Implementing Buy Clean

Guidance on Implementing Low Carbon Construction Material Policies and Limits on Public Projects

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CLF Carbon Leadership Forum

About the Carbon Leadership Forum

The Carbon Leadership Forum is a non-profit industry-academic collaborative at the University of Washington. We are architects, engineers, contractors, material suppliers, building owners, and policymakers who work collaboratively, pioneering research, creating resources, and incubating member-led initiatives for greatest collective impact. Our goal is to accelerate transformation of the building sector to radically reduce and ultimately eliminate the embodied carbon in building materials and construction.

Authors

The research team from the Carbon Leadership Forum at the University of Washington College of Built Environments:

- Meghan Lewis, Senior Researcher, Carbon Leadership Forum
- Jordan Palmeri, Technical Consultant
- Kate Simonen, Executive Director, Carbon Leadership Forum

Author contributions: M.L., J.P., and K.S. led conceptualization; J.P. and M.L. conducted research and analysis; M.L., J.P., and K.S. performed review and editing; J.P. and M.L. wrote the paper.

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EXECUTIVE SUMMARY

A growing number of government agencies are pursuing procurement policies to reduce the greenhouse gas emissions from the production of construction materials. Many of these policies are referred to as 'Buy Clean' policies, a nickname derived from the Buy Clean California Act passed in 2017.

'Buy Clean' is a type of procurement policy that establishes construction material purchasing requirements for government agencies. Buy-clean policies focus on reducing cradle-to-gate embodied carbon, or the greenhouse gas emissions arising from the raw material extraction, transportation, and manufacturing of construction materials. Embodied carbon is measured using life cycle assessment (LCA) with a metric called global warming potential (GWP).

Buy-clean policies vary in their scope (e.g., which material types are included), structure, and mechanisms for implementation. They typically include two primary components:

- **Disclosure:** Requirement to disclose the carbon footprint of covered products using an environmental product declaration (EPD). An EPD is a third-party-verified document that reports the environmental impacts of a product, including GWP, based on a product LCA.
- **Limits**: Requirements that a product's carbon footprint be below a maximum allowable GWP value (e.g. limit) established by a government agency or third party. Limits vary depending on the policy design and may be set at industry-average or a different threshold specified by the policy language. Policies may also use a two-tiered approach requiring an additional GWP value setting a high performance standard to incentivize innovation.

Policy design choices have a significant impact on implementation but are not the focus of this report. This report provides recommendations on how Agencies can increase success once a policy has been established, not on how legislators or other policymakers should design new buy-clean policies.

The guidance in this report was developed through research and interviews with agencies responsible for implementing procurement policies. Referenced policies include:

Federal policies and programs

- Clean Futures Act
- Executive Order 14057 (Federal Sustainability)
- FHWA Sustainable Pavements Program
- GSA Green Building Advisory Committee Advice Letter

State policies and programs

- Buy Clean California (BCCA)
- CalTrans EPD Program
- Buy Clean Colorado (BCCO)
- Buy Clean Buy Fair Washington (BCBF WA) Project
- New York State Low Embodied Concrete Act (LECCLA)
- Oregon Concrete EPD Program

Local policies and programs

- Marin County Low Carbon Concrete Building Code
- Port Authority of New York and New Jersey (PANYNJ)
- Portland Low Carbon Concrete Program, and
- Sound Transit.

Table 1 provides a summary of the recommendations included in this report.

Table 1. Summary of implementation recommendations, organized into loosely chronological steps. The research team expects that guidance will continue to evolve over time as more policies are implemented, given the nascent stage of this type of policy.

Disclosure-Only Phase	
Step 1: Establish Agency Buy-In	• Dedicate staff time to establish the program • Identify agency policy champions
Step 2: Develop Initial Limits	• Reference third-party benchmarks • Evaluate past public procurement practices to establish an agency baseline • Leverage regional and private sector data to inform public limits • Allow for a project average compliance pathway • Use a two-tiered limits approach
Step 3: Engage Stakeholders and the Public	• Provide a public notice and comment period • Establish an advisory committee • Address equity in committee design • Involve stakeholders early in GWP limit development
Step 4: Test Limits	• Compare against standard Agency specifications • Conduct pilot projects
Step 5: Incentivize EPD Development	• Incentivize local EPDs through financial, technical, or educational support and driving increased awareness of upcoming policy requirements
Step 6: Publish methodology	• Publish the methodology used to establish the adopted GWP limits
Mandatory Limits Phase	
Step 7: Track Compliance	• Establish a central resource for project team requirements • Create a centralized system for Tracking EPDs and Compliance • Utilize Policy Exceptions
Step 8: Incentivize High Performance	• Provide high performance incentives for contractors and/or provide purchasing preferences during the bid evaluation process • Use a two-tiered limits approach (see Step 2)
Step 9: Provide Education and Training	• Provide both internal and external education and training opportunities • Keep implementing agencies informed • Provide contractor training
Step 10: Re-evaluate Initial Limits	• Lower limits at a regular interval over time to continue to drive emissions reductions

INTRODUCTION

A growing number of government agencies are pursuing procurement policies to reduce the greenhouse gas emissions from the production of construction materials. Many of these policies are referred to as 'Buy Clean' policies, a nickname derived from the Buy Clean California Act passed in 2017.

This report summarizes guidance for government agencies who are responsible for implementing procurement policies. The guidance in this report was developed through research on existing procurement policies and programs targeting embodied carbon reductions and interviews with individuals at government agencies with experience implementing related policies. Given the nascent stage of this type of policy, the research team expects that guidance will continue to evolve over time as more policies are implemented.

Buy Clean Policy Framework

'Buy Clean' is a type of procurement policy that establishes construction material purchasing requirements for government agencies. Buy-clean policies focus on reducing cradle-to-gate embodied carbon, or the greenhouse gas emissions arising from the raw material extraction, transportation, and manufacturing of construction materials. Embodied carbon is measured using life cycle assessment (LCA) with a metric called global warming potential (GWP). GWP is quantified in kilograms of CO_2 equivalent (kg CO_2e). The GWP of a product can tell you the carbon footprint for a product's life cycle (or a specific subset of the product's life cycle).

