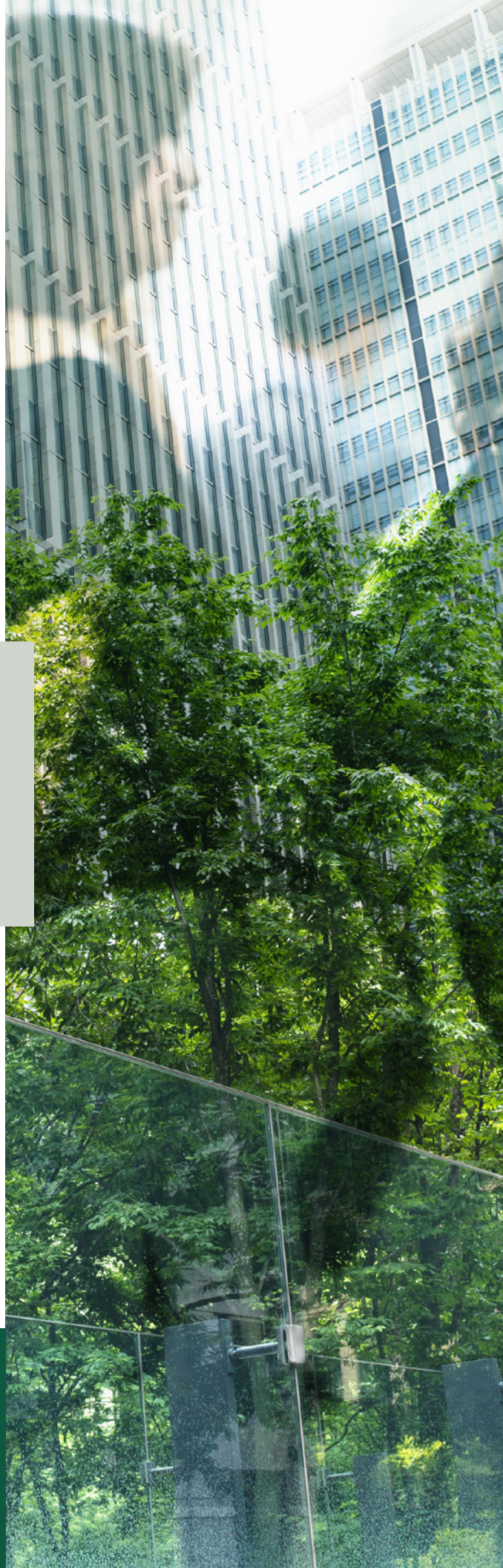
INTERNATIONAL CODE COUNCIL®

Pathways to Climate Resilience:

The Central Role of Building Codes in Climate Adaptation and Mitigation



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INTRODUCTION

Communities are facing the unprecedented challenges of responding to the increasing number, intensity, and frequency of disaster events, many driven by climate change. At the same time, governments are looking for solutions to stem the greenhouse gas (GHG) emissions that continue to drive changes in climate. The built environment is central to both enhancing resilience and mitigating GHG emissions. Buildings are our shelter against the storm, the homes of our governments and institutions, drivers of economies, and symbols of our ideals. At the same time, buildings are significant users of energy and materials.

Policies at the national and sub-national levels to achieve net-zero emissions and enhance community resilience must include a strong focus on current and future buildings. Building codes and the activities that support their effective use are central to the realization of a climate resilient future. The International Code Council (Code Council or ICC) calls on all governments to adopt and enforce building codes aligned with domestic and international goals for reduced GHG emissions and enhanced resilience.

INTERNATIONAL CLIMATE AND RESILIENCE GOALS

Setting the stage of climate resilience are an abundance of global policy mechanisms, targets and goals driving climate action to combat, mitigate and adapt to the detrimental impacts of the changing climate. At the core of global climate action are international climate and resilience goals. The United Nations (UN) has gained contemporary momentum in the creation of various forums rapidly urging and supporting countries in the implementation of bold climate actions through goal-oriented, global frameworks. The adoption of the 2030 Agenda for Sustainable Development and the Paris Agreement in 2015 by UN Member States has spurred modern climate action and awareness on a global scale.

Stemming from the 2030 Agenda for Sustainable Development and work of the UN Department of Economic and Social Affairs emerged the seventeen Sustainable Development Goals (SDGs), providing a framework of actions targeted towards thematic environmental, social, and economic issues to drive global change. Also, in 2015, came the adoption of the legally binding Paris Agreement at the 21st UN Framework Convention on Climate Change (COP21) aimed to limit global warming to 1.5 degrees Celsius compared to pre-industrial levels. The Paris Agreement requires signatories to declare Nationally Determined Contributions (NDCs), initiating climate action plans in signatory countries aimed to reduce national emissions and adapt to the impacts of climate change through targeted goals.

International initiatives lay the groundwork for targeted actions to combat climate change throughout various sectors. Within the buildings and construction sector, the Global Alliance for Buildings and Construction (GlobalABC) was established in 2015 during the COP21 meeting in Paris, largely to raise the ambitions within a fragmented sector, mobilizing all actors along the value chain – from design to construction, operations, and demolition in the private and public sectors – to retrofit existing buildings and ensure that new construction is sustainable to achieve higher levels of decarbonization. GlobalABC develops policy guidance and tools, while tracking progress and setting targets for the industry.

Building codes and the activities that support their effective use are central to the realization of a climate resilient future. The International Code Council calls on all governments to adopt and enforce building codes aligned with domestic and international goals for reduced GHG emissions and enhanced resilience.

The Global Resiliency Dialogue, a more recent initiative launched in late 2019, is a collaboration between building code development and research organizations in Australia, New Zealand, Canada and the United States, to develop a pathway to integration of forward-looking climate science into building codes, which have traditionally relied on historical data to construct hazard maps. The group will be publishing international guidelines for building resilience based on its findings and input from global stakeholders.

The UN's annual global climate summit, or Conference of the Parties, known as COP, continues to establish critical climate goals and resilience frameworks to drive change in conjunction with the Paris Agreement. This year, the United Kingdom is hosting the 26th COP summit with the goal of securing global net zero emissions by mid-century to continue towards the 1.5 degrees Celsius target of the Paris Agreement. COP26 has spurred multiple campaigns among non-state actors, which include local governments, businesses, non-governmental organizations, and civil society groups. Most notable among these campaigns include the COP26 Communiqué and Race to Zero that introduce further global emission reduction goals to support those of the Paris Agreement, and the Race to Resilience Campaign, targeting resilient capacity building to support 4 billion people vulnerable to climate risks. Also in conjunction with the Paris Agreement is the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework), established by the UN Office for Disaster Risk Reduction (UNDRR), a resilience plan introducing actions to enhance resilience of development gains from disaster risks. These international climate and resilience goals have been at the forefront of modern climate actions, providing a framework for global response to a changing climate.

IMPORTANCE OF TACKLING CLIMATE MITIGATION AND ADAPTATION

Globally, from 1980 to 2019 there were 11,560 major disaster events affecting over 7 billion people, claiming nearly 2.5 million lives and causing $4.6 trillion in damage. Approximately two-thirds of these events occurred from 2000 to 2019.[1]

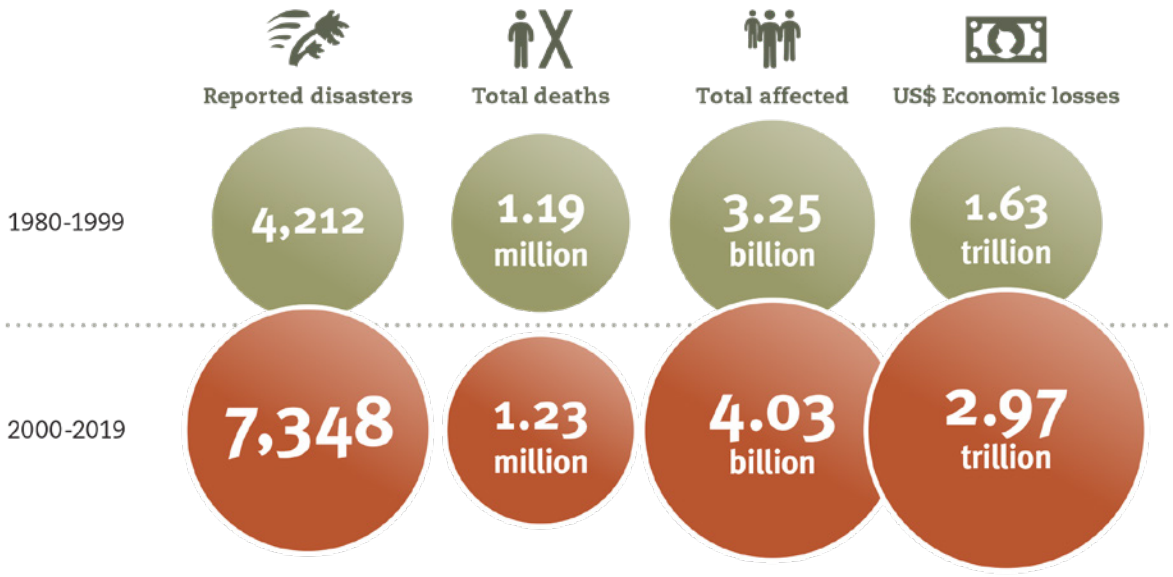


Figure 1. Global Disaster Impacts 1980-1999 vs. 2000-2019

[1] United Nations Office of Disaster Risk Reduction. The human cost of disasters: an overview of the last 20 years (2000-2019). https://www.undrr.org/publication/human-cost-disasters-overview-last-20-years-2000-2019.

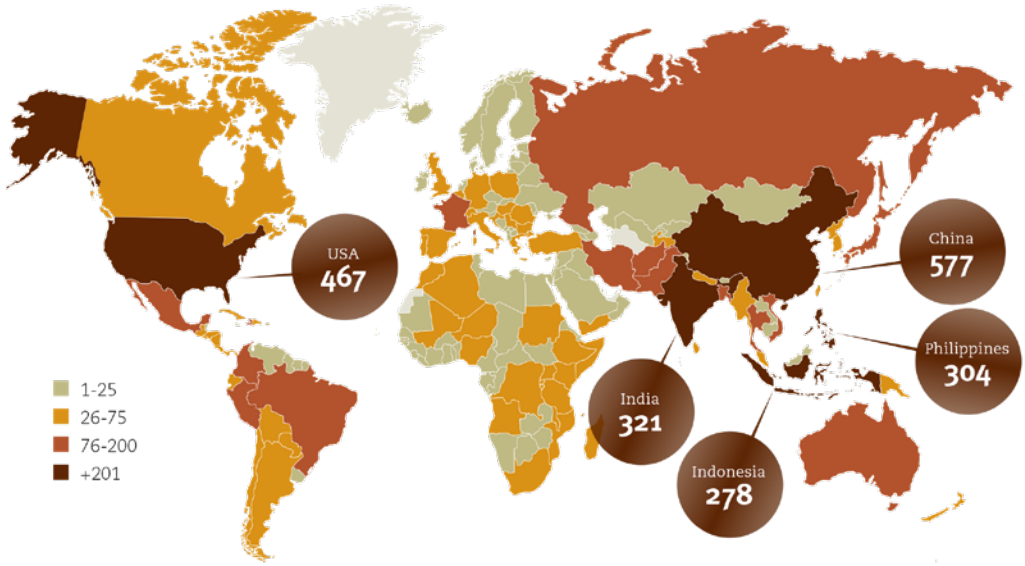


Figure 2. Number of Disasters Reported per Country/Territory (2000-2019)

In the United States, where the International Code Council is based and where the ICC-developed International Codes® (I-Codes®) are widely used, since 1980, almost 300 disasters each causing $1 billion in damage or more have occurred.[2] The number and costs of these events have been rising over time. In 2020 there were 22 such events, breaking the prior records set in 2011 and 2017 of 16 events. In the past six years (2015–2020) 10 or more billion-dollar weather and climate events have impacted the U.S. Since 1980, these disasters have cost $1.875 trillion with 2017 alone costing over $300 billion.[3] (See Figures 3 and 4.)

