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Building Codes and the International Breakthrough Agenda



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At the 2021 United Nations Global Climate Change Conference commonly known as COP26, 45 world leaders launched the Breakthrough Agenda as a commitment to work together to accelerate innovation and technology deployment to help achieve the mitigation and adaptation goals associated with the conference. The initial sectors of focus were power, road transport, steel, hydrogen and agriculture. At COP27, the governments of France and the Kingdom of Morocco called for the addition of a breakthrough for the buildings sector. The [Buildings Breakthrough](#) is set to be formally accepted as part of the Breakthrough Agenda at COP28 in December 2023 with current support from 27 countries.

The goals established for each sector are tracked annually to identify where further international action is needed and to galvanize public and private sector action towards quicker, cheaper and easier transitions. The International Energy Agency (IEA), International Renewable Energy Agency (IRENA) and UN Climate Change High-Level Champions released the [2023 Breakthrough Agenda Report](#) in September 2023, tracking progress in the initial breakthrough sectors in addition to buildings and cement.

ABOUT THE BUILDINGS BREAKTHROUGH

Each of the Breakthrough sectors establishes an overarching goal and identifies priority actions to achieve those goals. The Buildings Breakthrough establishes a target that “Near-zero emission and resilient buildings are the new normal by 2030.” Priority actions for the buildings sector have not been formally developed, but the 2023 Breakthrough Agenda provides some discussion on important measures to support the achievement of the target. Additionally, 17 initiatives have been recognized as supportive initiatives of the Breakthrough, including the [“Building Capacity for Sustainable and Resilient Buildings Initiative”](#) led by the International Code Council.

The Building Capacity for Sustainable and Resilient Buildings Initiative (the Initiative) recognizes the essential role building and energy codes and their effective implementation play in achieving the goals of zero energy and hazard-resilient buildings. The Initiative engages both public and private sector actors in the implementation and use of mandatory energy codes aligned with nationally-determined contributions and the delivery of zero energy buildings for all new construction by 2030 and hazard-resistant codes that result in buildings that are designed and constructed to a level of resilience commensurate with the hazards within the jurisdiction, including anticipated future risks due to climate change.



“Mandatory building energy efficiency codes are a key national policy, requiring a scale-up in technical assistance to ensure all countries have them in place.”
-The Breakthrough Agenda Report 2023

Initial signatories to the Initiative include Architecture 2030, ASHRAE, Global Alliance for Buildings and Construction (GlobalABC), HOK, International Building Quality Center (IBQC), International Living Future Institute (ILFI), Materials and Embodied Carbon Leaders’ Alliance (MECLA) +LAB Architects, ResALLience, Saint-Gobain, and U.S. Green Building Council (USGBC).

While the establishment of the Buildings Breakthrough allows for a dedicated focal point for progress, buildings also have strong connections to the steel, power and cement breakthroughs. Significant progress in each of these Breakthroughs will lead to improvements in the building sector. For example, embodied emissions for steel and cement need to drop by 25 percent and 20 percent respectively by 2030 to get on track with the IEA Net Zero Emissions Scenario.