Buy-clean policies can vary widely in their scope (e.g., which material types and projects are included), structure, and mechanisms for implementation. They typically include two primary components:

- **Disclosure:** Requirement to disclose the carbon footprint of covered products using an environmental product declaration (EPD). An EPD is a third-party-verified document that reports the environmental impacts of a product, including GWP, based on a product LCA.
- **Limits:** Requirements that a product's carbon footprint be below a maximum allowable GWP value (e.g. limit) established by a government agency or third party. Limits vary depending on the policy design: California and Colorado require limits to be set at industry-average, whereas the other policy proposals recommend higher thresholds such as the 80th percentile.[1] Policies using a two-tiered approach require two GWP standards: one GWP value setting a standard for broader implementation and a second GWP value setting a high performance to incentivize innovation.[2]

Procurement Policy Landscape

The cement and steel industries alone account for approximately 15% of global greenhouse gas (GHG) emissions, and approximately 46% of total cement and 18% of total steel consumption in the U.S. is for public construction.[3] Government procurement therefore has a large potential for reducing emissions from construction materials through leveraging money invested in public construction to set requirements for lower carbon products.

The Buy Clean California Act passed in 2017 was one of the first procurement policies to require agencies to set GWP limits for certain construction materials. Now a variety of local and state programs include GWP limits to reduce the embodied carbon associated with materials purchased for government projects. These policies can vary widely in scope, and many are not called Buy Clean.

Procurement policies at the federal, state, and local levels are considered a necessary policy to achieve the scale and pace of carbon reductions required to address climate change. The policy type will vary depending on the jurisdiction: some agencies may already be authorized to take the lead on establishing purchasing standards, whereas other jurisdictions may need legislative action to prompt action.

The policy precedents referenced in this document fall into the following categories:

- **Legislation:** Federal and state legislatures may pass new laws to establish a procurement policy. Depending on the legislation, additional rulemaking may be required to clarify the intent and implementation of the law/statute.

1 Olgyay, V., Nesler, C., Rohde, J., Arias, F., Peterson, K. (February 2021) *GSA Green Building Advisory Committee Advice Letter: Policy Recommendations for Procurement of Low Embodied Energy and Carbon Materials by Federal Agencies.* https://www.gsa.gov/governmentwide-initiatives/federal-highperformance-green-buildings/policy/green-building-advisory-committee/advice-letters-and-resolutions

2 U.S. House of Representatives 117th Congress (March 2021), *H.R. 1512 CLEAN Future Act.* https://www.congress.gov/bill/117th-congress/house-bill/1512.

3 Hasanbeigi, A., Shi D., & Khutal, H. (2021). *Federal Buy Clean for Cement and Steel: Policy Design and Impact on Industrial Emissions and competitiveness.* https://www.globaleffiencyintel.com/federal-buy-clean-for-cement-and-steel

Table 2. Summary of buy-clean policies and related programs referenced in this report.

Policy/Program	Type	Scope	Brief Summary
Federal			
Federal Sustainability E.O.	Executive Order	Scope to be determined	Order signed Dec. 8, 2021 that directs the federal government to achieve net-zero emissions from federal procurement no later than 2050 (among other requirements), including a Buy Clean policy to promote the use of construction materials with lower embodied emissions
GSA Green Building Advisory Committee Advice Letter	Agency recommendations	Scope to be determined	Policy recommendations from the GSA's GBAC to adopt (1) a material approach (EPD disclosure requirements and GWP limits) for all new construction and tenant improvements and (2) a whole building life cycle assessment approach requiring a 20% reductions from baseline building for all projects over the total prospectus value for new construction.
FHWA Sustainable Pavements Program	Agency program	Education, research, deployment	The Federal Highway Administration (FHWA) program provides training, financial, and technical assistance, and research on sustainable pavements. This program has also resulted in the development of specific resources and pilots, including the LCA Pave tool and the Demonstration to Advance New Pavement Technologies Pooled Fund.
State			
Buy Clean California (BCCA)	Legislation; Public Contract Code	Disclosure and limits	Requires CA Dept of General Service (DGS) to publish GWP limits for structural steel, rebar steel, mineral wool insulation, and flat glass by 1/1/2022, to be updated at 3 year intervals. Awarding agencies for CA state projects must enforce limits based on submitted EPDs beginning after 7/1/2022.
CalTrans EPD Program	Agency program	Disclosure and limits	Program requiring EPDs for state transportation projects in California. Program now includes enforcement of BCCA program, as described above.
Buy Clean Colorado (BCCO)	Legislation	Disclosure and limits	Requires the CO Office of the State Architect to publish GWP limits for covered products in state buildings by 1/1/2024, when projects will also be required to demonstrate compliance based on submitted EPDs for projects. Requires the CO DOT to require EPDs after 7/1/2022 and to develop a policy by 1/1/2025 to track and reduce carbon from projects. Covered products include asphalt mixtures, cement, concrete, glass, post-tension steel, rebar steel, structural steel, and structural wood.
Buy Clean Buy Fair Washington (BCBF WA) Project	Legislation	Disclosure pilot and reporting database	The BCBF WA project was commissioned by the Washington State Legislature in 2021 and requires the University of Washington College of Built Environments to (1) develop a reporting database to collect environmental and labor information from State construction projects and (2) conduct a case study using pilot projects.
New York State Low Embodied Concrete Act (LECCLA)	Legislation	Scope to be determined by OGS.	Directs the Office of General Services to establish guidelines requiring the procurement of low embodied carbon concrete on select projects. Establishes a stakeholder advisory group to help recommend guidelines. Encourages the consideration of incentives for low carbon bids and sets emission standards for concrete used in public works.
Oregon Concrete EPD Program	Agency program	Incentives	Voluntary incentive program led by Oregon Dept of Environmental Quality in partnership with the Oregon Concrete and Aggregate Producers Association to provide financial, technical, and educational support for Oregon suppliers to create concrete EPDs. Resulted in over 1,500 new concrete EPDs.
Local			
Marin County Low Carbon Concrete (LCC) Code	Building code	Limits	Amends 2019 building code in Marin County, California to require that projects meet (a) cement limits , as verified by batch receipts or (b) GWP limits, as verified by EPDs, for concrete. These two pathways require compliance forms to be submitted by the design team (structural engineer and/or architect) and contractor prior to field inspection.
Port Authority of New York and New Jersey (PANYNJ)	Specifications and Agency program	Disclosure and pending limits	Clean Construction program requires submittals of EPDs for concrete, asphalt, steel, aluminum, and wood as part of Division 1 specifications at the project level. Goal is to achieve a 30% GHG Reduction by 2025 and a 50% GHG reduction by 2030. Program also includes detailed benchmarking of past projects and will soon include GWP limits. Existing concrete specifications set cement limits for ready-mix and mass-pour work.
Portland Low Carbon Concrete Program	Specifications and Agency program	Disclosure and limits	Requires EPDs as part of construction specifications for concrete purchases as of 1/1/2020. City of Portland will publish GWP limits for concrete used on City projects by 3/1/2022. Program also includes pilot projects.
Sound Transit	Specifications and Agency program	Disclosure and % reduction	Construction specification requirements on certain Sound Transit projects to submit concrete EPDs for at least 75% of poured in place concrete by volume. Plans to integrate % reduction requirements from NRMCA regional benchmarks for concrete mixes.

