of California's cement factories have undertaken any of these measures."

- Ali Hasanbeigi, Principal Author (press release)

"The fuel-related CO₂ emissions intensity dropped by 17% mainly because of fuel efficiency improvement resulted (sic) from upgrades to more efficient preheater-precaciner kilns in several cement plants during this period."

- Ali Hasanbeigi, Principal Author (report, pg. 14)

The California cement industry has significantly reduced its GHG emissions since 2000.

Despite the Sierra Club paper's sensational claim that the California cement industry is "failing the climate challenge", the truth is that the industry has substantially reduced its GHG emissions. For instance, as noted in the paper, the California cement industry *decreased* CO₂ emissions by 2 million metric tons (Mt) from 2000 to 2015.² This is in sharp contrast to the Chinese cement industry, which *increased* its CO₂ emissions by roughly 700 million Mt over the same timeframe.³

As also noted in the paper, the reduction in CO₂ emissions in the California cement industry was due to a combination of factors, including:

- (1) A 17% reduction in fuel-related CO₂ emissions intensity due to investments in energy efficiency and greater use of lower-carbon fuels;⁴
- (2) A 13% reduction in cement output, which roughly halved during the Great Recession and still remains below pre-recession levels;⁵ and
- (3) A 10% reduction in electricity-related CO₂ emissions intensity due to investments in electricity efficiency and the decarbonization of the California electricity grid.⁶

According to the authors, these trends resulted in a *20% decrease* in the California cement industry's GHG emissions between 2000 and 2015.⁷ In contrast, GHG emissions in the Chinese cement industry *increased by more than 200%* over the same timeframe, which the paper neglects to mention in its efforts to position the Chinese cement industry as a model of environmental performance.⁸

The California cement industry's achievements are impressive by almost any standard, not just in comparison to China. For instance, the 20% decrease in the California cement industry's emissions is three times greater than the 6.4% reduction in statewide GHG emissions over the same timeframe.⁹

Given these facts, the California cement industry's performance in recent years is best described as an environmental policy trifecta — reduction of GHG emissions, improvement in energy efficiency, and greater use of lower-carbon fuels. All of this was accomplished while minimizing GHG emissions leakage, recovering from one of the most severe downturns in the industry's history, and complying with California's other stringent environmental regulations.

The California cement industry is just as carbon efficient as other high-performing cement industries when compared on an apples-to-apples basis.

The paper's conclusion that the California cement industry is "substantially dirtier" than cement industries in other nations is based exclusively on the results of its so-called "benchmarking" analysis. Although the benchmarking analysis is flawed in several respects, the authors' most egregious error is in manufacturing "apples-to-oranges" comparisons. Specifically, the authors measure CO₂ intensity on a per ton of cement basis, which introduces an extreme bias against the California cement industry.

To understand the nature of this bias, note that the primary purpose of a cement plant is to produce clinker, which is the key binding agent in cement and accounts for the vast majority of GHG emissions in the concrete supply chain. Various types of cement are then created by blending clinker with other substances, including gypsum, limestone, and supplementary cementitious materials (SCMs). The addition of these other substances effectively "dilutes" the amount of clinker, which reduces the amount of GHGs per ton of cement without any change in the environmental performance of the plant.

This bias is compounded by the fact that SCM blending can happen at either the cement plant or the ready-mix concrete facility. In fact, in most countries, it is customary to add SCMs at the cement plant. As the paper states, however, "in the U.S. (including California), most SCMs are added at ready-mixed concrete facilities."¹⁰ The Sierra Club paper acknowledges this important distinction in several places, but then inexplicably ignores it when conducting the benchmarking analysis.¹¹

By conducting their benchmarking exercise on a cement basis, the authors virtually ensure that the California cement industry will appear to be worse than all other cement industries. In other words, the result is more of a "feature" of the analysis than a "finding" from it.

Instead, the authors should have measured CO₂ intensity on a per ton of clinker basis, which provides a more objective measure for comparing carbon efficiency across industries. CSCME is confident that an apples-to-apples comparison that corrects for this bias would show that the Sierra Club's analysis is highly misleading and that the California cement industry is just as carbon efficient as other high-performing cement industries around the world.

Biased Benchmarks: How Much Caffeine is in Your Coffee?

To appreciate the bias that is inherent to a cement-based benchmark, consider an intuitive example: the caffeine in a cup of coffee.

Imagine a benchmarking analysis that aims to compare the "caffeine intensity" of coffee produced by two different coffee shops: China Coffee and California Coffee. Assume that both coffee shops use the same coffee beans and brew the coffee the same way, but China Coffee puts cream in the coffee (à la Dunkin Donuts) and California Coffee allows customers to add cream themselves (à la Starbucks).

If measurements are taken at the point of sale, one would mistakenly conclude that the caffeine intensity of coffee at China Coffee is lower than at California Coffee.

