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2021 GLOBAL STATUS REPORT FOR BUILDINGS AND CONSTRUCTION

Towards a zero-emissions, efficient and resilient buildings and construction sector

EXECUTIVE SUMMARY

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2021 GLOBAL STATUS REPORT FOR BUILDINGS AND CONSTRUCTION

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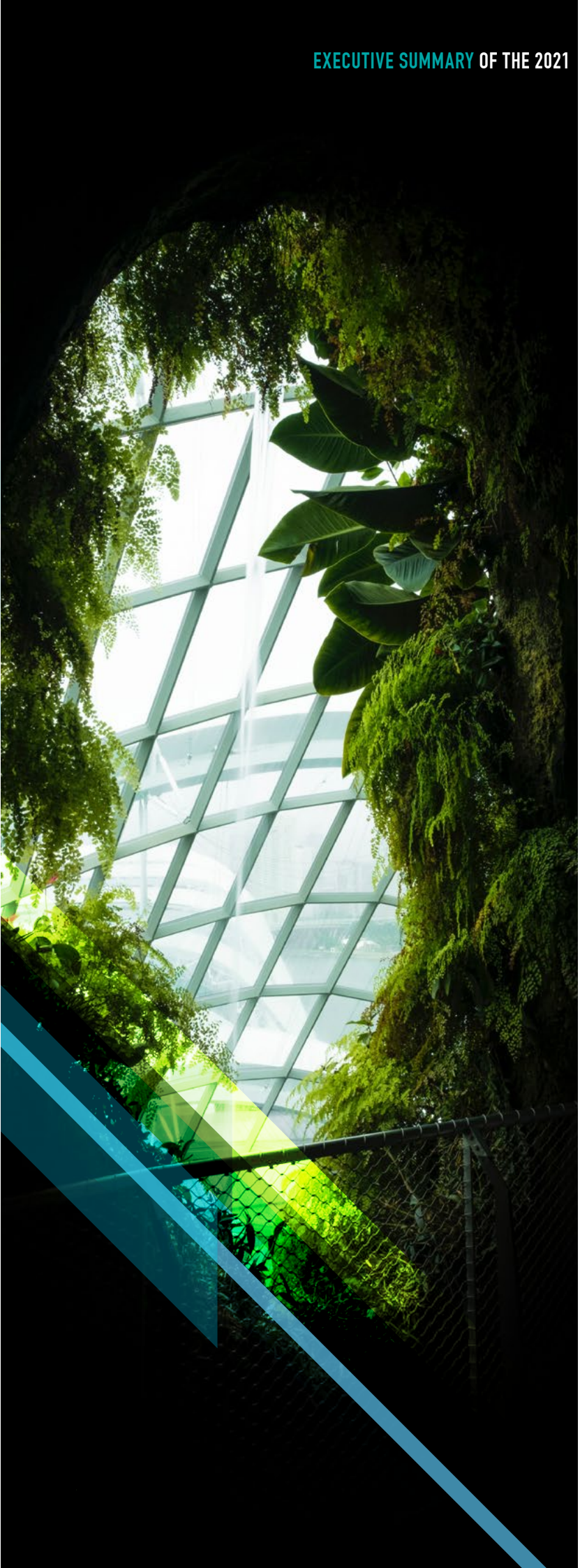


TRENDS OF 2020

FIVE YEARS IN REVIEW

Since the signing of the Paris Agreement in 2015, CO_2 emissions from the buildings and construction sector have peaked in recent years and subsequently fallen to 2007 levels in 2020. This current decline is due mostly to the COVID-19 pandemic, whereas transformative, long-term progress in sector decarbonizing remains limited. However, since 2015, next to some emission reduction in the power sector, more countries have adopted policies and codes that may have a future impact on the emissions and energy efficiency of buildings.

In 2015, the construction and operation of buildings was responsible for 38 per cent (13.1 gigatons) of global energy-related carbon dioxide (CO_2) emissions. By 2020, CO_2 emissions in the sector had fallen an estimated 10 per cent to 11.7 gigatons, a level not seen since 2007. This decline was driven largely by reduced energy demand due to the COVID-19 pandemic, but also by continued efforts to decarbonize the power sector. In 2015, energy use for the construction and operation of buildings totalled 144 exajoules (EJ), or 38 per cent of global demand. By 2020, energy consumption slowed to 149 EJ – or 36 per cent of global demand – reflecting the impact of pandemic-related lockdowns and the precarious ability of many households and businesses to maintain and afford energy access.

In 2015, 90 countries included actions for addressing buildings-related emissions or improving energy efficiency in their Nationally Determined Contributions (NDCs) under the Paris Agreement. In 2020, 136 countries mentioned building emission reductions in their NDCs, although these vary in their ambition. Additionally, around 62 countries had adopted building energy codes as of 2015, while today more than 80 countries have developed such codes, alongside similar efforts by local governments and cities.