- **Agency Purchasing Standards:** The existing authority of most government purchasing agencies extends to developing buy-clean purchasing standards for construction materials. Alternatively, agencies may be directed to develop a buy-clean program through Executive Order.
- **Executive Orders:** Executive orders (E.O.) can direct executive agencies to complete specific tasks and can therefore be used to direct agencies to exercise their authority to establish purchasing standards related to embodied carbon. Many agencies already have the procurement authority to require EPDs and set GWP limits. However, this authority is rarely utilized without additional funding and/or staff support, which may require legislative action or appropriations. For example, the Federal Sustainability E.O. signed in December 2021 by President Biden directs the federal government to initiate a Buy Clean policy to promote the use of lower carbon construction materials.
- **Building Code:** Whereas state or federal procurement policies would only impact public sector construction, inclusion of GWP limits in building codes targets private sector construction that is required to meet building code standards. Few public infrastructure projects have to meet building code standards and may not be covered under this pathway.

Table 2 provides an overview of the buy-clean policies and programs referenced throughout this report, including the policy type relevant for each.

Implementation Timeline

The implementation of buy-clean policies is typically phased in over several years. The length of each phase of implementation will vary depending on factors such as:

- Agency available capacity and level of commitment;
- Availability of existing EPDs on the market;
- Local expertise related to embodied carbon;
- Number of materials in the policy scope; and
- Rulemaking requirements.

For policies initiated by legislation or executive order, timelines may be predetermined, while Agency-led programs are more flexible. Figure 1 provides an illustrative timeline of the implementation of a buy-clean policy.

The guidance in this document is organized into two phases:

- **Disclosure-only Phase:** In this phase, projects may be required to submit EPDs to disclose the GWP of materials used on projects, but are not required to meet carbon footprint limits for any products.
- **Mandatory Limits Phase:** In this phase, project teams must submit EPDs that verify the products used on projects will meet GWP limits established for each product.

This report uses GWP limits as the division between these two phases. However, as noted in Table 2, not all programs require limits. While the guidance in this document is loosely chronological, there is a large amount of overlap between different steps to implementing buy-clean policies. See Figure 1 for examples of how these overlaps may occur.

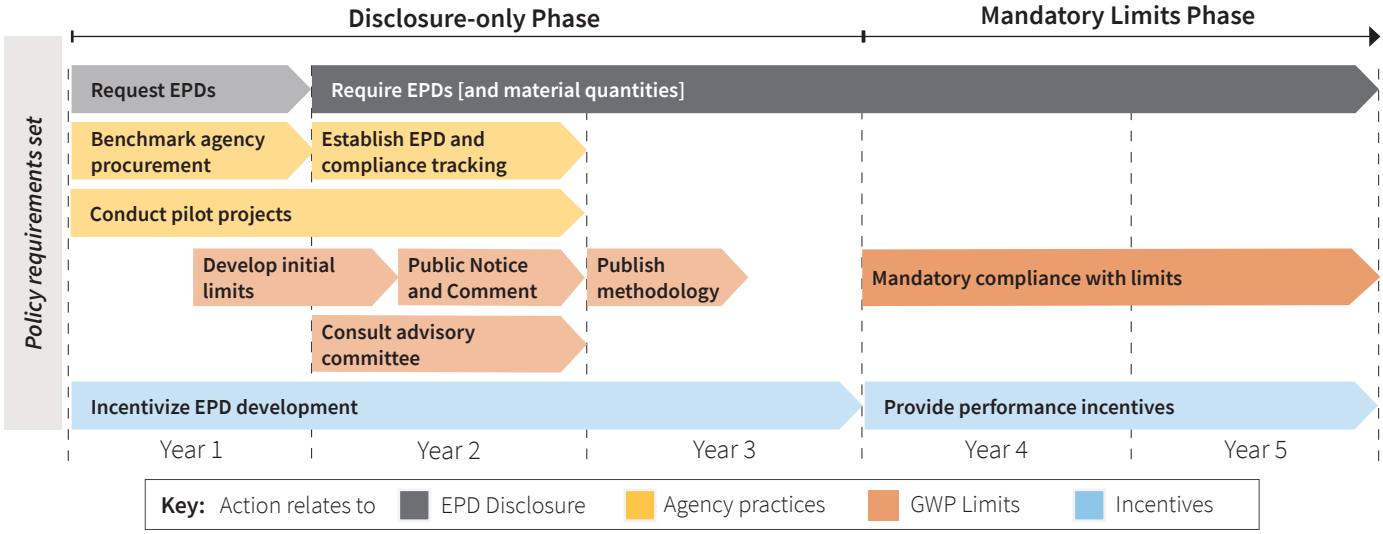

Figure 1. Illustrative timeline of the implementation of a buy-clean policy, including steps listed in this document. Length of phases varies by jurisdiction depending on policy design and requirements.

Addressing equity in policy design

When Agencies work to reduce embodied carbon through buy-clean or other policies, they are helping to eliminate the environmental and public health burden placed on frontline communities that suffer most from both global impacts related to climate change and local impacts related to fossil fuel use in transportation and manufacturing across construction supply chains, like smog and diesel emissions.

However, existing buy-clean policies and programs have not yet set a precedent for directly addressing the environmental and public health burden on local communities adjacent to manufacturing facilities, often referred to as fenceline communities.