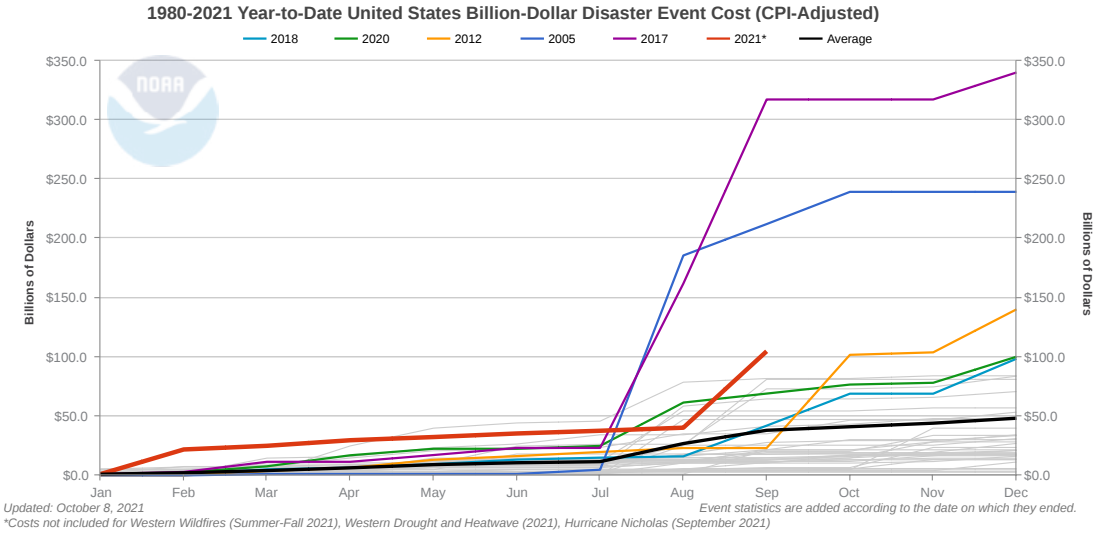


Figure 3. Costs of U.S. Disasters with $1bn Damage or More

[2] These statistics do not include disasters causing less than $1 billion in damage which can still have significant implications for communities.

[3] NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2021). https://www.ncdc.noaa.gov/billions/, DOI: 10.25921/stkw-7w73.

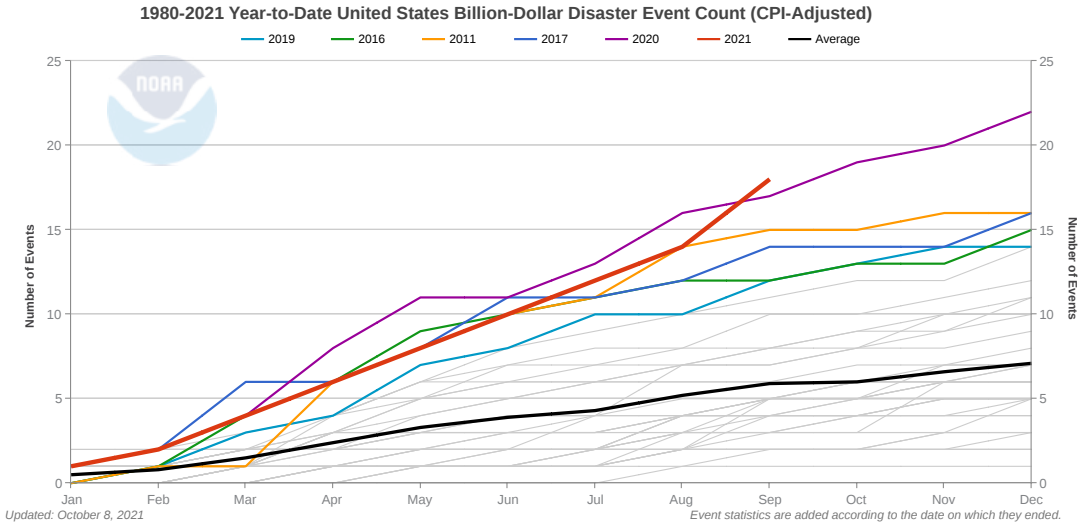


Figure 4. Number of U.S. Disasters Causing $1bn of Damage or More

Trying to respond to these disaster events in real time is clearly unsustainable – too many lives are impacted, and the economic costs are too high. Pre-disaster mitigation, generally defined as investments in actions that can reduce the impacts of hazards, has been proven to be highly cost effective. The National Institute of Building Sciences (NIBS), a research organization established by the U.S. Congress, found that investments in pre-disaster mitigation can save the U.S. between $4 and $11 for every $1 invested (see Figure 5). The continual update of building codes provided the greatest benefit at $11. These benefits represent avoided casualties, property damage, business interruptions, first responder expenses, and insurance costs, and are enjoyed by all building stakeholders – from developers, titleholders, and lenders, to tenants and communities.[4]

The U.S. Federal Emergency Management Agency (FEMA) in its *Building Codes Save: A Nationwide Study* found that the International Residential Code (IRC) and International Building Code (IBC) provided more than $27 billion in cumulative mitigation benefits against flood, hurricane wind, and earthquake hazards from 2000 to 2016. If construction continues at the pace the study observed and if the proportion of that construction adhering to the codes is consistent with the trend the study identifies, codes could help communities avoid $132 billion to $171 billion in cumulative losses through 2040. If all new buildings across the U.S. were built to modern codes, the country would save more than $600 billion by 2060.[5]

Trying to respond to these disaster events in real time is clearly unsustainable – too many lives are impacted, and the economic costs are too high. Pre-disaster mitigation, investments in actions that can reduce the impacts of hazards, has been proven to be highly cost effective.

[4] Multi-Hazard Mitigation Council (2019.). Natural Hazard Mitigation Saves: 2019 Report. Principal Investigator Porter, K.; Co-Principal Investigators Dash, N., Huyck, C., Santos, J., Scawthorn, C.; Investigators: Eguchi, M., Eguchi, R., Ghosh., S., Isteita, M., Mickey, K., Rashed, T., Reeder, A.; Schneider, P.; and Yuan, J., Directors, MMC. Investigator Intern: Cohen-Porter, A. National Institute of Building Sciences. Washington, DC. https://nibs.org/projects/natural-hazard-mitigation-saves-2019-report.

[5] Federal Emergency Management Agency. *Building Codes Save: A Nationwide Study.* November 2020. https://www.fema.gov/sites/default/files/2020-11/fema_building-codes-save_study.pdf.

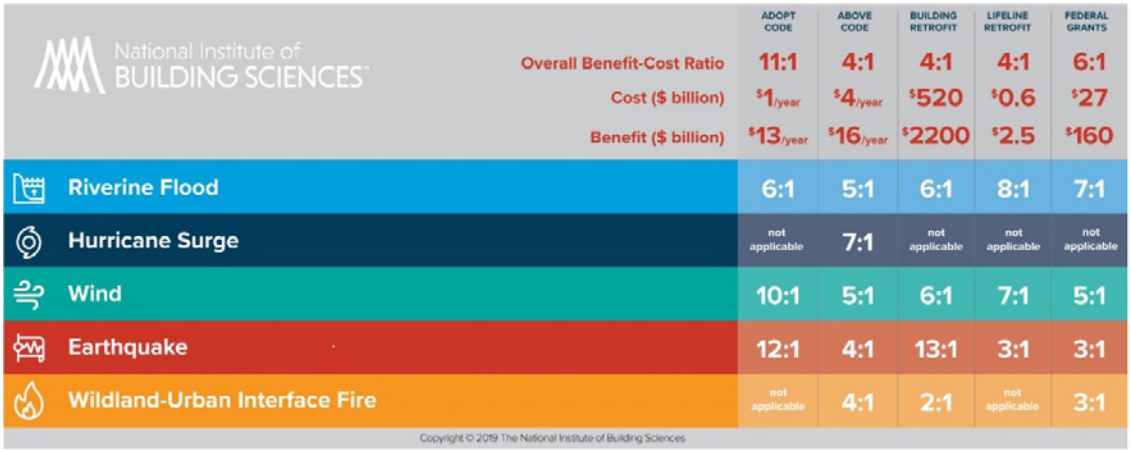
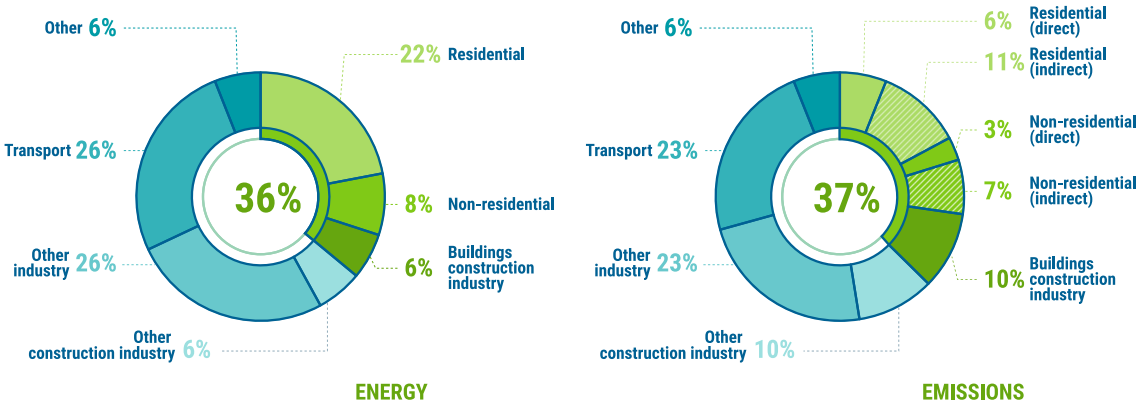


Figure 5. Benefit Cost Ratios for Various Mitigation Measures

In addition to protecting residents from the impacts of hazard events, buildings use energy to support occupant comfort and health, and the important functions they house. Assuring buildings use energy efficiently is essential for protecting human health, economic prosperity and reducing the impacts of climate change.

While these studies were focused on the U.S., the challenges and potential benefits are similar in countries around the world. In 2020, the global buildings sector was responsible for 36% of global final energy consumption and 28% of total global energy-related CO_2 emissions. When including construction, buildings accounted for 37% of global energy-related emissions.[6] (See Figure 6.) Approximately 255 billion m^2 (2.75 trillion ft^2) of buildings currently exist worldwide with the addition of roughly 5.5 billion m^2 (59.2 billion ft^2) added every year, equivalent to a city the size of Paris every week.[7]



Note: "Buildings construction industry" is the portion (estimated) of overall industry devoted to manufacturing building construction materials such as steel, cement and glass. Indirect emissions are emissions from power generation for electricity and commercial heat.

Source: IEA 2021a. All rights reserved. Adapted from "Tracking Clean Energy Progress"

Figure 6. Global Share of Buildings and Construction Final Energy and Emissions, 2020

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

[7] World Business Council for Sustainable Development. Net zero buildings: where do we stand? https://www.wbcsd.org/Programs/Cities-and-Mobility/Sustainable-Cities/Transforming-the-Built-Environment/Decarbonization/Resources/Net-zero-buildings-Where-do-we-stand.