If, however, measurements are taken behind the counter and before any other substances are added, one would correctly conclude that the caffeine intensity of coffee at both shops is similar.

Locally produced cement is the most environmentally responsible option for meeting California’s needs for durable and resilient infrastructure.

In its attempt to paint a distorted picture of the California cement industry, the Sierra Club paper neglects to point out that locally produced cement is the most environmentally responsible option for meeting the state’s infrastructure needs due to: (1) the stringent environmental regulations under which California plants operate and (2) the GHG emissions associated with transporting cement from other markets.

First, the California cement industry is subject to some of the most stringent local, state, and federal regulations in the world with respect to toxic and criteria air emissions (e.g., mercury, particulate matter, NO_x, SO₂). In contrast, the Chinese cement industry releases toxic and criteria air emissions on a breath-taking scale. As noted in a 2017 study co-authored by the principal author of the Sierra Club paper:

“Consistent with the Chinese cement industry’s large production volume, total carbon dioxide (CO₂) emissions from the industry are very high, as are associated air pollutant emissions, including sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM). These emissions cause significant regional and global environmental problems. The cement industry is the largest source of PM emissions in China, accounting for 40 percent of PM emissions from all industrial sources and 27 percent of total national PM emissions.” (emphasis added)¹²

Second, if California does not source its cement locally then it will most likely import it from countries that can logistically and economically access the coastal market, particularly China. This involves not only producing the cement, but transporting it from a plant to a port, loading it onto a ship, sending it halfway around the world using bunker fuel, unloading it at a port in California, and then transporting it in diesel-powered trucks through California’s port neighborhoods and other communities before it eventually reaches the end customer. This series of activities results in significant GHG emissions that are likely to outweigh any insignificant differences in the GHG emissions associated with producing clinker.

In short, the Sierra Club paper sidesteps the most important question, which is: How does California source the cement it needs in the most environmentally responsible manner? Instead, the paper focuses on making politically motivated arguments that erroneously paint the Chinese cement industry as a model of environmental performance and that ignore the environmental and climate change benefits of locally sourced cement. Policymakers should take action to ensure that the cement that California consumes meets the state’s stringent environmental standards and to avoid the additional GHG emissions associated with importing cement from China and other distant locations.

There are significant barriers to increasing the use of SCMs in California in an environmentally responsible manner.

The Sierra Club paper argues that, when measured on a per ton of cement basis, the California cement industry has a higher emissions intensity than China’s (as well as most others outside of California), primarily due to differences in the use of SCMs. The paper notes that SCMs are typically added at cement plants in most countries but are added at ready-mix concrete facilities in the United States, including California. However, the paper fails to mention that there are also substantial barriers to increasing the use of SCMs in California, regardless of whether blending takes place at the cement plant or concrete facility.¹³

The primary barrier is the lack of a steady local supply of SCMs such as fly ash and slag, which are waste products from coal-fired electric power and steel manufacturing, respectively. Given that California does not have coal-fired power generation or steel manufacturing, the California cement industry must import SCMs from other regions. In contrast, the Chinese cement industry has access to a large, local, and steady supply of SCMs due to the country’s heavy reliance on coal-fired electricity and steel manufacturing.

As a result of these market conditions, efforts to require or incentivize the increased use of SCMs in California could actually increase global GHG emissions. Given that SCMs are not produced locally in California and are highly utilized in areas where they are produced, increasing demand in California would curb their use elsewhere. This artificial “reshuffling” of materials could create an illusory benefit, with GHG decreases in California being offset by increases in other areas. Diverting cement substitutes to California from distant locations will also increase transportation-related emissions, which means that this artificial reshuffling of supply could, on net, actually increase global GHG emissions.

Policymakers have an opportunity to unlock and accelerate additional GHG emissions savings by facilitating the adoption of Portland-Limestone Cement (PLC) in California.

The California cement industry, unlike other cement industries, has limited ability to reduce GHG emissions through the blending of SCMs at the plant. It could, however, significantly reduce GHG emissions if the state adopts standards that permit the use of Portland-Limestone Cement (PLC), which would allow an additional 10% of limestone to be added to the final product.¹⁴ The use of PLC in California would advance the state's environmental goals, including the reduction of GHG emissions in the cement industry, while providing comparable performance.

PLC has been used in Europe for over 40 years and in Canada for over a decade.¹⁵ In the United States, a majority of states have accepted PLC standards, which include testing requirements to classify cement for use in high sulfate soil regions, such as California.¹⁶ Given the size of the California Department of Transportation (Caltrans) and the fact that many other entities use its standards, the agency's approval of these standards is an essential first step toward producing and using PLC throughout the state.¹⁷

Permitting the use of PLC is the quickest and most cost-effective pathway to reducing GHG emissions in the California cement industry. It is estimated that, given production dynamics, the widespread use of PLC could reduce the cement industry's GHG emissions by as much as 9%.¹⁸

Conclusion

The California cement industry is proud of the progress that it has made in decreasing its GHG emissions, and we look forward to engaging with policymakers, regulators, and other interested stakeholders to find new ways to reduce the industry's carbon footprint while minimizing the risk of emissions leakage. However, a constructive conversation about how the industry can continue to contribute to California's climate change objectives cannot be based on sensational claims and intentionally misleading analysis. Rather, it must be rooted in a complete, accurate, and even-handed accounting of the facts, as well as full consideration of the industry's unique circumstances.

