INTERNATIONAL CODE COUNCIL®

DECARBONIZATION OF THE BUILT ENVIRONMENT: SOLUTIONS FROM THE INTERNATIONAL CODE COUNCIL

INTRODUCTION

The Global Alliance for Buildings and Construction (GlobalABC) finds that 37 percent of global greenhouse gas (GHG) emissions are attributable to buildings during their design, construction, and operations. Governments and building industry organizations have recognized these impacts and set goals to reduce them. For example, the U.S. General Services Administration (GSA) has set maximum carbon targets for concrete and asphalt used in their projects. Eight of the largest cities in the U.S. including Los Angeles, New York City, Washington D.C., San Francisco, and Seattle, along with 20 other global cities have committed to maximize the reduction in operational and embodied carbon of buildings.[1]

Buy Clean programs to reduce the carbon impacts of construction materials have been established in Washington, Oregon, and Colorado, and a pilot project is underway in Minnesota. The Securities and Exchange Commission is undertaking a rulemaking to require publicly traded companies to disclose their carbon emissions including from their building assets.

As these programs gain momentum, consistency in how carbon is measured and evaluated will be essential to support the cost effective and efficient achievement of the targets set by governments, building owners and others. As the leading developer of model building codes and standards and the solutions that assist communities in achieving safe, resilient, and sustainable buildings, the International Code Council is committed to delivering tools to address the challenges and needs before the industry. Across the ICC Family of Solutions, existing and new initiatives are underway that help communities and the building industry achieve their decarbonization goals.

Decarbonization of the buildings sector is a very complex issue that touches almost every aspect of the design, construction, occupancy, and demolition process. Given the Code Council's unique position to address the entire building life cycle, the Code Council has an important role to play in addressing this challenge. Communities and the building industry need the tools to effectively implement and measure achievement of established goals.

Like many in the building industry, the Code Council is navigating this complexity, identifying our role and the solutions the Code Council can provide. Several initiatives are already underway, and others will emerge. This document outlines our current thinking on how the Code Council can support decarbonization initiatives, some of the open questions we are continuing to explore, and what steps we are taking to help answer these questions.

STRATEGY AND ROAD MAPPING

In March 2021, the ICC Board of Directors accepted and approved a new framework to advance energy efficiency and sustainability, *Leading the Way to Energy Efficiency: A Path Forward on Energy and Sustainability to Confront a Changing Climate*, in order to address significant feedback from members and stakeholders. Contained in the framework, the Board of Directors approved formation of an Energy and Carbon Advisory Council. The Advisory Council is made up of leaders from a broad cross-section of the economy who's policy and economic experience can inform our codes and standards development efforts and other activities. The Code Council will look to this group to provide insight into the activities and priorities developing outside our day-to-day work and how the Code Council can help deliver solutions to assist these initiatives.

The Advisory Council is positioned to provide recommendations to the Board of Directors on a wide spectrum of topics including priorities for the advancement of the International Energy Conservation Code (IECC), energy efficiency and GHG reduction resources, and other solutions that can help meet the individual goals and needs of governments, the building industry and other market actors including the finance sector. The first set of Advisory Council members was appointed by the Board of Directors in June with additional representatives to be named later this year.

1. Net Zero Carbon Buildings Commitment, https://www.worldgbc.org/thecommitment.

The Code Council staff is also undertaking an internal road mapping process to understand how our current solutions address identified needs and where there are opportunities to develop additional solutions. The road mapping will also take into consideration how the activity will be sustained financially. This approach will allow for a holistic and coordinated set of solutions that address the entire building life cycle. We have engaged one of the leading consulting firms in this space to assist this road mapping process.

Finally, we recognize that decarbonization of the built environment requires expertise and engagement from outside the Code Council. We are having discussions with other highly regarded organizations on how we can align our work to avoid duplication and potential confusion. We are also active globally to understand the strategies being considered and how efforts within the building industry interface with broader initiatives. As members of the GlobalABC we engage with building industry leaders in identifying approaches to reduce the impacts of buildings on climate change. We participate in the Framework Convention on Climate Change (FCCC) Conference of the Parties (COP) to share how codes, standards and other tools can support a decarbonized built environment and to help understand how other actors including governments, development banks, financial markets, carbon markets and others would leverage the actions undertaken in the built environment.

WHOLE LIFE CARBON

Decarbonizing the built environment requires a holistic approach that addresses all phases of the building process including the design, procurement, and construction process, materials used, building operations and deconstruction. Buildings and the materials used to construct them often must meet multiple performance goals including durability, fire safety, structural integrity, and sustainability. Designers and owners (and authorities having jurisdiction) need the tools to effectively weigh these performance requirements and the characteristics of different material choices to determine the optimum solution. For example, if a specific material has low embodied carbon but is not particularly durable it may need to be replaced more frequently than another material that may have a higher level of embodied carbon. Consistent approaches to measuring both embodied carbon and other important attributes across materials (and then the building as a whole) is required to make informed decisions. Additionally, some materials may have higher levels of embodied carbon but result in lower operational carbon emissions. Being able to make decisions based on the impacts of buildings across their life-cycle will result in the best outcomes.