Governments and international organizations have called for a focus on buildings as an essential component of any climate resilience policy. In fact, it is difficult to imagine successfully addressing climate resilience without significant contributions from the building sector. International initiatives to achieve zero energy or zero carbon buildings include the World Green Building Council's Net Zero Carbon Buildings Commitment (Six sub-national states, 27 cities and 79 businesses have committed to net zero buildings operations by 2050 or earlier); the World Business Council for Sustainable Development's Building System Carbon Framework; the C40's Clean Construction Forum; Architecture 2030's Achieving Zero; the Science Based Targets initiative for business (with 1,000 companies having signed up to reduce carbon emissions beyond their own operations by including other indirect carbon emissions in their carbon reduction action plans); and many more.[8] In the U.S., the White House has called for all new buildings to be zero energy by 2030 and all buildings to retrofit to zero energy by 2050.[9]

The World Resources Institute identified the building sector as having the greatest opportunity to capture unrealized cost-effective emissions savings.[10] (See Figure 7.) Residential and commercial buildings make up approximately 34% of the opportunity to improve energy productivity.

Seventy-two percent of the NDCs submitted in advance of COP26 cite buildings as a priority area for domestic mitigation measures (the second highest indicated measure behind renewable energy generation).[11] Sixty-three percent of the NDCs go further to include energy efficiency measures in buildings.[12] However, only 20% of NDCs include building energy codes as a

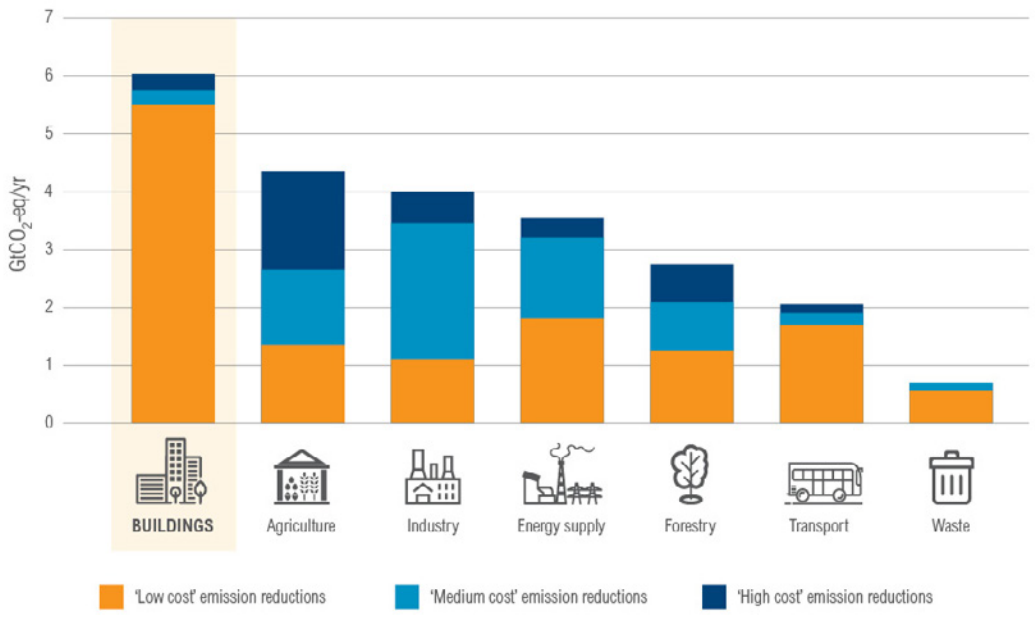


Figure 7. Economic Mitigation Potential by Sector, 2030

[8] United Nations Environment Programme (2020). *2020 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector.* Nairobi. http://globalabc.org/sites/default/files/inline-files/Buildings-GSR-2020_Report_24-03-21.pdf.

[9] The U.S. White House, Fact Sheet: 2030 Greenhouse Gas Pollution Reduction Target (April 22, 2021).

[10] World Resources Institute. *Accelerating Building Efficiency Eight Actions for Urban Leaders.* https://publications.wri.org/buildingefficiency/. Accessed October 14, 2021.

[11] United Nations Framework Convention on Climate Change (UNFCC). *Nationally Determined Contributions Under the Paris Agreement: Synthesis Report by the Secretariat.* September 17, 2021. https://unfccc.int/sites/default/files/resource/cma2021_08_adv_1.pdf.

[12] Ibid.

mitigation strategy.[13] When matched with United Nations population growth estimates, just 65% of the population growth by 2030 will be in countries that have identified building energy efficiency and/or energy codes in their NDCs.[14]

Just as building codes provide significant benefits against the impacts of hazard events, energy codes are highly effective in reducing energy use and GHG emissions while also saving building owners and tenants money and enhancing their resilience. Implementation of energy codes also results in job creation.

The U.S. Department of Energy (DOE) evaluates improvements in the International Energy Conservation Code (IECC) once a new edition is released every three years. Since 2006 the residential provisions of the IECC have delivered about a 40% improvement in energy savings. Improvements in the residential and commercial provisions of the IECC since 2009 will provide over 350 million metric tons (MMT) of CO_2 savings for residential buildings and 340 MMT for commercial buildings, totaling nearly 700 MMT of savings.[15] (See Figures 8 and 9.) The residential provisions in the 2021 edition of the IECC provide a 9.4% improvement in energy use and an 8.7% reduction in carbon emissions over the 2018 edition. The 2021 IECC also includes an appendix for achievement of zero energy buildings. DOE has also found that use of the 2021 IECC will save U.S. homeowners an average of $2,320 over the lifetime of a typical mortgage (30 years) and, if implemented nationally, would create over 22,000 jobs in the first year and 632,000 jobs cumulatively over 30 years.

According to DOE, from 2010 to 2040, if consistently implemented and regularly updated, the model energy codes for residential and commercial buildings are projected to save:

- $138 billion energy cost savings
- 900 million metric tons (MMT) of avoided CO_2 emissions
- 13.5 quads of primary energy

These savings equate to the annual emissions of:

- 195 million passenger vehicles
- 227 coal power plants
- 108 million homes

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According to the International Energy Agency (IEA), energy use reductions from building energy codes range from 22% (e.g., in the Netherlands and Germany) to 6% (e.g., Southern European countries) of average annual energy consumption per residential buildings.[16] Globally, just focusing on minimum performance requirements for building equipment, which are often referenced in building codes, could save between €280 and €410 billion in energy spending and create 1.7 to 2.5 million jobs.[17]

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[13] Architects Declare and Royal Institute of British Architects. Built for the Environment: Addressing the climate and biodiversity emergency with a fair and sustainable built environment. 2021. https://www.architecture.com/knowledge-and-resources/resources-landing-page/built-for-the-environment-report.

[14] United Nations Environment Programme (2021). 2021 Global Status Report for Buildings and Construction: Towards a Zero Emission, Efficient and Resilient Buildings and Construction Sector. Nairobi. https://globalabc.org/resources/publications/2021-global-status-report-buildings-and-construction.

[15] DOE has not yet completed analysis on the 2021 IECC commercial provisions.

[16] IEA. Modernising Building Energy Codes to Secure our Global Energy Future. OECD/IEA, 2013.

[17] European Commission. Savings and benefits of global regulations for energy efficient products. https://ec.europa.eu/energy/sites/ener/files/documents/Cost%20of%20Non-World%20-%20Final%20Report.pdf.

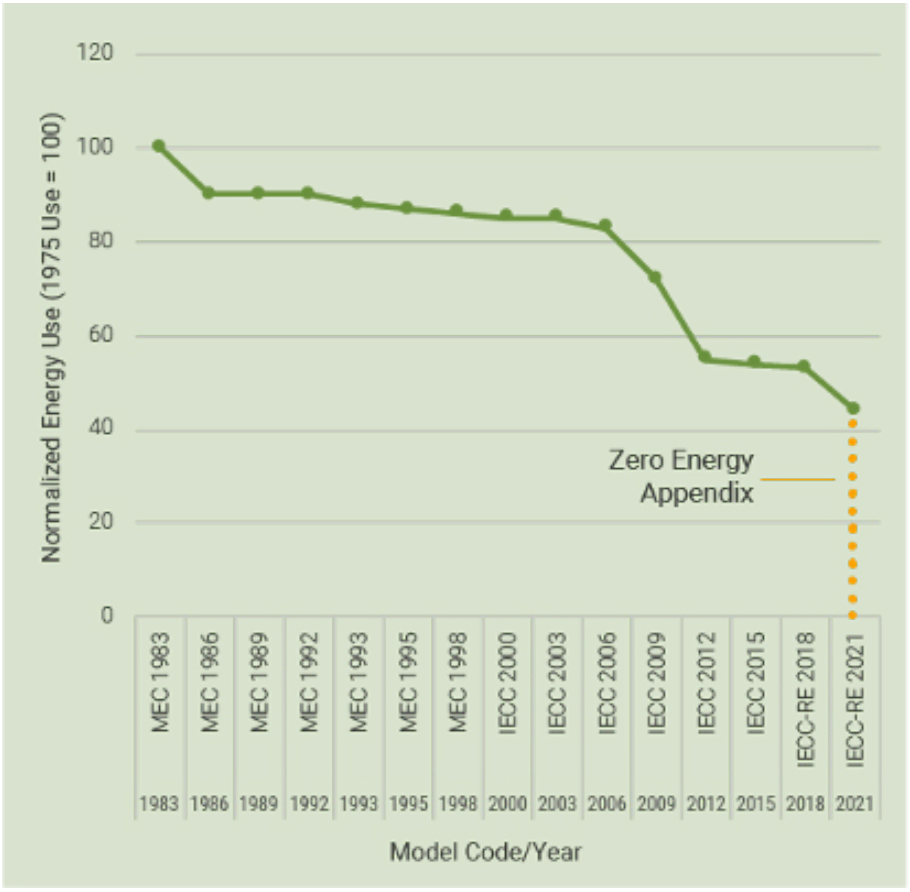
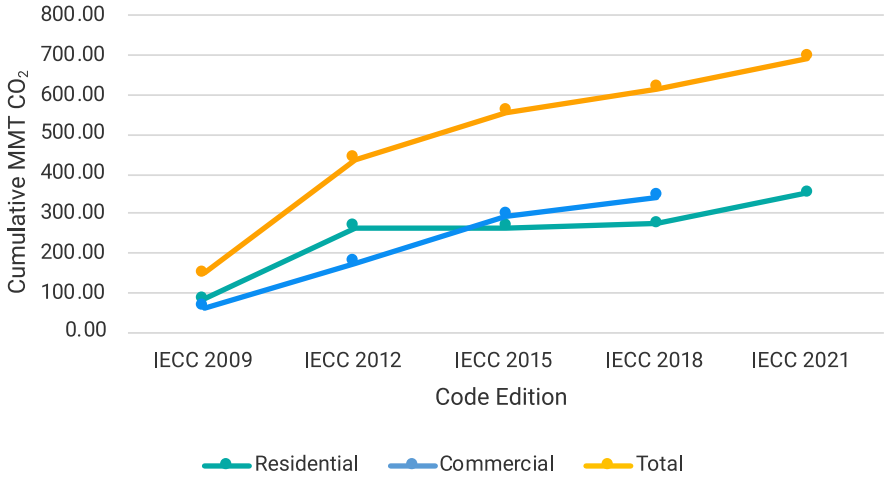


Figure 8. Improvements in Energy Use for Residential Model Energy Codes (1983-2021)



Note: DOE has not yet completed analysis on the 2021 IECC commercial provisions.