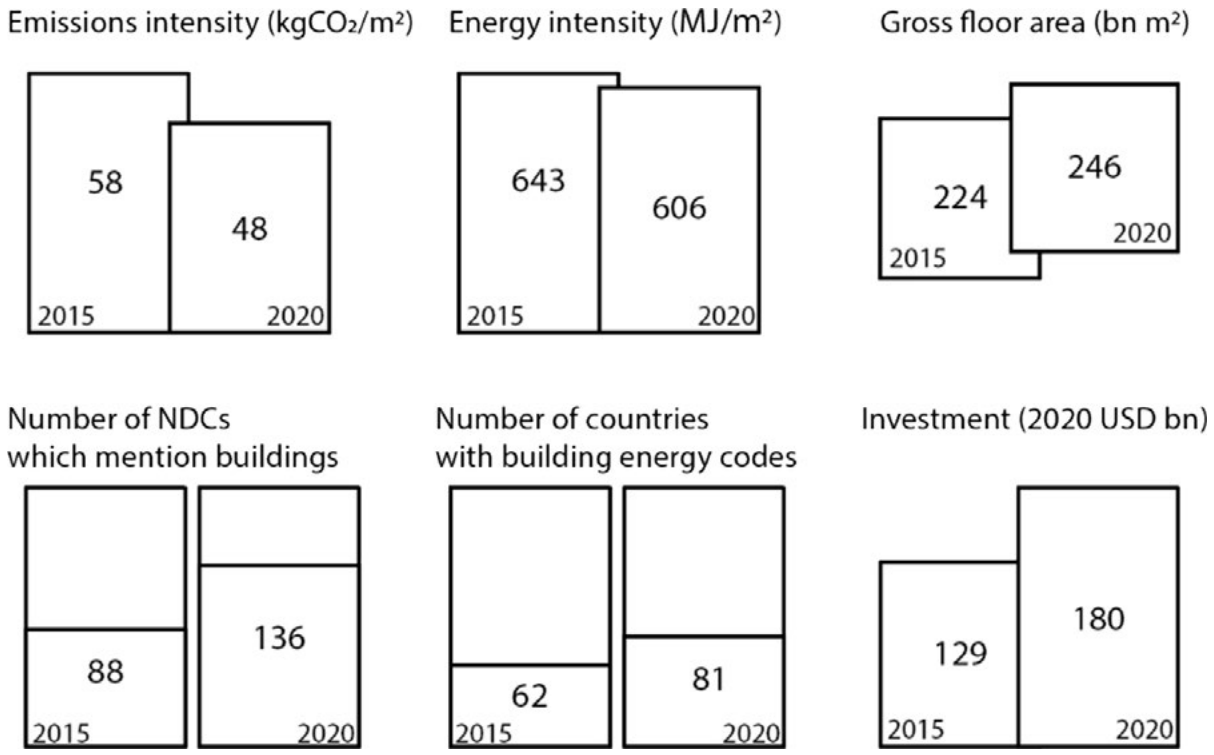
Investment in the energy efficiency of buildings continues to climb and reached more than US$180 billion in 2020, up from $129 billion (in 2020 dollars) in 2015. However, most of this increase came from a small number of European countries. Without broader investment, this level is unlikely to be sufficient to tackle efficiency improvements among the existing global building stock.

Looking ahead, the challenges to reaching a net zero, energy-efficient and resilient buildings and construction sector are considerable, with 82 per cent of the population that is to be added by 2030 living in countries without any building energy codes or only voluntary codes. Yet more than 65 per cent will be living in countries that have NDCs that mention building energy efficiency and/or building codes to improve energy performance, which offers a positive sign.

In addition, the recent reduction in energy-related emissions from buildings and construction is likely to be short-lived and is expected to rebound in 2021 as economies emerge from the pandemic. Therefore, immediately and significantly reducing greenhouse gas emissions from the buildings sector, on the global level, is critical for reaching the Paris Agreement goals.

As a global tool for tracking progress, the *Global Status Report for Buildings and Construction* has continued to evolve over the past five years, bringing forward insights and pointing to information to help understand efforts that support the transition to a zero emission, energy-efficient and resilient buildings and construction sector.

Figure 1 - Key changes in buildings sector between 2015 and 2020



Sources: UNFCCC 2021; Buildings-GSR 2021; IEA 2021a. All rights reserved.

Notes: Emissions intensity is total buildings construction and operations emissions over total floor area, energy intensity is total building operational energy over

GLOBAL BUILDINGS CLIMATE TRACKER

The Global Buildings Climate Tracker appears to indicate that the buildings and construction sector is on track to achieve complete decarbonization by 2050. However, this is a temporary result, reflecting the unprecedented changes in building use during the pandemic. While there is some progress in energy investment and power decarbonization, a negative rebound in overall progress should be expected unless building sector decarbonization efforts significantly increase.

The Global Buildings Climate Tracker monitors the progress of the buildings and construction sector towards achieving the Paris Agreement. It is designed as an index comprising a range of indicators that are used to measure progress in NDCs, certifications, building codes, the share of renewable energy in buildings, finance for energy efficiency in buildings, CO_2 emissions and energy intensity. Although this year's index shows a significant improvement compared to the previous level, on a closer look, the 2021 results indicate that the sector is not on track to reach the Paris Agreement goals.

An analysis concluded that the observed progress in 2020 is largely the result of a decrease in economic activity due to the COVID-19 pandemic. Nevertheless, some indicators used in the composite index show improvement from 2019. Energy efficiency investment in buildings increased 11 per cent, while green building certification increased 13.9 per cent, and 10 more countries adopted building energy codes. However, if the effect of the pandemic is excluded, the decarbonization level in 2020 was only at 40 per cent of the 2050 reference path to achieve the Paris Agreement goals.