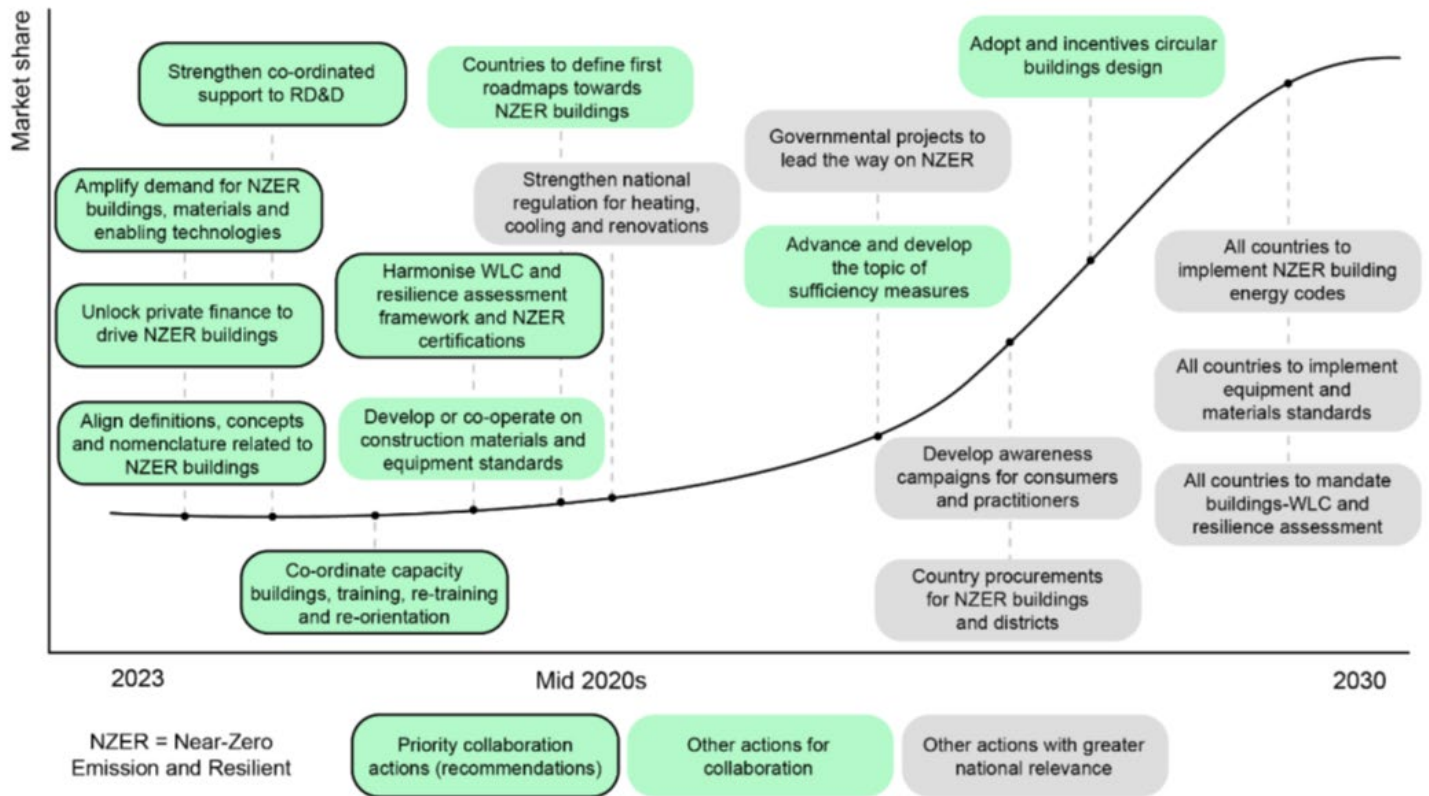


Figure 1. Critical Path to 2030 for the Buildings Sector (IEA 2023)

The Breakthrough Agenda Report identifies the critical path to achieving the goals outlined in the Buildings Breakthrough (see Figure 1). As outlined in the discussion below, this pathway relies heavily on policies like building and energy codes and their effective implementation through capacity building, including workforce development.

The 2023 Breakthrough Agenda Report takes an initial approach to identifying priorities for international collaboration to deliver near-zero emissions and resilient buildings. Identified priorities include: standards and certification; demand creation; finance and investments; research and innovation; and knowledge and skills. Building and energy codes are identified as essential tools in achieving the Breakthrough’s goals. As stated in the Agenda Report, “Mandatory building energy efficiency codes are a key national policy, requiring a scale-up in technical assistance to ensure all countries have them in place.”

“Near-zero emission buildings must be considered in the context of their whole-life impact, and for the enabling role they play in supporting the energy transition. Beyond their roles in reducing emissions, buildings are critical for delivering resilience to communities. Failure to embed resilience and adaptation measures into buildings will hinder efforts to decarbonize, as built assets will require more investment to maintain, repair and upgrade in response to physical climate risks and resulting changes in behavior, thus also creating more emissions.” – The Breakthrough Agenda Report 2023

Figure 18. Global status of building energy codes in 2021

This map is without prejudice to the status of or the sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city, or area.

