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GSA Green Building Advisory Committee Advice Letter: Policy Recommendations for Procurement of Low Embodied Energy and Carbon Materials by Federal Agencies

February 17, 2021

Kevin Kampschroer
Chief Sustainability Officer and Federal Director,
Office of Federal High-Performance Green Buildings
U.S. General Services Administration (GSA)

RE: Policy Recommendations for Procurement of Low Embodied Energy and Carbon Materials
by Federal Agencies

Dear Mr. Kampschroer:

This letter summarizes recommendations of the Green Building Advisory Committee (the Committee), based on the work of its Embodied Energy Task Group (EETG). This task group was formed to identify opportunities to study the energy, pollution, and cost savings that may be achieved by reducing the embodied energy and carbon in federal building construction and renovation. Having identified the potential savings to be significant, the EETG has produced relevant and readily adoptable procurement recommendations that can help GSA encourage the specification and adoption of low embodied energy and low embodied carbon materials. This report of the EETG was accepted pending revisions by the full Committee at its Winter 2021 meeting on January 28, 2021.

Background

As noted by the Government Accountability Office (GAO), “the Federal Government’s fiscal exposure from climate change is on our High Risk List.” As global energy use and carbon emissions rise, every mitigation technique is to be considered as a means of reducing energy use and carbon emissions. According to the UN Environment 2017 Global Status Report, “Building Materials and Construction” currently constitutes the 4th largest source of global carbon emissions, at 11% of the global annual total. According to analysis by Architecture 2030, in the critical 2020 – 2030 period, construction and materials will be responsible for nearly 3/4 of

emissions from buildings constructed in this time period as operational emissions are projected to be correspondingly reduced.

State, municipal, and private sector procurement policies, such as Buy Clean California (adopted October 2017; see Appendix for more detail), have demonstrated how policy can effectively improve the availability and standardization of product-specific emissions data, and can set performance-based targets that allow a technology-agnostic, market-based approach for decarbonizing the industrial and building sectors. Manufacturers have responded by developing and marketing lower-energy and carbon products. Existing policy, in California and elsewhere, demonstrates that future federal policy could be feasible and beneficial.

Low carbon building design prioritizes material efficiency and building reuse, and thereby can reduce construction costs. Specifically, reducing energy used to produce building materials by 10% could generate additional supply chain cost savings of around \$13 million per year, for GSA construction projects alone. Building decarbonization requirements are becoming more common, leading to regulations that require the use of low energy and low carbon materials. Getting ahead of these policies now will protect GSA from the challenges and costs of transitioning in the future. Reducing greenhouse gas emissions has significant co-benefits, including reducing the incidence of health problems from particulate matter in such emissions. Reduction in greenhouse gas emissions from the application of the procurement guidelines described in this advice letter to GSA construction projects can result in health cost savings of approximately \$12 million per year (per GSA calculations). There are also resilience and climate-readiness benefits to decarbonization: reducing embodied energy and carbon will help reduce the long-term risks that climate change and related extreme weather events pose to some of GSA's most at-risk assets.

The United States federal government has an opportunity to lead the nation in sending a clear, consistent signal to the market, creating meaningful change. Federal procurement impacts are significant: approximately 32% of construction-related embodied energy and carbon in the United States is from public (government-funded) projects, and 46% of Portland cement produced in the United States is used on public projects. From 2009 to 2019, GSA had 487 building and construction projects that affected over 253 million gross square feet (GSF), with a total value of \$11.3 billion. If small changes affecting the embodied energy and carbon content of materials can be implemented, the energy and carbon savings, health benefits, and costs reductions can be substantial. GSA's large footprint - and the fact that other institutions follow its lead - provides a unique opportunity to mitigate carbon emissions and ultimately climate change.

Low carbon building design and construction is a key strategy for economic recovery. To date, materials markets have not adequately kept up with the demand for climate change solutions nor have they recognized the available savings; low embodied energy and low carbon materials have not yet been properly valued, nor have they achieved broad market penetration. However, global regulations and manufacturing are progressing quickly. Encouraging the rapid transition to clean domestic manufacturing can protect existing domestic manufacturing jobs and can

result in the creation of new jobs related to technology development and maintenance, environmental analysis, and skilled deconstruction of buildings for reuse.

Key policy recommendations to address embodied energy and carbon

1. A *material approach* for all projects requiring environmental product declarations for 75% of materials used (by cost or weight), and that their emissions fall in the best-performing 80 percent of global warming potential (GWP) among functionally equivalent products as demonstrated by environmental product declarations (EPDs). And
2. A *whole building life cycle assessment approach* for larger projects (over \$3.095M), requiring designing a building in such a way that life cycle carbon assessment shows that the selected design results in a 20% carbon reduction, compared to a baseline building.

In conclusion, the pursuit of low embodied energy and low carbon building materials will help address some of GSA's biggest challenges. Climate change risks can be partially mitigated, construction costs can be reduced, human health impacts can be lessened, and market failures can be corrected. The success of Buy Clean California provides hope and guidance as to how this can be done. GSA has a unique opportunity to leverage its national role and purchasing power to lead the nation, while reducing the climate impact of their building portfolio.

