

USGBC Issue Brief #1: Building Decarbonization



What it is:

“Decarbonization” has become a short-hand way to talk about the process of getting GHG emissions out of the economy, since carbon dioxide (CO₂) dominates the GHGs.ⁱ **Building decarbonization** refers to plans, policies, and actions to achieve deep reductions in the building sector’s GHG emissions— totaling a whopping 31% of energy-related CO₂ emissions, both globally and in the U.S.ⁱⁱ

At the **building and portfolio scales**, decarbonization starts with well- insulated envelopes and high efficiency systems to reduce energy needs, and then meets those needs with low carbon sources (such as renewable energy) from onsite, grid, or purchase. Buildings can further reduce **operational carbon** with grid integration and demand response, smart technology, and energy and thermal storage; as well as reducing indoor and outdoor water needs and all forms of waste. Decarbonizing buildings also means addressing the **embodied carbon** in materials,ⁱⁱⁱ including initial construction and renovations, and **emissions from construction** site activity and equipment.

At the **community and policy scale**, building decarbonization efforts encompass a range of scopes and approaches. Climate action plans with robust building sector strategies can set the stage for decarbonization actions and policies. Leading building decarbonization strategies are **data-based** through modeling and use of building data, and **place-based** to reflect local priorities, needs, and equity considerations. Driven by goals, actions to decarbonize buildings typically involve policies and investments in deep energy efficiency, beneficial electrification, and renewable energy and storage, and ideally peak demand reductions. Policy approaches to decarbonize construction and materials are emerging (see discussion below). Some jurisdictions’ approaches aiming to achieve “net-zero carbon” or “carbon-positive” buildings may involve carbon offsets and binding carbon in construction materials.^{iv}

Why it matters:

In the latest Intergovernmental Panel on Climate Change (IPCC) report, the world’s top climate scientists warned that we are running out of time to avoid the worst impacts of climate change, and called for “immediate and deep emissions reductions across all sectors.”^v The IPCC offers some cautiously optimistic findings regarding actionable solutions and finds that there is a “brief and rapidly closing window of opportunity” to reverse course. As IPCC chair Hoesung Lee stated, “We are at a crossroads. The decisions we make now can secure a livable future.”^{vi}

This reality is driving 1.5° aligned goals and commitments from governments and corporations around the globe. Many states and cities are pledging to achieve climate neutrality by 2050. For the private sector, commitment platforms — such as the Science Based Target Initiative’s Net Zero Standard, the Climate Pledge, and the Net Zero Asset Owner Alliance — are growing and driving companies to announce Paris-aligned goals.^{vii} And, stemming from the recommendations of the Task Force on Climate-Related Financial Disclosures, financial regulators in a growing list of countries are putting in place requirements that will push public companies to increase transparency as they work towards implementing these goals.^{viii}

USGBC’s Issue Briefs explain current trends in buildings policy and technology with a focus on decarbonization, sustainability, and health. This brief explains what building decarbonization is about, how LEED supports decarbonization, and key policies.



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We can't meet the urgent climate goals without addressing new and existing buildings. Currently, buildings are responsible for an estimated 25.5% of global energy-related CO₂ emissions including direct (from onsite consumption of fossil fuel for heating and cooling) and indirect (fossil fuel-based electricity) energy consumption, comprising the majority of buildings' operational CO₂ emissions. A building's construction phase involves both construction site emissions and embodied carbon in materials and products, with cement and steel emissions alone estimated at 5.6%. Together, buildings and construction account for at least 31% of energy-related CO₂ emissions globally.^{ix}

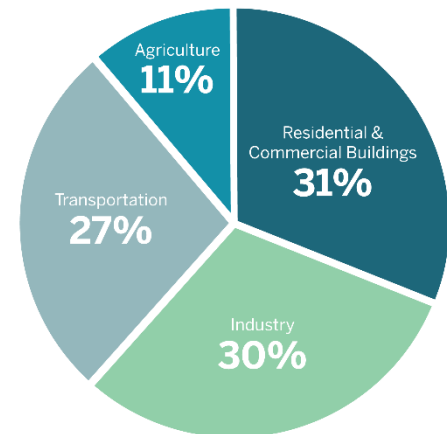
Decarbonization of the buildings sector *is* possible: the IPCC found that up to 61% of global building emissions could be mitigated by 2050 if policy packages are effectively implemented and barriers to decarbonization are removed.^x These reductions were projected to come from *energy efficiency policies* at 42%, *policies that avoid demand for energy and materials* (so-called "sufficiency" policies) at 10%, and *renewable energy* at 9%. This underscores the necessity of incorporating efficiency and clean energy into building decarbonization actions and policies. The IPCC concluded that "the 2020-2030 decade is critical for accelerating the learning of know-how, building the technical and institutional capacity, setting the appropriate governance structures, ensuring the flow of finance, and in developing the skills needed to fully capture the mitigation potential of buildings."^{xi}