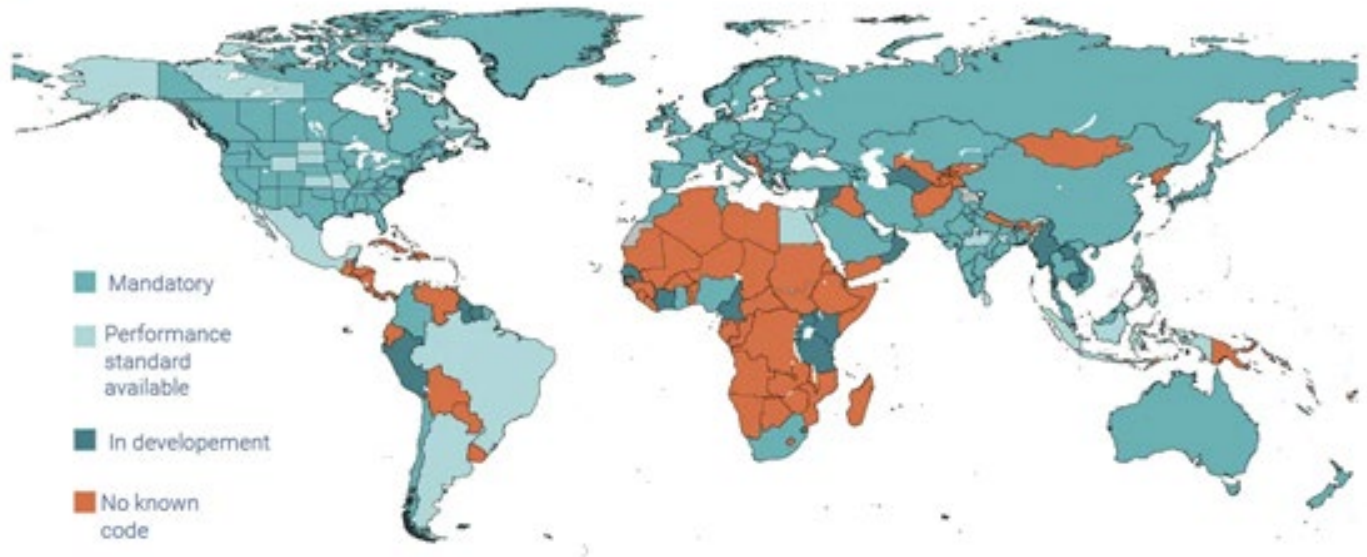


Figure 2. Global Status of Building Energy Codes in 2021 (GlobalABC 2022)

According to [GlobalABC](#), only 26 percent of countries currently have adopted mandatory energy codes at the national level for all building types (see Figure 2). A total of 79 countries have mandatory or voluntary energy codes covering some portion of the building stock. However, more than two-thirds of the buildings constructed between now and 2050 are expected to be built in countries lacking energy codes. But adoption alone is unlikely to result in the achievement of energy use reductions and resilience advancements.

The Agenda Report offers five recommendations for getting the sector on track. Each recommendation, either directly or indirectly, relies on building codes and standards. Each recommendation and pathway to implementation are discussed further below.

Recommendation 1: “Governments should work together to harmonize and upgrade the definitions and nomenclature for net zero and resilient buildings and their performance. Countries should work towards harmonizing whole-life carbon assessments, developing resilience assessments and aligning certification schemes with net-zero and resilient requirements. Harmonization should permit the flexibility to accommodate different regional contexts and should be supported by establishing shared international mechanisms, platforms and formats for data sharing of best-in-class net zero and resilient projects.”

Building codes and standards exist to provide a common set of requirements for how buildings should be designed, constructed and operated to meet community expectations on safety, sustainability and resilience. The [International Energy Conservation Code® \(IECC\)](#) already includes appendices that define requirements to achieve zero energy residential and commercial buildings. Most building codes are already centered on achieving some level of resilience to hazard events. Additional measures to support social and economic resilience through functional recovery provisions and resilience to the ongoing impacts of climate change are in development.