Figure 9. Cumulative CO_2 Savings from Each Edition of the International Energy Conservation Code (2009-2021)

Introduction to the International Codes

Building codes and standards provide a common language and requirements for the design, construction, and operation of buildings. They have long served as the main tool of governments in setting agreed-upon norms. The concept of building codes goes as far back as Hammurabi (circa 1772 BCE) who established a performance-based code with strict penalties for noncompliance. Codes were developed and adopted in Europe as it was settled and evolved over many decades. Those codes were imported to the new world and formed the basis for city codes as the U.S. was formed and grew. Significant fires in Chicago and Baltimore and a San Francisco earthquake in the late 19th and early 20th centuries spurred further development of codes for the design and construction of buildings, an initiative fostered by the insurance industry.[18] The primary focus at that time was to avoid loss of property and loss of life. Today, the type, rigor and adoption of building codes varies from country to country.[19]

With over 100 years of history and 64,000 members worldwide, the International Code Council facilitates the development of model building codes for adoption at the national, state, or local level. The International Codes, or I-Codes, are widely used throughout the U.S. and many global jurisdictions. They are also used as the basis for custom building codes adopted in the Caribbean, Middle East, Asia, and South and Central America. The I-Codes are a coordinated set of 15 codes including the International Building Code (IBC), International Residential Code (IRC), International Energy Conservation Code (IECC), International Green Construction Code (IgCC), International Plumbing Code (IPC) and the International Wildland Urban Interface Code (IWUIC). The I-Codes are updated every three years and developed through a consensus-based process, bringing together expertise from the public and private sector to capture the latest science and technology. The process used to develop the I-Codes is aligned with the six Principles for the Development of International Standards, Guides and Recommendations agreed upon by the World Trade Organization (WTO) Technical Barriers to Trade Committee.

In addition to the codes, the ICC provides a robust family of solutions to support effective building regulation including personnel training and certification, product evaluation, accreditation services, plan review, third-party plan review and inspection services for off-site construction, and engineering support services. The ICC Family of Solutions are of value to professionals and officials working in jurisdictions using the I-Codes as well as those in jurisdictions using independently-developed building codes and standards.

[18] Whole Building Design Guide. *Codes and Standards Development.* 2016. https://www.wbdg.org/resources/codes-and-standards-development. Accessed October 14, 2021.

[19] International Code Council. Global Building Codes Tool. https://www.iccsafe.org/products-and-services/global-services/global-codes/.

ICC INTERNATIONAL CODE COUNCIL®

GLOBAL BUILDING REGULATION

Building codes and standards are an essential element of a building regulatory system, but in order to truly achieve improved safety and performance, building codes must be bolstered by a building safety ecosystem that includes enabling legislation, an enforcement mechanism, and support infrastructure that facilitates the safe design, construction and operation of buildings. The support infrastructure often includes a wide range of material, design, test and installation standards, a product approval framework, and a system for educating and certifying professionals.

It is difficult to characterize a "standard" building regulatory system. Many countries' building codes are created by a national or federal level body, often within or appointed by a national government agency. The adoption of the national regulations may occur at a national, state, territory, provincial, or local government level. Enforcement may be the responsibility of local governments or licensed third party entities. Fire, plumbing and energy codes in some countries are regulated and enforced separately from structural building codes. Whatever the enforcement regime, this is an essential component in achieving building safety and should not be overlooked when building regulations are issued. Particularly for codes requiring specialized enforcement, like building energy codes, jurisdictions may need to implement training and certification programs to ensure that the codes are effectively enforced and actually achieve their intended targets or goals.

Building codes and standards are an essential element of a building regulatory system, but in order to truly achieve improved safety and performance, building codes must be bolstered by a building safety ecosystem that includes enabling legislation, an enforcement mechanism, and support infrastructure that facilitates the safe design, construction and operation of buildings.

The Energy Building Codes working group of the International Energy Agency's Energy in Buildings and Communities Programme has recently conducted research that reveals the critical importance of code compliance. The findings, which will be published in a forthcoming report, focused particularly on building energy codes, which depend heavily on compliance measures to ensure that the codes meant to reduce energy consumption are properly implemented in order to achieve the stated policy objectives. Therefore, when energy efficiency and green measures are introduced into building regulation, with them should come robust compliance tools, which include not only training and certification, but also mechanisms that help jurisdictions to build enforcement capacity, including through potential third-party organizations.

Particularly in performance-based design, which does not rely on prescriptive standards to dictate how and when materials, forms of construction or designs should be used, a robust conformity assessment system becomes a critical element that enables the safe and compliant use of innovative technologies – especially important in designing for high performance and energy efficiency. Conformity assessment tools, such as product testing, inspection, and certification, as well as the accreditation of manufacturers, third party inspectors, testing labs, product certification bodies, and even building departments, can be successfully leveraged to ensure that innovative design and use of emergent technologies are applied and installed correctly. In any case, a robust oversight and enforcement system that is supported with adequate funding as well as a system of checks and balances is essential.

DEFINING BUILDING CLIMATE RESILIENCE

In considering national and international level efforts to enhance resilience – particularly against the impacts of climate change, it is important to convey a common starting point. Given the myriad pressures on society from natural and man-made hazards and social and economic stresses, resilience in its broadest sense must recognize the changing risk posed by climate change. While this holistic vision is important for setting international, national, and sub-national goals, achieving these goals requires action within individual disciplines or segments of the economy. Figure 10 illustrates some of the ways in which several groups in the sector define resilience.

Figure 10. Select definitions of resilience

The International Code Council has developed a broad definition of resilience that reflects engagements with communities from the individual building level to community-wide resilience benchmarking. The definition captures the value of a holistic perspective that includes both social and organizational considerations and allows the Code Council's building resiliency work to mesh with other resilience initiatives in other sectors.

The Alliance for National and Community Resilience™ (ANCR™) (a member of the ICC Family of Solutions) recognizes the importance of a holistic vision for communities that identifies and captures the important factors that lead to community resilience. ANCR has developed Community Resilience Benchmarks® (CRB™), through the identification of 19 community functions that define a community, in order to evaluate their resilience within and across these functions and chart a path towards increased resilience. In the context of their work and through the CRBs, ANCR has adopted the U.S. Presidential Policy Directive 8's definition for resilience.[20]

[20] This directive was issued in 2011 with an aim of strengthening the security and resilience of the United States. More information can be found at https://www.dhs.gov/presidential-policy-directive-8-national-preparedness.

The Alliance for a Climate Resilient Earth (ACRE) presents their principles for a climate resilient earth, acknowledging that communities are facing increased risk to the emerging impacts of climate change. ACRE takes a multi-faceted approach to provide a comprehensive view of resilience in the context of climate change.

The Global Resiliency Dialogue is focused on those hazards associated with climactic and weather-related events likely to be influenced by a changing climate. The Global Resiliency Dialogue, through their analysis of comparative findings on the incorporation of climate change projections in building codes, agreed on a definition of building climate resilience.

As of September 2021, only 80 countries had mandatory or voluntary building energy codes on the national or subnational level, out of which 43 countries had mandatory codes on the national level for both residential and non-residential buildings. Eighty-two percent of the population to be added by 2030 are living in countries without building energy codes or just voluntary codes.

ENERGY CODES ARE A MITIGATION AND ADAPTATION STRATEGY

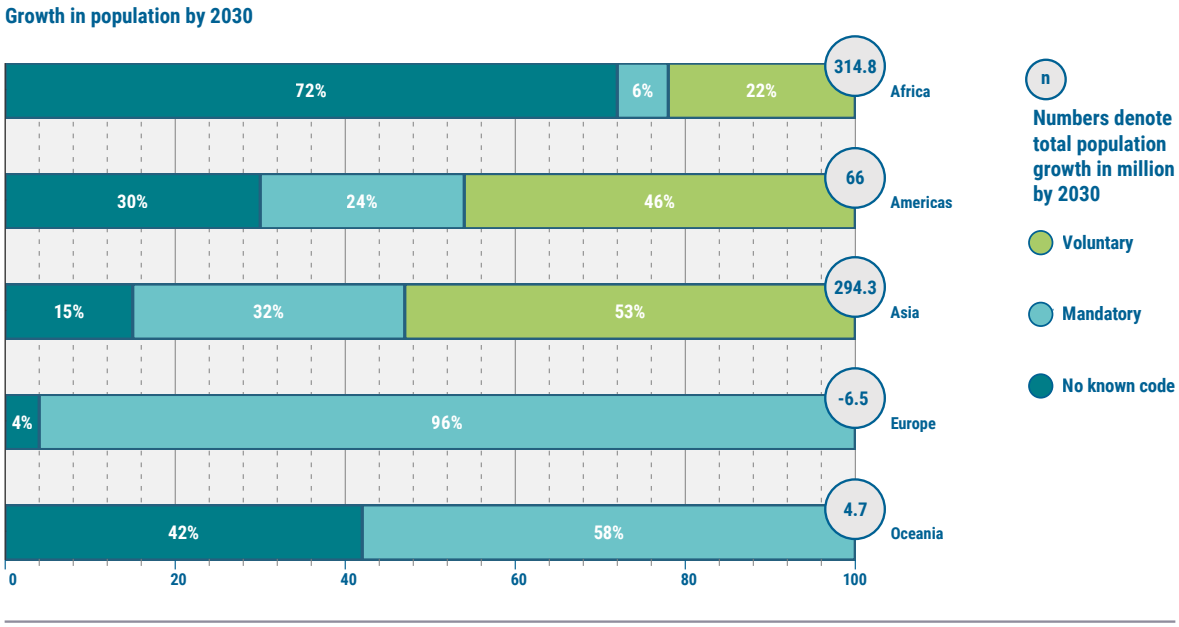
Building energy codes are an important policy tool in both climate mitigation and adaptation. As outlined above, approximately 40% of GHG emissions globally are tied to buildings and construction. Any efforts to achieve NDCs that do not address buildings are overlooking an essential opportunity. Energy codes are the foundation to any effort to drive new buildings towards zero energy and zero carbon and set requirements for how renovations to existing buildings should be undertaken. However, as of September 2021, only 80 countries had mandatory or voluntary building energy codes on the national or subnational level, out of which 43 countries had mandatory codes on the national level for both residential and non-residential buildings. Eighty-two percent of the population to be added by 2030 are living in countries without building energy codes or just voluntary codes.[21] (See Figure 11.)

Increasing levels of energy efficiency in buildings can lead to less energy demand—thus decreasing reliance on fossil fuels and enhancing the ability to achieve zero energy goals through increased renewable energy deployment. Additional buildings policies including incentives to drive retrofits or ongoing performance requirements should be coordinated with building energy codes to assure a holistic policy approach aligned with overall energy and GHG reduction goals.

In the Caribbean, the CARICOM Regional Organization for Standards and Quality (CROSQ) recognized the importance of a region-wide energy strategy driven by tools that include a strong energy code. Working with the International Code Council and ASHRAE, CROSQ developed the CARICOM Regional Energy Efficiency Building Code (CREEBC) based on the 2018 IECC. The CREEBC was passed by the CARICOM Council for Trade and Economic Development in 2018 and is currently in the process of being adopted into national legislation in several CARICOM member states.[22] Since the publication of the CREEBC, CROSQ has become actively engaged in the process to update the IECC, with a mirror committee established within CROSQ to update the CREEBC and ensure that the CREEBC remains contemporary and reaps all of the incremental benefits of increased energy efficiency from one version to the next. In addition to the code itself, CROSQ and the International Code Council have developed training and certification programs to help facilitate its effective application. While the CREEBC was developed for the Caribbean, most of the provisions could be applicable or easily adapted to countries in tropical climate zones throughout Southeast Asia, Africa, Latin America, and the Pacific Islands.