Depending on the legislation, economic disparities and labor standards may have been considered in the policy design framework through:

- **Public incentive programs** targeting EPD development and educational outreach may target economically disadvantaged manufacturers that may otherwise lack internal technical resources. See Steps 5 and 9 for more details.
- **Reporting requirements:** Buy-clean policies and programs may incorporate reporting on the impacts of products and supply chains outside of global warming potential. For example, HB 1103 (Buy Clean Buy Fair WA) introduced in Washington State legislature in 2021[1] included requirements for manufacturers to report health certifications, working conditions data, and measures taken to promote the ILO's four Fundamental Principles and Rights at Work.[2]

1 Washington State Legislature. HB 1103. 2021-2022 Legislative Session (2021). Retrieved from https://app.leg.wa.gov/

2 International Labour Organization (1998). *ILO Declaration on Fundamental Principles and Rights at Work*. https://www.ilo.org/declaration/lang--en/index.htm

DISCLOSURE-ONLY PHASE

STEP 1: ESTABLISH AGENCY BUY-IN

Whether the policy is mandated or Agency-led, the first step to successful implementation is establishing internal buy-in and identifying leaders at the staff and management level to champion the policy.

Dedicate staff time to establish the program

- Dedicating 1+ Agency staff to developing and implementing Buy Clean policies will increase the success of the policy over time by building internal capacity.
- When possible, develop limits and run the stakeholder process for Buy Clean internally, rather than hiring consultants. These are key opportunities for building internal (Agency) capacity and technical expertise.

Table 3 provides a summary of funding and staffing information for existing programs and policies.

Identify agency policy champions

- Buy-clean policies can be developed and implemented at different administrative levels. An organizer or champion at the staff and management level is key.
- Get upper management and/or Agency Director support.

Table 3. Funding and staffing provided for existing buy-clean policies and programs.

Policy/Program	Funding	Staffing
BCCA	The original legislation did not include funding for development and implementation of this program.	Approximately 2 FTE: • 1 new FTE funded through the annual budget process. • 4 existing staff engineers dedicated approximately 25% of their time over the program development phase, equaling approximately 1 FTE of existing staff. It is expected that required DGS staff time will decrease during implementation, while awarding agency staff time may increase.
BCCO	Legislature allocated approximately $180,000 dollars for 1 FTE (90K/year for two years) to develop and implement the program within the office of the state architect.	1 FTE funded for 2 years added for CO Office of the State Architect. CO DOT expected to absorb increased workload, FTE not yet known.
BCBF WA Project	The BCBF WA project is funded by two budget provisos that provide $425,000 for creation of a public reporting database and $150,000 to conduct pilot projects.	Funding is provided to the University of Washington College of Built Environment, with 3% of the budget retained for administration by the WA State Department of Commerce.
Oregon Concrete EPD Program	Spent approximately $80,000 of existing program allocations, including roughly $50,000 on EPD reimbursement; $20,000 on EPD tool development; and $10,000 on program administration.	No new staffing. A single State agency staffer spent about 15% of their time over 3 years.
Marin County LCC Code	$200,000 grant used to run an advisory group, develop code language, run pilot projects, and disseminate support to other jurisdictions.	No new staffing added after code adoption. Multiple consulting teams were required to develop the code, Staff is currently looking for funding for the ongoing implementation of the new code.
PANYNJ	No initial funding. Some program funding was allocated once team efforts were organized under the Clean Construction Program. Additional funding currently provided for the Low Embodied Carbon Concrete (LECC) Pilot Program.	No new staffing funded. Efforts have been led by existing staff in the Construction Management Division and Engineering and Architectural Design Division and are now a part of the Clean Construction Program.
Portland Low Carbon Concrete Program	No new funding. Limited existing procurement program funding allocated. Funding used for local mobile mix EPDs and minor extra testing costs of pilot projects.	No new staffing. All efforts absorbed by existing procurement lead staffer who spent 20-30% of time over 2 years dedicated to the program. State environmental staff also spent 20% of time over 2 years assisting the City effort. No additional staff funded.
Sound Transit	Some funding provided by the Sustainability Cost Allowance (SCA) earmarked in the project budget for innovation in ST3 Link transit expansion projects.	No new staffing. Current efforts are absorbed by the Lead Sustainability Planner with some time from outside consultants. Engineering staff will play a larger role in the future as requirements are adopted as standard design practice.

Buy-clean policies demonstrate action to directly reduce carbon, which Agency leaders will likely want to celebrate or promote.

- For policies that include infrastructure projects, it's important to get chief engineers involved. Chief engineers often make final decisions on material specifications.
- If a policy impacts multiple agencies, identify a point person from each agency for leading coordination.

STEP 2: DEVELOP INITIAL LIMITS

The policy design heavily influences which type of GWP value needs to be established and whether one or multiple GWP values is required. Buy Clean California and Buy Clean Colorado require a single GWP limit to be set at industry-average for each eligible material, whereas other policies recommend higher thresholds (such as the 80th percentile). Policies requiring a two-tiered approach or that include a performance incentive may require setting an additional, lower GWP value that is harder to meet to incentivize innovation.

Reference third-party benchmarks

The Carbon Leadership Forum has developed resources that may be referenced by Agencies during the initial limit-setting process.

The CLF Material Baseline reports are updated annually and provide low, typical, and high GWP values for product types. Each value includes which methods and data sources were used to assess the value, indicating the level of confidence in the representativeness of the values for each category. Categories with more available data will result in higher representativeness of the GWP value set for each product.

If setting industry-average limits, Buy Clean California Limits includes guidance on setting limits for structural and reinforcing steel products, flat glass, and mineral wool.

Evaluate past public procurement practices

Most Buy Clean policies have an EPD collection period solely focused on disclosure and EPD submittal. This is a great time to evaluate past procurement practices from the past few years to identify areas where the Agency already has lower carbon specification or procurement practices versus where the largest opportunities for improvement exist.