The [Global Resiliency Dialogue](#), established by codes and standards development and research organizations in Canada, Australia, New Zealand and the United States, developed the [Global Building Resilience Guidelines](#). These Guidelines established a definition for climate resilience of buildings: “The ability of a building and its component parts to withstand current and future climatic conditions (including wildfires/bushfires, extreme wind, extreme precipitation and extreme temperature), to minimize the loss of functionality and recovery while sustaining damage proportionate to the intensity of the events experienced, and preserving the intended level of performance at the time of construction over the proposed design life of the building.”

Based on this definition, the Guidelines identify 15 principles to inform and encourage the development of building codes that incorporate future-focused climate resilience. The Guidelines are organized around principles that provide a basis for advancing building resilience through building codes. Several countries have already begun to incorporate provisions to address future-focused climate risk (e.g., Canada and New Zealand).

It is also important for building-level resilience metrics to be coordinated with community-level resilience assessments. An [ecosystem of resilience standards](#) allows for a deliberate, coordinated approach to advancing resilience at multiple scales. The [Alliance for National & Community Resilience \(ANCR\)](#) includes buildings as one of 19 community functions that influence a community’s resilience. ANCR’s Buildings Benchmark includes metrics on the effective adoption and enforcement of building codes.

Approaches are also beginning to solidify around whole-life carbon assessment standards. ASHRAE and the International Code Council are developing [ASHRAE/ICC Standard 240P: Quantification of Life Cycle Greenhouse Gas Emissions of Buildings](#) as an international standard that can be incorporated into building codes and regulations, and can be used to support other programs. The standard should be completed by early 2025. The [International Green Construction Code® \(IgCC\)](#) currently includes provisions to support the conduct of life-cycle assessments and the use of environmental product declarations (EPDs).

As identified in the Action Report, several forums exist for further dialogue including the [IEA Working Group on Building Energy Codes](#) and the [Global Alliance for Building and Construction](#).

Recommendation 2: Governments should jointly create and strengthen procurement commitments for near-zero emission and resilient buildings, as well as join existing material procurement alliances. Countries should work to establish new joint commitments on deploying clean and efficient heating and cooling technologies.

In many countries, governments are one of the largest building owners and have multiple levers to drive markets. Governments also have a fiscal obligation to protect public investments. Procurement policies and commitments require a basis to specify and validate products and buildings. Building codes and standards provide that basis.

Design requirements for government buildings should drive towards zero energy and emissions and climate-resilient buildings.

Building codes provide a basis for these requirements. As government projects achieve performance requirements beyond minimum code requirements, lessons learned can feed back into the code development process. Above code applications in government projects can also help drive familiarity with new techniques and technologies for designers, contractors and tradespeople.




“Building energy codes have been central to improving the energy performance of new buildings. Transitioning towards near-zero emission and resilient buildings will require whole-life carbon and resiliency assessments, in addition to energy performance, to become the norm for building construction and major renovation projects.”
– The Breakthrough Agenda Report 2023

Many governments have implemented “buy clean” legislation requiring certain materials to be under specific target emissions levels as identified in EPDs. In the United States, the U.S. General Services Administration (GSA) has implemented requirements for concrete and asphalt and is developing requirements for additional materials including glass and steel. These requirements are incorporated into their design criteria alongside other code-based requirements.

It will be essential to ensure that the environmentally preferable products also meet other performance requirements captured in building codes. Embedding environmental performance requirements alongside the existing conformity assessment process for building products will be essential.

The evaluation and listing of building products for current code and standard performance requirements relies on a robust process centered on ISO/IEC standards and accreditations, specifically the set of 17000 standards known as the [ISO CASCO Toolbox](#). Confidence in EPDs relies on a similar verification process through accredited third-party program operators like the [ICC Evaluation Service \(ICC-ES\)](#).



“National and sub-national building energy codes have been central to improving the energy performance of new buildings. Emerging and developing economies largely do not have stringent building energy codes in place. Capacity building needs to focus on supporting these countries by implementing and increasing the stringency of building energy codes. Such efforts need to be guided by tracking the present stringency of energy codes internationally.”
– The Breakthrough Agenda Report 2023

Recommendation 3: “Countries should increase the scale of funding available for near-zero emission and resilient building projects, as well as improving the coordination of assistance going forward through the establishment of a matchmaking platform dedicated to the delivery of near-zero emission and resilient building projects. This platform would act as a single point of contact for emerging and developing countries, with support from donor countries, MDBs, NDBs, private financial institutions and investors, philanthropic organizations, buildings and real estate companies and technical assistance partners.”