The International Codes (I-Codes) currently provide significant guidance that influences the carbon impacts of buildings—although often not directly labeled as such. The resilience measures contained within the suite of I-Codes have contributed significantly to reducing the carbon impacts of buildings. Buildings that remain standing or sustain less damage in the face of a hazard do not need to be rebuilt and the GHGs embodied in those buildings continue to provide value. The lead investigator for the National Institute of Building Sciences (NIBS) Mitigation Saves study found that the 15,000 homes preserved per year due to use of current codes avoids 1.5 million metric tons of CO_2 emissions per year (equivalent to about 168 million gallons of gasoline or the annual emissions of 323,000 passenger vehicles). Structures consumed by fire (either inside or outside of the wildland urban interface) release significant amounts of carbon into the atmosphere. Constructing buildings to wildfire resistant codes has the equivalent value of preserving about 4,800 new homes and avoiding 500,000 metric tons of CO_2 emissions per year.

The International Green Construction Code (IgCC) provides a holistic approach to addressing sustainability—including through materials and energy efficiency and water conservation. The IgCC already includes measures in chapter 9 on the carbon impacts of materials and the use of environmental product declarations (EPDs) and life cycle analysis. Continuing to build out IgCC content to further a whole life approach will provide jurisdictions with a consensus-based code approach. The Code Council, working with IgCC's co-sponsors (ASHRAE, USGBC, and IES), will support adoption of the IgCC as a stretch code and a path for implementing a holistic approach to carbon.

This past January, the Code Council announced its intent to create an American National Standard to support the consistent measurement and verification of carbon in

construction, materials and operations of buildings. Such a standard would allow for designers and owners to balance carbon-related decisions across the building's life cycle. The standard would also support consistency in how governments, investors and others set targets and how the building industry can report compliance with those targets. The Code Council is engaging organizations both in the U.S. and internationally to assure the standards are broadly applicable and can support a global approach.

While the overall approach will focus across the building life cycle, such an approach relies on actions taken to address the carbon impacts of materials and the construction processes used and the energy used during building operations. Current activities and future considerations for initiatives in each of these areas is addressed below.

MATERIALS AND PROCESSES

The carbon impacts of the materials used in buildings is becoming an area of increased interest as the operational energy of buildings continues to decrease. As identified above, materials selected are based on a broad set of factors—including their performance in withstanding natural forces. Within the I-Codes, the performance requirements of materials is generally captured in the International Building Code (IBC) and International Residential Code (IRC).

Like other performance requirements, the expected levels of performance and the methods for verifying such performance should rely on a robust set of standards or protocols. Additionally, they should be easily verified by those responsible for enforcing the codes. The environmental performance requirements should also be considered in the context of the existing performance requirements in the codes and in a manner that is consistent across materials providing similar function. The standard on measurement and verification will help support consistency across materials, but additional work will be needed to navigate the relationship with other performance requirements and the level of detail necessary for effective implementation.

Given the diversity of approaches and timelines being pursued by governments; the lack of standards to support consistent measurement and verification of results; and the knowledge gap among designers, manufacturers and code officials, a deliberative approach to code development is necessary. An ad hoc committee provides the forum for experts and stakeholders to gather the necessary research, compile current best practices, and develop consensus code proposals on complex and emerging topics. The Ad Hoc Committee on Tall Wood Buildings serves as an example of the success of such an approach. A similar approach for code-based approaches to environmental performance of building materials would be valuable.

Chapter 9 of the IgCC already contains some provisions to support verification of environmental performance. These are primarily based on EPDs. EPDs have been identified as a primary tool for transparency communication of the environmental impacts of products/materials. However, EPDs have not been generated for all materials and products used in construction. The ICC Evaluation Service (ICC-ES) is an accredited EPD Program Operator, providing the tools necessary for development of product category rules (PCRs) and verification of EPDs and stands ready to assist manufacturers in expanding the availability of EPDs. This allows AHJs to have a trusted partner in the marketplace when needing these EPDs to show compliance. Congress recently passed the Inflation Reduction Act which includes $350 million to support the development and standardization of EPDs and over $4 billion to support their use by the GSA and Department of Transportation.

One concern often expressed is whether materials with lower environmental impact than traditional versions of the material deliver a similar level of performance. Here too, ICC-ES plays a valuable role. In addition to being an EPD Program Operator, ICC-ES evaluates products for their compliance with building codes or relevant industry standards. ICC-ES recently developed an Acceptance Criteria on the performance of low-carbon alternative cements for use in concrete (AC529). ICC-ES recently signed a Memorandum of Understanding with the American Concrete Institute to help advance the achievement of carbon neutrality in cement. Marrying EPDs with product evaluations can be a valuable tool to address multiple performance requirements.