Nexus with LEED:

For over a decade, LEED has aimed to reduce the GHG pollution of buildings. As part of the rigorous cycle of continuous improvement and evolution, USGBC is currently working with our volunteers and committees to take big steps forward with the next version of LEED. We understand this is the time for "**sweeping change**," and we intend to address all opportunities for reducing carbon emissions, including operational carbon, embodied carbon, refrigerants, electric mobility options, and carbon sequestration.

Project teams working to decarbonize a project can apply LEED as a holistic framework, helping not only to develop an integrated approach for climate, but also to ensure baseline consideration of health, clean water, and other important outcomes. To emphasize decarbonization results, aim for Gold or Platinum levels while maximizing EA points to go deeper on energy efficiency, implement grid optimization to reduce contributing to peak demand and its typical higher GHG intensity, and use renewable energy credits. With the v4.1 Energy Optimization credit, LEED adds the metric of GHG emission improvement with the intent to push all projects towards decarbonization.^{xii} Projects should also utilize key credits supporting low-carbon outcomes such as the whole building life cycle analysis credit; and those that reduce non-energy sources of carbon emissions, including water, materials use, building-related transportation, and waste generation. Bringing projects into LEED EB:O+M and pushing operational performance is critical and drives

U.S. Greenhouse Gas Emissions by Sector



Source: All emission estimates from the EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020. Percentages may not add up to 100% due to independent rounding.



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outcomes. For example, a University of California at Berkeley study of the GHG reductions from non-energy categories for LEED-certified existing buildings in the state, finding the LEED certified buildings were associated with 50% less GHGs from water use, 48% less GHGs from solid waste, and 5% less GHGs from transportation. Learn more from our brief, “How green buildings can support climate mitigation.”^{xiii}

To go further, LEED Zero recognizes buildings that demonstrate net-zero carbon operations through one year’s data. Jurisdictions can use LEED and LEED Zero with directed credits and levels as a component of decarbonization policies.

USGBC Policy Position:

USGBC supports building decarbonization policies at the local, state and Federal level. Policies that aim to decarbonize building operations include a suite of policy mechanisms focused on energy-related GHG emissions: energy efficiency standards in codes and incentives; building energy benchmarking; building performance mandates; incentives and code pathways for low net zero green buildings; beneficial electrification; public building leadership policies; requirements and incentives for building-grid integration, demand response, and peak demand reduction; renewable energy and solar-ready requirements and incentives; and policies targeting workforce development, utility programs, and other market forces.

For embodied carbon in materials, emerging policies have focused on public procurement by specifying GHG intensity of key construction materials, and requiring Environmental Product Declarations for products and materials;^{xiv} we support multi-attribute approaches to consider human and environmental health, as well as GHG emissions. Beyond energy-related emissions, policies for refrigerant replacement and management can help reduce potent GHG releases; policies requiring or incentivizing green roofs, walls, and sites can absorb CO₂ and reduce other air pollutants;^{xv} and regulations to reduce wastes, including C&D waste, and to increase reuse, recycling, and composting, are important to address lifecycle GHGs.

Three things to know:

Decarbonizing buildings, including operations and construction phases, is essential to meet our collective climate goals.

Building decarbonization policies provide the opportunity to address multiple priorities of the jurisdiction, such as improving health and equity, while reducing the GHG emissions from the building sector.

USGBC supports building decarbonization efforts and plays a role in informing and engaging our members, as well as advocating for strong and effective policies.

We actively engage in supporting and shaping policies across this spectrum.^{xvi} We advocate for clear, time-bound goals and targets, backed by specific policies that may include regulatory and non-regulatory approaches. Transparent tracking and accountability are critical to provide feedback loops and inform policy refinement. As jurisdictions develop policies to implement building decarbonization, we recommend that they consider integrating priorities beyond carbon reductions, such as public health, water resources, and others; often the best practices for these areas are complementary and also reduce associated carbon emissions. To learn more and receive updates, join our Advocacy Working Group.^{xvii}



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Opportunities and Challenges:

Recognizing Carbon Intensity – Understanding the true carbon emissions of a building requires factoring in the time-of-use of grid energy, because grid carbon intensity varies by minute and by season; yet the availability of granular data or factors to reflect time of use is still developing. Additionally, the relevant carbon intensity of power delivered to a building can be altered significantly through green fuel programs or renewable fuel subscriptions.