As discussed under Recommendation 2 above, efforts to drive towards zero-emission and resilient building projects require a basis on which to direct design teams and to verify the achievement of those requirements. Building codes facilitate this role. This is true for both public and private sector funding schemes. Financiers need a replicable and consistent basis to verify the performance of buildings.

In emerging economies where much of the future growth in construction will occur, the implementation of mandatory building and energy codes will be necessary to ensure poor-performing buildings do not become long-term burdens. Investors in these areas (and elsewhere) should actively engage in the adoption and implementation of codes.

While setting requirements within financial transactions can help drive advancements in building performance, that alone is not sufficient to achieve measurable results. The entire construction ecosystem must be prepared to deliver the required results. Financial institutions (particularly development banks and international aid organizations), as part of their broader mission, should support capacity building across the construction ecosystem to advance community-level impacts. This provides an opportunity to expand the impact of investments beyond individually funded building projects.

Recommendation 4: Countries and companies should work together to identify knowledge gaps that can be overcome via joint working, and align RD&D priorities to shared policy goals. Countries should also facilitate the expansion of existing networks to bring in new expertise and country members, and work through those networks to improve communication of high-quality research and best practices, and deliver training to deploy innovative technologies, construction practices, tools and business models at scale, using government projects to lead the way.

Research and development in the construction sector are essential to achieving increasing levels of performance. Such research should not be limited to technologies, but include processes and techniques, social science and economics. Social science research should examine how building operators and occupants interact with buildings and technologies and how they can impact building and system performance. Knowledge and techniques from traditional or vernacular architecture should be studied to identify efficient and effective passive solutions that can be incorporated into engineered buildings.

As identified in the Breakthrough report, “Research areas with critical importance for policy priorities in the sector include assessing and designing building resilience, assessing embodied emissions, advancing understanding of the role of sufficiency, near-zero emission and resilient construction practices for different building types, circular design, passive building design and construction, energy management systems, and clean and efficient space cooling and heating technologies.” Building codes and standards serve as mechanisms for identifying, capturing and disseminating research under these policy priorities as discussed in further depth under Recommendation 1 above.

Building codes and related conformity assessment mechanisms have the potential to become either a barrier or an enabler to scaling the implementation of new technologies or practices. To enable rather than hamper change and innovation, researchers should consider how their findings or products interact with building codes proactively rather than as an afterthought. Ongoing interaction between the research and regulatory community is essential to help bring new technologies into the market.

Technologies like [off-site construction](#) can deliver more sustainable and resilient structures more quickly and with less waste, helping address the needs of growing populations or delivering affordable housing. New approaches to housing like tiny houses can also be part of the solution. Codes and standards must evolve to recognize these new practices. Recognizing this need, the International Code Council has developed [standards](#) to support the verification of off-site construction projects for compliance with building and energy codes and has developed [resources](#) to support the safe and sustainable use of tiny houses.



“International collaboration can help to support curriculum development, encourage experiential learning and exchange programs, and strengthen partnership and resource sharing. Technical assistance and capacity-building support for developing training programs is particularly urgent in countries with limited resources.”
– The Breakthrough Agenda Report 2023

Recommendation 5: “Countries and companies should jointly identify knowledge gaps and define training and capacity building priorities, strengthening the role of existing networks to share knowledge and provide guidance, tools, and resources to build capacity across all regions. This includes a focus on supporting developing countries with implementing and increasing the stringency of building energy codes. Countries should also work together to assist in curriculum design, implementation of training programs and accreditation frameworks to enhance the transferability of skills and qualifications, and ultimately promote net zero and resilient building practices.”

