Maryland Green Building Council

Interim Report

BUY CLEAN MARYLAND ACT AND USE OF GLOBAL WARMING POTENTIAL OF CONSTRUCTION MATERIALS PRODUCED IN MARYLAND

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Introduction

In response to specific requests[1] by the Maryland Senate Budget and Taxation Committee and Maryland House of Delegates Health and Government Operations Committee, the Maryland Green Building Council has prepared this interim report on its progress in addressing specific topics requested by the committees. The topics are associated with and supplemental to, the reporting requirements of HB 261 (2023) (Public Projects - Procurement of Construction Materials (Buy Clean Maryland Act)). Topics requested to be addressed are:

- *identify the two construction materials produced in the State, other than cement or concrete mixture, with the highest global warming potential as compared to other construction materials.*

- *for the two construction materials identified, conduct the study contemplated in the draft version of the bill and outlined*:
    - *the use of EPDs to measure the climate impact of construction materials produced by the State, including glass, steel, and wood;*
    - *the use of performance incentives to encourage adoption of low-carbon materials and methods by manufacturers that provide construction materials for State-funded projects;*
    - *the establishment of an expedited product evaluation, testing, and approval protocol for low-carbon products;*
    - *the implementation of performance-based specification standards for construction materials, as specified; and*
    - *the use of methods of compliance, including specifications based on maximum potential for global warming;*

[1] Correspondence to Atif Chaudhry Secretary, Department of General Services dated April 19, 2023, from Guy Guzzone, Chair Senate Budget and Taxation Committee and Joseline A. Peña–Melnyk, Chair, House Health and Government Operations Committee

I. "…two construction materials produced in the state, other than cement or concrete mixture, with the highest global warming potential…"

The Global Warming Potential (GWP) of construction materials is a measure of the emissions of greenhouse gases associated with their production, expressed in terms of the equivalent amount of carbon dioxide (CO_2e). The exact GWP can vary based on factors like production technology, transportation distances, and whether the materials are recycled or sustainably sourced.

Using life cycle assessment (LCA) data specific to the region and production methods can provide more accurate GWP values for these materials.

The ranking depicted below, provides a general idea of GWP for a variety of construction materials based on typical production processes. For precise data, the Maryland Green Building Council intends to research available data from each product manufacturer within the state, consult specific life cycle analyses, studies and databases[2] for each material.

A general ranking of highest to lowest GWP for construction materials produced in the State of Maryland, is based on their typical production processes:

1. Asphalt
   - High GWP: Asphalt has a significant GWP due to the energy-intensive process of heating and mixing bitumen with aggregates. Additionally, the extraction and refining of petroleum products contribute to its high carbon footprint.

2. Brick
   - Moderate to High GWP: The production of bricks involves the extraction of clay and the energy-intensive firing process in kilns, which releases CO_2. However, the GWP can vary depending on the fuel used for firing.

[2] The availability of GWP data for construction materials and products is dynamic, rapidly expanding and evolving as a result of government requirements and funding of research and, product manufacturer's desire to address the requirements. A partial listing of GWP resources to be researched by the Maryland Green Building Council:

- BlueGreen Alliance Foundation: https://buildingclean.org/
- The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.
- Global Material Flows Database: https://www.resourcepanel.org/global-material-flows-database,
- Global Water Partnership: https://www.gwp.org/ , digital library with digital objects, including text, images, audio, video, and documents. The GWP also has databases developed with partners and allies to help Caribbean stakeholders make climate-resilient decisions.
- GHGRP Reported Data: GHG emissions data that reflect the GWP values from the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC).
- EDGARv5.0 and 6.0: Provides emissions of the three main greenhouse gases (CO2, CH4, and N2O) per sector and country.
- World Bank DataBank: GHG totals expressed in CO2 equivalent using the GWP100 metric of the Second Assessment Report of IPCC.

3. Gypsum (Drywall)
   - Moderate GWP: Gypsum production involves quarrying and the calcination process, which requires energy and releases CO_2. However, it has a lower GWP compared to highly processed materials like asphalt or brick.

4. Crushed Stone
   - Low to Moderate GWP: The GWP for crushed stone is relatively low because it is primarily related to the mechanical processes of quarrying and crushing. However, the transportation of heavy materials can increase its carbon footprint.

5. Sand
   - Low GWP: Sand has a very low GWP as it generally requires minimal processing after extraction. The environmental impact mainly comes from the energy used in transportation and any additional washing or sorting.

