DIALOGUE

CLIMATE COMPLIANCE VERSUS ACTION 2023

SUMMARY

The Inflation Reduction Act and Federal Buy Clean Initiative have each inspired states and municipalities to regulate embodied carbon (Scope 3) using "Buy Clean" policies and legislation. Reducing embodied carbon has become mainstream, and environmental product declarations (EPDs) have surfaced as the tool. Are EPDs alone enough? Is the compliance timeline sufficient? On February 1, 2023, the Environmental Law Institute hosted a panel of experts that provided an update on Buy Clean policy, green funding, the status of carbon emissions, and a primer on EPDs. Below, we present a transcript of that discussion, which has been edited for style, clarity, and space considerations.

Madison Calhoun is Senior Manager of Educational Programs at the Environmental Law Institute.
Bill Caplan (moderator/presenter) is the author of *Thwart Climate Change Now: Reducing Embodied Carbon Brick by Brick*.
Chris Kardish is an Industrial Fellow at the Center for Climate and Energy Solutions.
Keith Killpack is Technical Director of Environmental Certification Services at SCS Global Services.
Fatou Jabbie is Chief Executive Officer and Founder of USL Technology Inc.
Ken Berlin is a Senior Fellow at the Atlantic Council's Global Energy Center.

Madison Calhoun: I want to briefly introduce our speakers. First, we have Bill Caplan, our moderator and presenter. After a 34-year career in high technology and with an engineer's understanding of sustainability, Bill studied the built environment from an environmental perspective for more than a decade, contrasting designers' claims with their ecological veracity. A sober look at our efforts to contain global warming inspired Bill to write *Thwart Climate Change Now: Reducing Embodied Carbon Brick by Brick*, published in 2021.

Ken Berlin is a senior fellow and the director of the Financing and Achieving Cost Competitive Climate Solutions Project at the Atlantic Council's Global Energy Center. He has devoted his career to leadership on environment, energy, and climate change issues. From 2014 to 2022, Ken was president and chief executive officer (CEO) of the Climate Reality Project, an organization founded and chaired by former U.S. Vice President Al Gore. He was a co-founder with Reed Hundt in 2010 of the Coalition for Green Capital, which works with governments at the international, national, state, and local levels to establish green bank finance institutions to accelerate the deployment of renewable energy, energy efficiency, and clean transportation.

Fatou Jabbie is an information technology professional with experience in fieldwork and integrating smart technology systems for large corporations. She's the principal at USL Technology, a New York City-based sustainability and energy efficiency firm that provides regulatory compliance, engineering, and technical advisory service to real estate developers, property management firms of large multifamily hotels, supermarkets, restaurants, and commercial buildings. In her work in the Metropolitan Transportation Authority's Design and Construction Division, Fatou works on design-build projects, energy code compliance, engineering plan reviews, and whole-building energy simulation modeling.

Chris Kardish is the industrial fellow at the Center for Climate and Energy Solutions, where he works to advance industrial decarbonization through research and policy advocacy, including through the Renewable Thermal Collaborative, a coalition of large energy users focused on reducing emissions from heating and cooling at their facilities.

Keith Killpack manages SCS Global Services' lifecycle services department and environmental product declaration (EPD) program. Under his supervision, the department conducts studies to help a wide range of industries and clients design products and services to minimize environmental impacts, optimize operational efficiencies, satisfy customer requests, engage stakeholders, and support comparative eco-labels and EPDs. He draws from prior experience in environmental chemistry and applied biology, validation of environmental analytical data, environmental remediation projects, and sustainability.

Bill Caplan: Today's panel includes updates on Buy Clean policies,[1] EPDs, funding, and the status of global emissions. Viewed in the context of timely climate action, it will reveal one glass half full and another glass half empty, and possibly leaking. Our panelists' presentations will focus on new regulations in the pipeline. This will be followed by a discussion to explore potential issues of compliance and the efficacy of its impacts.

A year ago today, the Environmental Law Institute hosted a discussion[2] of my recently published book. Back then, embodied carbon emissions were mostly taken for granted. They were a normal cost of doing business that was too perplexing to resolve. Fighting global warming was relegated to replacing fossil fuel energy with sustainable, carbon-free sources, which is a long-term endeavor; and to using less energy in the meantime by designing energy-efficient buildings, appliances, and transportation.

In a little more than a year, things have changed. Embodied carbon is now at the center of a new category of regulations: Buy Clean. Buy Clean initiatives are working their way through an increasing number of regulatory bodies. Why? Because embodied carbon in building materials constitutes approximately 11% of the world's energy-related emissions,[3] and because embodied carbon is released to the atmosphere upfront before a building or an infrastructure or a product is first used.

If you are new to embodied carbon, in simple terms, it is merely a product's carbon footprint. For Buy Clean policy, the initial concern is from cradle to gate. In other words, the carbon emissions released while fabricating a product from its raw material extraction to the manufacturer's shipping dock. If you are advising large corporate clients, you might be discussing embodied carbon already in terms of upstream Scope 3 emissions. In the fight to thwart global warming, this glass is filling up, perhaps half full.

Chris Kardish will start us off with an update on Buy Clean policies in the pipeline. In doing so, he will introduce you to the new buzzword—"environmental product declarations"—that forms the basis for Buy Clean compliance.

Chris Kardish: I'm going to provide a sense of the state of play of Buy Clean before we get into some specifics from the other presenters going deeper into other areas. Just so we're on the same page, when we talk about embodied emissions, we're talking about those across all the stages of a product's life cycle. But most of the attention, particularly on Buy Clean, is focused on the stages around manufacturing, which includes the raw materials used for that manufacturing. And I'll be using the terms "embodied emissions" and "embodied carbon" interchangeably.

As Bill mentioned, we're talking about 11% of global emissions embodied in infrastructure and buildings from common materials, particularly steel and cement. This additionally matters because those materials are among the most ubiquitous in our economies. Looking beyond their emissions from the built environment, these two sectors account for 15% of global emissions.[4] And when we talk about Buy Clean, we're talking about ideally shifting to broader markets.

Embodied emissions are those from our purchases and our consumption habits. When we're talking about policies to address them, we're talking about more of the demand side of the equation. This is certainly true of Buy Clean. And when we talk about Buy Clean, broadly speaking, we're talking about attempts by governments to put limits on the emissions content of materials that are sourced in public projects.

The reason for this strong emphasis on public projects is that about 32% of embodied emissions in the United States are from the construction of public projects.[5] At the same time, we know that to have effective policies, we need ways to reliably measure the differences in emissions between manufacturers to actually empower those choices and to deliver the promise of public procurement, which is ideally shifting broader product markets toward lower-carbon goods by leveraging that buying power.

The leading way of measuring the embodied carbon for construction materials is through EPDs. Keith is going to talk more in depth about this, but so we're all on the same page, EPDs provide a range of environmental impacts in a standardized document, including the carbon dioxide (CO_2) equivalent emissions per unit of the product, which is referred to as the "global warming potential" (GWP).

EPDs are grounded in overarching guidelines and principles that are set by the International Organization for Standardization (ISO). These can be applied to measuring the embodied emissions of any product; so, broad principles. More granular product-specific rules known as product category rules (PCRs) spell out the finer details of measuring a specific product. In fact, the measurements for the same products must have used the same PCRs in order to be comparable because, otherwise, you're not comparing apples to apples. These PCRs are generated through stakeholder processes that include industries and manufacturers themselves, and are administered by program operators, which are often companies that specialize in third-party verification.

There are different types of EPDs, some of which have emerged from Buy Clean laws themselves. Industrywide EPDs provide an average across a range of manufacturers. They're often produced by industry trade associations as

1. Carbon Leadership Forum, *What Is a Buy Clean Policy?*, https://carbonleadershipforum.org/what-is-a-buy-clean-policy/ (last visited May 5, 2023).
2. Environmental Law Institute, *Thwart Climate Change Now: Reducing Embodied Carbon Brick by Brick*, Env't L. Inst. (Feb. 1, 2022), https://www.eli.org/events/thwart-climate-change-now-reducing-embodied-carbon-brick-brick.
3. Fact Sheet, White House, Biden-Harris Administration Announces New Buy Clean Actions to Ensure American Manufacturing Leads in the 21st Century (Sept. 15, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/09/15/fact-sheet-biden-harris-administration-announces-new-buy-clean-actions-to-ensure-american-manufacturing-leads-in-the-21st-century/; International Code Council, *Embodied Carbon*, https://www.iccsafe.org/advocacy/embodied-carbon/ (last visited May 5, 2023).
4. European Commission, EDGAR—Emissions Database for Global Atmospheric Research, *Global Greenhouse Gas Emissions*, https://edgar.jrc.ec.europa.eu/dataset_ghg50 (last visited May 5, 2023).
5. Carbon Leadership Forum, *What Is a Buy Clean Policy?*, *supra* note 1.

a first step before more specific EPDs are available. They can be useful for setting thresholds for maximum allowable greenhouse gas emissions. In other words, for getting a sense of where an industry is.