EFFECTS OF THE COVID-19 PANDEMIC

The COVID-19 pandemic had a major impact on the global buildings and construction sector in 2020. The effects were wide-ranging, from construction sites being left empty for months during lockdowns, to disruptions in the financing of construction, to how supply chains for materials reacted to sudden drops and surges in demand. In addition, the way buildings were occupied and used changed dramatically, from a status quo of workplace-based employment for most sectors, to a quick transition to remote working arrangements, the abandonment of commercial and retail premises, increased demand on warehousing and logistics and delivery, and the shutdown of public services and buildings.

In 2020, the average annual growth rate in buildings and construction across the world fell an estimated 4 per cent from 2019 levels. The main reason for this decline in market growth was the profound impact of the global pandemic on construction activities through the effects of lockdowns on the labour supply, limited demand for new buildings, the slowdown in public and private procurements, and disruptions in the supply chain.

ENERGY AND EMISSIONS

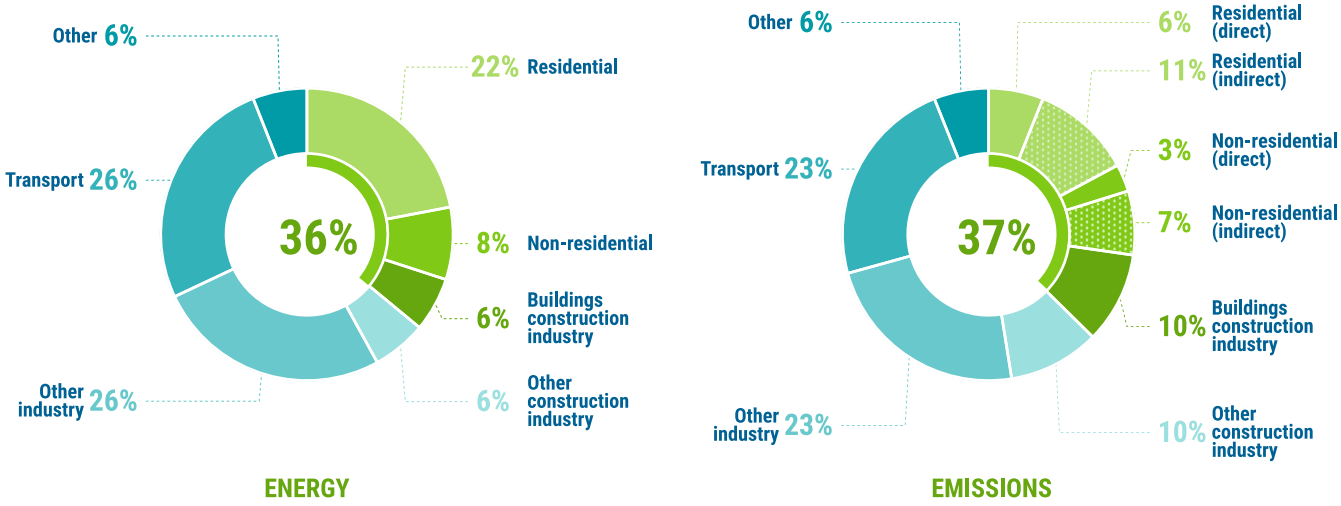
Global CO_2 emissions from buildings operations fell 10 per cent, although this decline appears to be temporary as emissions pick up again with increasing economic activity. Overall, buildings accounted for 36 per cent of global energy demand and 37 per cent of energy-related CO_2 emissions in 2020.

Global energy demand in buildings fell 1 per cent in 2020 to around 127 EJ, although the sector's share of overall energy demand stands at 36 per cent, compared to 35 per cent in 2019. This is due to a shift in sectoral demand. The decline in energy use for buildings and construction was largely driven by the change in the way existing buildings were used as a result of the pandemic, alongside the overall drop in production and demand for construction materials due to the economic slowdown. Energy demand shifted from the commercial and retail sectors to the residential sector, while many public buildings also closed for significant periods

CO_2 emissions from building operations fell 10 per cent in 2020 to around 8.7 gigatons, down from around 9.6 gigatons in 2019, as a result of the shift in building-related energy use patterns. With the historic drop in new buildings and construction, construction-related energy emissions - mostly from the manufacturing of buildings construction materials - fell from 3.6 gigatons of CO_2 in 2019 to 3.2 gigatons of CO_2 in 2020.

Despite these reductions, the global share of energy-related CO_2 emissions from buildings and construction compared to other sectors stands at 37 per cent in 2020, compared to 38 per cent in 2019, due to sectoral shifts (see figure 2).

Figure 2. Buildings and construction's share of global final energy and energy-related CO_2 emissions, 2020



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"

To achieve the Paris Agreement, the global buildings and construction sector must almost completely decarbonize by 2050. Collectively, stakeholders in the sector must seize the opportunity that the COVID-19 economic recovery period offers to foster transformation for decarbonizing the sector. The sector must simultaneously meet a projected near-doubling of global demand for energy services in buildings and at least a doubling of floor space as developing economies continue to respond to the growing demand for building floor space, access to energy services and economic activities.