Construction phase and materials – Policies to address these components of construction-related emissions are evolving but typically embed lower-carbon materials incentives or standards into their procurement, often referred to as “Buy Clean” policies. Buy Clean policies aim to use government construction procurement for lower carbon building materials through incentives (by rewarding bids with such materials) or requirements (such as with carbon intensity standards). Some Jurisdictions – including a coalition of five western states and the Federal government -- are joining together to leverage their purchasing power in this way. Coalitions are also working on reducing construction site emissions including solutions like electric construction vehicles as well as materials.

End of Life –Part of a building’s life cycle footprint comes at the end of its life when it is demolished, creating construction and demolition (C&D) waste requiring transportation and disposal, typically landfill or incineration. Approaches to reduce end of life carbon impacts include deconstruction policies, C&D recycling requirements, and building material and product design and selection.

Additional Resources

Billimoria, Sherri, and Mike Henchen, RMI. *Regulatory Solutions for Building Decarbonization: Tools for Commissions and Other Government Agencies.* (2020) Available at <https://rmi.org/insight/regulatory-solutions-for-building-decarbonization/>.

Building Decarbonization Coalition. *A Roadmap to Decarbonize California Buildings.* (2019) Available at https://www.buildingdecarb.org/uploads/3/0/7/3/30734489/bdc_roadmap_2_12_19.pdf

Caputo, Samantha, Northeast Energy Efficiency Partnerships. *Building Decarbonization Public Policy Framework.* (2019) Available at: <https://neep.org/building-decarbonization-public-policy-framework>. This policy framework lays out a pathway for achieving building decarbonization. While focused on a dozen eastern states and the District of Columbia, the key policy approaches explained in the report have broader applicability.

Hausker, Karl, World Resources Institute. “Decarbonization Pathways to Meet Our Climate Imperative,” presented at NASEO Energy Policy Outlook conference (2022) (slide deck). Available at <https://energyoutlook.naseo.org/data/energymeetings/presentations/Hausker-Karl.pdf>. This presentation outlines the four IPCC pathways and the US strategy for decarbonization across the economy, key technologies, and risks.

Institute for Market Transformation (IMT). Building Performance Policy Center (online resource), available at <https://www.imt.org/public-policy/building-performance-policy-center/>



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Intergovernmental Panel on Climate Change (IPCC). Working Group III Contribution to the IPCC Sixth Assessment Report (AR6), *Climate Change 2022: Mitigation of Climate Change*, (2022), available at <https://www.ipcc.ch/report/ar6/wg3/>

New Buildings Institute. *Building Decarbonization Code v1.2* (2021). Available at <https://newbuildings.org/resource/building-decarbonization-code>

NYSERDA. Building Decarbonization Insights (webpage). Available at <https://www.nyserdera.ny.gov/All-Programs/Empire-Building-Challenge/Building-Decarbonization-Insights>

Ritchie, Hannah; Max Roser; and Pablo Rosado. "CO₂ and Greenhouse Gas Emissions," published online at OurWorldInData.org. Available at <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions> (2020) This online resource provides visualizations for various energy and climate data for individual countries and for the world.

United Nations Environment Programme (UNEP), *2021 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector* (2021), available at <https://globalabc.org/resources/publications/2021-global-status-report-buildings-and-construction>

U.S. Department of Energy. State and Local Energy Benchmarking and Disclosure Policy. Available at: <https://www.energy.gov/eere/slsc/state-and-local-energy-benchmarking-and-disclosure-policy>. This page includes resources for state and local governments interested in creating building benchmarking policies.

U.S. Environmental Protection Agency (EPA). Energy Star Portfolio Manager Building Emissions Calculator. Available at https://www.energystar.gov/buildings/resources_topic/portfolio_manager_building_emissions_calculator. This free tool is integrated with ENERGY STAR Portfolio Manager to estimate energy-based GHG emissions for a single building, a set of buildings, or a portfolio of buildings. The tool can calculate GHG emissions using national, regional, supplier-provider, or locality-specified factors.