Product-specific EPDs provide specific data on a manufacturer. The data might be averaged across multiple facilities of that manufacturer, but they provide a representation of that manufacturer.

Taking it a step further, facility-specific EPDs can actually be traced to a single facility of a manufacturer, and were introduced in the Buy Clean California Act.[6]

Lastly, supply chain-specific EPDs require primary or actual data for certain materials and upstream inputs, so data directly from a supplier. For instance, requiring data on cement that's used to make concrete because the cement is a very emissions-intensive component, and you want the actual data. This was introduced in the Buy Clean and Buy Fair Washington Act,[7] which didn't become law but has still been influential.

Buy Clean laws are emerging at every level of government, but they started in the states, and they're particularly active in the states. California was the first in 2017. The Buy Clean California Act requires the Department of General Services to set firm emissions limits on a variety of materials that could be used in public projects, including a variety of steel products, flat glass, and mineral wool boards. In some cases, these categories are further subdivided because there's a lot of variation within the subproducts in these categories. The state requires facility-specific EPDs for compliance.

California took a bit of time to get to the implementation stage and faced some challenges, particularly around setting thresholds through a collection of facility-specific EPDs and finding instead that they needed to largely rely on industry-average EPDs that were more representative and reliable.

Other states have followed suit in recent years, including Colorado and Oregon,[8] which have set somewhat similar laws but with differences in the types of EPDs required. They require product-specific EPDs for instance. They're covering concrete off the bat, and have different approaches or timelines to set limits on embodied carbon.

Another set of states, like New York and New Jersey,[9] have set more limited Buy Clean laws, so I put them in another category. In this case, they only cover concrete and have not been quite as firm in setting thresholds on emissions content.

Washington and Minnesota have been very active, and have considered laws a number of times, but in the meantime have commissioned studies and pilots and could be expected to follow suit soon among the Buy Clean states.[10] We're likely to see more laws floating about in statehouses this year. Last year, we saw them going through in Virginia, Illinois, and Maryland, among others.[11]

Under the Joseph Biden Administration, Buy Clean has really accelerated at the federal level, which is important because that's where we need to reach scale. The Buy Clean Task Force was established in 2021 via an Executive Order[12] as an interagency group that's focused on formalizing a federal policy around key aspects, including covered materials and EPD reporting requirements. The group issued a set of priority products in September 2022,[13] and then a month later established a $7.1-million program through the Federal Highway Administration (FHwA) that's working with state-level departments of transportation on pilots, demonstrations, and ways to really build capacity there. The General Services Administration (GSA) was the first federal agency to act on Buy Clean. They set standards on concrete and asphalt purchases in March 2022,[14] and compliance on that has begun and has reportedly been quite successful so far.[15]

The Inflation Reduction Act (IRA)[16] has a number of other big programs, including efforts by the U.S. Environmental Protection Agency (EPA) to improve EPD data quality and reliability and harmonization, as well as creating a labeling program to broaden knowledge and the ease of information around this. Then, GSA and FHwA make these purchases, which often could come with a green premium when trying to target ultra-best-in-class performers.

States, localities, and cities have also stepped into the mix. Portland is among the only cities with a formal Buy Clean-type law targeting concrete, with specifications that have limits on the emissions content and compliance obligations that started this year.[17] So, they've moved ahead in the state of Oregon to be first on this. New York City issued Executive Order No. 23[18] last year requiring capital project agencies to make their best efforts to incorporate low-carbon concrete rules and to begin collecting EPDs for concrete and steel.

Some localities have looked to target this issue by encouraging recycling and reuse of construction materi-

6. A.B. 262, 2017-2018 Reg. Sess. (Cal. 2017).
7. H.B. 1103, 2021-2022 Reg. Sess. (Wash. 2021).
8. H.B. 21-1303, 74th Gen. Assemb., Reg. Sess. (Colo. 2021); H.B. 4139, 2022 Reg. Sess. (Or. 2022).
9. S. 542A, 2021-2022 Reg. Sess. (N.Y. 2021); S. 3091, 2020-2021 Leg. Sess. (N.J. 2021).
10. H.B. 1103, 2021-2022 Reg. Sess. (Wash. 2021); H.B. 2110, 92d Leg. (Minn. 2021).
11. S. 272, 2022 Leg. Sess. (Va. 2022); H.B. 5564, 102d Gen. Assemb. (Ill. 2022).
12. Fact Sheet, Biden-Harris Administration Advances Cleaner Industrial Sector to Reduce Emissions and Reinvigorate American Manufacturing (Feb. 15, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/15/fact-sheet-biden-harris-administration-advances-cleaner-industrial-sector-to-reduce-emissions-and-reinvigorate-american-manufacturing/.
13. Fact Sheet, *supra* note 3.
14. Press Release, GSA, GSA Lightens the Environmental Footprint of Its Building Materials (Mar. 30, 2022), https://www.gsa.gov/about-us/newsroom/news-releases/gsa-lightens-the-environmental-footprint-of-its-building-materials-03302022.
15. Chris Kardish, Center for Climate and Energy Solutions, A Building Block for Climate Action: Reporting on Embodied Emissions (2022), https://www.c2es.org/wp-content/uploads/2022/11/a-building-block-for-climate-action-reporting-on-embodied-emissions.pdf.
16. Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818.
17. City of Portland Office of Management and Finance, Notice of New Requirements for Concrete (May 15, 2019), https://www.portlandoregon.gov/brfs/article/731696.
18. Exec. Order No. 23 (Sept. 22, 2022).

als—for instance, setting debris recovery requirements on city projects. San Francisco, California,[19] and Cook County, Illinois,[20] would be among these localities.

Lastly, some are taking the approach of addressing this issue through the building codes, so not as much from a procurement lens. Marin County[21] was the first, but Denver[22] recently issued some amendments to their building code along these lines.

Bill Caplan: Chris wrote a paper[23] reporting on embodied emissions, which addresses the importance of EPDs to the success of Buy Clean initiatives.

Most people have never heard of an EPD. Fewer have ever seen one. We are fortunate to have with us Keith Killpack, technical director of environmental services for SCS Global Services. SCS is one of the world's leading EPD program operators. Keith will provide us with a primer on EPDs.

Keith Killpack: I'm looking forward to sharing with you the perspectives from a program operator on life-cycle assessment (LCA) and EPDs and how it ties in with Buy Clean legislation. About my firm, SCS is an international leader in third-party environmental and sustainability certification and standards development. SCS specializes in auditing, testing, certification, verification, LCA, and EPDs, as well as training and strategic consulting. SCS helps businesses, governments, and nongovernmental organizations (NGOs) meet government regulations, stand out in their markets, as well as demonstrate environmental and social responsibility. SCS is headquartered in Emeryville in the San Francisco Bay area, but we have offices globally.

With that, I will dive into the discussion with a bit of background on LCA. Typically, we think of this as a cradle-to-grave exercise, looking at the impacts of a product, or a process or service as well, but looking at that over its entire product life cycle. That would begin with the extraction of raw materials or the recycling of materials, in some cases. Then, the processing and refining of those materials, and transportation to a facility where a product is manufactured, packaged, and then distributed to customers. It will also quantify the product use phase as well as the product end-of-life.

Throughout the life cycle, we're looking at impacts to various environmental areas, such as what we're talking about here today, to climate change. But it looks at other areas too, such as depletion of the ozone layer, and pollution of water such as eutrophication, or acidification, which is sometimes referred to as "acid rain." There are a number of other areas, but LCA attempts to be more holistic in looking at a range of issues and not just climate change, for example.

A little bit of background on the benefits of LCA. It represents the most comprehensive tool and technique for measuring environmental and human health impacts of a product. It can also be used as a cost-effective way to identify environmentally efficient improvements. One great thing about LCAs is that they can be applied before making physical changes to the manufacturing process to investigate where one might be able to have opportunities to reduce those impacts, prior to making actual changes.

What we really appreciate as LCA practitioners is that some of our clients are interested in understanding the environmental hot spots along their supply chain, or maybe it's the manufacturing process. For some products, it might be other life-cycle stages, such as the use or end-of-life of products. But it's important to understand where these hot spots are if we're going to be able to take actions toward reducing them.

LCAs can be used as a way to transparently communicate to customers and stakeholders about the impacts of a product over its life cycle. The EPD is one of those applications. LCAs can also be used to substantiate consumer-facing claims that might be made in the marketplace and help the company manage risk.