Thank you for your careful consideration of this package, and for the opportunity to recommend these important policies to GSA. On behalf of the Green Building Advisory Committee, I respectfully submit these recommendations for your consideration.

Sincerely,

David Kaneda, Chair
Green Building Advisory Committee

GBAC Members:

Victor Olgyay (Co-Chair)
Fernando Arias

Clay Nesler
Kent Peterson

Jane Rohde

Task Group Members, Observers, and Other Attendees:

Brendan Owens (Co-Chair)
Stacy Smedley
Jennifer Frey
Heather Goetsch
Theresa Blaine
Jenna Hamilton

Mark Thimons
Josh Kneifel
Kevin Carbonnier
Saif Sadeq
Steve Bruno
Elizabeth Beardsley
Scott Whiteford

Kate Simonen
Frances Yang
Dirk Kestner
Alison Kinn Bennett
Bruce King
Ryan Zizzo
Monica Huang

Meghan Lewis
Audrey Rempher
Dorothy Robyn

Matt Jungclaus
Erin McDade
Jennifer O'Connor

Betsy Dutrow
Monica Henn
Danny Macri

GSA Attendees:

Jed Ela
Michael Bloom
Don Horn

Lance Davis
Alex Rogers
Olivia Thorson

Rebecca Stevens
Walter Tersch

Proposed Low Embodied Carbon and Energy Procurement Policy

Introduction

This document represents the work and recommendations of the Embodied Energy Task Group (EETG), which is set up within the General Services Administration's Green Building Advisory Council (the Committee) to study the potential energy, carbon, and cost savings opportunities associated with reducing the greenhouse gas footprint of federal building construction and modernization. The EETG met every other week between February 2020 and September 2020. Its goal was to produce relevant and readily adoptable procurement recommendations to help GSA advance the specification of low embodied energy and carbon materials.

Mission Statement

The EETG studied the federal energy, pollution, and cost savings that may be achieved by reducing the energy and carbon embodied in building construction and materials. Implementation of low energy and carbon construction and building material strategies can save money and reduce carbon emissions. Additionally, the EETG aimed to correct the current market failure by addressing and promoting awareness of the need for low embodied energy and carbon building materials. It identified a unique opportunity for federal leadership by example.

State, municipal, and private sector procurement policies, such as Buy Clean California (adopted October 2017; see Appendix for more detail), have demonstrated how policy can effectively improve the availability and standardization of product-specific emissions data, and can set performance-based targets that allow a technology-agnostic, market-based approach for decarbonizing the industrial and building sectors. Manufacturers have responded by developing and marketing lower-energy and carbon products. Existing policy, in California and elsewhere, demonstrates that future federal policy could be feasible and beneficial.

Problem Statement

The global necessity to address climate change has never been more urgent. While the pandemic caused by COVID-19 requires equally urgent action that may temporarily dampen demand for new construction and momentarily pause the rise in global greenhouse gas emissions, building construction is likely to be a key piece of potential economic recovery plans in the United States. Emissions and energy use will continue to rise unless concerted effort is made to reduce the footprint of building construction. In addition, the pandemic has brought the critical link between human health and air quality into even better focus. Reduced usage of carbon-intensive modes of transportation quickly resulted in dramatically cleaner air in many areas. The same communities of color most impacted by COVID-19 are also often most directly impacted by industrial emissions in their neighborhoods, e.g. through higher rates of asthma. Reducing emissions from building material manufacturing is a key strategy for improving public health and environmental justice, especially for communities of color. As correlations between environmental emissions from energy and increased negative effects of COVID-19 induced

illness are revealed, it becomes clearer that emissions reduction strategies and improved public health are complementary.

To date, materials markets have not adequately kept up with the demands for climate change-mitigating products and solutions. Carbon emissions from construction materials currently make up 11% of global energy-related emissions. Construction material manufacturing emissions result from energy used during manufacturing, and the direct release of emissions as a result of chemical reactions during the production of materials like cement. Energy usage and carbon emissions are easily measured, yielding opportunities for managing and mitigating them. Given the size and reach of GSA's construction capabilities and its public building portfolio, there is an opportunity to significantly reduce global carbon emissions, while encouraging the market availability of lower-energy and lower-carbon materials.