Building emissions will need to be reduced along their lifecycle through a triple strategy, namely a combination of reducing energy demand (behaviour change and energy efficiency), decarbonizing the power supply (e.g., electrification through renewable sources and increased use of other zero-carbon heating technologies) and addressing embodied carbon stored in building materials. Through the first two measures, it could be possible to nearly eliminate carbon emissions from building operations by 2050.

Additionally, emissions from materials and construction processes must be urgently addressed, to ensure that the buildings being built today are optimized for low-carbon solutions across the full life cycle. This involves maximizing the refurbishment of existing buildings, evaluating each design choice using a whole life-cycle approach and seeking to minimize upfront carbon impacts (e.g., lean construction, low-carbon materials and construction processes, etc.), as well as taking steps to avoid future embodied carbon during and at the end of life (e.g., maximize the potential for renovation, future adaptation, circularity, etc.).

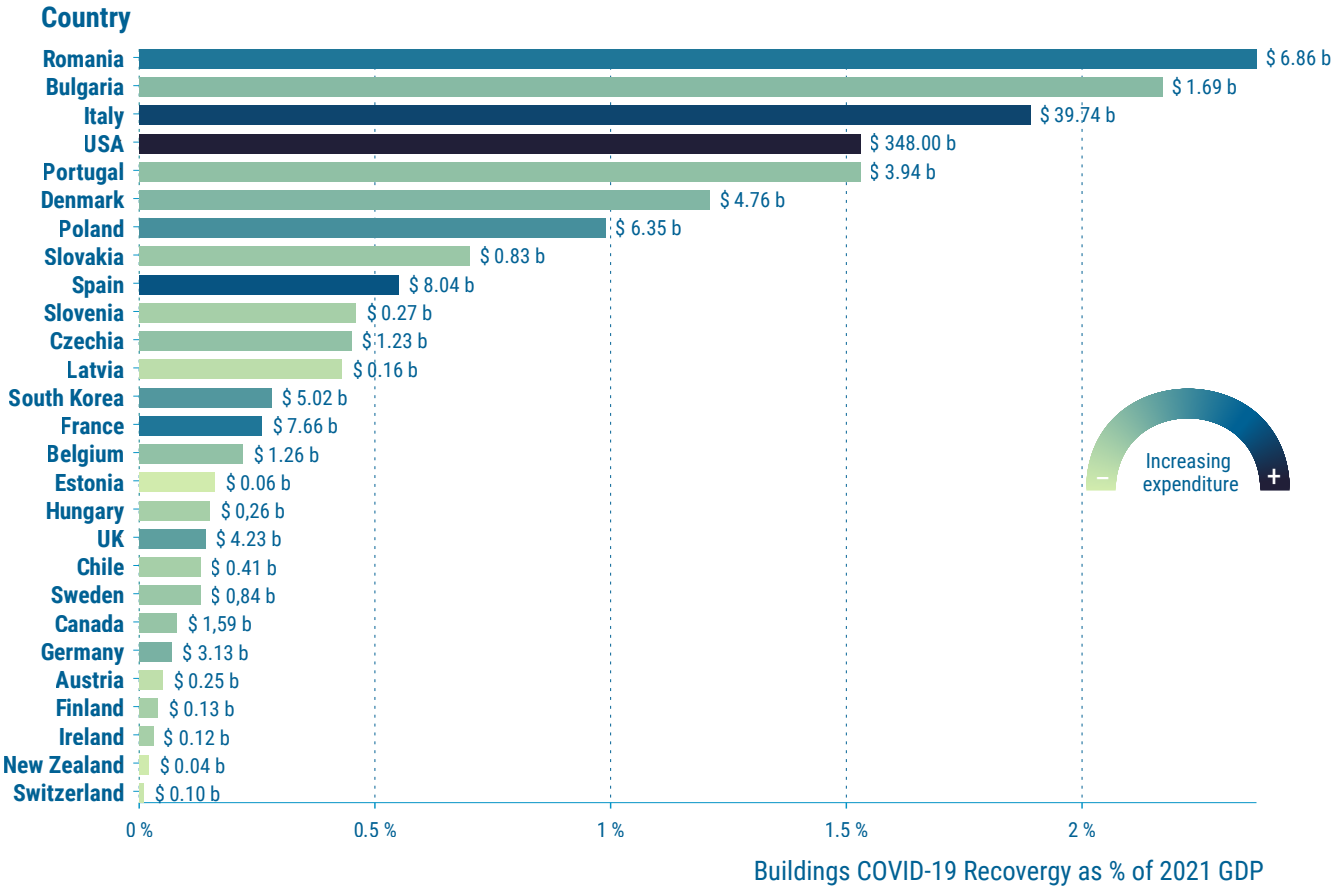
COVID–19 STIMULUS

The buildings and construction sector plays a critical role in pandemic recovery plans.