Following the ISO standards, there are four essential stages for preparing an LCA. The first is the goal and scope definition. This is where, for example, the product system is identified, the system boundaries are selected, the level of data quality that's going to be necessary for the LCA is defined, and the indicators to be reported are determined.

The next stage of an LCA is the life-cycle inventory stage. This is when we collect the data and environmental inputs and outputs, to prepare a virtual representation of the product. It's typically done using LCA software, but it can also be done using tools such as Excel.

The third stage of an LCA is the life-cycle impact assessment stage. This is when we process the environmental flows and environmental data to quantify the impacts on the environment, such as impacts on climate change and other environmental areas.

The final stage of the LCA is documenting the LCA in a report, including the analysis and interpretation of results. The EPD is essentially a derivation of this fourth stage of reporting.

There are four key ISO standards for EPDs of construction products, which Chris alluded to. There are two foundational standards for LCA: ISO 14040 and ISO 14044. These standards provide a general framework that should be applied for all LCAs. An LCA framework can be used for different applications, from internal design research, hot spot analysis, or a comparative analysis.

In 2006, ISO 14025 was finalized. This standard laid out the rules for EPD program operators, the development of PCRs, and the idea of using EPDs as a way to communicate the life-cycle impacts of a product to customers. In addition, ISO 21930 is an emerging and important standard for the building and construction products sector. This standard sets a foundation for the rules for PCRs for construction products, to try to create more parity when we're looking at products from different categories.

19. Carbon Leadership Forum, *Embodied Carbon Policy Toolkit*, https://carbonleadershipforum.org/clf-policy-toolkit/ (last visited May 5, 2023).
20. *Id.*
21. *Id.*
22. *Id.*
23. Kardish, *supra* note 15.

To provide a bit more background on how the EPD comes together, first, there must be a PCR established. This lays out the rules of the LCA and the format for the EPD. Once a PCR has been prepared, that gives the guidance for an LCA to be conducted and documented in a background report.

From that LCA report, the EPD can be prepared. It's essentially a transparency disclosure based on the LCA report. It is prepared using a standardized format based on the PCR and following the ISO standards.

It should be noted that an EPD is not a comparison in and of itself. ISO is very explicit about that—that the EPD should not be making a comparison—but it can be used to make comparisons easier. One of the intentions of ISO 14025 is to help guide decisionmaking on purchases.

For those of you who may have looked at an EPD for construction products at some point, ISO 21930 and European EPD standard EN 15804 have developed the idea of life-cycle stages or life-cycle modules. These modules break down the life cycle of a product into various stages, so that users of the EPD can repurpose that information in their own projects. Maybe they want to model a whole-building LCA, or their own specific project.

Let me give an overview of this. Initially, we have the product stage. The product stage includes life-cycle modules A1 (raw material extraction, processing), the A2 module (transport to a manufacturing site), and the A3 module (manufacture of a product). The construction stage includes modules A4 (transport to a site) and module A5 (installation of the product).

Modules B1 through B7 include impacts during the use stage, whether it's from use or various activities to maintain the product such as maintenance, repair, replacement, and refurbishment. If a product uses energy or water, the impacts from that can also be reported under the use stage.

This is followed by the end-of-life stage, which includes the C1 through C4 modules: the removal of the product or deconstruction from the building (C1), the transport to a waste processing site (C2), any waste processing or sorting that's necessary (C3), and the end fate of the product either in a landfill or via incineration (C4).

When all of the life-cycle stages are included in the EPD, it is considered cradle to grave. Some EPDs do not cover the full life cycle and may be cradle to gate, which only considers the manufacture of the product. Cradle-to-gate EPDs are also relevant for today's discussion. For example, in the case of the Buy Clean California legislation, only the product stage modules are relevant for the GWP calculations. The downstream stages are outside the scope.

I want to highlight a nuance of that. It can even be a bit more complicated, at least under Buy Clean California for steel products, in that the final fabrication of the product is excluded from the GWP calculation.

That means that when you're looking at these EPDs, you really have to understand what you are looking at. Let's talk about rebar for a moment. If it was fabricated rebar, we would have the production of the reinforcing bar in module A1, transportation to a fabrication shop in A2, and then the fabrication of rebar in A3. But from the perspective of Buy Clean California, they're actually only focused on the impacts from making the reinforcing bar[24] because that's where 90+% of the climate change impact occurs.[25] It's actually from that steel mill.

A word of caution when interpreting these: you do have to be careful to know which stages are relevant to the legislation.

Bill Caplan: For a client, a manufacturer who wants to produce an EPD—meaning cradle to gate—what's a typical time frame from start to finish if they came to SCS?

Keith Killpack: We're quoting about four to six months for a typical project to complete. Some of these projects take longer though, because there is a data-collection component on the manufacturer's and the client's end. As long as that comes through in a timely fashion, we can typically get these completed in about a four- to six-month time frame.

Bill Caplan: What's a typical cost for something like that?

Keith Killpack: It would vary from product to product. Since there are several reviews in the LCA, there are a lot of upfront costs. If there are multiple products or multiple facilities, these costs aren't linear. They go down quite significantly. If you're just looking at a single product manufactured at a single facility, the cost starts at about $15,000 for working with SCS. Of course, there are other EPD program operators that will give you their own information on that.

Bill Caplan: Fatou Jabbie, the founder of USL Technology, a sustainability and technology consulting firm, will talk about helping designers and construction and building operation professionals to find a solution to decarbonization.

Fatou Jabbie: My colleagues have laid out the current landscape, that at the federal, state, city, and municipal levels EPDs are starting to be a requirement. An example was given with the GSA, which is also prioritizing federal buildings from a new construction perspective. The same sentiment in the current landscape is happening in New York State where I work and live, and also in New York City.

Generally, public agencies are leading by example and integrating EPD requirements and addressing embodied carbon within publicly funded projects. Existing frameworks are being leveraged, as shared previously by my fellow panelists in terms of ISO standards, and Leadership in

24. California Department of General Services, *Buy Clean California Act*, https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act (last visited May 5, 2023).
25. Concrete Reinforcing Steel Institute, Environmental Product Declaration—Fabricated Steel Reinforcement (Sept. 20, 2022), https://www.crsi.org/wp-content/uploads/CRSI_Industry-Wide_EPD_Sep2022.pdf.

Energy and Environmental Design (LEED), which I will talk about in a bit, that was incorporated in our Executive Order No. 22 with New York City.[26]

We're also talking about design and construction. It's pretty complex. We're looking at our existing environment of the building envelope, architecture, and engineering. There are known gaps in our existing frameworks, and these are the realities that we're going to have to deal with. But at least given what we know, there are different solutions that would fit different design and construction projects for major renovations.

There is a code I got from the nonprofit Architecture 2030 that basically shows how much embodied carbon accounts for emissions in construction. Operating business as usual means that embodied carbon is going to grow up to 74% in the next decade.[27] Addressing that will require a concerted effort across different municipalities. That's the very reason why both New York City and New York State, as of the last quarter of 2022, have implemented Executive Order No. 22 and Executive Order No. 23.

This is going to require collaboration across the legal field, architects, and design engineers to really understand what these Executive Orders are asking us to do. The requirements are nothing new. Some of these frameworks have been around since 2015, so there have been a lot of foundations that we can build upon.

New York City is committed to carbon neutrality by 2050. Within the framework of that commitment, it's counted that 23% of our global greenhouse gas emissions come from embodied carbon, which has already been shared. Again, we're talking about embodied carbon from cement and manufacturing, of which 8% contributes to global greenhouse gas emissions, and approximately 7% comes from embodied carbon from iron and steel. That runs across the manufacturing, transportation, installation, maintenance, and disposal of these building materials.

What I find very interesting across the industry is that we're now starting to address the building envelope, which is the biggest opportunity that we as a city and as a nation can focus on to be able to have a bigger impact and get us to our 2030 goals and our 2050 goals toward a low-carbon economy.

In New York City, building materials and construction equipment are what we're focusing on. The city is leading by example to encourage market development and the uptake of low-embodied-carbon products and materials in our clean construction strategies. This applies across all disciplines—architecture, engineering, and legal—for design and construction projects to really start having this type of conversation at the planning stage, to be able to determine what pathway needs to be taken to identify the compliance path to these mandates.

In New York City, there are specific city agencies that handle capital construction. These are the dedicated agencies that my team and our clients are looking at: the Departments of Design and Construction, Citywide Administrative Services, Environmental Protection, and Parks and Recreation. At the state level, New York has identified more than 75 agencies and authorities that need to comply with Executive Order No. 22.