- No need to inventory every single project: get data from an array of different projects/applications if possible. Look for variety rather than completeness.
- Focus on the past 1-2 years of purchases, as you're more likely to find EPDs that match the purchase.
- Public agencies often have ongoing maintenance or construction contracts with specific contractors and/or material suppliers: engage directly with these material suppliers to collect data. They often have better sales records and may be able to pull information more efficiently than Agency tracking systems.
- Use this process as an opportunity to engage Agency staff. There's usually sufficient time during the EPD collection phase of a policy to allow for staff to gain a basic understanding of EPDs.

This process of benchmarking performance or establishing an Agency baseline can inform the development of GWP limits by providing a solid foundation of where the Agency is today and identifying areas to focus on for improvements.

If your agency is responsible for identifying which materials to use, establishing an Agency baseline can be critical in determining which materials to focus on (e.g. those purchased in the highest volumes and with the largest opportunity for reductions in GWP).

Leverage regional and private sector data to inform public limits

- Collect regional data to benchmark both private and public sector projects and compare to the initial limits.
- Regionally-specific product data is particularly important for concrete and asphalt products. For concrete,

Case Study: Evaluating Past Practices

To benchmark their past procurement practices, the City of Portland requested maintenance records from a single producer that had a contract to provide small quantities of concrete requested by the City run maintenance workers. This producer happened to have EPDs for the mixes, which allowed for an easy calculation of baseline performance for City-led maintenance work.

Portland also found that the vast majority of their concrete was consumed on large infrastructure projects like water reservoirs or treatment plants. For these projects, the City found it was simple to obtain the concrete quantities and mix EPDs from the concrete supplier to provide a solid baseline for future water-related projects.

reference the NRMCA Member National and Regional LCA Benchmarks to understand regional differences in industry average.

- The private sector is ahead of public projects in their demand for transparency and embodied carbon reductions on projects. Ask local architects, engineers, and contractors what EPDs and GWP limits they require.
- To identify local experts, look for engineering firms participating in the SE 2050 Challenge and see if your region has a CLF Regional Hub.

By comparing the consumption-based data (i.e., what's being purchased by the agency) with the initial GWP limit value that represents North American practice, Agencies can have a more complete picture of how they are performing compared to the industry as a whole. For material types with more localized supply chains like concrete or asphalt, this may result in fine-tuning limits to represent regional production.

Allow for a project average compliance pathway

- Consider including a compliance pathway based on a project's total average GWP per material, rather than requiring each individual. This allows for project based flexibility and acknowledgment that certain applications have more readily available low carbon solutions than others.

This approach is used by Marin County, City of Portland, and Sound Transit and is allowed by the Buy Clean Colorado Act.

Use a two-tiered limits approach

- Consider a two-tiered approach by setting two limits: Limit 1 would apply to the majority of projects and support the uptake of current best practices. Limit 2 would be more stringent and only apply to a smaller subset of materials and/or contracts and drive larger reductions and innovation.

Transportation and Construction Emissions

Buy-clean policies focus on reducing emissions from products. EPDs also focus on product emissions and cover (at a minimum) life cycle stages A1-A3, covering raw material extraction (A1), transportation to manufacturer (A2), and manufacturing (A3) emissions.

Policymakers may be interested in including emissions from life cycle stages beyond A1-A3, including:

- A4 (transportation from manufacturer to construction site) to capture the impacts of purchasing from local producers; and
- A5 (construction) to capture the impact from construction vehicles, power tools, and other on-site emissions sources.

A4 and A5 impacts are typically outside the scope of EPDs, as they require site-specific calculations or are based upon average scenarios. Therefore, calculating project specific A4 and A5 impacts would require Agencies to request additional reporting from the contractor.

Currently, focusing on A1-A3 emissions (via EPDs) will maximize impact for Agencies with limited resources, as these stages are larger contributors to total GWP than A4 and A5 and require less additional time on the part of the agency. Local transportation and construction emissions may be best tracked as part of a broader project approach, rather than product approach, which would also allow for inclusion of use (B) and end of life (C) stages.

Figure 2 illustrates the relative GWP from the A1-A3, A4 and A5 life cycle stages from Skanska USA Building for three case study projects in the Pacific Northwest.

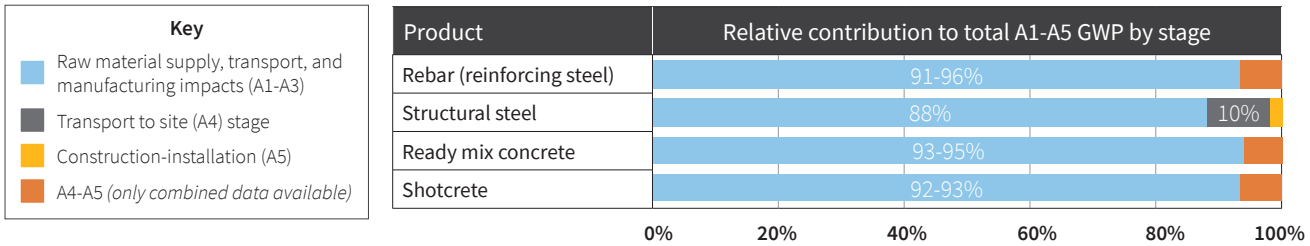

Figure 2. Relative contribution to total A1-A5 global warming potential (GWP) from life cycle stages A1-A3, A4, and A5. Data provided by Skanska USA Building from three case study projects in the Pacific Northwest.

STEP 3: ENGAGE STAKEHOLDERS AND THE PUBLIC

Provide a public notice and comment period

Providing an opportunity for public comment is an integral part of an inclusive and transparent public process. Even if a formal rulemaking is not specifically required by legislation, Agencies may follow a typical rulemaking process.

- Provide advance notice and opportunity for public comment.
- Address each concern methodically, recording the rationale for the proposed approach.
- Keep a comment response document for the public record.
- Plan for 1+ FTE or more depending on the number of materials being addressed over the length of the committee

Establish an advisory committee

Forming an advisory committee or working group of stakeholders early in the development of GWP limits is a part of an inclusive and transparent public process and will provide an opportunity for targeted feedback and support successful implementation by increasing awareness and buy-in from stakeholders impacted by the policy.

For Buy Clean policies that include vertical construction (buildings), consider including:

- State architect;
- Procurement analyst responsible for design and construction contracts;
- Agency staff with upcoming construction projects;
- Structural engineers, architects, and contractors;
- Material producers; and
- LCA experts.