6. Lumber
   - Potentially Negative to Low GWP: If sustainably sourced, lumber can have a very low or even negative GWP due to its ability to sequester carbon during the tree's growth. The processing and transportation of lumber contribute some emissions, but it is generally considered a low-carbon material, especially compared to fossil fuel-based materials.

These materials support a wide range of construction activities, from residential housing to large infrastructure projects within Maryland. Each of the Maryland-produced products is also distributed and used beyond the borders of the state.

This listing excludes cement and concrete. The GWP standards of those products are being addressed in the detailed report and standards required by other portions of HB 261 (Public Projects - Procurement of Construction Materials (Buy Clean Maryland Act)).

This listing excludes steel and glass. Neither of those materials used in construction of facilities are manufactured in Maryland.

II. "for the two construction materials identified, conduct the study contemplated in the draft version of the bill…"

A. Address "the use of EPDs to measure the climate impact of construction materials produced by the State, including glass, steel, and wood;"

The two materials with the highest GWP that are manufactured in Maryland are asphalt and brick. EPDs for those materials will be researched and presented in a final report. This listing and the use of EPDs excludes steel and glass. Neither of those materials used in construction of facilities are manufactured in Maryland. EPDs for lumber produced in Maryland will be evaluated.

B. Address "the use of performance incentives to encourage adoption of low-carbon materials and methods by manufacturers that provide construction materials for State-funded projects;"

Encouraging the adoption of low-carbon construction materials can be driven through performance-based incentives, which reward companies and projects for reducing greenhouse gas (GHG) emissions and using sustainable materials. Here are several effective incentives:

1. Tax Credits and Rebates

- **Green Building Tax Credits**: Governments can offer tax credits to builders and developers who use low-carbon materials like sustainable wood or recycled aggregates. For instance, the **U.S. Green Building Council (USGBC)** advocates for such incentives tied to achieving Leadership in Energy and Environmental Design **(LEED)** certification levels, which incorporate low-carbon materials.
- **Energy-Efficient Material Rebates**: States can provide direct rebates for projects that include materials with a lower GWP, such as low-carbon concrete or sustainably sourced lumber.

2. Carbon Credits and Offsets

- **Cap-and-Trade Programs**: In regions with carbon markets, like California, construction firms can earn carbon credits by reducing their material-related GHG emissions, which can then be sold in the market or used to offset other emissions.
- **Voluntary Carbon Offsets**: Companies adopting low-carbon materials can sell carbon offsets as part of voluntary carbon markets, creating a financial incentive for emissions reductions.

3. Green Public Procurement Policies

- **Low-Carbon Procurement**: Governments can mandate or reward public projects that prioritize low-carbon materials. For example, certain federal or municipal contracts could give preference or additional points in the bidding process to projects using materials with lower carbon footprints, such as **low-carbon cement** or **sustainable insulation**.
- **Carbon Reporting Requirements**: Governments may require bidders on public contracts to report their carbon footprints, giving an edge to companies that demonstrate lower GHG emissions through material choices.

4. Performance-Based Building Codes

- **Carbon Reduction Mandates**: Building codes can be updated to require certain performance standards related to GWP. For example, materials with low embodied carbon might become mandatory for meeting future **zero-carbon building** targets.
- **Energy Performance Bonuses**: Municipalities or states could offer height or density bonuses to developers who use certified low-carbon materials in their projects, similar to incentives used for energy efficiency.

5. Subsidized Innovation Funds

- **R&D Grants**: Governments and private institutions could create funds to subsidize research and innovation in low-carbon materials, such as new types of concrete or **carbon-neutral steel**. These grants encourage industry players to adopt and scale innovative materials.
- **Pilot Projects**: Subsidies for pilot construction projects that showcase new materials can accelerate market adoption by covering the higher costs or risks associated with these early initiatives.

6. Recognition and Certification Programs

- **Green Labeling Programs**: Certification systems like **LEED** or Building Research Establishment Environmental Assessment Methodology (**BREEAM)** often reward projects that incorporate low-carbon materials. Projects achieving these certifications can attract tenants or buyers willing to pay a premium for environmentally friendly buildings.
- **Performance-Based Recognition**: Special awards or recognition (e.g., for the lowest GWP in a building project) can enhance a company's reputation and marketability, incentivizing more widespread adoption of sustainable practices.