When does the Executive Order apply? When there's a substantial reconstruction required on some of these city- and state-funded projects. Their laws define what a substantial renovation is and what a new construction is. What I find very exciting is that a lot of these Buy Clean new construction laws and Executive Orders are piggybacking on our existing energy codes and old building codes, so that compliance can be slightly easier for industry professionals when they're starting to look at these projects. Using definitions and requirements that already exist will help mitigate some of the confusion that design and engineering teams may face down the line trying to identify EPD products for their projects.

At a high level, the frameworks have been established. Is it perfect? Absolutely not. But the objective here is that, for example with Executive Order No. 23, it is leveraging LEED as a framework. This is a voluntary rating system. LEED has been requiring EPDs in certified projects since 2015.

Envision is another existing international framework for transportation and infrastructure projects. The city integrated the Envision framework as a means of compliance with the city's Executive Order No. 23. And the New York City School Construction Authority, which is a capital agency in the city, has its own LCA framework that it's been using since 2018: New York City Green Schools.

There is an opportunity here for design engineering teams, for developers that are bidding on city and state projects, to really understand what these frameworks are asking of them in order to be able to integrate that into their design process.

The main goal of Executive Order No. 22 is decarbonization and sustainability at the state level. Under the Order, starting January 1, 2023, every project has to require EPDs in new construction projects. It also defines what constitutes a "significant renovation" or when the EPD requirements will kick in.

The law specifies how design teams both internally at these state agencies or with a private developer and design engineering firm partnerships need to do their own calculations in terms of LCA, and give it to bidders so that they know what parameters they would need to use to submit EPDs when it's available for their projects.

I want to elaborate on the scope of EPDs because there are specific categories that may be applicable to some construction projects, major renovations, and some that may not be applicable. Based on the city or state agencies that the private sector's working with, they're going to have their own internal specifications if a project would require a cradle-to-gate EPD or a cradle-to-site EPD. Again, if it's a design-bid-build project, certain EPDs may work for them. If it's a design-build project, certain EPDs may not work for them.

26. Exec. Order No. 22 (Aug. 15, 2022).
27. *The Embodied Carbon Imperative: GSA's Next Big Sustainability Opportunity*, GSA Blog (Apr. 5, 2021), https://www.gsa.gov/blog/2021/04/05/the-embodied-carbon-imperative-gsas-next-big-sustainability-opportunity.

The complexity is there. And the direction to take will not be straightforward or obvious to most. But the collaborative nature of looking at the legal aspect of it, looking at the design and engineering aspect of it, will help set the stage and make it easier for project teams to comply with these mandates.

I want to highlight here that if projects' EPDs are being required for bidding, there are product-specific EPDs, which was touched upon. Design teams would have to be a bit more specific as to what they put in their request for proposal. And that would help set the stage in terms of what materials they would be able to source to meet the requirements in the LCA calculation limit that the project needs to meet.

The path forward is going to require us doing a lot more due diligence to be able to meet some of these mandates. New York City is leaning on the LEED system. A lot of design engineering firms that have worked on LEED projects or have worked on New York City design and construction projects may have already been subjected to some of these requirements. But going forward, it's going to be a lot more granular to help the city meet its 40% carbon emission reductions by 2030, which is less than seven years from now.

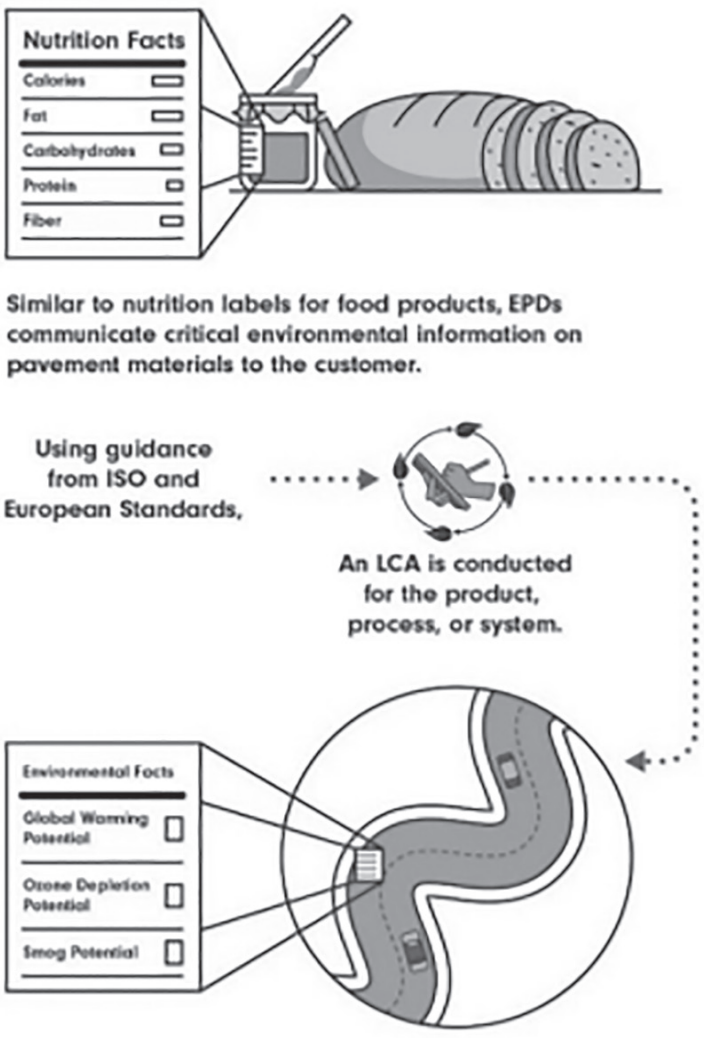
Cradle-to-grave assessment has been mentioned in this discussion a few times. A lot of projects are currently following that. The New York City School Construction Authority has a project in which they used the cradle-to-grave EPD scope. They're using an LCA assessment—through Athena, which I haven't used before—to address the EPD requirements and to focus on the building materials that are used around evaluating materials for a building envelope and its assembly.

Again, there are many different tools that are available in the industry. Some are much more complex than others. But depending on the city or state agency and the specifications they're asking for, that's going to determine what type of EPD project teams you would be considering to be able to meet that embodied carbon emission cap or limit that the project needs to meet.

There is a great deal of complexity for all of the different stakeholders when it comes to looking at the materials that go into the construction process. There are trade organizations, policymakers, design engineers. But we can do it. The pathway is already there. We'll be able to rely on what is there and solidify the specificities for and validation of these EPDs to make sure that we're accounting for them in a way that counts toward the goals that we're trying to meet.

Figure 1 illustrates a label concept for an EPD. We want to get to a place where it's really easy to identify some of these materials in a way like you would look at a food label. We're not there yet. But in terms of all of the different organization that it takes to get to a label like this, it's going to take a while. Eventually, you'll have an interior design project team look at a product and be able to select it without going through the complexities that we're currently faced with in the market today.

Figure 1. EPD Concepts



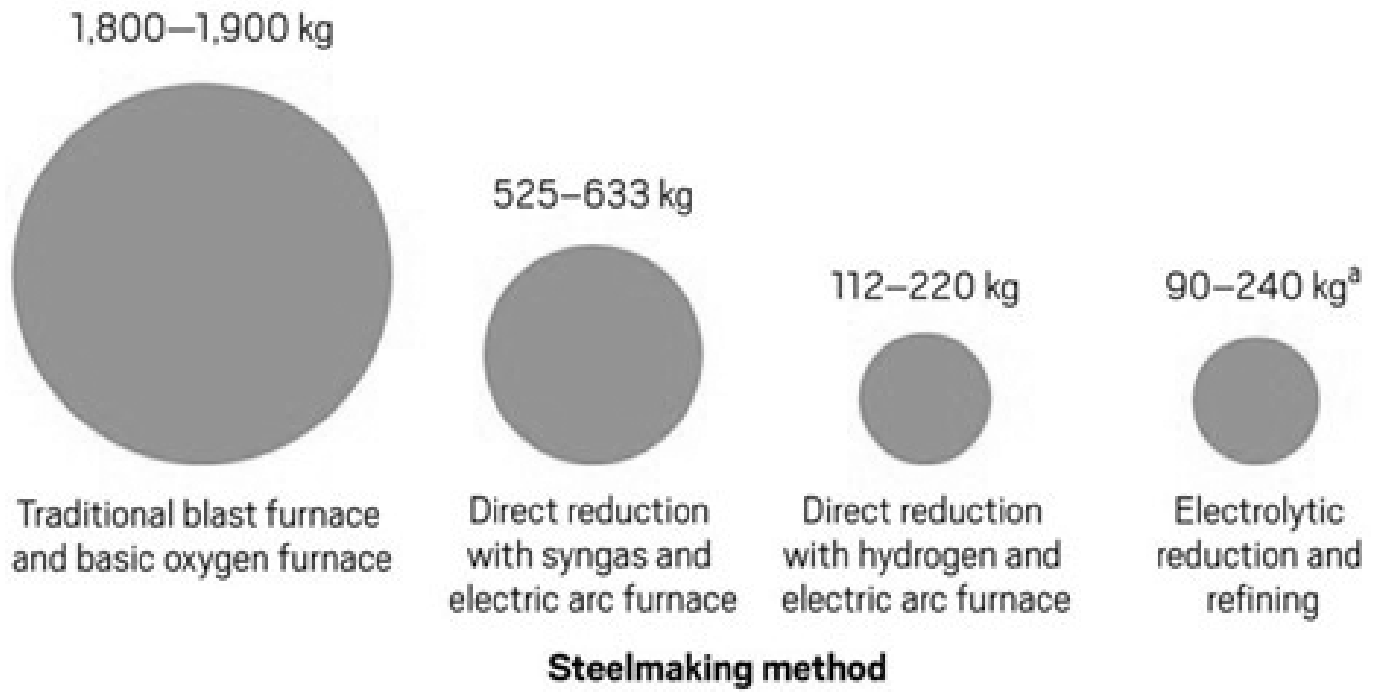
Source: FHwA Tech Brief: Environmental Product Declarations (2020) (FHWA-HIF-19-087), https://www.fhwa.dot.gov/pavement/sustainability/hif19087.pdf.