For Buy Clean policies that include horizontal infrastructure, consider including:

- Department of Transportation's chief engineers;
- Agency project engineers;
- Private sector structural engineers and contractors;
- Material producers; and
- LCA experts.

If the policy went out for public comment, consider drawing directly from the organizations who commented.

Case Study: Committee Goals

The City of Portland set the following goals for their Low Carbon Concrete advisory committee:

"...Develop recommendations to the City on low-embodied carbon thresholds to be used in concrete specifications. Include key implementation recommendations, such as how to calculate and reasonable exemptions.

These thresholds shall be:

- *Meaningful = will result in a reduction in embodied carbon compared to baseline*
- *Feasible = can meet thresholds with current technologies/know-how while still meeting concrete performance needs for all kinds of applications*
- *Equitable = recommendations do not result in excluding any key stakeholders; impacts of thresholds on all types of operations are considered; implementation strategies developed accordingly*

The Committee will strive for consensus on the recommendations."

Address equity in committee design

If an advisory committee is formed, balance representation from the full spectrum of stakeholders.

- Consider virtual meeting options to broaden the geographic scope of stakeholders.
- Consider paid stipends for attending and provide feedback. Larger companies may have staff paid to participate on this type of advisory committee. That's rarely the case for smaller businesses.

Involve stakeholders early in GWP limit development

- Engage stakeholders as early as possible. Create an advisory committee during the EPD collection period, and at least 1 year prior to GWP limit setting.
- Send formal invitations. Ideally, invitations should come from a senior official (directors, chief engineers, etc.)
- State the goals of the committee clearly in the invitation.

The Advisory committee will have differing recommendations for decision makers. If possible, consensus recommendations from the committee will hold more weight and may ease adoption and implementation.

STEP 4: TEST LIMITS

As identified in Step 3, GWP limits (or targets) are already used on private sector projects. The local building industry community may be able to provide readily available case studies for many project types.

However, Agencies may also have unique project or delivery requirements that would benefit from Agency-led pilots. For example, the City of Portland found that lower carbon concrete mixes were more common on larger projects specified by structural engineers, compared to the maintenance projects relying on the City's standard construction specifications and associated pre-approved concrete mix list. Private sector case studies may be relevant for testing updates to the standard specifications and pre-approved concrete mixes for City projects.

Test limits against standard Agency specifications

- Initial GWP limits should be achievable with existing Agency specifications.
- Where possible, use performance specifications for concrete and asphalt, as some construction specifications have prescriptive elements that limit opportunities to reduce carbon emissions. For example, concrete specifications for minimum cement content, low water/cement ratios, SCM limits, exclusion of Type 1L cement, and a 28 day strength requirements are all barriers to lowering carbon. For asphalt, specifications that limit recycled asphalt pavement (RAP) and recycled asphalt shingles (RAP) are also barriers to lowering carbon.

Conduct pilot projects

- Perform pilot projects to demonstrate a proof of concept and train project managers, engineers, and contractors. This is particularly important for any low carbon product that may have different performance than a 'standard' product or requires different installation.
- Conduct pilot projects as early as possible. If possible, conduct pilot projects before or in parallel with the advisory committee process.
- Use pilot project findings to help inform what GWP limits are achievable on Agency projects.
- Publish case studies and share success stories.

Table 4. Overview of pilot projects associated with buy-clean policies and programs.

Policy/Program	Pilot projects
FHWA Sustainable Pavements Program	The Demonstration to Advance New Pavement Technologies Pooled Fund initiated in 2013 funds demonstration projects to showcase pavement technologies, such as increased in-place asphalt density and performance engineering concrete mixtures. As part of this program, FHWA provides up to $250,000 and 100 hours of technical staff assistance running LCAs, for members with an annual $10,000 membership from State DOTs.
BCBF WA Project	The BCBF WA project funds up to 10 pilot projects for testing the environmental and social impact disclosure requirements associated with BCBF WA, including EPDs, manufacturing location(s), and working conditions in facilities. Current pilots include UW's Interdisciplinary Engineering Building (IEB) at UW Seattle, UW's Milgard Hall at UW Tacoma, and a fuel island and radio tower at WSDOT's Olympic Region Maintenance Administration Facility.
PANYNJ	The PANYNJ Clean Construction program is funding a pilot program with academic partners to develop and test a set of low embodied carbon concrete mixtures that could be used on Port Authority projects.
Portland Low Carbon Concrete Program	The City of Portland is conducting at least 5 pilot projects to test the application of low carbon concrete in different City applications. • The first pilot project (published here) focused on sidewalks and ADA ramps. • The second pilot project (published here) focused on traffic signal pole footings. • Additional planned case studies include pavement, driveways, and park infrastructure elements. The pilot programs have been integral to the development of GWP limits, Agency staff education, contractor education, and material producer engagement for the City of Portland Low Carbon Concrete program. These projects have required significant coordination and a dedicated staff member leading the initiative.

STEP 5: INCENTIVIZE EPD DEVELOPMENT

Provide agency support for local EPD development

Developing and implementing buy-clean policies is easier when EPDs already exist in a local or state market.

- Consider providing direct financial, technical, and educational support for EPD development prior to or during buy-clean policy development.
- EPD incentives can be funded through grants to nonprofits or other administering organizations, rather than Agency-led. For some materials, carbon reductions can also be tied to energy conservation, which may provide an opportunity to tie EPD disclosure into existing utility-based incentives.

Address economic disparities

To address concerns related to supporting small businesses in compliance, EPD incentive programs may provide additional support to businesses under a certain size threshold or who are otherwise economically disadvantaged.

STEP 6: PUBLISH METHODOLOGY

Once the GWP limits are finalized, publish the methodology used to establish the adopted GWP limits. This will allow for consistent, transparent communication from the Agency to the public about how the limits were set, saving project managers time in responding to questions.

If a public comment period was provided, include a record or summary document of the comments that were raised and how they were resolved.

For example, Marin County published a *Study of Limits for Cement and GWP of Concrete* to summarize the work of the advisory committee to review industry-average data from the National Ready-Mix Concrete Association (NRMCA) and regional data collected from ClimateEarth and Structural Engineer's Association of Northern California (SEAONC) and eventually set limits.