7. Financing Incentives

- **Green Bonds**: Developers can issue **green bonds** to finance projects that use low-carbon materials. These bonds often come with lower interest rates and attract environmentally conscious investors.
- **Lower Loan Rates for Sustainable Projects**: Financial institutions may offer lower interest rates for projects that meet certain environmental criteria, such as using certified low-carbon materials.

8. Material Circularity Incentives

- **Recycled Material Mandates**: Offering bonuses or credits to projects that incorporate recycled materials (e.g., **recycled concrete aggregate** or reclaimed wood) incentivizes reducing embodied carbon by reusing existing materials.
- **End-of-Life Recycling Subsidies**: Subsidizing the recycling or repurposing of materials at the end of a building's life encourages the use of materials that can be sustainably reclaimed.

To create and use each of the incentives described requires a concerted effort among government entities, manufacturers and vendors. By using these strategies, the state and local governments, industries, and markets can accelerate the transition to low-carbon materials in construction. This not only helps reduce the environmental impact but also aligns with global climate goals.

C. …"the establishment of an expedited product evaluation, testing, and approval protocol for low carbon products;"

Establishing an expedited product evaluation, testing, and approval protocol for low-carbon products is essential for promoting their rapid adoption in construction and other industries. This process should ensure that innovative low-carbon materials are evaluated efficiently while maintaining high standards of safety, performance, and sustainability. Below are some potential components for developing such a protocol:

1. Define Key Criteria and Metrics

- **Carbon Footprint Evaluation**: Set clear benchmarks for what constitutes a low-carbon product. This could involve requiring Environmental Product Declarations (EPD) based on Life Cycle Assessments (LCA) to quantify the carbon emissions associated with the product across its lifecycle.
- **Performance Standards**: Establish minimum performance standards for strength, durability, fire resistance, and other relevant criteria specific to the material's intended use.
- **Health and Environmental Safety**: Ensure that low-carbon materials meet safety and toxicity standards to avoid introducing materials that may harm human health or the environment.

2. Create a Fast-Track Application Process

- **Streamlined Documentation**: Design a simplified application process specifically for low-carbon products, ensuring that applicants provide only the most essential documents, such as EPDs, third-party certifications (e.g., Cradle to Cradle), and technical performance reports.
- **Pre-approved Categories**: Develop a list of pre-approved low-carbon materials and technologies that have already undergone rigorous review. New products that are similar to, or based on, these materials can receive expedited approval.
- **Digital Submission Platform**: Build an online platform for submitting applications, allowing applicants to upload digital documentation and track the progress of their submissions in real time.

3. Collaborate with Third-Party Certifiers

- **Recognized Certification Bodies**: Partner with internationally recognized organizations like the **US Green Building Council (USGBC)**, **Cradle to Cradle**, or **Carbon Trust** that have experience in verifying the carbon footprint and sustainability of products.
- **Use Existing Certifications**: Where applicable, accept existing certifications from trusted third-party verifiers to reduce redundancy in testing and evaluation.
- **Fast-Track for Pre-Certified Materials**: Create an expedited process for products that have already been certified by credible bodies, which can bypass certain steps in the approval process.

4. Prioritize Testing and Lab Resources

- **Dedicated Testing Centers**: Establish dedicated labs or third-party testing partnerships specifically for evaluating low-carbon materials, prioritizing lab resources and personnel for rapid testing of these products.
- **Provisional Approvals**: Allow provisional approvals based on initial test results for pilot projects, enabling products to be used while long-term testing is completed.
- **Public-Private Partnerships**: Collaborate with universities and research institutes to conduct rapid testing of low-carbon products, leveraging their expertise and resources.

5. Accelerated Pilot Project Approval

- **Pilot Projects**: Allow low-carbon products to be tested in pilot construction projects or limited applications under expedited timelines. Track and evaluate the performance in real-world conditions.
- **Performance Monitoring**: For products granted provisional approval, implement real-time monitoring and data collection during use to quickly evaluate performance. Results from pilot projects can then feed into the final approval decision.

6. Develop Specialized Review Teams

- **Expert Panels**: Create specialized review teams within approval agencies (e.g., state building commissions) that are trained in evaluating low-carbon products. These teams can focus solely on green products and use accelerated timelines for review.
- **Cross-Disciplinary Collaboration**: Include environmental scientists, material engineers, and sustainability experts to ensure a holistic review of the product, balancing carbon reduction with performance and safety.