Bill Caplan: Ken Berlin has weighed in on environmental issues from his tenure at Skadden Arps, to his eight-year term as president and CEO of the Climate Reality Project, to his new role at the Atlantic Council. He's worked on everything from carbon capture and sequestration to "no coal" to green financing. Ken will talk about avenues that are becoming available to fund decarbonization.

Ken Berlin: I'd like to start by saying a word or two about my organization, the Atlantic Council. The Atlantic Council works on a series of global challenges covering many different areas. It covers the energy area through the Global Energy Center. At the center, we work with NGOs, business groups, and governments on energy and climate change issues. We have a staff of 18 members and about 58 fellows. I am a senior fellow and director of the "Financing and Achieving Cost Competitive Climate Solutions" project.

What we've really been talking about today is reducing embodied carbon emissions through Buy Clean programs.

Figure 2. CO_2 Emissions Per Metric Ton of Steel Produced



Source: Mark Peplow, *Can Industry Decarbonize Steelmaking?*, Chem. & Eng'g News (June 13, 2021), https://cen.acs.org/environment/green-chemistry/steel-hydrogen-low-co2-startups/99/i22.

It could be business-to-business activities or other kinds of programs, all of which are informed by EPDs and PCRs. So, they're informed by disclosure.

I think it's important to take a step back before I discuss funding issues and review the level of emissions from embedded sources. EPDs don't necessarily show significant reductions in emissions: they can show very minor reductions. To the extent that EPDs show only minor reductions in industries that are major emitters, the EPDs show that too little is being done in those industries. I've picked two industries as examples—emissions from steel and emissions from cement and concrete.

Steel generates about 8% of industrial CO_2 emissions in the United States,[28] and between 7% and 9% of total emissions worldwide.[29] Looking at Figure 2 above, the big disk on the left is emissions from a traditional blast furnace and basic oxygen furnace. The two disks to the right, which are much smaller, are emissions from electric arc furnaces using either syngas, the bigger one, or hydrogen, the smaller one.

We've made progress in the United States because we are producing a significant amount of steel from electric arc furnaces. About 69.2% of crude steel in the United States was produced from these furnaces and 30.8% from blast furnaces in 2021.[30] As you'll see in a minute, the profile around the world is very different than that. But steel is still producing 24% of all industrial U.S. emissions. Through technological innovation, fuel-switching, energy efficiency, and other measures, we're likely to see in the coming decades a continuous decrease in the amount of CO_2 emissions from steel.

Worldwide, about 70.8% of crude steel is produced in high-carbon-emitting blast furnaces.[31] The vast majority of that right now is from China,[32] although we expect it to even out over time, with India to start producing a lot more. But there will have to be more conversion away from blast furnaces or other measures to reduce the carbon impact from those furnaces. McKinsey & Company in a 2022 report estimated that it will cost about $4.4 trillion to decarbonize the entire industry.[33]

If we look at cement and concrete, we can see pretty significant progress here also, although it still has a long way to go. A request for information study found that 80% of concrete manufacturers reported already producing or supplying low-embodied-carbon materials.[34] Very significantly, 55% said that they could do so at a cost-competitive

28. Sachin Nimbalkar, Presentation: Potential Decarbonization Strategies and Challenges for the U.S. Iron & Steel Industry (2022), *available at* https://www.energy.gov/sites/default/files/2022-02/Nimbalkar%20-%20ORNL%20-%20Decarbonizing%20US%20Steel%20Industry.pdf.
29. World Steel Association, Climate Change and the Production of Iron and Steel (2021), https://worldsteel.org/publications/policy-papers/climate-change-policy-paper/.
30. World Steel Association, World Steel in Figures (2022), https://worldsteel.org/wp-content/uploads/World-Steel-in-Figures-2022.pdf.
31. *Id.*
32. *Id.*
33. Steven Vercammen, *Steel*, McKinsey & Co. (Aug. 1, 2022), https://www.mckinsey.com/capabilities/sustainability/our-insights/spotting-green-business-opportunities-in-a-surging-net-zero-world/transition-to-net-zero/steel.
34. Press Release, GSA, *supra* note 14.

nature with conventional concrete.[35] Now again, there's a way yet to go. But what we've got so far is working out pretty well. And 60% have developed a product-specific EPD.[36] GSA has used this information from EPDs and elsewhere to develop new standards for purchasing for concrete and asphalt manufacturers.

But again, concrete has a long way to go. There will be many steps, and they will be implemented over the years ahead. This means we're in a very dynamic environment when it comes to EPDs and PCRs because the underlying products will be changing and hopefully becoming less carbonized fairly rapidly.

I thought I might spend a minute talking about my views on the use and value of EPDs. First, they provide useful information for government and other regulators to set minimum or required environmental specifications for products as well as for bidding and other aspects. They enable purchasers to make informed selection decisions and buy less carbon-intensive products, a critical role in their work. And they allow parties to assess emissions not only from embodied materials, but, as we've heard, emissions from the entire product. So, EPDs can and will play a very valuable role going forward.

We've heard about the cost of EPDs. We looked at, specifically, EPDs back in 2017. Now, this is probably obviously not for LCAs. And at that time, the cost ranged from $13,000 to $41,000. They took about 22 to 44 person-days. We think those numbers will go up over time. And as we've heard, the cost includes things like registration, data collection, LCAs or EPD report generation, verification, and so on.

Turning to funding, there's specific funding for EPD-related activities in the IRA—$100 million to create a selection program and $250 million for grant and technical assistance.[37] Those are pretty significant amounts of money for the issues that they're covering. The $250 million to help manufacturers develop and verify can be a very valuable addition to the industry and to how these products develop.

There's also direct funding in the Act for Buy Clean programs. That's critical because it helps provide the demand for EPDs. It helps push companies to develop more carbon-efficient products. The bill includes $2.15 billion for the Federal Buildings Fund to buy cleaner materials; $2 billion to FHwA; and, as was mentioned previously, $7.1 million for state-level work through departments of transportation. The Federal Emergency Management Agency also provides incentives for various low-carbon and net-zero energy products. So, what we're seeing now is to some degree a market developing before all the regulations and standards are in place. That's actually a pretty healthy development.

There's additional funding. The Bipartisan Infrastructure Law includes a carbon reduction program of $6.4 billion for projects to reduce transportation emissions.[38] Very significantly, it includes $9.5 billion for hydrogen initiatives because clean hydrogen can play a significant role in reducing industrial emissions by replacing fossil fuel-based sources of energy in the production processes.[39] The America COMPETES Act includes $1.8 billion to the U.S. Department of Energy for energy-related supply chain activities, and $1.2 billion to expand manufacturing capacity in the United States on these kinds of products.[40]

With that, let me summarize what I've said. I think significant funding is available, but decarbonizing emissions is an expensive process. It's going to cost $4.4 trillion, McKinsey says, to address steel emissions alone around the world. But this funding—developing EPDs and PCRs and getting Buy Clean programs off the ground—will be very helpful in pushing the decarbonization process.

Progress is being made to reduce industrial emissions and therefore embodied carbon. Government should continue to standardize PCRs and streamline EPD certification so we're always talking about apples-to-apples in what we're looking at.