Case Study: Incentivizing EPDs

Oregon's Concrete EPD program was a voluntary incentive program operated from 2017 - 2020. The program was a partnership between the Oregon Department of Environmental Quality (ODEQ) and Oregon's Concrete and Aggregates Producers Association (OCAPA). The program focused on financial, technical, and educational assistance to Oregon concrete producers and resulted in:

- Approximately $50,000 of direct reimbursements for the cost of producing concrete EPDs.
- Successful publication of over 1500 EPDs across 20 different Oregon concrete plants.
- This incentive program provided considerable help in enabling the City of Portland to get the go-ahead from key internal stakeholders to launch their initiative.

Case Study: Addressing economic disparities

Directly supporting smaller producers can ensure equitable access to public projects impacted by buy-clean policies. During the development of GWP limits, the City of Portland was exploring how to get EPDs for a mobile mix concrete truck they own. A number of mobile mix producers that regularly provide concrete on small City of Portland maintenance jobs were also interested.

To support these smaller producers, the City teamed up with 3 other mobile mix concrete producers to create an industry average EPD for the companies that participated in the process. This process:

- Enabled mobile mix truck to continue to meet the interim requirement to have EPDs
- Identified several actions mobile mix producers can take to source lower carbon materials to meet the City's future GWP limits.

EPDs are like manufacturing efficiency labels and can effectively identify opportunities for impact reduction in the supply chain and/or manufacturing process.

STEP 7: TRACK COMPLIANCE

Establish a central location for project team requirements

Establish an accessible information source for project teams clarifying policy requirements, such as:

- When and how are EPDs submitted?
- Who on the project team is responsible for submitting?
- How are EPDs tracked?
- By agency, which projects are covered by the policy?

If applicable, this is a great place to include other links to educational resources, example specifications, and other information for teams.

Create a System for Tracking EPDs and Compliance

Creating a tracking system for collecting EPDs and other relevant project information is important for tracking compliance and measuring policy-wide progress in reducing the carbon emissions of government purchased building materials. Agencies may be required by legislation to provide a summary report on the program after several years. Without a central tracking system, this analysis will be difficult to provide.

Table 5 provides an overview of existing approaches for tracking EPDs and compliance.

Table 5. Overview of tracking approaches among select policies used for EPD and compliance by select buy-clean policies and related programs.

Policy/Program	System	Brief summary of EPD and/or Compliance Tracking
BCCA	Tracked by each agency and submitted to DGS to measure progress.	Compliance efforts are led independently by each awarding agency. DGS developed an Excel-based data collection tool as a means of tracking progress by awarding Agencies. However, awarding agencies are permitted to determine their own tracking mechanism. For example, CalTrans integrated EPD collection into their current document collection system. Awarding agencies will be required to submit data to DGS as part of an effort to report the obstacles and effectiveness of the program to the legislature by 7/1/2023.
BCBF WA Project	Online database	The Washington state legislature directed the Department of Commerce to fund the UW College of Built Environments to create a public reporting database to collect EPDs and material quantities for Buy Clean Buy Fair WA pilot projects.
Marin County LCC Code	No central tracking system	Standard building code compliance forms track compliance with the low carbon concrete components of the building code.
PANYNJ	Project tracking + Custom tool developed by LOCUS	EPDs are submitted via the standard general contractor(GC) submissions process for each project. The PANYNJ Resident Engineer for that project is responsible for making sure the GC provides the data, and members of the Clean Construction Unit review and verify based on what material was approved by the Materials Engineering Unit (MEU) and the quantity delivered against on-site inspection reports by MEU. The Locus tool then stores the data of material GWP, material quantity, and associated contract to track an entire projects' embodied carbon.
Portland Low Carbon Concrete Program	No central tracking system	There is no central system yet for long term comprehensive tracking of carbon impacts of all concrete purchases. Two compliance pathways are available: 1. Selection of a concrete mix from a pre-approved list (all of which have EPDs), which are confirmed by a single point of contact at City's concrete testing lab; 2. Centralized email for EPD submittal for mixes not on the City's pre-approved list. Reporting requirements will be included into each relevant procurement template to be submitted to the centralized email.
Sound Transit	Spreadsheet tool	A spreadsheet tracking tool is provided to the contractor. The contractor must submit mix volumes and GWPs of each mix, along with the EPDs for at least 75% of the total poured in place concrete volume used in the project. This detailed information is used for tracking and setting GWP baselines for different project types. The spreadsheet is submitted to the project engineer and sustainability coordinator for review and compliance.

Case Study: Policy Exceptions

For the Buy Clean California Act, each awarding agency implements their own policy exceptions based on their interpretation of the law. CalTrans provided a detailed explanation of their policy exceptions in a published report:

- Carbon reinforcing steel, when less than 20,000 pounds of steel is required
- Structural steel, when less than 5,000 pounds is required
- Flat glass, if less than 2,000 square feet is required
- Mineral wool board insulation, if less than 4,000 square feet is required
- Projects with less than 175 working days
- Projects with total bid values of $1,000,000 or less
- Projects contracted under emergency or Director's Orders
- Materials where a valid PCR has been issued less than 100 days before the time of bid opening, or the PCR is expired or does not exist at the time of bid opening.
- Materials where the program operator has determined that an EPD cannot be produced under their PCR for a project's material and Caltrans has affirmed that determination at the project level

Utilize Policy Exceptions

The scale of carbon reductions needed calls for an economy wide transition to lower carbon products. GWP limits exceptions should be tailored to phase in all players in a regulated sector. Table 6 provides an overview of policy exceptions used by existing policies and programs.

STEP 8: INCENTIVIZE HIGH PERFORMANCE

Policies that set one GWP limit (at industry-average or a different threshold specified by the policy) do not incentivize continual improvement below the established limit. By using a two-tiered approach (see Step 2) or providing incentives for better performance, Agencies can encourage innovation in addition to uptake of current best practices.[4]

- Consider performance incentives for contractors to reward procurement of materials below a specified level GWP value (or X% below the maximum allowable GWP limit). This type of incentive already exists for contractors for other types of performance, such as early completion and/or criteria like asphalt density.
- Consider providing purchasing preference for the lowest carbon product. Public procurement preference is already common in state and local procurement policies, especially for materials with recycled content. Low carbon preferences can be integrated into the typical low bid scenarios on public projects through price adjustments. The original New York LECCLA bill introduced in 2020 proposed a price discount for the lowest carbon bid.
- If your procurement agency provides "points" for different criteria as part of the bid evaluation process, consider adding extra points for the lowest carbon products.