7. Performance-Based Approval

- **Conditional Use Permits**: Issue conditional or temporary use permits based on the product's projected performance, subject to final approval once long-term testing is completed.
- **GWP Reduction Targets**: Products that demonstrate significant reductions in GWP relative to conventional alternatives can be fast-tracked if they meet minimum safety and durability criteria.

8. Government Incentives for Fast-Tracked Products

- **Incentivized Testing**: Provide financial or regulatory incentives for companies that develop low-carbon products and submit them for expedited testing and approval. This could include grants, tax incentives, or rebates for materials that are successfully approved.
- **Expedited Review Fees**: To manage resource allocation, charge a fee for fast-tracked evaluations, with revenue directed toward additional testing capacity.

9. Continuous Improvement and Feedback Loop

- **Post-Market Surveillance**: Continue to monitor the performance of approved low-carbon materials in the market to ensure they meet the required standards over time.
- **Continuous Update of Standards**: As new low-carbon technologies emerge, periodically update testing protocols and benchmarks to reflect advancements in materials science and sustainability.

10. Transparent Reporting and Communication

- **Publicly Available Database**: Develop a publicly accessible database where developers, builders, and other stakeholders can review approved low-carbon products, including details on their environmental performance and usage guidelines.
- **Open Feedback Channels**: Allow users of the product (e.g., builders, project managers) to provide feedback on the performance of materials, which can help improve the evaluation process and identify issues in the field quickly.

The above approaches balance rapid adoption of low-carbon materials with the need to ensure performance, safety, and environmental integrity. They also encourage innovation by reducing the time and cost barriers associated with bringing sustainable materials to market.

D. …"the implementation of performance-based specification standards for construction materials, as specified;"

Implementing performance-based specification standards for construction materials focuses on ensuring that materials meet predefined performance outcomes, such as strength, durability, and environmental impact, rather than adhering to prescriptive manufacturing processes. This approach is ideal for promoting the use of low-carbon and innovative materials, as it allows flexibility while ensuring safety and performance.

Potential Steps for Implementing Performance-Based Specification Standards:

1. Define Key Performance Metrics

- **Structural Integrity**: Materials must meet minimum requirements for load-bearing capacity, resilience, and mechanical performance under specified conditions (e.g., seismic or wind loads).
- **Durability**: Standards should specify how long materials are expected to last in given environments, considering factors like weather, corrosion, and wear.
- **Thermal and Acoustic Performance**: For insulation materials, performance-based standards can define minimum R-values (thermal resistance) and sound transmission coefficients.
- **Environmental Impact**: Key metrics include GWP, energy consumption during production, and recyclability or end-of-life impact.

2. Life Cycle Assessment (LCA)

- Mandate the use of **LCA** to assess the environmental footprint of materials throughout their lifecycle, including raw material extraction, production, use, and disposal.
- **Environmental Product Declarations (EPDs)** should be required as part of the submission process for material approval. These declarations quantify the environmental impacts, including carbon emissions.

3. Develop Material Performance Testing Protocols

- Establish standardized testing protocols for evaluating the performance of materials in real-world conditions. These could include:
    - **Mechanical tests** for strength and fatigue resistance.
    - **Thermal performance tests** for insulation or energy efficiency.
    - **Fire resistance tests**, especially for new materials like engineered wood or composites.
    - **Moisture and chemical resistance tests**, particularly for materials used in harsh environments like coastal areas.

4. Create a Material Certification Program

- Partner with certification bodies to create a performance-based approval process that evaluates materials based on their demonstrated results. Some recognized certifications include:
    - **LEED** (Leadership in Energy and Environmental Design)
    - **BREEAM** (Building Research Establishment Environmental Assessment Method)
    - **Cradle to Cradle Certification** for assessing a product's sustainability and recyclability.

5. Collaborate with Industry and Academia

- Establish partnerships with universities, research labs, and industry stakeholders to conduct independent testing and innovation.
- Use research to establish **baseline performance standards** for materials, allowing for the inclusion of cutting-edge or experimental materials, such as **low-carbon cement** or **bio-based materials**, once they meet specified performance criteria.

6. Integrate into Building Codes and Procurement Policies

- Incorporate performance-based specifications into building codes at local, state, or national levels. For example, require that all materials used in structural applications demonstrate a certain level of environmental and mechanical performance.
- Adjust **public procurement policies** to mandate or prioritize the use of materials that meet both performance and environmental criteria. For instance, governments can incentivize the use of low-carbon concrete or energy-efficient insulation by awarding contracts to projects using certified materials.