We will be seeing a very dynamic environment where we should be seeing continued reductions in emissions from embodied products like steel and cement. That means there will be a positive incentive—not a government requirement, but a positive incentive—for companies to constantly update their EPDs to reflect the fact that they're using products that are less carbon-intensive. I think that's all very healthy. We have disclosure that's effective and becoming more effective because there are incentives in the disclosure process. People will continuously update their disclosure as products become more carbon-efficient.

Bill Caplan: My presentation is on the status of carbon emissions and the status of our progress toward slowing global warming. But before I start, I would like to recommend the source of more Buy Clean information. You have the Atlantic Council. The Carbon Leadership Forum has excellent resources, including toolkits for embodied carbon policy for building owners and for architects.[41] And no, I am not affiliated with the Carbon Leadership Forum.

The state of global warming is where we began. Real-time emissions provide a context in which Buy Clean initiatives must be evaluated and effected. Like it or not, by the end of this decade, the level of atmospheric CO_2 will likely determine our fate. Time flies. Only seven years remain in this decade.

This is not my own offhand assessment. It comes from the opening remarks made by United Nations Secretary General António Guterres at the 27th Conference of the Parties to the United Nations Framework Convention on Climate Change. He was particularly blunt:

35. *Id.*
36. *Id.*
37. Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818.
38. Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429 (2021).
39. *Id.*
40. CHIPS and Science Act, Pub. L. No. 117-167, 136 Stat. 1366 (2022).
41. *See* Carbon Leadership Forum, *Resource Library*, https://carbonleadershipforum.org/resource-library/ (last visited Apr. 14, 2023).

> [O]ur planet is fast approaching tipping points that will make climate chaos irreversible. . . . [T]hat 1.5 degree goal is on life support—and the machines are rattling. We are getting dangerously close to the point of no return. . . . The global climate fight will be won or lost in this crucial decade—on our watch.[42]

The answer can be found in the carbon budgets.

A table included in the Intergovernmental Panel on Climate Change's *Climate Change 2021: The Physical Science Basis* report illustrates the remaining carbon budgets to achieve the Paris objectives with a likelihood for success.[43] The carbon budget estimates the cumulative CO_2 emissions that are allowable from the beginning of 2020 until net zero is achieved. Holding cumulative emissions to 300 gigatons afforded an 83% likelihood of limiting warming to 1.5 degrees Celsius (C).[44]

Now, only one year later, there is no such carbon budget table in *Climate Change 2022: Impacts, Adaptation, and Vulnerability*.[45] Instead, the foreword greets us with the following statement: "Unless there are immediate and deep reductions across all sectors, limiting warming to 1.5 degrees Celsius will be beyond reach."[46] In the summary for policymakers, a footnote elaborates: "This implies that mitigation after 2030 can no longer establish a pathway with less than a 67 percent probability that it will exceed 1.5 degrees C."[47] In other words, without deep reductions now in the 2020s, it is likely that we will exceed 1.5 degrees even with CO_2 emissions mitigation. At our current rate, we will burn through a 1.5-degree budget in 2027, only four years from now.

Let's have a reality check on the trend of annual CO_2 emissions worldwide, and more importantly on the level of CO_2 in the atmosphere, the factor that induces global warming. New CO_2 emissions were reduced in 2020 due to the COVID shutdown by more than two billion tons. But the level of atmospheric CO_2 continued to climb. Why? Because CO_2 emissions remained in the atmosphere. They are not reduced as emissions decrease. They will remain in the atmosphere for centuries.

To flatten the growth of atmospheric carbon, we must reduce emissions now, annually. But annual emissions have already returned to their pre-COVID levels. Waiting until the 2030s to start flattening the curve is wishful thinking.

The National Oceanic and Atmospheric Administration (NOAA) has created a series of slides that correlate trends in global phenomena with a steady increase in atmospheric CO_2.[48] The continuous climb is clear, including a steady increase over the past 30 years of the ocean's heat compared to its average; a continuous measure of glacier mass loss over the past 50 years; and an upward trend for the global sea level. Unlike chaotic weather conditions that vary locally and come and go, these global trends continue in the same direction.

Fortunately, 2022 has seen significant movement in climate action initiatives and significant movement to provide climate action funding. The IRA will have a major impact over the long term, providing support for electrification, clean energy, and Buy Clean initiatives. But time is of the essence. The timeline to reduce near-term emissions effectively is of the utmost importance, which depends on the tools and the databases analyzed in order to make an impact.

The second part of this webinar, the panel discussion, is about compliance versus impact. Compliance with a regulation by itself will not stimulate an effective climate impact if the regulatory basis is unsound. I've asked our panelists to address potential hurdles inherent not only to compliance, but also to the performance of Buy Clean initiatives within this decade.

Chris, the first question goes to you. You stated in "A Building Block for Climate Action" that there are numerous ways that EPDs and the data they rely on fall short, which presents hurdles to making product-level reporting more useful and widespread. Please elaborate.

Chris Kardish: There are a few things that come to mind. First, EPDs often lack primary data for important upstream sources of emissions because the PCRs don't require this often. So, for a lot of products, but especially concrete, this is really significant because it means you're using generic data for major sources of emissions, and then making the EPD less useful in distinguishing between manufacturers.

Second, there can be issues with comparability even between products that follow the same PCRs, because they may use different sources of generic or secondary data, or even different LCA software tools. There's a need to use generic data to some extent because there are so many dif-

42. *Secretary-General's Remarks to High-Level Opening of COP27—As Delivered*, United Nations (Nov. 7, 2022), https://www.un.org/sg/en/content/sg/statement/2022-11-07/secretary-generals-remarks-high-level-opening-of-cop27-delivered-scroll-down-for-all-english-version.
43. Richard P. Allan et al., *Summary for Policymakers* tbl. SPM.2, *in* Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Valerie Masson-Delmotte et al. eds., Cambridge Univ. Press).
44. *Id.*
45. Intergovernmental Panel on Climate Change, Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (H.-O. Pörtner et al. eds., Cambridge Univ. Press).
46. Intergovernmental Panel on Climate Change, Climate Change 2022: Mitigation of Climate Change v. Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Priyadarshi R. Shukla et al. eds.).
47. Jim Skea et al., *Summary for Policymakers* n.24, *in* Climate Change 2022, *supra* note 45.
48. Climate.gov, National Oceanic and Atmospheric Administration (NOAA), *Atmosphere Carbon Dioxide Amounts and Annual Emissions (1750-2021)*, https://www.climate.gov/media/14596 (published June 13, 2022); Climate.gov, NOAA, *Atmospheric Carbon Dioxide*, https://www.climate.gov/media/14603 (published June 17, 2022); Climate.gov, NOAA, *Ocean Heat Compared to Average*, https://www.climate.gov/media/14872 (published Oct. 25, 2022); Climate.gov, NOAA, *Glacier Mass Balance (Yearly)*, https://www.climate.gov/media/13057 (published July 21, 2021); Climate.gov, NOAA, *Global Sea Level*, https://www.climate.gov/media/14659 (published July 19, 2022).

ferent inputs and processes you're measuring. But there can be inconsistency there.

Third, the sheer availability of EPDs tends to vary a lot by the sector and the state. States that have been active on embodied carbon policy, of course, tend to have better availability, but for some sectors, even in these states, it's limited—products like masonry, aluminum, and wood products to some extent. The availability of even more granular EPDs, like facility-specific and supply chain-specific EPDs, is of course more limited currently. These are things that are not spoken of really in PCRs, and are relatively new ideas introduced by Buy Clean laws.

Bill Caplan: Can you explain why EPDs for the same product type may be based on different rules, databases, and software tools, and as a result, cannot be compared?

Chris Kardish: Communication of LCA results can be complex. Users need to use caution when trying to compare EPDs. This is something that's reinforced in the ISO standards and some of the PCRs, and is even stated on many of the EPDs to use caution when trying to compare EPDs.

With that said, though, one of the intentions of ISO 14025 is for EPDs to guide decisionmaking and help improve purchasing decisions. We've outlined three areas where there could be a potential for differences when trying to compare EPDs: PCRs, software, and databases.

Starting with the PCR, the ISO standards encourage developers of these PCRs to harmonize, which means that there are multiple program operators in North America, as well as a number of them in Europe. When developing a rule for a new category of products, we need to look at what already exists in the marketplace. If there's already a sufficient standard, we should not be duplicating that, or, if there's good justification, a new PCR might be developed.

I'd say that within the EPD program operator world we've done a pretty good job of not duplicating PCRs within regions. Although there are situations where there's a different set of rules, for example for steel products in North America as compared to Europe, and that could be said for a number of different categories. That can be concerning because they are going to lay out different rules on how to conduct the LCA and the indicators to be included.