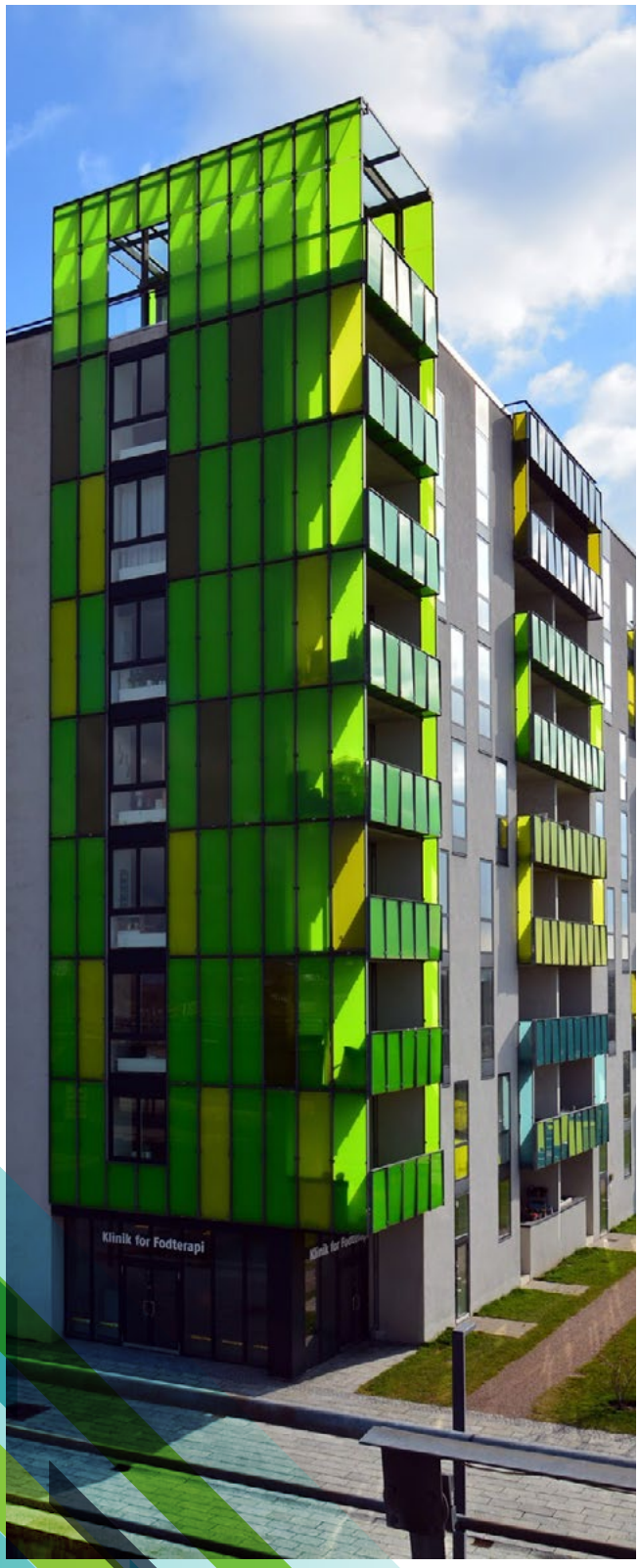
The COVID-19 pandemic has prompted a focusing of investment on supporting critical industries, such as buildings and construction, which represents around 4-7 per cent of most major economies' added value, according to the Organisation for Economic Co-operation and Development (OECD).

Many countries have provided investment to support the buildings and construction industry through economic stimulus packages and policies and as a reaction to the global pandemic (see figure 3). Yet the effect of support for decarbonizing the sector has been limited. A survey of major global economies has shown that many countries have dedicated pandemic funding to buildings, and that elements of these initiatives will have a beneficial impact on decarbonizing the sector; however, more effort is needed to direct stimulus and future economic investment towards aligning to the Paris Agreement.

Figure 3. COVID-19 recovery funding relating to buildings as per cent of 2021 GDP, with total buildings commitment figures in billion US dollars



Source: Latest available data based on Carbon Brief (Evans and Gabbatiss 2020) and Green Recovery Tracker (2021a), with data for Switzerland from the Global Recovery Observatory (Smith School of Enterprise and the Environment 2021). Figures are liable to change as new policies are announced and programmes are cancelled.