[21] United Nations Environment Programme (2021). 2021 Global Status Report for Buildings and Construction: Towards a Zero Emission, Efficient and Resilient Buildings and Construction Sector. Nairobi. https://globalabc.org/resources/publications/2021-global-status-report-buildings-and-construction.

[22] CARICOM Regional Energy Efficiency Building Code (CREEBC) Project, http://energy.CROSQ.org/creebc.



Notes: Population projection estimates show a decline in European population and this occurs in countries already covered by building codes.
Source: IEA 2021e. All rights reserved.

Figure 11. Percentage of population growth 2021-2030 covered by energy codes

To date, energy codes have primarily been focused on reducing energy costs, energy use, and GHG emissions. However, as climate adaptation becomes a priority, energy codes are also being recognized for their contributions to resilience. Climate change is expected to result in an increase in extreme temperature events.[23] Through provisions for efficient building envelopes and heating, ventilation, air-conditioning and refrigeration equipment plus guidance on shading and reducing solar heat gain, energy codes can reduce the impacts of such extreme events. Additionally, during these extreme events, the energy grid may become strained. Reduced energy demand to obtain comfortable temperatures through increased building efficiency can also enhance resilience of the energy grid.[24] (See Figure 12.)

Research has shown multiple benefits associated with energy efficiency measures in buildings including during emergency response and recovery, for social and economic resilience, and for climate mitigation and adaptation.[25] (See Figure 13.)

Energy insecurity, fuel poverty or high energy burdens impact the social resilience of low- and moderate-income populations.[26] Energy insecurity intersects with other hardships, compounding the severity of the others, contributing to

[23] National Academies. *Based on Science: Global warming makes heat waves hotter, longer, and more common.* https://www.nationalacademies.org/based-on-science/global-warming-makes-heat-waves-hotter-longer-and-more-common. Accessed October 11, 2021.

[24] International Code Council. The Important Role of Energy Codes in Achieving Resilience. https://www.iccsafe.org/wp-content/uploads/19-18078_GR_ANCR_IECC_Resilience_White_Paper_BRO_Final_midres.pdf.

[25] See Ribeiro, D., E. Mackres, B. Baatz, R. Cluett, M. Jarrett, M. Kelly and S. Vaidyanathan. Enhancing Community Resilience through Energy Efficiency. American Council for an Energy Efficient Economy. October 2015.

[26] Energy insecurity, fuel poverty or high energy burdens refer to inability to access energy sources or the cost of using such sources is significant compared to monthly income.

Figure 12. Energy Code Contributions to Resilience

Benefit type	Energy efficiency outcome	Resilience benefit
Emergency response and recovery	Reduced electric demand	Increased reliability during times of stress on electric system and increased ability to respond to system emergencies
	Backup power supply from combined heat and power (CHP) and microgrids	Ability to maintain energy supply during emergency or disruption
	Efficient buildings that maintain temperatures	Residents can shelter in place as long as buildings' structural integrity is maintained.
	Multiple modes of transportation and efficient vehicles	Several travel options that can be used during evacuations and disruptions
Social and economic	Local economic resources may stay in the community	Stronger local economy that is less susceptible to hazards and disruptions
	Reduced exposure to energy price volatility	Economy is better positioned to manage energy price increases, and households and businesses are better able to plan for future.
	Reduced spending on energy	Ability to spend income on other needs, increasing disposable income (especially important for low-income families)
	Improved indoor air quality and emission of fewer local pollutants	Fewer public health stressors
Climate mitigation and adaptation	Reduced greenhouse gas emissions from power sector	Mitigation of climate change
	Cost-effective efficiency investments	More leeway to maximize investment in resilient redundancy measures, including adaptation measures

Figure 13. Resilience Benefits of Energy Efficiency

detrimental health consequences. Competing needs and hardships, such as food insecurity, water insecurity, and housing insecurity, result in tradeoffs where basic needs are prioritized and sometimes foregone. The stress from having to make trade-offs between basic needs for food, water, housing, and energy profoundly affects adult and child mental health, exacerbating many kinds of physical health and social issues.[27]

In many countries, access to energy is limited. According to the IEA, 770 million people worldwide still live without access to electricity, mostly in Africa and lower income countries in Asia. After decreasing 9% annually on average between 2015 and 2019, preliminary data show that progress stalled between 2019 and 2021 globally, and that the number of people without electricity access increased in sub-Saharan Africa.[28] The IEA estimates that providing universal access to electricity and clean cooking by 2030 would require investments of $43 billion per year, closing an important gap in the global energy system at a fraction of the overall cost of transitions.[29] Increasing the electricity supply without focusing primarily on renewable energy sources and considering energy efficiency enhancements to buildings could be detrimental to the fight against climate change. Contrarily, coupling such investments with building efficiency strategies and renewable energy deployment can help overcome energy poverty and improve quality of life.

In the U.S. for example, low-income households face energy burdens two to three times that of median households. Of all U.S. households, 25% (30.6 million) face a high energy burden (i.e., pay more than 6% of income on energy bills) and 13% (15.9 million) of U.S. households face a severe energy burden (i.e., pay more than 10% of income on energy).[30] Building codes and weatherization or retrofit programs provide important mechanisms for reducing energy burdens. Importantly, such efforts can improve quality of life and health outcomes while providing economic stimulus and job creation.[31]

A more in-depth discussion on the energy/resilience nexus can be found in the International Code Council publication, *The Important Role of Energy Codes in Achieving Resilience*.[32]

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[27] Jessel, S., S. Sawyer, and D. Hernández. "Energy, Poverty, and Health in Climate Change: A Comprehensive Review of an Emerging Literature." *Frontiers in Public Health,* v7, 2019. https://www.frontiersin.org/article/10.3389/fpubh.2019.00357.

[28] International Energy Agency. World Energy Outlook 2021. https://www.iea.org/reports/world-energy-outlook-2021.

[29] Ibid.

[30] Drehobl, A,. Ross, L., and Ayala, R. 2020. How High are Household Energy Burdens? Washington, DC: American Council for an Energy-Efficient Economy.

[31] Ibid and Royal Institute of British Architects, Greener Homes: Decarbonising the housing Stock. December 2020. https://www.architecture.com/knowledge-and-resources/resources-landing-page/greener-homes-decarbonising-our-housing-stock#available-resources.

[32] International Code Council. The Important Role of Energy Codes in Achieving Resilience. https://www.iccsafe.org/wp-content/uploads/19-18078_GR_ANCR_IECC_Resilience_White_Paper_BRO_Final_midres.pdf.

ICC INTERNATIONAL CODE COUNCIL®

Recognition of the Role of Building Codes in Achieving Climate Goals

"Governments should set ambitious policy, regulation, and legislation covering strategies and roadmaps, financial frameworks, building codes, and planning systems, as well as creating the system change needed through public infrastructure." Architects Declare & Royal Institute of British Architects[33]

"The [American Institute of Architects] is committed to advocating for energy efficient, resilient, and zero carbon buildings in our cities, suburbs, and rural communities. It is imperative that world leaders meeting in Glasgow fully commit to adopting aggressive building policies, incentives, and codes that meet the 1.5°C carbon budget. As our nation's leaders set ambitious targets, architects are making them a reality." Peter Exley, FAIA, 2021 President, American Institute of Architects[34]

"National and sub-regional policy actions are crucial elements to accelerate an industry shift towards a net zero carbon built environment. Arup supports the development of policy, codes and standards which drive down emissions – confident that we have the knowledge and expertise to implement them. Arup stands ready to support our clients as they embrace the importance of this moment when the aspirations of climate action must convert to tangible action at scale and pace." Dame Jo da Silva, Global Sustainable Development Leader, Arup[35]

"Business calls on governments to: . . . Implement mandatory performance-based building energy codes addressing both operational and embodied carbon, as well as measures to enhance building resilience." We Mean Business Coalition[36]

"Among all policy actions, the most widely recognised and scalable action that can be taken to reduce energy related GHG emissions from the buildings sector is the implementation of building energy codes. Having such codes in place and enforced effectively lifts the minimum performance of all buildings to which they apply." United Nations Environment Programme, Global Alliance for Buildings and Construction[37]

"Priority 3: Investing in disaster risk reduction for resilience. . . To encourage the revision of existing or the development of new building codes and standards and rehabilitation and reconstruction practices at the national or local levels, as appropriate, with the aim of making them more applicable within the local context, particularly in informal and marginal human settlements, and reinforce the capacity to implement, survey and enforce such codes through an appropriate approach, with a view to fostering disaster-resistant structures;" Sendai Framework for Disaster Risk Reduction 2015-2030[38]

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[33] Architects Declare and Royal Institute of British Architects. Built for the Environment: Addressing the climate and biodiversity emergency with a fair and sustainable built environment. 2021. https://www.architecture.com/knowledge-and-resources/resources-landing-page/built-for-the-environment-report.

[34] 1.5°C COP Communique, Signatory Quote Sheet. https://cop26communique.org/wp-content/uploads/COP26-Communique%CC%81-Quotes.pdf. Accessed October 13, 2021.

[35] Ibid.

[36] We Mean Business Coalition. Bold Climate Policy Drives Decisive Business Action. https://www.wemeanbusinesscoalition.org/policy/#built%20environment. Accessed October 13, 2021.

[37] United Nations Environment Programme (2018): A GUIDE FOR INCORPORATING BUILDINGS ACTIONS IN NDCs Job No: DTI/2225/PA. https://globalabc.org/sites/default/files/2020-03/GABC-NDC-GUIDE_ENGLISH.pdf.

[38] United Nations General Assembly. Sendai Framework for Disaster Risk Reduction 2015–2030. 2015. https://www.preventionweb.net/files/resolutions/N1516716.pdf.

Recognition of the Role of Building Codes in Achieving Climate Goals (continued)

"Parliamentarians can support a national shift towards [disaster risk reduction] by . . . fostering cooperation across all government levels by integrating and aligning [disaster risk reduction] initiatives with localized solutions, such as land-use regulations and building code improvements." United Nations Office of Disaster Risk Reduction[39]

"Across the globe, the intensity, duration, frequency and location of extreme weather events are changing. Communities and the built environment they rely on to support their economic and social prosperity must be prepared to respond to these changing risks. Building codes are fundamental to assuring buildings support the health, safety and welfare of communities, including protecting life during hazardous events." Global Resiliency Dialogue[40]

"Adopting the latest building code requirements is affordable and saves $11 per $1 invested. Building codes have greatly improved society's disaster resilience, while adding only about 1% to construction costs relative to 1990 standards. The greatest benefits accrue to communities using the most recent code editions." National Institute of Building Sciences (U.S.)[41]

"With the adoption of the Sendai Framework for Disaster Risk Reduction, there is a clear international consensus recognizing the importance of building codes and standards. Going forward, improved building regulatory capacity must be part of the effort to reduce risk among the most vulnerable and ensure shared prosperity." Francis Ghesquiere, Global Facility for Disaster Reduction & Recovery, World Bank Group[42]

"In emerging market and developing economies, rapid urbanisation and development calls for huge investment in ensuring that new construction is zero carbon-ready, driven by the adoption of building energy codes." International Energy Agency[43]

"Energy efficiency standards and retrofits are a suite of tools including equipment performance standards and building energy performance construction codes that are among the most direct and high impact actions that governments can take, and they have a long history of success. Standards and codes are an indispensable part of any energy efficiency strategy that seeks impacts at scale, since they have the potential to affect every piece of equipment sold in a country or every building constructed." U.S. Agency for International Development[44]

"Energy codes play a fundamental role in energy efficiency objectives, making them a priority policy pathway for developing and emerging economies." World Resources Institute[45]

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[39] United Nations Office of Disaster Risk Reduction. Disaster Risk Reduction to Achieve the Sustainable Development Goals: A Toolkit for Parliamentarians. 2021. https://www.undrr.org/publication/disaster-risk-reduction-achieve-sustainable-development-toolkit-parliamentarians.