A Note on the Sierra Club Paper's Lack of Transparency

CSCME attempted to reproduce the CO₂ intensity data presented in the Sierra Club's paper to establish a baseline. However, we were unable to do so for a variety of reasons, including lack of transparency and specificity. For example, although the paper provides a chart of CO₂ intensity by region, it does not provide a table showing the underlying data. Similarly, although the paper references the data sources used, it does not provide any detail regarding the methodology.

The lack of a methodology description is particularly concerning given that it appears that the authors mixed and matched data from *five* sources, all of which use different methods and data vintages. For example, the paper notes that the CO₂ intensity for the Chinese cement industry was estimated from two different studies, both of which report intensity estimates on a clinker basis. It is unclear whether the authors combined the two estimates in some fashion, how they converted those estimates to a cement basis, and the extent to which the final estimate is comparable to other data sources.

Although the authors of the paper assert that they "took several measures to make sure the data used and results are comparable", the lack of transparency and specificity makes it impossible to verify that claim. Consistent with best practices, the authors should publish all data used in the paper, as well as a detailed description of the methodology and any steps taken to ensure comparability.

Endnotes

¹ In addition, portions of the Executive Summary are taken almost verbatim from an April 2017 letter from the Director of the Sierra Club California, confirming that the paper is actually an advocacy piece that is masquerading as third-party research.

² Hasanbeigi, A. and Springer, C. 2019. California's Cement Industry: Failing the Climate Challenge, p. 18. Global Efficiency Intelligence. San Francisco, CA. ([Link](#))

³ Shan, Y., Zhou, Y., Meng, J., Mi, Z., Liu, J., & Guan, D. Peak cement-related CO₂ emissions and the changes in drivers in China, p. 6. Journal of Industrial Ecology. ([Link](#))

⁴ Hasanbeigi, A. and Springer, C. 2019. California's Cement Industry: Failing the Climate Challenge, p. 18. Global Efficiency Intelligence. San Francisco, CA. ([Link](#))

⁵ Hasanbeigi, A. and Springer, C. 2019. California's Cement Industry: Failing the Climate Challenge, p. 15. Global Efficiency Intelligence. San Francisco, CA. ([Link](#))

⁶ Hasanbeigi, A. and Springer, C. 2019. California's Cement Industry: Failing the Climate Challenge, p. 18. Global Efficiency Intelligence. San Francisco, CA. ([Link](#))

⁷ Ibid.

⁸ Shan, Y., Zhou, Y., Meng, J., Mi, Z., Liu, J., & Guan, D. Peak cement-related CO₂ emissions and the changes in drivers in China, p. 6. Journal of Industrial Ecology. ([Link](#))

⁹ California Air Resources Board (2018). GHG Emission Inventory (GHG EI) 2000-2016. ([Link](#))

¹⁰ Hasanbeigi, A. and Springer, C. (2019). California's Cement Industry: Failing the Climate Challenge, p. 26. Global Efficiency Intelligence. San Francisco, CA. ([Link](#))

¹¹ This error would be understandable if it were an oversight, but the authors acknowledge the bias on multiple occasions. It would also be understandable if better measures (e.g., CO₂ per ton of clinker) were unavailable, but such measures are both easily accessible and widely used, including in the studies referenced in the paper. This raises questions about whether the authors ignored the bias or actively sought to exploit it.

¹² Hasanbeigi, A., Khanna, N., & Price, L. (2017). Air Pollutant Emissions Projections for the Cement and Steel Industry in China and the Impact of Emissions Control Technologies, p. 1. Energy Analysis and Environmental Impacts Division Lawrence Berkeley National Laboratory. ([Link](#))

¹³ An objective assessment of SCM usage across regions should include a discussion of barriers to increasing the use of SCMs. On page 26, the authors of the Sierra Club paper suggest that they will provide such an assessment when they state, "Below we briefly discuss availability and some other issues related to each of these SCMs." However, the paper then immediately and inexplicably proceeds to the conclusion without any discussion of this critical issue.

¹⁴ California-Nevada Cement Association (2017). Bringing a Lower Carbon Cement to California: Portland-Limestone Cement.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Caltrans currently has a research study underway with Oregon State University on this issue.

¹⁸ California-Nevada Cement Association (2017). Bringing a Lower Carbon Cement to California: Portland-Limestone Cement.