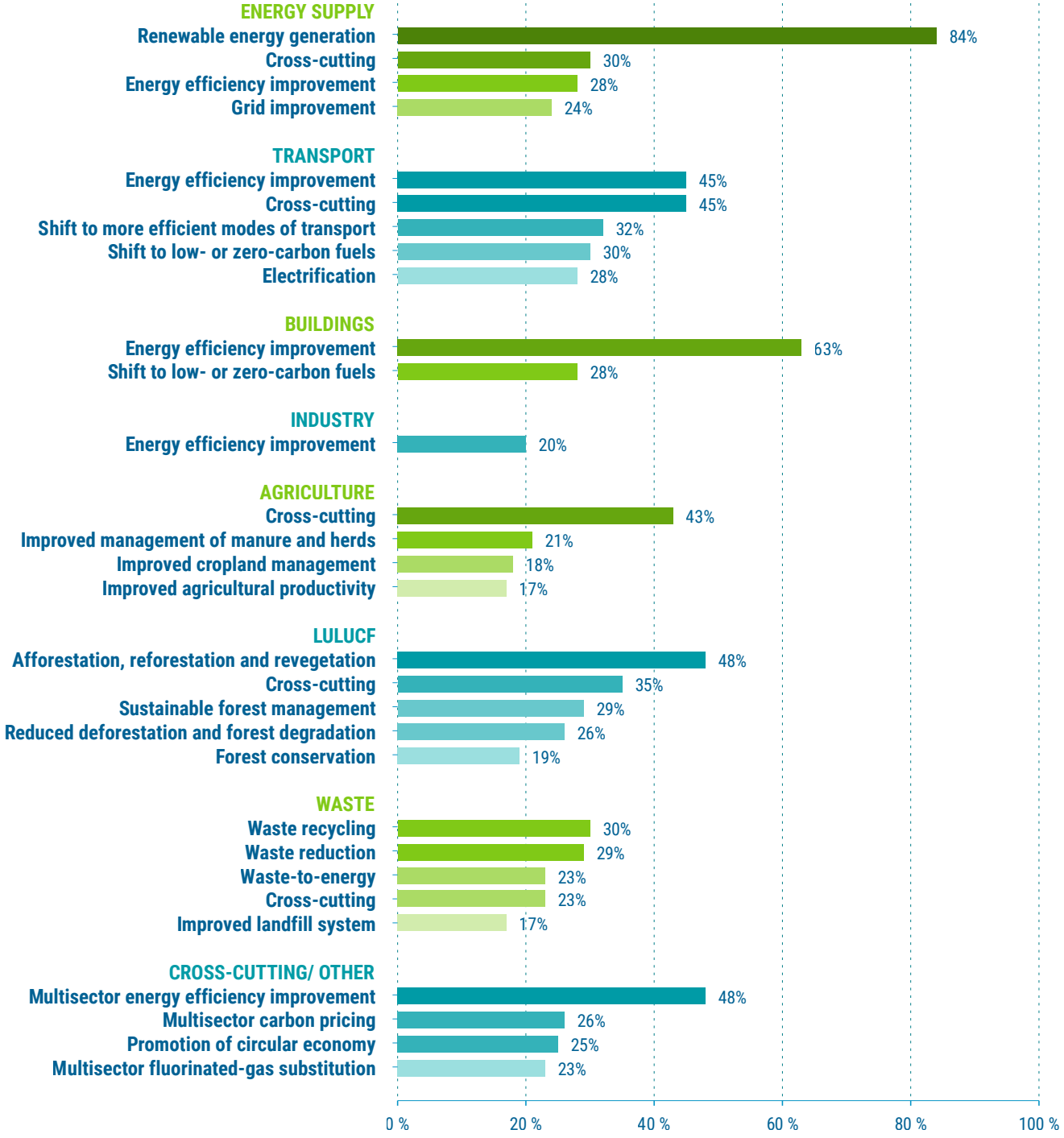
The construction sector is essential for an economic recovery from the COVID-19 crisis and offers a pathway forward to building a more sustainable future aligned with the goals of the Paris Agreement. It is therefore essential that we build back better, literally. The International Energy Agency's *Sustainable Recovery* report pointed out that stimulus programmes for the buildings and construction sector are a proven response to economic crises and will typically align to the needs that countries face for housing, economic activities and the renovation of existing buildings.

NATIONALLY DETERMINED CONTRIBUTIONS

Energy efficiency and energy codes in buildings are the second most frequently cited actions within all Nationally Determined Contributions.

As of October 2021, a total of 192 countries had submitted a first NDC and 11 had submitted a second NDC outlining their national contributions towards reducing emissions under the Paris Agreement. Across the NDCs communicated, improvement in the energy efficiency of buildings is the second most frequently referred to policy after the use of renewable energy in the power sector (see figure 4). While actions related to building energy efficiency codes are dominant, other actions targeted by countries include incentives and market instruments as well as resilience, renovation and retrofitting measures. For example, the NDCs from Colombia, the European Union, Lebanon, Maldives, Montenegro, Panama and Vanuatu mention efforts to either improve energy efficiency in buildings or reduce building-related emissions.

Figure 4. Share of Parties referring to the frequency indicated mitigation options in Nationally Determined Contributions



Note. If a Party communicated more than one measure for one of the frequently indicated mitigation options, it was counted as one Party communicating measures for that option.

Source: UNFCCC 2021

Despite these promising examples, when considering the needed triple strategy of reducing energy demand, decarbonizing the power supply, and addressing the footprint of construction materials, it is noticeable that building materials are under-addressed in countries' NDCs. Going forward, governments need to strengthen key areas such as sustainable urban development, new construction, rehabilitation and materials through the relevant implementing ministries and agencies, as was done in Viet Nam's NDC Roadmap for a low-carbon, climate-resilient buildings and construction sector.