[40] Global Resiliency Dialogue. Findings on Changing Risk and Building Codes.2019. https://www.iccsafe.org/wp-content/uploads/Findings_ChangingRisk_BldgCodes.pdf.

[41] National Institute of Building Sciences. Natural Hazard Mitigation Saves: 2019 Report. https://nibs.org/projects/natural-hazard-mitigation-saves-2019-report.

[42] World Bank Group. Building Regulation for Resilience: Managing Risks for Safer Cities. 2015. https://openknowledge.worldbank.org/bitstream/handle/10986/24438/Building0regul0sks0for0safer0cities.pdf.

[43] International Energy Agency. World Energy Outlook 2021. https://www.iea.org/reports/world-energy-outlook-2021.

[44] U.S. Agency for International Development. *Scaling up Energy Efficiency in Developing Countries: The Building Blocks of Energy Efficiency.* November 2020. https://ee4d.org/wp-content/uploads/sites/40/2021/05/USAID_EE4D_Energy-Efficiency_Building-Blocks_Toolkit_508.pdf.

[45] World Resources Institute. *Accelerating Building Efficiency Eight Actions for Urban Leaders.* https://publications.wri.org/buildingefficiency/. Accessed October 14, 2021.

BUILDING CODES AS A PATH TO RESILIENCE

In addition to energy efficiency, building codes address multiple other important climate factors including water use, materials and waste, indoor air quality including ventilation and filtration, and sustainable economic growth and job creation. They also help protect occupants from the devastating impacts of climate change. While the perils covered by building codes can vary, they generally address climate-based risks including flooding, tropical cyclone/hurricane, wildfire/bushfire, and extreme snow through the provision of either performance or prescriptive requirements for structural loads, material properties, enclosure characteristics, and other design requirements.

Building codes are a fundamental contributor to community resilience. A community cannot be resilient without resilient buildings and the codes that support their development. Resilience in the built environment starts with strong, regularly adopted, and properly administered building codes.[46] (See Figure 14.)

Building codes are a fundamental contributor to community resilience. A community cannot be resilient without resilient buildings and the codes that support their development. Resilience in the built environment starts with strong, regularly adopted, and properly administered building codes.

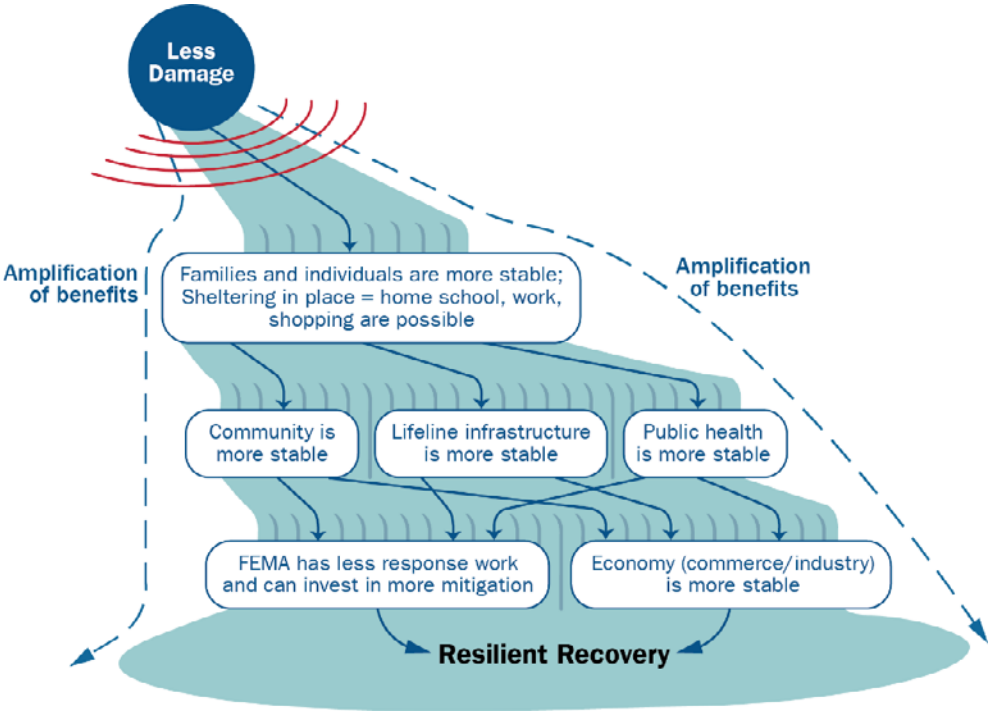

Figure 14. Cascading Benefits from Implementation of Building Codes

[46] International Code Council. *Resilience Contributions of the International Building Code.* 2019. https://www.iccsafe.org/wp-content/uploads/19-17804_IBC_Resilience_WhitePaper_FINAL_HIRES.pdf.

SETTING THE PATH TO CLIMATE RESILIENCE

Two-thirds of the buildings to be constructed through 2050 are predicted to be built in countries without building codes.[47] Without building codes in place, these buildings could lock in higher than necessary emissions and costs while also failing to build in resilience measures across their entire life cycle. Integrating energy efficiency measures is relatively simple and can be done at little to no cost at the planning and design stage, but becomes more difficult and expensive once the building is complete.[48] The International Building Quality Centre (IBQC), a global think tank of building safety experts, has reported that superimposing building codes developed for advanced economies is not an effective strategy to ensure local uptake in lower- and middle-income countries.[49] Similarly, building regulation does not need to be overly complex – but it does need to be implementable and enforceable particularly in the engineered buildings proliferating in the growing urban centers of these countries. It is essential that lower- and middle-income countries adopt reasonable building regulations that are aligned with national and international climate goals and can be effectively enforced within their unique cultural and political environments.

As identified by the IBQC, the effective regulation of buildings requires a multi-pronged approach that recognizes the landscape of the adopting country. Building regulations developed for low-income jurisdictions can best achieve their goals if they are sympathetic to the needs of engineered, vernacular, and informal construction.[50] While the application of codes and regulatory schemes from high-income countries are not likely to directly translate to lower income countries, IBQC identified some core characteristics of building regulatory programs. Key features include:

- Designation of a central government regulator with building control responsibility;
- A central and consolidated buildings act providing building regulatory authority and capturing the objectives of improving health and safety;
- A building code containing technical requirements and standards;
- A consultative framework allowing stakeholder engagement in code and regulatory development;
- A practitioner licensing system;
- Regulations that recognize different construction paradigms (engineered, vernacular and informal construction);
- A product approval agency;
- A dispute resolution process;
- A robust building permitting system;
- Municipal level enforcement and inspection powers; and
- Emergency power regulations for informal settlements.

Two-thirds of the buildings to be constructed through 2050 are predicted to be built in countries without building codes. Without building codes in place, these buildings could lock in higher than necessary emissions and costs while also failing to build in resilience measures across their entire life cycle.

[47] Global Alliance for Buildings and Construction. *GlobalABC Roadmap for Buildings and Construction 2020-2050.* https://globalabc.org/sites/default/files/inline-files/GlobalABC_Roadmap_for_Buildings_and_Construction_2020-2050_3.pdf.

[48] Laustsen, Jens. Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings. IEA Information Paper. Sweden. 2008. https://www.iea.org/reports/energy-efficiency-requirements-in-building-codes-policies-for-new-buildings.

[49] International Building Quality Centre. *Good Practice Guidelines and Principles for the Developmentof Building Regulations in Low Income Countries.* April 2021. http://www.ibqc.org.au/wp-content/uploads/2021/05/IBQC-Good-Practice-Guidelines-for-Low-Income-Countries-2021.pdf.

[50] International Building Quality Centre. *Good Practice Guidelines and Principles for the Development of Building Regulations in Low Income Countries.* April 2021. http://www.ibqc.org.au/wp-content/uploads/2021/05/IBQC-Good-Practice-Guidelines-for-Low-Income-Countries-2021.pdf.

Organizations like the International Code Council can work with governments to support an incremental approach to improvement, leveraging existing resources and best practices. For example, the Code Council is working with the government of Bangladesh to develop and implement educational resources that support effective code administration.

The Bangladesh National Building Code 2020 was promulgated in 2020, however, the country found that it lacked sufficient capacity to effectively implement and enforce the new code. This – coupled with increasingly frequent and severe disasters and rapid urbanization – was enough to warrant the implementation of a $172 million World Bank funded Urban Resilience Project. One segment of this large project was earmarked to improve the ability of RAJUK, the Capital Development Authority of Dhaka, in the area of building code implementation and enforcement. The International Code Council was awarded a contract to develop and launch an extensive training program on the new building code for delivery to architects, engineers, planners and other building industry professionals. Although the Bangladesh National Building Code was not developed using the International Building Code or another model code published by the International Code Council, it does reference many US-developed international standards, particularly those related to structural safety. The general expertise of the International Code Council in training and capacity building was more than sufficient to develop a customized training program for RAJUK, which included 43 webinars, delivered over the course of four months (March–July 2021) to 1,374 individuals – some attending more than one training.

The United States Agency for International Development's (USAID's) Energy Efficiency for Development (EE4D) program provides technical resources and expert advice to USAID partner countries to advance energy efficiency strategies and achieve more resilient and sustainable economic development. EE4D helps countries access technical assistance for standards and retrofits, market priming and financing, and policy planning interventions necessary to scale up energy efficiency rapidly and effectively.[51]

To date, most building codes base requirements on risk calculations based on past events. However, as climate change drives changes in the frequency, intensity, duration and location of extreme events, codes must adapt to ensure that buildings, their owners and occupants can remain safe throughout their lifecycle. Building code development and research organizations from Australia, Canada, New Zealand and the United States came together to form the Global Resiliency Dialogue, a joint initiative to inform the development of building codes that draw on both building science and climate science to improve the resilience of buildings and communities to intensifying risks from weather-related natural hazards.

> Building codes and the activities that support their effective use are central to the realization of a climate resilient future. The International Code Council calls on all governments to adopt and enforce building codes aligned with domestic and international goals for reduced GHG emissions and enhanced resilience.

While establishing a building regulatory scheme including development and adoption of codes; education and training programs for regulators, designers, and constructors; and product testing and evaluation capacity may take time, organizations like the International Code Council can provide tools and expertise to help jumpstart the process. Additionally, while such schemes develop, countries and cities should lead by example and help build capacity through their procurement processes.

Off-site construction or pre-fabrication has been identified as a core strategy in addressing multiple building industry and societal challenges – including sustainability and access to affordable housing. Off-site construction can reduce material

[51] See https://ee4d.org/.

waste while enhancing building quality and improving the safety of builders. To incentivize increased use of off-site construction, building regulatory programs must be designed to effectively inspect and approve factory-built components. For example, the International Code Council and Modular Building Institute (MBI) have developed ICC/MBI Standard 1200-2021: Standard for Off-Site Construction: Planning, Design, Fabrication, and Assembly and ICC/MBI Standard 1205: Standard for Off-Site Construction: Inspection and Regulatory Compliance. The standards can integrate with any building codes used globally and include procedures for plan review and in-factory inspection and approval. The International Code Council and MBI have just initiated work on a new standard, ICC/MBI Standard 1210: Standard for Mechanical, Electrical and Plumbing Systems, Energy Efficiency and Water Conservation in Off-Site Construction.[52] Off-site construction can also provide opportunities for more expedient rebuilding post-disaster.