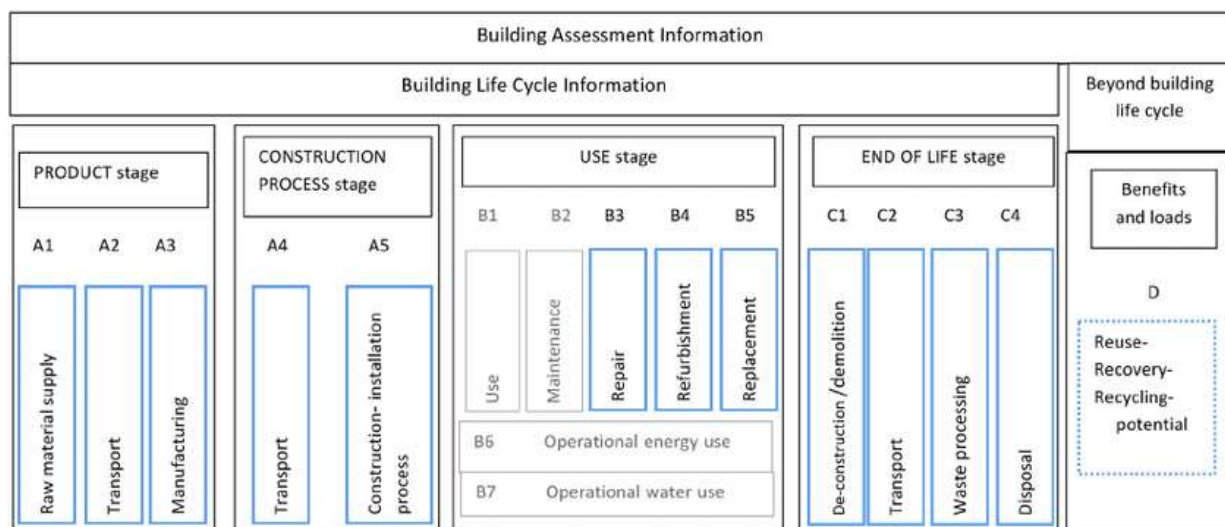
Moreover, low embodied energy and carbon materials may lead to cost savings. Reducing the energy and carbon embodied in construction can result in lower capital costs via reduction of materials used, more energy-efficient production, and prefabrication strategies, as well as lower life cycle impacts. To date, the market has not recognized these savings, as low embodied energy and carbon materials have not been properly valued to recognize their benefits, nor have they achieved broad market penetration.

The President's fiscal year (FY) 2019 Budget Request for GSA requested a total of \$2.2 billion for Construction and Acquisition, and for Repair and Alteration investments in GSA's owned inventory. This budget includes new construction as well as renovation. Even a carbon reduction of a few percent will result in substantial benefits in terms of cost savings, reduced energy use, and lower greenhouse gas (GHG) emissions (i.e. pollution) produced during the manufacture of materials. For example, an average of 10% annual reduction in embodied carbon on all GSA projects (including both new buildings and repair and alteration projects) would avoid approximately 185 thousand metric tons of carbon emissions. This savings is equivalent to constructing an additional building containing two million gross square feet of space.

Definition of Low Embodied Energy and Carbon Materials

Globally, the building construction and operation sectors account for nearly 40% of global energy-related carbon emissions (including the impacts of upstream power generation). Current building codes address energy buildings use to operate, but do not typically address the impacts 'embodied' in up-front building materials and products. As building operations become more efficient, these embodied impacts related to producing building materials become increasingly significant.

Figure 1. Definition of lifecycle stages in building construction and operations.



Source: Moncaster, Alice & Symons, Katie. (2013). A method and tool for 'cradle to grave' embodied energy and carbon impacts of UK buildings in compliance with the new TC350 standards. *Energy and Buildings*. 66. 514–523. 10.1016/j.enbuild.2013.07.046.

508 Compliance: A graphic showing the various stages of a whole building life cycle assessment and its respective boundaries. This includes the product, construction, use, and end of life stages.

Environmental Product Declarations (EPDs) are based on life cycle assessments that measure the environmental impacts of products throughout their life cycles. At a minimum, EPDs describe the “upfront carbon” associated with the production of materials, specifically stages A1-A3 (raw material supply, transport, and manufacturing) in figure 1 above. This is useful for comparing similar products and choosing based on lower cost and impact.

A Whole Building Life Cycle Assessment (WBLCA) typically includes operational energy use and captures the reduced impact from materials reuse and material efficiency strategies. This WBLCA approach therefore allows for a more inclusive analysis that will result in an overall lower environmental impact. The Committee recommends that GSA utilize EPDs (A1-A3) for

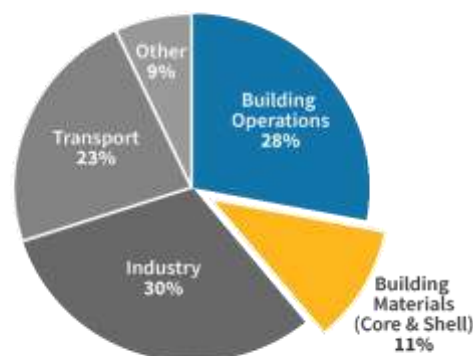
projects below the prospectus threshold (approximately \$3M), and utilize a WBLCA approach (A1-C4) for projects above the prospectus threshold.