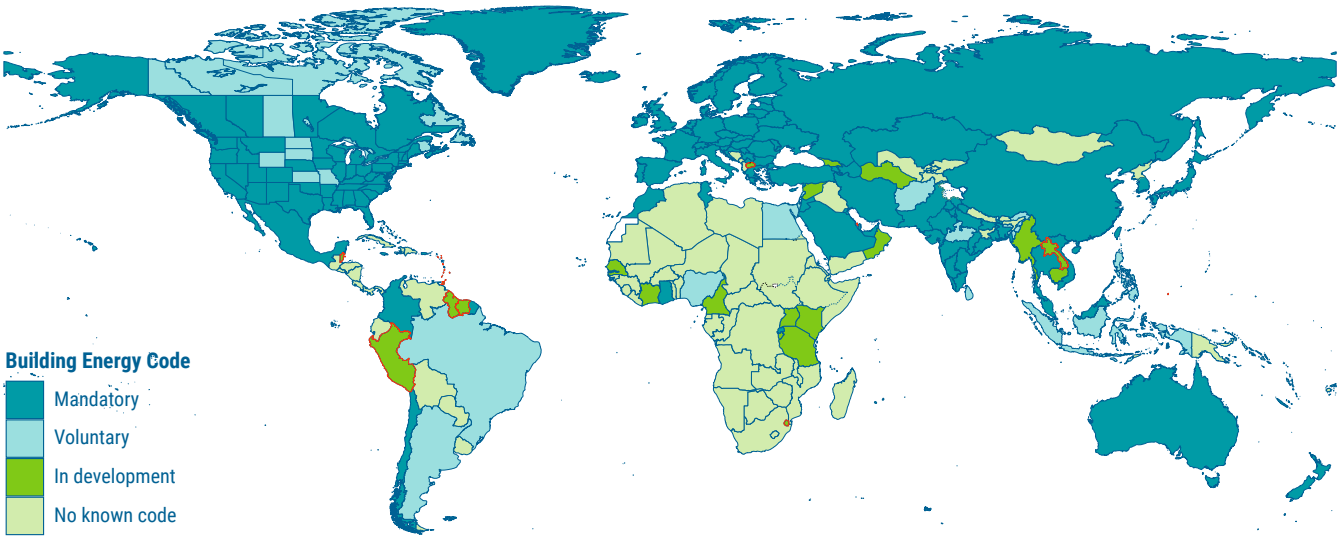
BUILDING CODES

Countries increasingly recognize that building energy codes are essential, yet their application remains low in Sub-Saharan Africa and in South and Central America.

Building energy codes are a key tool for governments to mandate the construction and maintenance of low-energy buildings. However, current coverage of building energy codes is far from universal, and where they are implemented, the codes are typically not aligned with meeting a net zero goal by 2050. To support countries in their NDCs and implementation of codes, the Global Alliance for Buildings and Construction (GlobalABC) has produced 10 key messages for the buildings and construction sector, covering ambitious energy codes, integrated design, energy efficiency financing and the carbon footprints of materials, among others (GlobalABC 2021a).

As of September 2021, 80 countries had mandatory or voluntary building energy codes on the national or sub-national level, out of which 43 countries had mandatory codes on the national level for both residential and non-residential buildings (see figure 5). Eighteen of the countries have adopted their codes since 2015. The current extent of national and sub-national building energy codes worldwide shows that Sub-Saharan Africa and South and Central America have the least coverage of mandatory codes.

Figure 5. Building energy codes by country/state



Note: 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. Recent updates are highlighted with a red border. Building energy codes relating to specific cities only are not shown.

Source: IEA 2021d. All rights reserved.

However, there are some signs of change, notably through the 2018 CARICOM Regional Energy Efficiency Building Code (CREEBC), which is currently being implemented throughout the Caribbean. Morocco and Tunisia have mandatory building codes that cover the entire buildings sector. Ghana and Nigeria have codes that cover part of the sector, while Egypt and South Africa have voluntary codes. Several additional countries are in the process of developing building code standards, including Botswana, Burundi, Cameroon, Côte d'Ivoire, Ghana, the Gambia, Kenya, Senegal, Tanzania and Uganda.

ENERGY EFFICIENCY INVESTMENT IN BUILDINGS

Global investment in the energy efficiency of buildings increased an unprecedented 11 per cent, dominated by EU investments. The flow of finance to this area continues to accelerate.

In the face of the COVID-19 pandemic, global investment in energy efficiency in the buildings sector rose an unprecedented 11.4 per cent in 2020 to around $184 billion, up from $165 billion in 2019, primarily through targeted government support in Europe (separate from any stimulus packages). For the first time since 2015, the annual rate of growth in energy efficiency investment in the sector has exceeded 3 per cent.

Despite the negative impact of the pandemic on the value of the global buildings and construction sector, which the IEA estimate declined by an estimated 2 per cent to $6 trillion in 2020, the increased investments in Europe supported the acceleration in global investments in buildings efficiency.

However, this relative increase occurred as most economies slowed and the buildings and construction sector faced unprecedented challenges in demand, delivery and supplies. The need to meet the global lack of housing alongside the need to decarbonize the sector means that more investment in improving the energy efficiency of existing buildings and in constructing buildings that are net zero emission is needed from all actors within the finance and investment sector.

BUILDINGS DATA MAPPING

The availability of data describing the global building stock is limited and lacks sufficiently high resolution to present a clear picture of the trends and changes experienced across regions and parts of the sector.

A data mapping activity was undertaken through an in-depth search and review of databases and datasets that provided insights in describing the trends and drivers affecting energy performance and carbon performance within the building stock.