However, I think the good news for today's discussion, and I'm speaking more from the perspective of the Buy Clean California Act, is that there can only be one PCR per class of eligible material that can be used to be an eligible EPD. This avoids the issue of having multiple PCRs that might be used for those EPDs. That was an important decision the state had to make in that case.

In the case of databases, there's been a growing number of LCA databases, and software as well, and there can be some differences in how these databases are put together or even with the software with how some of the calculations are done.

But again, the good news is that when it comes to the indicator that we're discussing—the GWP indicator—this is the most consistent indicator, I would say, across databases and software, and it's the most comparable one. If we were looking at other indicators, I would raise additional concerns about the software and databases. However, focusing on the climate change indicator is more consistent and more reliable for comparison across EPDs.

Bill Caplan: The purpose of Buy Clean is to reduce embodied carbon. The embodied carbon benchmarks and regulations will rely on the EPDs. Therefore, the veracity of the EPDs in the database is paramount to success. This opens the door to an important line of inquiry.

The Buy Clean California Act requires that limits be set at the industry average of facility-specific values, which are to be computed from the EPDs. The California Department of General Services has stated that environmental impacts from a facility-specific EPD must be attributed to a single manufacturer's specific production facility.[49] Let's take the embodied carbon emissions from an insulated metal panel product manufactured at two different facilities (California and Florida) of a single manufacturer.

California's plant panels are responsible for 35% more emissions than the panels produced in Florida, perhaps due to the materials suppliers, manufacturing efficiency, energy sources, or other factors. If a manufacturing plant submits an EPD derived from average industrywide data, its own emissions are not disclosed. Most concrete product EPDs use industry-average data with caveats included to cover the cement component of their emissions.

Please note a single product is responsible for 8% of all energy-related emissions: cement. Buy Clean California does not cover cement yet, but it will, as will others. However, GSA does. GSA issued new low-embodied-carbon concrete standards for all GSA projects. They require prime contractors to submit EPDs that meet the maximum emissions specified in the standards.

A simple enough statement, but let's track the regulation's source. GSA's limits reflect a 20% reduction proposed by the New Buildings Institute.[50] The New Buildings Institute collected more than 36,000 ready-mixed concrete EPDs from the Building Transparency EC3 database to evaluate concrete emissions. The data were compared to industry-average data, which was supplied by the National Ready Mixed Concrete Association (NRMCA). According to the NRMCA Member Industry-Average EPD of 2022, they sampled only about 6% of the 8,000 concrete plants in the United States from those that volunteered.

A caveat on a typical ready-mixed concrete EPD might read "cement LCA impacts can vary by as much as 50%." Cement accounts for as much as 90% of a concrete mixture. That's 90% of the impacts in this EPD. Thus, cement impacts could result in a variation of as much as 45%. Does that mean 40% higher or 40% lower?

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49. California Department of General Services, Buy Clean California Act Legislative Report 12 (2022).
50. GSA, Low Embodied Carbon Concrete Standards for all GSA Projects (2022), https://www.gsa.gov/cdnstatic/Low%20embodied%20carbon%20concrete%20SOW%20language-Sept%202022.pdf.

If the cement was delivered with an EPD that disclosed its own emissions, then what's the problem? Why would there be a 45% uncertainty in the concrete mixture it was mixed with? A regulator might consider this to be transparent and compliant; after all, it is currently acceptable. But an engineer might consider it valueless.

As of January, nearly 80% of all EPDs in the EC3 database were for ready-mix concrete products, more than 83,000. But just three companies constituted half of them. Most of them had disclaimers like this or other warnings in the fine print, but not all of them. Some of them looked pretty good. Does this disproportionately impact averaging?

Does creating EPDs with a sampling of industrywide data—to produce more EPDs based on the same—become self-perpetuating? Is this data mining or data creation? Building Transparency's database tool does an excellent job of mining the data and making it accessible. It provides the bandwidth for emissions levels and calculates the mean, the average, and various percentiles.

But the veracity of Buy Clean regulations depends on the quality of the EPDs that the regulations are based on, which leads to my next question. First, should benchmarks and emissions limits be based on EPDs like these? Second, what are your thoughts on the role of industry trade groups in developing the rules and formats for product data disclosures where there may be an element of self-interest?

Ken Berlin: The bottom line of all of this is that companies and EPDs should reflect the most accurate information they have available. If they don't reflect that accurate information, then they start raising legal problems for themselves, both in the people they're selling their products to and potentially with the government.

Trade associations, if they're doing this work, have a pretty high standard they have to meet as a trade association in looking at that. If people then examine what they've done and it turns out that what they've done is inaccurate or misstated or exaggerated or something like that, then they create a whole series of issues for themselves and for the companies that potentially rely on what they're saying.

In my view, this comes down to there being a responsibility for everybody to come up with accurate information and accurate analysis. If they fail to do that, they potentially face consequences, including legal consequences. And the people who rely on the information they receive, if they've done proper due diligence, they've relied on it, they may be okay in one sense. But they could lose a contract because of it. They could have all kinds of problems too, and could wind up having actions against the people who gave them the underlying data that wasn't effective.

Keith Killpack: I agree with both Ken and Bill that EPDs should have the most accurate information available and be tailored to the supply chain. I'll give some examples of where this can present challenges. I'm less familiar with concrete EPDs, so I'll provide examples of steel rebar or cold-formed steel studs. These are smaller shops that manufacture these final products for their customers. Typically, their supply chains are not coming from just one single steel mill due to redundancy. Or maybe they want to have the advantage of having different options for cost reasons. They may have a more complex supply chain.

Maybe they have half a dozen steel mills supplying their steel coils so that they can produce steel studs or provide a reinforcing bar to create a fabricated rebar. It becomes a challenge. How do you create an EPD for a company with a very complex supply chain? There's going to be some variability. Some of their steel might be coming from an electric arc furnace, and some may be coming from a basic oxygen furnace, which can have very different impacts to climate change for the same steel product.

From that manufacturer's perspective, it's as accurate as possible, but they're not able to tell you for one piece of product what steel mill it originated in because there's a lack of chain of custody within that industry. That may be something that is going to be important going forward, to have better traceability from where these materials are coming from. I'm not trying to excuse these companies that are using more generic data, but sometimes there are challenges.

With respect to the question about the role of trade associations in developing these EPDs, we do see value in that. These trade associations can represent a large group of manufacturers and help smaller manufacturers in particular be able to have an EPD for their products, where they might not have the resources to develop one on their own for some of these larger industries. But I absolutely agree with Ken on the importance of the veracity of these efforts because they can create major issues as these EPDs are scrutinized.

Fatou Jabbie: Looking at it from a city and state compliance perspective, a city-verified database or a state-verified database of EPDs at some point would have to come into effect. We're not there yet. But also a lot of city and state agencies in New York have their own specifications when it comes to materials that go into design and construction projects that I think will need to set precedents for design engineering firms that are working on public projects. With that combined, naturally, you have the different EPD types that are meant for designing, you know, product-specific EPDs, cradle-to-gate-type EPDs. Those would have to go into proposal requirements to help contain different options that already exist in the market and industry today.

Bill Caplan: What can we do to make this system better to improve the efficacy of the Buy Clean policies? Clearly, to have Buy Clean policies that have been dependent on a small sampling of EPDs, which may not reflect anything other than some industry average, you'll end up with working on an average. Then, we have the issue of differing standards. What can we do to make this work better and sooner because we're running out of time?

Chris Kardish: A big part of that will come from the federal government acting as both a large buyer and a standard setter, and then having a lot of that filtering down

to states and localities that are just beginning to discover these laws because only California has standards in place at this point.

There's a real opportunity for the federal government to come in and make a big impact, particularly because of the scale we're talking about. The Buy Clean Task Force will need to move rather quickly to encompass all federal purchases, and ideally something with longevity that can also continue into a future administration.

The EPA program as part of the IRA is also critical to this harmonization side.[51] But if the federal government decides to get more ambitious, it can. If it decides to engage with PCR processes or start its own, it can. I think there's a big role here, but again, that longevity aspect is also important.

There was a bill called the CLEAN Future Act that did not pass,[52] but it would have done through legislation a lot of things that the Buy Clean Task Force is doing. There is a longer shelf life when you do something through legislation. I think those aspects are key.

Bill Caplan: Should the federal government provide the guidelines for rules and regulations for a single standard?

Keith Killpack: Interesting question, Bill. I hadn't thought about that until now. From my prior work with EPA and on the EcoLogo and Environmentally Preferable Purchasing Program development, what we've seen is EPA playing a role, developing guidance and requirements for certification programs. I could see a similar type of role here. I'd want to think a bit further about having the government develop PCRs before I necessarily endorse that proposal though.