Purpose of the Policy

This proposed policy is designed to encourage the use of low embodied energy and carbon construction materials and design principles in federal building projects, including use of energy-efficient new materials, use of salvaged or reclaimed materials, building reuse, and material-efficient design strategies. Research shows that these low embodied energy and carbon strategies can lower the overall cost of construction or renovation. An added benefit would be a shift in the product manufacturing and materials industries toward lower embodied energy and carbon technologies in supply chains, and a larger industry focus on carbon efficiency. Sourcing materials from manufacturing plants where carbon reduction has been achieved through energy efficiency and/or renewable energy use can reduce stress on electric grids and promote further innovation and adoption of renewable energy technologies.

Furthermore, the policy promotes the creation and facilitation of an economically beneficial commercial reuse market. Building removal through demolition or deconstruction is a source of salvaged and reclaimed materials or products that can reduce the embodied carbon impacts of building material selection. The greenest material is the one that is already made. Lastly, the policy seeks to motivate the manufacturing, design, and construction markets, to provide and specify more low embodied energy and low carbon materials while increasing transparency by disclosing the embodied energy and carbon content of materials.

Figure 2. Global Energy-Related CO₂ Emissions by Sector



Adapted from the UNEP 2019 Global Status Report

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Source: Carbon Leadership Forum: The Carbon Challenge. (2020, December 26). Retrieved February 16, 2021, from <https://carbonleadershipforum.org/the-carbon-challenge/>

508 Compliance: A pie chart that highlights the importance of building materials as they relate to other sources of emissions.

This important issue was appropriate for GSA’s Green Building Advisory Committee to address. With GSA’s purchasing volumes, the Federal Government has an opportunity to correct this market failure. Using Carbon Leadership Forum data as a guide, a reduction target aimed at the

80th percentile provides a potential savings of 296 kg CO₂e/m². Applying this savings to GSA's average of 2.14M m² (23M GSF) in annual construction would yield annual energy savings equivalent to 72,000 homes' annual energy usage, with annual carbon savings of 633 million kg CO₂e.

These benefits of low embodied energy and carbon materials are aligned with the intent of the Energy Independence and Security Act of 2007 (EISA), and - as detailed in the following section - the benefits are likely to outweigh costs. Adopting a low embodied energy and carbon policy within GSA is likely to be return on investment (ROI) positive, continuing to save money as the program expands its impact.

Benefits of Reducing Embodied Carbon and Energy

Low energy and carbon options are price-competitive compared to higher embodied energy and carbon options. Lower embodied energy and carbon materials can be produced in more efficient factories with lower production costs (e.g. lower energy use), which can then be passed on to consumers. Those consumers such as building owners can generate further cost savings by reducing the quantities of materials used. In conditions where material savings are achieved through prefabrication of building components, these processes can result in substantially quicker construction timelines and lower total project costs, by supporting earlier start of occupancy or operations within a building or space, and a reduction of the cost of contractual general conditions. Reducing energy use in the production of building materials by 10% could generate supply chain cost savings of around \$13 million per year for GSA construction projects alone. Additionally, reducing greenhouse gas (GHG) emissions also reduces the incidence of health problems from particulate matter (PM) in these emissions, resulting in health cost savings of approximately \$12 million per year from GSA Projects alone.

Reducing energy use and switching to cleaner energy sources are the first steps to reducing carbon and other emissions related to building material manufacturing. Combusting less fuel onsite to produce a product results in lower emissions and using less electrical energy reduces emissions from the power being generated offsite. Reducing energy used in industrial plants correspondingly reduces the power demand on the electrical grid. This can boost grid resiliency and reliability, mitigate the need for bringing additional power plants online during peak demand periods, and reduce the amount of additional energy sources that need to be deployed to achieve a more carbon neutral grid.

Designing a building to extend its useful life and facilitate deconstruction/disassembly and reuse when the building is renovated or replaced reduces embodied energy and carbon by reducing overall material demand, and providing economic and environmental benefits for builders, owners, occupants, and communities. Selecting salvaged and reused building materials can also reduce the embodied carbon impacts of a building or tenant improvement. Expanding the market for salvaged and reused building materials also creates job opportunities for skilled deconstruction of existing buildings, which is a growing field that contributes substantially more economic vitality than simply landfilling demolition materials.

Building decarbonization requirements are becoming more common, leading to regulations that require the use of low carbon materials and design strategies. Green building certifications and reporting structures (such as LEED and Green Globes certification, currently required on GSA projects) increasingly look at materials as part of their requirements. Adopting policies now will provide a proactive, leadership approach by GSA to incorporate these strategies.

Reducing embodied energy and carbon can ultimately help reduce the long-term impacts of climate change on some of GSA's most at-risk assets. GSA's coastal assets (including those in South Florida, Puerto Rico, or St. Croix) may need higher maintenance budgets, climate adaptation/ resilience upgrades, and/or need to be abandoned and replaced due to rising sea levels and increasing extreme weather events. Some of these facilities have already been subject to heavy storm and/or flood damages and have faced early consequences of climate change. While the value of mitigating climate change is hard to specifically quantify, it is clear that climate change has already and will continue to cause damage to some of GSA's more at-risk facilities, due to disruptive events such as hurricanes and wildfires.