This recommendation drives the Building Capacity for Sustainable and Resilient Buildings Initiative, focusing on the adoption and effective implementation of building energy codes. This is particularly important for developing economies as approximately 80 percent of the growth in floor area through 2030 is set to occur in emerging and developing economies. Because of this, a deliberate approach recognizing the current regulatory infrastructure and capacity of the industry is necessary.

A one-size-fits-all approach is unlikely to achieve these desired results. As identified in the report published by the International Code Council,

Adaptation and Mitigation of Buildings in Emerging Economies: The Importance of a Focused Approach to Regulatory Compliance. “In many emerging economies, the greatest barrier to achieving safe buildings is not access to strong building codes and standards, but the capacity to successfully implement and enforce those building codes. The same principle is true for achieving energy efficient and green buildings, which are frequently touted as important elements in achieving Nationally Determined Contributions (NDCs), and which can mitigate the impact of climate change and result in more resilience. In emerging economies and the Global South, it can be argued that investing in a strong regulatory infrastructure and capacity building for enforcement could be more effective in achieving cleaner, more resilient buildings, than updating building regulations to the most advanced energy efficiency standards. Furthermore, so-called vernacular, or traditional, construction should be addressed in a manner that reflects its mitigation benefits and unique character.”

The International Code Council is developing a free [capacity building toolkit](#) to help jurisdictions around the world identify and support the implementation of an effective building regulatory infrastructure. Key elements of the infrastructure are identified in Figure 3.

“Coordinated capacity building needs to focus on supporting developing countries – who will contribute most significantly to floor area growth – with implementing and increasing the stringency of buildings energy codes. This capacity building will need to be enhanced by tracking of energy code stringency and supported by finance for development and implementation of such codes.”
– The Breakthrough Agenda Report 2023

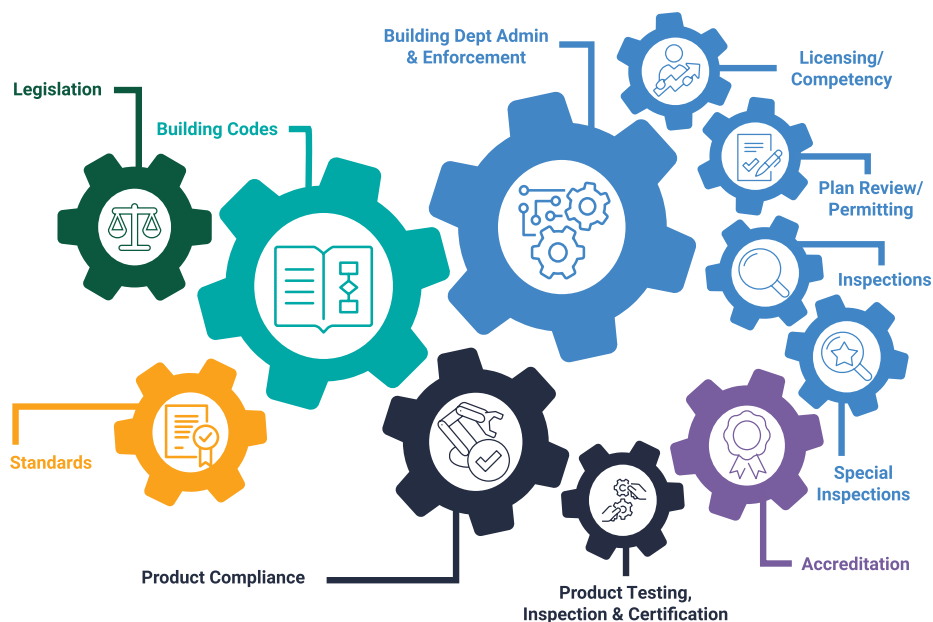


Figure 3. Building Safety Regulatory Ecosystem (ICC 2023)

CONCLUSION

Buildings play a significant role in the achievement of climate adaptation and mitigation goals as captured in the Buildings Breakthrough. Significant progress has been made in the sector, but additional work still needs to be done. Building and energy codes are essential components to driving progress. However, to be truly effective, they must be adopted and implemented deliberately with particular attention to local needs, rather than taking a one-size-fits-all approach that assumes the existence of adequate knowledge, skills and resources to enable effective enforcement.

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