Ken Berlin: The advantage of that, if it happens, is that you would get a more uniform set of rules around the country.

Bill Caplan: What about the timeline? We only have one or two Buy Clean policies or regulations that have already passed. It's going to take a year or more to get more in. And that, as pointed out, is primarily for public buildings; most of them start with only needing to submit EPDs. By the time you roll through this, it will be the end of 2023 or 2024 before we actually have the EPD database for at least a couple of products to really work with other than industry standards.

Then, the regulations need to be created and a notice period of maybe a year for industry to get started. In fact, it really doesn't have an impact until a couple years down the line when people apply for permits to put up their buildings. So, you're looking at best maybe 2027 or 2028 for the start of any real benefits from this. It's very easy to be passive and say, well, this is what it is, but we are creating regulation. Is there any way that we can move this forward?

Fatou Jabbie: We're certainly racing against time, but there are known constraints that we have to deal with. It will take a combination of regulation, private-public partnerships with trade organizations that represent business interests, being able to come up with PCRs that can be scaled, and outlining an incremental process to get to our 2030 goals. The ultimate objective is to get there, and the challenge is how soon. There are also real challenges that we have to figure out to make it more inclusive, but also open and transparent.

Bill Caplan: Let me wrap this up by saying there's a lot to unpack here, but it's clear that we need short-term gains. If you look around outside, concrete is everywhere. Reducing cement use by 15% will cut one billion tons of CO_2 every two to three years. But I'm not going to recommend, just use less cement.

Let's move on to some viewers' questions. Here's one: I hear that EPDs and therefore PCRs do not cover land use change very well. For example, an iron ore mine can dam up a large rainforest valley to gain power, but that is classified as hydro, and no emissions are recorded. There are many examples. How can a PCR account for land use change, and so on? And how can wood products document forestry management?

Keith Killpack: ISO 21930 is the international standard for the development of PCRs and EPDs of construction products. It does require land use change to be accounted for if it's significant. It may be more intuitive for certain types of products; if you have a forest that's been converted from one type to another, for example, that would trigger the process. The example with a dam in the Amazon is an interesting one that would take some additional investigation to make sure that the land use change was properly calculated in the LCA.

ISO 21930 has applied guidance for wood products, under which wood that is coming from a forest that is certified by the Forest Stewardship Council, the Programme for the Endorsement of Forest Certification, or the Sustainable Forestry Initiative is considered to be a carbon-neutral wood source.

That's a simplifying assumption, which is in that standard based on the idea that the wood is being sourced from a well-managed forest. There's also an allowance in the standard that if, on a national basis, it can be demonstrated that the overall forest coverage is increasing over time, that that same assumption of carbon neutrality can be applied. But if the wood source is from outside of those situations, then that would not be a valid assumption under the standard.

There is some criticism, I'll say, and ongoing research within the LCA community on trying to advance the subject so that we're not using that simplified assumption and really looking at the forest landscape itself to understand how management of the forest is affecting carbon storage

51. U.S. EPA, *Inflation Reduction Act Programs to Fight Climate Change by Reducing Embodied Greenhouse Gas Emissions of Construction Materials and Products*, https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-programs-fight-climate-change-reducing-embodied (last updated Apr. 13, 2023).
52. H.R. 1512, 117th Cong. (2021).

across the landscape. There's emerging work, but I see that as still evolving and forthcoming before there's going to be guidance ready on how to do those calculations.

Bill Caplan: Another audience question: Is there any movement by GSA to look at these issues for renovations and tenant improvement projects? The requirements for new building construction are much stricter, and there don't seem to be any requirements guidance for renovations and tenant improvements currently.

Fatou Jabbie: It's all about context, right? When we talk about renovations, how substantial is that renovation? If you have a single tenant in a building that's doing a renovation that's 50% larger than the construction cost of that, then it will kick in. If you have multiple tenants and the renovation job that they're doing doesn't qualify as substantial, then it probably wouldn't apply. But these are different scenarios that have to be addressed depending on what stage the project is at.

Bill Caplan: Actually, I think that New York State under Executive Order No. 22 is covering renovations. And if I recollect, the guideline was that the cost of a renovation or a reuse project was 50% of the budget of new construction that was going to come under this requirement.

Fatou Jabbie: That is correct. And it's irrelevant if it's a tenant or owner. As long as that percentage applies, then the compliance goes into effect.

Bill Caplan: Another question: What are the hallmarks of low-carbon building materials? Is it the use of clean energy in the production of such materials or are there other elements to reducing embodied carbon in such materials?

Keith Killpack: I don't know that there's a simple answer to that. One of the things I really appreciate about LCA is that it gives us an opportunity to investigate and identify where those hot spots are.

But in the case of cement, while it's only using a small percentage—I think it was 8% of the energy use—it is responsible for more than 50% of the CO_2 emissions of the concrete. That's an area where clean energy would not necessarily have the effect that you would expect on the product. But other products like steel, produced by using the electric arc furnace, are going to be largely driven by the carbon intensity of the energy grid. I don't have a simple answer for that one, but it's an interesting question.

Bill Caplan: Another question: How are these declarations and LCAs considered in calculating or estimating Scope 3 emissions?

Keith Killpack: This comes up quite a bit. When we're looking at corporate greenhouse gas reporting, emissions are classified into Scopes 1, 2, and 3. We use a different framework when we're looking at the impacts of a product from an LCA perspective. And we don't use the Scope 1, 2, and 3 terminology. Instead, we think of it as looking at the inputs and outputs from each stage of the life cycle of the product. Scope 3 would include activities such as employee commuting and business travel. Those things are typically excluded from an LCA in an EPD of a product, because those are not directly tied to the manufacturer of the product.

Bill Caplan: Another viewer question: If EPDs cost at a minimum about $1,000 per product line, how can small suppliers compete in providing EPDs for public projects? If I recollect, wasn't there some kind of funding in the IRA available to fund EPDs?

Ken Berlin: There's very significant funding in the IRA to address that. Eventually, as you do this kind of work and as these areas develop, you see smaller companies generally being held to slightly different standards than bigger companies. They may be able to rely on data. They may not have to do all the work themselves. There's always an attempt to balance this out a little bit so that smaller companies can compete in these markets.

Keith Killpack: I think that's a great point. This may have expired at this point, but I recall when Buy Clean was initially launched, the Los Angeles chapter of the U.S. Green Building Council was providing funding for small and medium enterprises to develop EPDs. I expect there'll be other resources available, too, for these small companies.

Bill Caplan: Another question: How are the impacts looked at perhaps at the end-of-life for deconstruction of a building?

Keith Killpack: For an EPD, we'll look at this from the perspective of the product—what it takes to remove the product from the building. To be transparent, there's not a lot of great data on this. Sometimes, we'll have to assume it's a manual process done with tools. More research and more LCA data sets would be beneficial on the impacts from deconstruction of buildings at end of life.

Bill Caplan: I've noticed in some of the Buy Clean policies coming down the pipeline that they're looking for full life-cycle data from cradle to grave, not cradle to gate. What is that doing to this whole process? Because that really isn't available and a lot of it is supposition. How do you feel about throwing that into the mix now in new Buy Clean policies?

Fatou Jabbie: For cradle-to-grave assessment, the New York City Construction Authority that I gave as an example is already using that on their public projects. There are a lot of lessons to be learned from them. I think from the city's perspective, leading by example, we're using existing frameworks that have already been there. To expand on doing more public projects that are going to need to use cradle-to-grave EPD scope is something that's been done,

so it can be leveraged and expanded on some of these city-funded projects.

Bill Caplan: But it seems that there were so few cradle-to-grave EPDs out there. What if the city comes along and says, all right, you have to submit this now?

Fatou Jabbie: Again, I hate to take the shortcut, but the reality of it is that there are not varied materials available today that are cradle to grave. A city-verified or state-verified database, as I suggested, would be something from a compliance perspective that would provide more guidance down the line because of the nonexistence or limited quantity of some of these EPDs. And there are going to be a lot of lessons to learn.

Bill Caplan: Ken, how do you feel about this, about requiring the whole life-cycle EPDs for compliance now when they're not really available?

Ken Berlin: It depends a lot on the product and how much the various stages of the life cycle influence it. Ninety percent of the common emissions come from, let's say, the manufacturing and development of the product. Maybe you can stop with that because it's much simpler and you get your EPDs much faster.

I don't know whether there is even a capability in the industry to do hundreds of thousands of LCAs in a relatively short period of time. That's another issue that has to be looked at. I think we want to set up a system that gets to the essence of the issue, that captures the vast majority of these emissions, but tries to keep things relevant, as simply as you can in doing that.