In general, these benefits can be achieved with little to no additional cost beyond a minimal amount of administrative time to ensure specification and bid documents include embodied energy and carbon criteria and proper contract administration by contracting officer's representatives. By reducing energy use and decreasing emissions, an embodied energy and carbon policy would help advance federal energy and environmental goals, as well as the industrial innovation and competitiveness of product manufacturers within the United States.

Alignment with Existing Federal Policy and Systems

This proposed low embodied energy and carbon policy attempts to align with existing federal policy and systems. The primary directives this policy follows are: Energy Independence & Security Act of 2007 (EISA), Energy Policy Act of 2005 (EPAAct), and Executive Order 13834: Efficient Federal Operations. Similarly, there are statutory requirements such as the Comprehensive Procurement Guidelines and BioPreferred/Federal Purchasing, as well as a mandate through the National Technology Transfer and Advancement Act (NTTAA) to use private sector standards in lieu of government-unique standards to meet policy and procurement needs.

The [EPA's Recommendations of Specifications, Standards, and Ecolabels](#) identify private sector performance standards and ecolabels for federal purchasers in a number of product categories. EPA could assess and recommend environmental performance standards and/or ecolabels for steel and other product categories which include criteria incentivizing low embodied energy, and federal purchasers could then require use of products conformant to these standards in construction contracts, as an additional approach to help federal and other purchasers identify and use low embodied energy building materials.

Additionally, the recommendations in this document would be relatively simple to adopt into current GSA procurement standards, because they are similar to existing requirements in the GSA's P100 Facilities Standards for the Public Buildings Service, such as those regarding energy targets, accessibility, or waste diversion. These policies on embodied carbon would simply be an expansion of GSA's current suite of procurement standards, and therefore the implementation approach would be similar to that of existing standards and policies.

Criteria for Guidelines

The task group recommended an approach to the adoption of guidelines based on the following criteria:

- Easy to rapidly adopt
- Effective in securing significant value for GSA and the public (low cost materials, better performing materials)
- Incorporates automaticity (thresholds are defined with reference to current market conditions to drive continued improvement without updates to policy)
- Non-controversial, non-partisan
- Easy, simple, understandable
- Compatible with existing Federal/GSA/industry systems and processes
- Easy to use
- Reflects consideration of other human and environmental health impacts, externalities, and trade-offs (e.g., chemicals of concern)

Policy Recommendations for Procurement of Low Embodied Energy and Carbon Materials and Products

Recommendation 1: Material Approach for Below-Prospectus Projects and Tenant Improvements in Leased Space

Applicable types of projects:

- Projects costing less than the total prospectus value for construction/alteration projects based on the year they are funded (\$3.095M for FY 2020) and;
- Tenant improvement fit-outs in leased space, to the greatest extent possible

The committee recommends that GSA require contractors to demonstrate that 75% of those new project materials (by estimated dollar value or weight) included in the list below have a third party certified environmental product declaration (EPD). Where product-specific EPDs are available, the global warming potential (GWP) of the material installed must be in the best-performing 80% of functionally equivalent products based on values calculated from in a publicly-available EPD database. The utilization of publicly-available databases, such as the Embodied Carbon Construction Calculator (EC3) tool by Building Transparency, will enable these tools to grow and improve their value they provide for both GSA and beyond.

At the time of implementation, Industry Wide (or Industry Average) EPDs can be used for evaluation of products where product specific EPDs are not available. Three years after the date of implementation, EPDs must be facility or product specific, ISO 14025:2006 Type III compliant or developed using similarly robust LCA methods that are documented as part of the EPD reporting.

Design to reduce the need for additional products, and to minimize necessary materials, is encouraged. Where possible, product reuse (salvaged products) is highly encouraged, as these products do not create new emissions (low/zero additional GWP) and can be considered zero embodied carbon for this analysis. This does not include new materials with recycled content. EPDs are not required for salvaged or reused materials/products even if these materials are included in the 75% (by estimated dollar value and/or weight) above.

Since the GHG emissions from processing raw materials into a manufactured product is significantly connected to the energy intensity of the manufacturing process, which may not always be adequately represented in an EPD in cases where industry averages or proxies are used, the energy intensity of the manufacturing process must also be considered. Metrics for determining suitability of these products for use in federal projects must consider a measure of the reduction of the energy-related carbon impacts at the manufacturing plant.

In addition to EPDs, for the categories of glass, steel and concrete or other materials where an [ENERGY STAR plant Energy Performance Score can be provided](#), the input steel, glass,

cement, or other material are encouraged to be produced in a manufacturing plant that has supplied a professional engineer-verified and EPA-validated ENERGY STAR Energy Performance Score at the time of purchase.

Preference will be given to products using cement, steel or glass manufactured in plants where a minimum score of 50 or higher using the ENERGY STAR plant energy performance scoring system can be verified.