The Code Council has also initiated activities to support the widespread deployment of off-site construction. Due to its fabrication in a factory, off-site construction has been found

to reduce material waste and spoilage (among addressing other industry and societal challenges). A recent study out of the United Kingdom found that off-site construction projects resulted in a 45 percent reduction in carbon impacts when compared to similar site-built projects.[2] In September 2021, the Code Council and Modular Building Institute released two new standards that address the design, fabrication, assembly, plan review and inspection of off-site construction projects (Standards 1200 and 1205). Work is now underway on Standard 1210 covering energy efficiency and water conservation opportunities in off-site construction. ICC-ES, ICC NTA and the International Accreditation Service (IAS) also provide a suite of conformity assessment services that support off-site construction.

OPERATIONAL CARBON AND ELECTRIFICATION

In the March 2021 Framework, the Board of Directors took significant steps to assure that the IECC will continue to reduce the operational energy use of buildings and provide communities with pathways to achieve zero energy buildings. Development using a standards process will lead to a code based on strong consensus that can be adoptable and adaptable to jurisdictions' needs. The IECC Development Committee members (Residential and Commercial) were selected to represent a diversity of interests that will deliver a consensus-based code. The IECC will retain its focus on reducing energy use during the operational phase of a building while the solutions to reducing carbon impacts in other phases of the building life-cycle will be identified through the road mapping process and with the input of the Energy and Carbon Advisory Council and the Ad Hoc Committee on Decarbonization.

Electrification, the transition from use of fossil-based fuels in buildings to strictly on-site electricity, has been identified as a strategy to reduce GHG emissions. Several cities and states have enacted laws restricting the use of natural gas in the future. Several states also have laws prohibiting such actions. As the IECC development committees consider the inclusion of provisions that reduce GHG emissions through electrification, they must also consider the adoptability of the code across the U.S. and internationally.

Natural gas will continue to be used across the U.S. given its prevalence, existing infrastructure investments, the cost and pace of electrification retrofits, and, relatedly, the passage of laws prohibiting bans on natural gas in at least 20 states. Recognizing the diversity of policy approaches across the country, the Code Council is focused on assuring whatever energy source a community chooses to use is used safely and efficiently. Where it is installed, natural gas infrastructure must be installed, operated and maintained in a manner that protects building occupants and property. The International Fuel Gas Code (IFGC) provides requirements for fuel gas systems and gas fired appliances. In addition to natural gas, the IFGC includes provisions for the use of gaseous hydrogen systems which can have lower GHG impacts. As utilities and the communities they serve look to lessen the use of fossil-based fuels, other fuels may emerge. The IFGC should adapt to assure these fuels are also deployed safely.

CONCLUSION

As a leader in advancing safety, resilience and sustainability of buildings and communities, the International Code Council is committed to delivering the resources and tools communities and the building industry needs to achieve their goals. The Code Council Family of Solutions is positioned to provide a holistic approach to building decarbonization. To meet the growing demand for solutions, the Code Council Board of Directors recognizes the need to continue and enhance existing decarbonization-related initiatives and establish new initiatives that will provide a strategic approach that recognizes the complexity of the topic and the diversity of approaches jurisdictions will pursue.

Strategy development

- Support completion of road mapping of current and potential Code Council Solutions supporting decarbonization
- Continue engagement with U.S. and international leaders to identify opportunities for collaboration and alignment

2. https://www.building.co.uk/news/modular-construction-emits-45-less-carbon-than-traditional-methods-report-finds/5117779.article

- Solicit recommendations from the Energy and Carbon Advisory Council on needed decarbonization policies and solutions and garner feedback on current and potential Code Council tools to support decarbonization
- Establish an Ad Hoc Committee on Decarbonization to develop a comprehensive, consensus-based approach to decarbonization requirements for the Board's consideration. The approach shall consider the roles of existing I-Codes, the measurement and verification standard, and the potential for new standards, stretch codes or other guidance, considering the diversity of jurisdictional approaches and timelines and the adoptability of the identified solutions (new)

Research

- Work with the Federal Emergency Management Agency, Environmental Protection Agency, NIBS and others to quantify the carbon savings associated with the hazard resistance provisions of the I-Codes (new)
- Work with government and outside stakeholders to quantify the IgCC's environmental benefits (new)
- Conduct a research study in collaboration with the Modular Building Institute to measure cost savings, energy efficiency and carbon reduction benefits of off-site construction (new)

Solutions Development and Deployment

- Co-develop the Standard on Measurement and Verification of Carbon in Construction, Materials, and Operations with ASHRAE
- Continue support of the International Green Construction Code (IgCC) as a coordinated approach to GHG reductions across the design, construction, and operations of buildings
- Expand the development of environmental product declarations (EPDs) for materials and products used by the construction industry alongside the conduct of evaluations of the performance of materials and products with lower environmental impacts
- Continue development of the International Fuel Gas Code (IFGC) to assure the safe use of natural gas and explore updates necessary to address the safe deployment of emerging fuels
- Continue development of the International Energy Conservation Code (IECC) under the revised scope and intent to continue energy use reduction as approved by the Board in *Leading the Way to Energy Efficiency: A Path Forward on Energy and Sustainability to Confront a Changing Climate*

Approved: September 10, 2022