7. Monitor and Evaluate Performance in Use

- Set up mechanisms for continuous monitoring of materials in actual construction projects. This can include collecting data on material performance over time to ensure that they meet long-term expectations.
- **Feedback loops**: Use the data gathered from real-world applications to refine performance criteria and encourage improvement in material design and production.

Benefits of Performance-Based Standards:

- **Encourages Innovation**: Since manufacturers are not restricted by prescriptive processes, they are free to develop new, low-carbon, and more efficient materials that still meet safety and durability requirements.
- **Reduces Environmental Impact**: With a focus on GWP and lifecycle sustainability, performance-based standards help reduce the carbon footprint of construction projects.
- **Flexibility**: This system allows for a range of materials, including recycled or locally sourced products, as long as they meet the required performance outcomes.
- **Cost-Effectiveness**: Encourages competition and can lead to cost reductions as manufacturers explore alternative materials that still comply with performance expectations.

Challenges:

- **Verification and Testing**: Establishing robust and consistent testing protocols can be complex and resource-intensive.
- **Initial Costs**: Some low-carbon or innovative materials may have higher upfront costs, though they may provide long-term environmental and economic benefits.

Incorporating performance-based specification standards fosters a more flexible and innovative approach to material selection, helping to achieve sustainability goals while maintaining construction quality and safety.

III. Reporting in compliance with provisions of the Buy Clean Maryland Act

Chapter 202 of 2023[3] (that was HB 261), the Buy Clean Maryland Act, requires producers of cement and concrete mixtures used in the construction of an eligible project (i.e., a subset of all capital budget projects) to submit an Environmental Product Declaration (EPD) to the DGS by December 31, 2024; requires DGS to establish a maximum acceptable global warming potential (GWP) for certain cement and concrete mixtures used in State of Maryland construction. The standards must be in place by January 1, 2026.

The Maryland Green Building Council by and through the Maryland Department of General Services (DGS) and, in coordination with the Maryland Department of Transportation, is receiving technical assistance from consultants to evaluate and set the GWP standards. The consultant work performed on behalf of the State of Maryland is contracted to the U.S. Climate Alliance. who has been awarded and will administer a grant from the United Nations.

The selected consultant firm, GreenPlum Street LLC. of Seattle, Washington is providing professional services to:

- Conduct market research and concrete industry engagement.
- Develop of GWP standards for cement and concrete mixtures (through a process that may be replicated in the future for other construction materials).
- Review and recommend for approval, EPDs for cement and concrete mixtures.
- Draft green procurement policies for construction projects, with an emphasis on government contracting.

Specifically, the consultant is responsible for collaborating with DGS and other State personnel on the following tasks:

- Outreach to the industry who supply State contracts with cement and concrete mixture products to coordinate with them as they develop EPDs for their products.
- Perform a literature search of federal and state buy clean concrete programs appreciating that DGS initially looks favorably at the New York State Buy Clean Concrete Program.
- Provide a training program to State of Maryland personnel on how to interpret GWP and EPDs for cement and concrete mixture products.
- Recommend the industry averages of GWP emissions for several categories of cement and concrete mixtures.
- Collaborate with State personnel to express the maximum acceptable GWP potential that is consistent with the criteria in an EPD for cement and concrete mixtures.
- Provide guidance to Sate personnel on incorporating GWP and EPDs in procurement documents and contracts with vendors.

The performance of tasks and compliance with required milestones set forth in the Act is on schedule.

[3] 2023 Regular Session - House Bill 261 Chapter 202
{https://mgaleg.maryland.gov/2023RS/chapters_noln/Ch_202_hb0261E.pdf

- January 1, 2024 through December 31, 2024 – Assist manufacturers who supply eligible products to the State with EPD development and funding. Cement companies must submit EPDs to DGS before December 31, 2024.
- July 1, 2024 through December 31, 2024 - Coordinate with State personnel on including GWP and EPD requirements in State contracts. Train State personnel on interpreting GWP and EPD requirements.
- July 1, 2024, through June 30, 2025 – review EPDs submitted by cement manufacturing companies. Establish a maximum GWP for each category of eligible product.

The deliverables will be documents possibly with YouTube video(s) that may be transmitted via Zoom, or through other similar readily available commercial products.

The principal contacts for these efforts are:

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