Each score shall be produced within the year of the bid, verified by a licensed, professional engineer (PE), recorded on a PE-stamped Statement of Energy Performance produced using the ENERGY STAR system, and reported to EPA for recording in an annual, public registry of eligible plants scoring 50 or higher. EPA will randomly audit a subset of these Statements of Energy Performance annually.

The committee recommends the following applicable product categories, which together represent the vast majority of energy and carbon impacts in typical projects. Contractors may include additional products within 75% of new materials if sufficient EPD information is available.

- a. Concrete (ReadyMix, Shotcrete, Slurry, Paving, Precast Concrete, Grouting)
- b. Steel (Rebar, Plate Steel, Hot-Rolled Structural Steel, Hollow Structural Steel, Cold Formed Steel, Steel Decking)
- c. Wood (Prefabricated Wood Products, Trusses, I-Joists, Unfinished, Dimensional Lumber, Wood Framing, Wood Decking, Plywood and OSB Sheathing Panels, Composite Lumber, Mass Timber, Non-Structural Wood)
- d. Aluminum (Structural Aluminum Framing)
- e. Thermal/Moisture Protection (Dampproofing and Waterproofing)
- f. Insulation (Membrane, Board, Blanket, Blanket Facing, Foamed-In-Place, Blown, Sprayed, Mechanical Insulation)
- g. Weather Barriers (Membrane Roofing, Applied Fireproofing)
- h. Cladding (Stone Cladding, Insulated Roof Panels, Wall Panels, Insulated Wall Panels)
- i. Openings (Storefronts, Curtain Walls, Glazing, Doors and Frames, Glass Panes)
- j. Ceiling Tile (Acoustic Ceiling, Steel Suspension Assemblies)
- k. Finishes (Backing and Underlay, Gypsum Board, Tiling)
- l. Flooring (Resilient Tile, Composition Cork Tile, Polymeric Tile, Linoleum Tile, Rigid Core LVT, VCT, Luxury Vinyl Tile, Rubber Tile, linoleum Sheet, Vinyl Sheet, Rubber Sheet, Carpet)
- m. Data Cabling
- n. Wallcovering (Paints, Stains)
- o. PETG, Acrylics, Decorative Panels
- p. Asphalt (Roofing Tar, Pavement)
- q. Aggregates
- r. Stone and Masonry (Mortar, CMU)
- s. Furniture
- t. MEP/HVAC systems

Recommendation 2: Material and Whole Building Life Cycle Assessment Approach for Prospectus-Level Projects

Applicable types of projects:

- Projects costing more than the total prospectus value for construction/alteration projects based on the year they are funded (\$3.095M for FY 2020) that are not limited to tenant improvement fit-outs

The committee recommends that GSA require in addition to the requirements for Path 1: Material Approach, the project team will perform a whole building life cycle assessment (WBLCA) of the project's structure and enclosure. Additionally, to further support the creation, development, and furthered use of WBLCA databases, the project team must, if possible, submit the results to a publicly-available database, such as the American Institute of Architects Design Data Exchange (AIA DDX), the Structural Engineers 2050 Commitment Program (SE2050), LEED or Green Globes databases, or the Federal LCA Commons.

The project WBLCA will meet the requirements of the WBLCA option in [LEED Building Design & Construction v4.1 Building Life-Cycle Impact Reduction Credit](#) (Path 4, demonstrating at least a 20% reduction in GWP) OR [ANSI/GBI 01-2019](#) Green Globes Assessment Protocol for Commercial Buildings (Green Globes NC 2019): Whole Building Life Cycle Assessment (ANSI/GBI #10.1, [Green Globes NC 2019](#) #5.1) (demonstrating at least 20% reduction in GWP). In cases where the project is not seeking either LEED or Green Globes certification, the WBLCA must be verified by a third party.

Where possible, material reuse (salvaged material) is strongly encouraged, as these materials can be designated to have low/zero GWP.

Conclusions

The goal of these recommendations is to encourage the production and specification of materials and products with low embodied energy and carbon emissions across GSA's building portfolio, to mitigate cost and climate issues and risks, while demonstrating leadership. The next steps would include: 1) Establish baseline data for GSA building types that can be referenced by the building, design, and construction industry to develop WBLCA comparisons. and 2) Use EPDs as part of the Materials Approach, foster the understanding that evaluation of products is based upon performance, application, and embodied energy and carbon. Apply updated specifications to meet the Owner's Project Requirements (OPR) established during the programming and planning stage of the GSA project being completed.

Next steps

For Recommendation 1: Material Approach for Below-Prospectus Projects and Tenant Improvements in Leased Space

After 3 years, GSA should evaluate this recommendation as follows.