U.S. Green Building Council (USGBC). An Introduction to LEED Zero: Getting to LEED Zero Energy and LEED Zero Carbon. 2021. Available at <https://www.usgbc.org/education/sessions/introduction-leed-zero-getting-leed-zero-energy-and-leed-zero-carbon-12849271> (free, on-demand course, view using free usgbc.org account)

USGBC's Issue Brief Series is a resource developed by the Advocacy & Policy Team to help inform the green building community on trending built environment topics. Each Issue Brief will provide an explanation of the topic, the relevance to USGBC and green building policy, the nexus with LEED, and curated resources to learn more.

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References:

- ⁱ See Intergovernmental Panel on Climate Change (IPCC), Working Group III Contribution to the IPCC Sixth Assessment Report (AR6), Climate Change 2022: Mitigation of Climate Change, Summary for Policymakers, p.SPM-6 (2022), available at <https://www.ipcc.ch/report/ar6/wg3/>; EPA, Overview of Greenhouse Gases (showing CO2 is 79% of US GHGs in 2020), available at <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>
- ⁱⁱ EPA, Greenhouse Gas Emissions by Electricity End-Use, available at <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>
- ⁱⁱⁱ Carbon Leadership Forum, Embodied Carbon 101 (2020), available at <https://carbonleadershipforum.org/embodied-carbon-101/>.
- ^{iv} McDonough, William. "Carbon is not the enemy". (2016) Nature News. 539: 349–351; Eillie Anzilotti, "Climate positive, carbon neutral, carbon negative: What do they mean?" in Fast Company (2018), available at <https://www.fastcompany.com/40583176/climate-positive-carbon-neutral-carbon-negative-what-do-they-mean>.
- ^v IPCC, Working Group III Contribution to the IPCC Sixth Assessment Report (AR6), Climate Change 2022: Mitigation of Climate Change, Chapter 9: Buildings (2022), available at <https://www.ipcc.ch/report/ar6/wg3/>
- ^{vi} Remarks by the IPCC Chair during the Press Conference presenting the Working Group III contribution to the Sixth Assessment Report (April 4, 2022), available at <https://www.ipcc.ch/2022/04/04/ipcc-remarks-wgiii-ar6-press-conference/>
- ^{vii} See UN Race to Zero Campaign, <https://unfccc.int/climate-action/race-to-zero-campaign#eq-4>; <https://sciencebasedtargets.org/net-zero> ; The Climate Pledge at <https://www.theclimatepledge.com/us/en>; The UN's Principles for Responsible Investment, Net Zero Asset Owner Alliance at <https://www.unepfi.org/net-zero-alliance/>
- ^{viii} U.S. Securities and Exchange Commission (SEC), "SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors," Press Release (March 21, 2022), available at <https://www.sec.gov/news/press-release/2022-46>, and links therein to proposed rule.
- ^{ix} IPCC, Ch. 9, section 9.3.1, page 9-15. See also UNEP, 2021 Global Status Report for Buildings and Construction (2021), available at <https://globalabc.org/resources/publications/2021-global-status-report-buildings-and-construction>
- ^x IPCC, Summary for Policymakers at SPM-40.
- ^{xi} IPCC, Summary for Policymakers at SPM-41; see also Chapter 9: Buildings.
- ^{xii} USGBC, LEED BD+C v4.1 [Optimize Energy Performance credit](https://www.usgbc.org/credits), available at <https://www.usgbc.org/credits>
- ^{xiii} USGBC, Taking the LEED: How Green Buildings can Support Climate Mitigation (2022), available at <https://www.usgbc.org/resources/how-green-buildings-can-support-climate-mitigation>
- ^{xiv} See Carbon Leadership Forum, Embodied Carbon Policy Toolkit, available at <https://carbonleadershipforum.org/clf-policy-toolkit/>.
- ^{xv} See, e.g., Lilauwala, Rohan, Green Infrastructure Foundation & Green Roofs for Healthy Cities, Designing for Maximum Energy and Climate Benefits of Green Roofs (2021) in Living Architecture Monitor, available at <https://livingarchitecturemonitor.com/articles/designing-for-maximum-energy-and-climate-benefits-of-green-roofs-and-walls-f21>.
- ^{xvi} See USGBC, "2021 in advocacy: Green building progress and policies," available at <https://www.usgbc.org/articles/2021-advocacy-green-building-progress-and-policies>;
- ^{xvii} USGBC, Join USGBC's Advocacy Working Group, available at <https://www.usgbc.org/articles/join-usgbcs-new-advocacy-working-group>.