As nations and non-party actors come together at COP26 to set the path forward to climate resilience, the role of buildings and building codes in achieving NDCs while also lessening the impacts of climate change is clear. Policies at the national and sub-national levels to achieve net-zero emissions and enhance community resilience must include a strong focus on current and future buildings. Building codes and the activities that support their effective use are central to the realization of a climate resilient future. The International Code Council calls on all governments to adopt and enforce building codes aligned with domestic and international goals for reduced GHG emissions and enhanced resilience.

[52] For more information on the International Code Council's off-site construction activities see www.iccsafe.org/offsite.

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APPENDICES

INTERNATIONAL GOALS FOR CLIMATE

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

The United Nations Member States adopted the 2030 Agenda for Sustainable Development in 2015 to provide a shared blueprint for peace and prosperity for people and the planet, now and into the future.[53] In accordance with the work of the UN Department of Economic and Social Affairs and the 2030 Agenda, came the development of the seventeen Sustainable Development Goals (SDGs). The SDGs are a modern version of the eight Millennium Development Goals established at the 2000 Millennium Summit to reduce extreme global poverty by 2015. The SDGs cover thematic issues felt around the world including, but not limited to, water, energy, climate, oceans, urbanization, transport, science and technology, infrastructure, peace and justice, equality, and poverty. The seventeen goals consist of 169 targets, 3,087 events, 1,304 publications, and 5,476 actions. The framework of the 2030 Agenda for Sustainable Development aims to engage Member States to implement the SDGs, which translates into advocacy and outreach activities relating to specific target areas to drive global change.

THE PARIS AGREEMENT

The Paris Agreement, established by the United Nations Framework Convention on Climate Change (UNFCCC), is a legally binding international treaty on climate change aimed to limit global warming to 1.5 degrees Celsius compared to pre-industrial levels.[54] The Paris Agreement landmark was adopted by 196 Parties at COP21 in 2015, which provides countries with a framework and network for financial, technical and capacity building support to undertake ambitious actions to combat climate change and adapt to the subsequent impacts. Under the Agreement, signatory countries immediately aim to reach global peaking of greenhouse gas (GHG) emissions to achieve a climate neutral world by mid-century.[55] The Agreement works on a 5-year cycle of increasingly ambitious climate actions by signatory countries, known as Nationally Determined Contributions (NDCs), which include many low-carbon solutions and new markets established through the best available climate science across all sectors.[56] Signatory parties will begin formally reporting their climate actions in 2024 through the newly established enhanced transparency framework (ETF) to comprehensively track global progress to combat climate change through the Paris Agreement forum.

NATIONALLY DETERMINED CONTRIBUTIONS

NDCs are post-2020 climate action plans to reduce national emissions and adapt to the impacts of climate change. Under the Paris Agreement, determined in Article 4-Paragraph 2, countries are required to prepare, communicate and maintain succeeding NDCs within the 5-year cycle that each country intends to achieve in order to realize the long-term goals of the Agreement.[57] NDCs determine specific actions to reduce their GHG emissions and build resilience to adapt to the impacts of rising temperatures in order to reach their climate targets that contribute to the 1.5 degree Celsius goal of the Paris Agreement.[58] In conjunction with NDCs under the Paris Agreement, countries are invited to develop long-term greenhouse gas emission development strategies (LT-LEDS) to provide the long-term vision to the NDCs. For example, the United States has established their nationally determined contribution by setting an economy-wide target of reducing its net GHG emissions by 50-52% below 2005 levels by 2030.[59]

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[53] THE 17 GOALS | Sustainable Development (un.org).

[54] The Paris Agreement | UNFCCC.

[55] The Paris Agreement | UNFCCC.

[56] The Paris Agreement | UNFCCC.

[57] Nationally Determined Contributions (NDCs) | UNFCCC.

[58] The Paris Agreement | UNFCCC.

[59] Microsoft Word - United States NDC April 21 2021 Final.docx (unfccc.int).

COP26: RACE TO ZERO CAMPAIGN

COP26 is the United Nation's 26th annual global climate summit which will be held in Glasgow from October 31st to November 12th, 2021, with the United Kingdom serving as President. The goals of COP26 include securing global net zero by mid-century to keep 1.5 degrees Celsius within reach, adapting to protect communities and natural habitats, mobilizing climate finances to support these goals, and working together to finalize the Paris Agreement Rulebook and accelerate comprehensive action to tackle the climate crisis.[60]

In line with the goals of the Paris Agreement and in conjunction with COP26, the High-Level Climate Champions for Climate Action are leading the Race to Zero campaign. "Race to Zero is the UN-backed global campaign rallying non-state actors – including companies, cities, regions, financial and educational institutions – to take rigorous and immediate action to halve global emissions by 2030 and deliver a healthier, fairer zero carbon world in time."[61] The Race to Zero campaign mobilizes a coalition of leading climate action plans and bold targets to rapidly reduce emissions to net zero across all scopes. The campaign was launched at the UN Secretary Generals' (UNSG) Climate Action Summit in 2019 and represents 31 regions, 733 cities, 3,067 companies, 624 educational institutions, 173 investors and over 3,000 hospitals from 37 healthcare institutions. These actors are jointly working with 120 counties to halve emissions by 2030 and achieve net zero carbon emission by 2050.

COP26 COMMUNIQUÉ

Architecture2030 and the American Institute of Architects (AIA) have established a Communiqué for COP26 outlining current and future initiatives that the building industry is undertaking to reduce GHG emissions and the importance of governments committing to strong reductions in emissions. The Communiqué is comprised of high-profile organizations and large firms and sub-national governments responsible for planning, designing, constructing, and developing the built environment.[62] The COP26 Communiqué calls on governments to take specific actions that fully harness the capacity to affect significant carbon emissions reductions including a 65% emissions reduction by 2030, and zero CO_2 emissions by 2040. The initiative works in concurrence with the goals and climate actions of the Paris Agreement, urging governments to set ambitious NDCs that align with the 340-400 $GTCO_2$ global carbon budget to meet the 1.5 degrees Celsius target.[63] The Communiqué will engage government leaders at COP26 to join the signatories in undertaking bold climate actions to combat the climate crisis.

[60] COP26 Goals - UN Climate Change Conference (COP26) at the SEC – Glasgow 2021 (ukcop26.org).

[61] Join the race - Race to Zero & Race to Resilience (unfccc.int).

[62] Communique – COP26 Communique.

[63] Communique – COP26 Communique.

INTERNATIONAL RESILIENCE GOALS

UNITED NATIONS OFFICE FOR DISASTER RISK REDUCTION

The UNDRR brings governments, partners and communities together to reduce disaster risk and losses to ensure a safer, more sustainable future.[64] UNDRR is responsible for the Sendai Framework, supporting countries to implement, monitor and share the unique strategies that are successful in reducing existing risk and preventing the creation of new risk. The Sendai Framework is a resilience mechanism that provides Member States with concrete actions to protect development gains from disaster risk.[65] The Framework works in conjunction with the other 2030 Agenda agreements, including the Paris Agreement. "The Sendai Framework focuses on the adoption of measures which address the three dimensions of disaster risk (exposure to hazards, vulnerability and capacity, and hazard's characteristics) in order to prevent the creation of new risk, reduce existing risk and increase resilience."[66] The Framework consists of four main priorities, outlined by seven global targets to guide resilience building and 38 indicators to measure progress.

COP26: RACE TO RESILIENCE

The Race to Resilience is a global campaign to rally leadership and support from key stakeholders to assist frontline communities in building their resilience capacity and adaptation to the impacts of climate change.[67] The campaign is run by the COP26 Presidency and the High-Level Climate Champions in conjunction with the goals of the Paris Agreement and Race to Zero. "The Race to Resilience aims to catalyze action by non-state actors to build the resilience of 4 billion people from vulnerable groups and communities to climate risks."[68] The Campaign was launched at the Climate Adaptation Summit 2021 and includes the Cities Race to Resilience initiative aimed at engaging cities to commit to taking crucial climate change adaptation actions to enhance community-wide resilience. The Cities Race to Resilience includes unique resilience actions for buildings, digitalization, energy, food systems, governance and community engagement, nature-based solutions, risk and vulnerability planning, social equity, urban-rural linkages, waste and water.

GLOBAL RESILIENCY DIALOGUE

The Global Resiliency Dialogue was established in 2019 by The International Code Council, the Australian Building Codes Board, the National Research Council of Canada, and the New Zealand Ministry of Business, Innovation and Employment, to foster global collaboration in addressing evolving climate risks in codes and standards. The aim is to create an international resiliency guideline and enable collaborative research efforts that will aid jurisdictions across the globe to better prepare the building stock to withstand the more extreme weather events, including high wind, flooding, and wildfire, that the evidence and science tells us have been and will continue to increase in frequency and duration. In February 2021, the Global Resiliency Dialogue published findings of its first international survey in the report, *The Use of Climate Data and Assessment of Extreme Weather Event Risks in Building Codes around the World*. The second publication *Delivering Climate Responsive and Resilient Building Codes and Standards*, due to be released during COP26, provides a definition for climate resilience in the context of building regulation and analyzes comparative findings on the incorporation of climate change projections in building codes from a second survey conducted in each member country.

[64] About UNDRR | UNDRR.

[65] What is the Sendai Framework? | UNDRR.

[66] What is the Sendai Framework? | UNDRR.

[67] About – Cities Race to Resilience.

[68] About – Cities Race to Resilience.

Supporting the Sustainable Development Goals

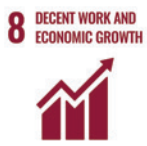
In 2015, the United Nations Member States adopted a shared blueprint for peace and prosperity for people and the planet, now and into the future. This blueprint includes 17 Sustainable Development Goals (SDGs) that support developed and developing countries in ending poverty, improving well-being and spurring economic growth.[1]

The International Code Council® and its Family of Solutions is dedicated to providing safe and resilient buildings and communities. In many cases, the ideals captured in the SDGs mirror the Code Council's priorities and the tools and other resources offered by its Family of Solutions. The information that follows captures how the Code Council's activities are aligned with the SDGs.