- a. Gradually decrease embodied energy and carbon material specific thresholds to net-zero GWP by 2050 (make the threshold more stringent to select better materials).
- b. Review and lower carbon material specific thresholds (where feasible) at least every three years.
 - i. Note: As the embodied energy and carbon caps are based on industry average GWP values, they should decrease naturally as industry responds to market signals that advantage lower GWP materials and more product specific EPDs that utilize the same PCR and product life cycle framework become available. However, depending on market progress, GSA may wish to consider adjusting the 80% threshold for products to be more selective in the future, as needed to keep pace toward the IPCC recognized goal of net-zero emissions by 2050. Do not adjust embodied energy and carbon caps upward.

GSA could consider providing preferential procurement for materials that have a GWP value below the embodied carbon cap, to encourage aggressive embodied carbon reductions. This could be accomplished by selecting materials based on a combination of their price and their embodied carbon value, such as by preferring products in the best 20th percentile of the range of GWP data collected from EPDs in the previous two years, making low carbon a source selection criteria, or by applying a discount rate onto the price of the lowest-carbon bids.

For Recommendation 2: Material and Whole Building Life Cycle Assessment Approach for Prospectus-Level Projects

In addition to the 20% reduction against a project specific baseline defined by the user, GSA should aim to set a GWP cap, defined as the maximum global warming potential (GWP) value per floor area (i.e. kg CO₂e/sf), for projects by 2025.

This goal can be achieved by supporting publicly-available databases of material quantities and embodied energy and carbon in order for the building industry to develop GWP caps per project type and location such that one could set objective targets such as:

- a. The GWP result from the WBLCA must not exceed the GWP cap for the project building type as indicated by the GSA baseline building information provided publicly.
- b. Under LEED and Green Globes, the GWP cap values can be determined using baseline buildings for different GSA building types. GSA could establish baseline GWP cap

values representative of typical GSA building types (e.g. office building, courthouse, land port of entry, lab, data center), providing a baseline for the architectural design industry to utilize for reference.

- c. Lower GWP caps over time. For example, the GWP caps could be lowered based on the 90th percentile of the data reported, or the GWP caps could be lowered to achieve net-zero by 2050.
- d. GSA may offer rewards or incentives for projects with GWP results significantly below the GWP cap, to encourage aggressive embodied carbon reductions.

Finally, GSA is requested to work with EPA, DOT, and other agencies to identify and implement additional methods for ensuring low carbon building materials are properly used and installed.

Appendix: Existing Policies, Resources, and Case Studies

Material-Specific Case Study: Buy Clean

An example of a material-specific embodied energy and carbon policy is Buy Clean. Buy Clean is a policy strategy that focuses on procuring lower-embodied carbon materials in government construction projects. The first American iteration of Buy Clean legislation was passed into law by the State of California in October 2017, limiting state procurement of certain materials to lower energy and embodied carbon options by 2021. A version of Buy Clean was also introduced in the Oregon State legislature in 2017, Washington in 2018, Minnesota in 2019, and Colorado in 2020, but these have not been passed into law. New variations of Buy Clean-like procurement legislation are being considered or introduced in New York, Washington, Oregon, and other states going into 2021. Municipal government agencies have also expressed interest in adopting procurement policies, such as the lower-embodied carbon concrete procurement requirements adopted in Portland and Marin County (San Francisco). The spread of Buy Clean in its various forms is a sign that this is a promising policy strategy for reducing embodied carbon in government procurement of materials and products.

More information about past iterations of material-specific Buy Clean policy is listed below:

- Buy Clean California
 - [AB 262](#) (original bill, passed)
 - [Buy Clean California Act \[3500 - 3505\]](#) (includes amendments)
- Buy Clean Washington
 - [HB 2412](#) (not passed, revised bill draft under development)
 - [Buy Clean Washington Report](#) prepared by the Carbon Leadership Forum for the State of Washington
- Buy Clean Minnesota
 - [HR 2204](#) (not passed)

- Buy Clean Colorado
 - [SB 20-159](#) (not passed)
- Federal Buy Clean
 - [S.1864](#) (introduced in the 2019-2020 session)
- New York State Low Embodied Carbon Concrete Leadership Act
 - [A08617](#)
- City of Portland Low-Carbon Concrete Purchasing (introduced in 2019)
 - [Requirements for Portland Cement Concrete \(PCC\)](#)
- Bay Area Low-Carbon Concrete Codes Project
 - [Marin County Code \(adopted November 2019\)](#)

Whole Building LCA Case Study: Helen Sommers Building

An example of how a whole building LCA resulted in significant embodied energy and carbon reductions in a government building is the Helen Sommers Building in Washington State. This building achieved significant embodied carbon reductions by combining WBLCA with a Buy Clean procurement strategy. As a part of the overall sustainability strategy, the design-builder focused on reducing the embodied impacts by requiring concrete suppliers to provide publicly-available EPDs. This requirement was considered early in the design process, which allowed for planning and budgeting on behalf of the builders and low energy and carbon concrete mix development on behalf of the concrete suppliers. This strategy served to:

1. Signal to concrete producers that creating low energy and carbon mixes and EPDs were required in order to participate in this project.
2. Provide evidence of the low energy and carbon material decisions made during procurement.
3. Help shift the state's concrete industry towards more transparency.