4 Dell,R. (December 2020) *Build Clean: Industrial Policy for Climate and Justice.* https://www.climateworks.org/report/build-clean-industrial-policy-for-climate-and-justice/

Table 6. Overview of policy exceptions among select buy-clean policies and programs.

Policy/Program	Policy Exceptions
BCCA	The legislation allows for exceptions related to technical feasibility, project cost, project schedule delay, emergencies, or sole sourcing concerns. Individual awarding authority must publish written justification for exceptions on their website.
BCCO	Implementing agencies can make project EPD exceptions based on cost and feasibility.
Marin County LCC Code	Provides 30% increase in GWP limits for high early strength concrete and policy exceptions for hardship and feasibility.
PANYNJ	EPD exceptions at the project level are made when bidders on an individual project show proof that EPDs are not available from at least 5 bidders. Exceptions to the cement content limit are available for concrete when the project specifies high early strength, such as for certain roadways and airport runways.
Portland Low Carbon Concrete Program	Any mix used under 50 cubic yards in total over the course of a project is exempt. Mobile mix concrete producers are allowed to submit regional industry average EPDs instead of product specific. Temporary exemptions can also be requested in writing when there is a supply chain disruption of materials needed to comply with the GWP limit.
Sound Transit	Current specifications require only 75% of total poured in place concrete volume to provide EPDs. The next project will pilot raising that to 90%.

STEP 9:
PROVIDE EDUCATION AND TRAINING

Providing education and training to both internal and external stakeholders is key to successful implementation:

- **Internal:** Education and awareness for Agency project managers, engineers, and others who manage design and construction teams and projects, construction specifications, or approved material lists
- **External:** Training for contractors, suppliers, and other members of construction project teams

Table 7 summarizes existing external and internal education efforts led by agencies implementing buy-clean policies and programs.

Keep implementation agencies informed

Depending on how the policy is structured, the agency required to set limits may not be the same agency responsible for implementation. In all situations, it's important to keep the implementing agencies up to date:

- EPD 101 education for agency staff, including project managers (who act as point person for project teams).
- Write articles in newsletters or present at all staff meetings.
- Education on how to implement limits to affected staff.

Provide contractor training

For low carbon options of "site cured" materials like concrete and asphalt, there may be construction implications that slow the cure time, lengthen the schedule, or alter installation or finishing approaches.

- Involve the entire supply chain of producers and installers for "site cured" materials like concrete and asphalt in GWP limit development and pilot projects as much as possible.
- Targeting a variety of contractors, as well as project types, during pilot projects to expose them to the lower carbon mixes.
- Consider hosting broader training opportunities with industry associations to help transition the industry to lower carbon products.

Table 7. External and internal education and outreach efforts led by government Agencies related to buy-clean policies and programs.

Policy/Program	Education and outreach efforts
FHWA Sustainable Pavements Program	The Sustainable Pavements program has published 15+ webinars, 30+ technical documents, and 50+ technical presentations and hosts a Sustainable Pavements Technical Working Group for knowledge sharing. They have also released a free LCA Pave tool for measuring embodied carbon and other environmental impacts across the life cycle of pavements.
BCCA	Initial external outreach led by DGS with affected industries, focusing on trade associations for eligible materials. Meetings and opportunities for public comment were provided. Internal education led by DGS and executed through quarterly meetings with leads from each awarding agency.
Oregon Concrete EPD Program	Extensive external outreach to individual concrete producers, regional technical forums, regional engineering groups, local governments, and private market project teams.
Marin County LCC Code	External education is unfunded and relies on partnerships for regional education. External education currently focuses on design community such as structural engineers and architects (on how to specify low carbon concrete), with some outreach efforts to contractors. Future internal educational efforts to building inspectors is ongoing.
PANYNJ	Extensive external education efforts with industry associations, individual material producers, contractors, and universities. Internal efforts focused on design, materials, and construction engineers .
Portland Low Carbon Concrete Program	External education through 5 pilot project efforts focused on different concrete applications and contractors. Internal education efforts targeted Engineers, DOT and Lab staff. Complementary efforts to educate concrete producers already existed through the Oregon Concrete EPD program executed by OR DEQ.
Sound Transit	External outreach/roundtables with the concrete producers and general contractors. Internal efforts focus on project structural engineers. Lunch and Learn opportunities also provided by CLF.

Embodied Carbon Educational Resources

A growing number of free educational resources are available to support agencies in providing education and training to internal and external stakeholders. Examples include:

- The CLF Embodied Carbon Policy Toolkit includes a resource library and five introductory primers on embodied carbon, Buy Clean, and environmental product declarations.
- The AIA-CLF Architect Toolkit includes three primers and a list of tools for architects to understand and reduce embodied carbon.
- Building Transparency's Resources library has a variety of free resources and templates for project teams, such as EPD Request Letters, Bid Document Examples, Owner Basis of Design contract language, and model specifications, as well as a How to get an EPD guide for manufacturers.
- The FHWA Sustainable Pavements Program includes webinars, case studies, tools, and a resource library.
- The West Coast Materials Management Forum's Climate Friendly Purchasing Toolkit includes "How To Complete a Supply Chain GHG Inventory" and sector-specific material management guidance.

STEP 10: RE-EVALUATE INITIAL LIMITS

Re-evaluation of limits over time is critical to the decarbonization strategy of buy-clean policies that include limits: lowering limits over time ensures that more polluting products will be excluded over time, continuing to drive emissions reductions. Additionally, re-evaluation of limits over time can enable new embodied carbon data to be incorporated to ensure that GWP limits are representative.

Most policies have a reevaluation of the limits built into the policy. For example, BCCA requires DGS to review the maximum GWP limit for each material beginning in 2025 and every three years thereafter. DGS may adjust the number downward to reflect industry improvements if the department, but may not adjust that number upward for any eligible material.[5]

5 Buy Clean California Act, California Public Contracts Code, Article 5, Buy Clean California Act, Sections 3500 - 3505 (2018). Available at https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?division=2.&chapter=3.&part=1.&lawCode=PCC&article=5.

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