SUSTAINABLE DEVELOPMENT GOALS

ICC INTERNATIONAL CODE COUNCIL®

Sustainable Development Goals	International Code Council®
3 GOOD HEALTH AND WELL-BEING **Ensure healthy lives and promote well-being for all ages**	**International Codes® (I-Codes®):** The I-Codes® support the health, safety and welfare of building occupants and communities through provisions covering indoor environmental quality (IEQ), material safety, daylighting, building operations and sustainability.[2]
4 QUALITY EDUCATION **Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all**	**Safety 2.0 Initiative including the High-School Technical Training Program (HSTTP) and the Military Families Career Path Program:** Safety 2.0 is focused on welcoming a new generation of building safety leaders through access to education, mentors and other resources.[3] **Learning Center:** The Code Council offers a variety of training options for every individual to earn continuing education units that can be used toward certifications or support career advancement and knowledge building.[4]
6 CLEAN WATER AND SANITATION **Ensure availability and sustainable management and sanitation for all**	**International Plumbing Code® (IPC®):** The IPC® sets minimum regulations for plumbing systems and components to protect life, health and safety of building occupants and the public.[5] **International Private Sewage Disposal Code® (IPSDC®):** The IPSDC® is designed as a companion to the IPC® to enable the design, installation and inspection of private sewage disposal systems, which is particularly helpful in rural and less developed areas lacking municipal sewage services.[6] **ICC-Evaluation Service™ (ICC-ES™):** ICC-ES™ provides product certification for plumbing, mechanical and fuel gas products to meet the requirements of International and Uniform Codes and Standards.[7]
7 AFFORDABLE AND CLEAN ENERGY **Ensure access to affordable, reliable, sustainable and modern energy for all**	**International Energy Conservation Code® (IECC®):** The IECC® establishes minimum regulations for energy-efficient buildings using prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new energy-efficient designs.[8] **International Green Construction Code® (IgCC®):** The IgCC® provides the design and construction industry with the single, most effective way to deliver sustainable, resilient, high-performance buildings. It includes fundamental criteria for energy efficiency, resource conservation, water safety, land use, site development, indoor environmental quality and building performance.[9] **Solar Rating & Certification Corporation® (SRCC®):** SRCC® develops standards and certifies products that advance the safe and effective use of renewable energy including *ICC901/SRCC100 – Solar Thermal Collector Standard, ICC900/SRCC300 – Solar Thermal System Standard, and ICC902/APSP902/SRCC400 – Solar Pool and Spa Heating Standard.*[10]



Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

A117.1 Standard for Accessible and Usable Buildings and Facilities: Standard A117.1 provides criteria to assure sites, facilities, buildings and elements are accessible to and usable by people with physical disabilities, providing independence and access to workplaces.[11]

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Alliance for National & Community Resilience (ANCR): ANCR is developing community resilience benchmarks to help communities understand their resilience and support improvements. The Sendai Framework was instrumental in formulating the ANCR Benchmarks.[12]

Off-Site Construction: Off-site construction has been identified as a strategy to address housing affordability and availability, worker safety, sustainability and resilience. ICC has or is developing numerous tools to support the use of off-site construction including standards, product evaluations and third-party plan review and inspection.[13]

Reduce inequality within and among countries

International Codes® (I-Codes®): The consistent adoption of building codes support the delivery of safe, affordable housing regardless of socio-economic status. The I-Codes are developed through a consensus-based process that results in cost-effective requirements.

cdpACCESS®: cdpACCESS® allows remote participation in the development of the model International Codes for all jurisdictions around the world. This engagement can support adoption of code criteria globally saving the time and expense required to self-develop codes and underwriting the cost of keeping them current.[14]

Make cities and human settlements inclusive, safe, resilient and sustainable

International Codes® (I-Codes®): The Code Council develops a family of fifteen coordinated, modern building safety codes that help ensure the engineering of safe, sustainable, affordable and resilient structures. The *International Building Code®* (IBC®) and *International Residential Code®* (IRC®) have been found to provide $11 in benefits for every $1 invested.[15]

Alliance for National & Community Resilience (ANCR)
International Green Construction Code® (IgCC®)

Ensure sustainable consumption and production patterns

International Green Construction Code® (IgCC®)
International Energy Conservation Code® (IECC®)
Rainwater Collection Standard (BSR/CSA/ICC 805-201x) applies to the design, installation and maintenance of rainwater collection systems intended to collect, store, treat, distribute and utilize rainwater for potable and non-potable applications.[16]

Take urgent action to combat climate change and its impacts

Global Resiliency Dialogue: The Code Council, in conjunction with code developing organizations from Canada, Australia and New Zealand, formed a collaborative forum to discuss common struggles, and to share knowledge, research, and best practices, as they consider the role of building codes in resilience and durability in the face of increasingly severe weather events.[17]

Low and Zero Energy and Carbon Buildings: The Sustainability Membership Council has convened a subcommittee to support communities seeking solutions that deliver low and zero energy and carbon buildings.

International Energy Conservation Code® (IECC®)
International Green Construction Code® (IgCC®)

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

International Accreditation Service® (IAS®) Building Department Accreditation: Accreditation allows a building department to demonstrate that they meet national standards and are competent to provide professional public safety services to their community.[18]

Personnel Certifications: The Code Council Assessment Center recognizes code officials and other building industry participants for their competence and ability to support effective institutions.[19]

[1]https://sustainabledevelopment.un.org/sdgs, [2]https://www.iccsafe.org/products-and-services/i-codes/the-i-codes/, [3]https://www.iccsafe.org/professional-development/safety2/, [4]https://www.iccsafe.org/professional-development/training/, [5]https://www.iccsafe.org/content/international-plumbing-code-ipc-home-page/, [6]https://shop.iccsafe.org/codes/2018-international-codes-and-references/2018-international-private-sewage-disposal.html, [7]https://icc-es.org/pmg-listing-program/, [8]https://www.iccsafe.org/products-and-services/i-codes/2018-i-codes/iecc/, [9]https://www.iccsafe.org/products-and-services/i-codes/2018-i-codes/igcc/, [10]https://www.iccsafe.org/products-and-services/standards-development/is-stsc/, [11]https://www.iccsafe.org/advocacy/safety-toolkits/accessibility-info/, [12]http://resilientalliance.org/, [13]http://www.iccsafe.org/offsite, [14]https://www.iccsafe.org/cdpaccess/, [15]http://www.nibs.org/mitigationsaves, [16] https://www.iccsafe.org/products-and-services/i-codes/code-development-process/is-rcsdi/, [17]https://www.globalresiliency.org, [18]https://www.iasonline.org/services/building-departments/ [19]https://www.iccsafe.org/professional-development/certifications-and-testing/certification-overview/

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Pathways to Climate Resilience:
The Central Role of Building Codes in Climate Adaptation and Mitigation: Key Findings

Communities are facing unprecedented challenges of responding to the increasing number and frequency of disaster events, many driven by climate change.

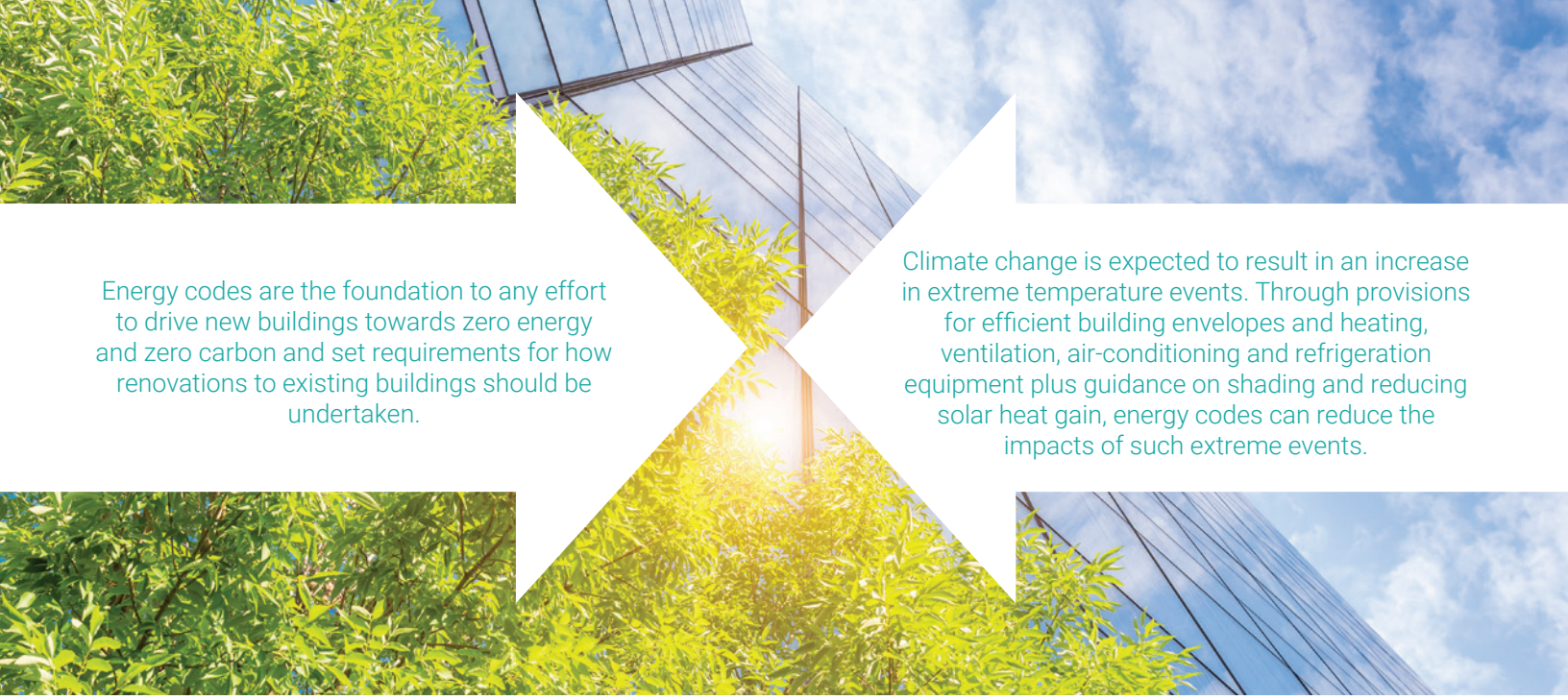
Governments are looking for solutions to stem the greenhouse gas (GHG) emissions that continue to drive changes in climate.

The built environment is central to both enhancing resilience and mitigating GHG emissions.

Buildings are our shelter against the storm, the homes of our governments and institutions, drivers of economies, and symbols of our ideals.

Buildings are significant users of energy and materials.

Building codes and the activities that support their effective use are central to the realization of a climate resilient future.



Energy codes are the foundation to any effort to drive new buildings towards zero energy and zero carbon and set requirements for how renovations to existing buildings should be undertaken.

Climate change is expected to result in an increase in extreme temperature events. Through provisions for efficient building envelopes and heating, ventilation, air-conditioning and refrigeration equipment plus guidance on shading and reducing solar heat gain, energy codes can reduce the impacts of such extreme events.

Why buildings?

- According to the 2021 Global Status Report for Buildings and Construction, in 2020, the global buildings sector was responsible for 36% of global final energy consumption and 28% of total global energy-related CO_2 emissions. When including construction, buildings accounted for 37% of global energy-related emissions.
- According to the World Business Council for Sustainable Development, approximately 255 billion m^2 (2.75 trillion ft^2) of buildings currently exist worldwide with the addition of roughly 5.5 billion m^2 (59.2 billion ft^2) added every year, equivalent to a city the size of Paris every week.
- The World Resources Institute identified the building sector as having the greatest opportunity to capture unrealized cost-effective emissions savings. Residential and commercial buildings make up approximately 34% of the opportunity to improve energy productivity.
- ***Any efforts to achieve NDCs that do not address buildings are overlooking an essential opportunity.***

Why building codes?

- According to GlobalABC, when matched with United Nations population growth estimates, just 65% of the population growth by 2030 will be in countries that have identified building energy efficiency and/or energy codes in their NDCs
- Just as building codes provide significant benefits against the impacts of hazard events, energy codes are highly effective in reducing energy use and GHGs while also saving building owners and tenants money and enhancing their resilience.
- Building codes are a fundamental contributor to community resilience. A community cannot be resilient without resilient buildings and the codes that support their development.

The International Code Council calls on all governments to adopt and enforce building codes aligned with domestic and international goals for reduced GHG emissions and enhanced resilience.

ICC INTERNATIONAL CODE COUNCIL®

For additional information and to read the full paper, please visit www.iccsafe.org/UNFCCC