As a result of this strategy, minor changes to the concrete mixes and curing times resulted in a 31% reduction in the project's concrete-related embodied energy and carbon with minimal impact on schedule or material cost. This resulted in an overall reduction of 15% of the total embodied energy and carbon of the building. [More information and pictures.](#)

Additional WBLCA Case study links:

- [HDR Carbon Balance](#)
- [Life Cycle Assessment of Residential Buildings](#)
- [Brookfield Properties Mass Timber Project](#)
- [Microsoft's Silicon Valley campus: Sustainably built employee design](#)

Additional resources

Guides and Reports

- [LCA Practice Guide](#)
- [Embodied Carbon Benchmarking Study](#)

- [Carbon Leadership Forum Online community forum](#)
- [Bringing embodied carbon upfront](#)
- [How to calculate embodied carbon](#) by UK Institution of Structural Engineers
- [City Policy Framework for Dramatically Reducing Embodied Carbon](#) - Carbon Neutral Cities Alliance (CNCA), One Click LCA, Architecture 2030
- [Top 10 Steps to Reducing Embodied Carbon](#) - American Institute of Architects (AIA)
- [Carbon Smart Materials Palette](#) - Architecture 2030

Standards

- [LEED v4.1 Guides](#)
- [Green Globes® for New Construction 2019 Technical Reference Manual](#)
- [ANSI/GBI 01-2019 Green Globes® Assessment Protocol for Commercial Buildings](#)
- [ASTM E2921-13 Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes and Rating Systems](#)

LCA Tools and Calculators

- [The Athena Impact Estimator for Buildings](#)
- [Tally®](#), LCA app that lets you calculate the environmental impacts of your building material selections
- [One Click LCA](#), One stop Carbon and Life-cycle Metrics Software made for construction.
- [EC3 Tool](#), The Embodied Carbon in Construction Calculator (EC3) tool, is a tool that allows benchmarking, assessment and reductions in embodied carbon per material category, focused on supply chain emissions of construction materials.

Abbreviations

- ANSI - American National Standards Institute, a private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel
- ASTM - American Society for Testing and Materials, an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services
- EISA 2007 - Energy Independence and Security Act of 2007, an Act of Congress concerning the energy policy of the United States
- EPA - Environmental Protection Agency, an independent executive agency of the United States Federal Government tasked with environmental protection matters
- EPAct 2005 - The Energy Policy Act of 2005, an Act of Congress to combat growing energy problems by changing US energy policy by providing tax incentives and loan guarantees for energy production of various types
- GAO - Government Accountability Office, a legislative branch government agency that provides auditing, evaluation, and investigative services for the United States Congress
- GBAC - Green Building Advisory Committee, provides independent policy advice and recommendations to GSA's Office of Federal High-Performance Buildings, as required

by the Energy Independence and Security Act of 2007 (EISA), to advance federal building innovations in planning, design, and operations to reduce costs, enable agency missions, enhance human health and performance, and minimize environmental impacts

- GBI - Green Building Initiative, a 501 nonprofit organization that owns and administers the Green Globes green building assessment and certification in the United States and Canada
- GHG - Greenhouse Gas, a gas that absorbs and emits radiant energy within the thermal infrared range
- GSA - General Services Administration, an independent agency of the United States government established in 1949 to help manage and support the basic functioning of federal agencies
- GWP - Global Warming Potential, the heat absorbed by any greenhouse gas in the atmosphere as a multiple of the heat that would be absorbed by the same mass of carbon dioxide
- LCA - Life Cycle Assessment, a multi-step procedure for calculating the lifetime environmental impact of a product or service
- LCC - Life Cycle Costing, a life cycle approach but it looks at the direct monetary costs involved with a product or service and not environmental impact
- LCI - Life Cycle Inventory, the data collection portion of LCA
- LCIA - Life Cycle Impact Assessment, the “what does it mean” step
- LEED - Leadership in Energy and Environmental Design, a green building certification program used worldwide
- NTTAA - National Technology Transfer and Advancement Act, the Act amended several existing acts and mandated new directions for federal agencies with the purpose of: bringing technology and industrial innovation to market more quickly, encouraging cooperative research and development between business and the Federal Government by providing access to federal laboratories, making it easier for businesses to obtain exclusive licenses to technology and inventions that result from cooperative research with the Federal Government
- P100 - Facilities Standards for the Public Buildings Service (P-100), establishes design standards and performance criteria for GSA’s Public Buildings Service. This document contains policy and technical criteria to be used in the programming, design, and documentation of GSA buildings
- PM - Particulate Matter, microscopic particles of solid or liquid matter suspended in the air
- WBLCA - Whole Building Life Cycle Analysis - LCA is a long-established, credible, multi-criteria method for the transparent evaluation of a wide range of goods and services. The comparison of whole building LCA results and of individual impact parameters, for each design alternative between baseline and proposed building design, can guide teams in achieving the goal of sustainable design,