The findings of the review of over 40 key indicators and more than 300 sources of data shows that some very basic information on buildings is largely lacking or incomplete. Building stock characteristics at a global scale and national level are mostly unavailable, which makes it very challenging to track the changes in the composition and amount of building stock area constructed. No global source of data yet exists to describe buildings in this way, and the knock-on implications are that activities related to economic activities, energy and CO_2 emissions, and materials are all open to a degree of uncertainty.

ADDRESSING THE CLIMATE IMPACT OF BUILDINGS AND CONSTRUCTION ACROSS THE WHOLE LIFE CYCLE

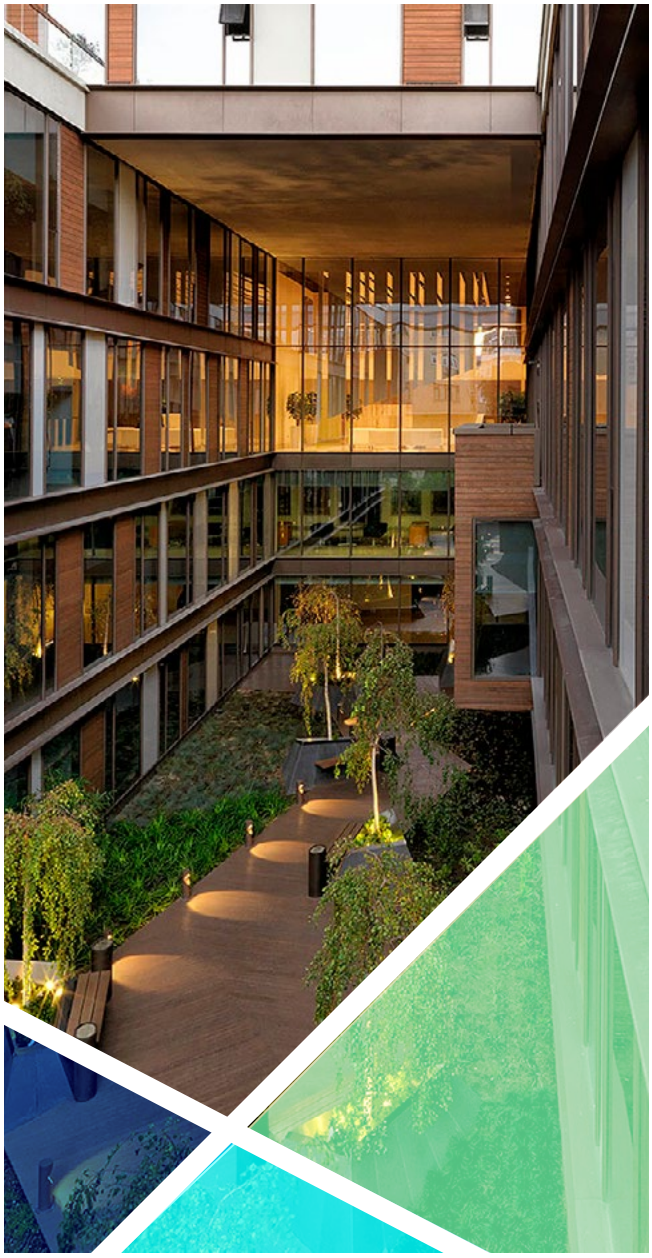
Some European countries have introduced policies to reduce whole-life carbon emissions from buildings and construction. Further national and EU-level initiatives can be expected in the near future.

A whole-life carbon perspective includes carbon emissions arising from the built environment during both the use of buildings (operational emissions) and their construction (embodied emissions). The *2021 Global Status Report for Buildings and Construction* puts a spotlight on recent developments in Europe and provides a high-level summary of the latest policy and data development. The importance of embodied emissions is set to increase dramatically as more buildings are constructed and renovated to higher energy efficiency standards.

Until recently, embodied carbon in buildings has been addressed at the EU level only with voluntary measures. Various provisions have been put in place across Europe by cities, regions and countries in the form of certification systems, regulations, standards and guidelines.

However, the European policy landscape is set to change. In the Renovation Wave strategy, the European Commission has adopted the principle of "life cycle thinking and circularity" to make buildings "less carbon-intensive over their full life cycle" (European Commission 2020a). The ongoing review of key policy and legislative files – such as the Energy Performance of Buildings Directive, the Energy Efficiency Directive and the Construction Products Regulation – is likely to start integrating whole-life carbon in the policy framework.

While a common EU policy on whole-life carbon is still in the making, Denmark, the Netherlands and France have introduced CO_2 limits for a large share of new buildings, while Finland and Sweden have plans to do so. Germany, as well as non-EU members the United Kingdom and Switzerland, have life-cycle assessment requirements for certain public buildings; Belgium is planning similar requirements.



OUTLOOK FOR 2021–2026

BUILDING BACK BETTER

In the effort to recover from the global pandemic and simultaneously address climate change through making substantial and lasting reductions in global emissions, the buildings and construction sector offers a route forward for all countries to build back better, literally.

Although 2020 was an exceptional year in terms of the pandemic's impact on reducing energy use and emissions related to buildings and construction, there is still much that needs to be achieved. In the coming five-year cycle, countries will need to make substantial improvements in the ambitions of their NDCs and must build on their commitments, for which buildings efficiency is a notable focus. Countries also need to consider addressing building materials in their NDCs in order to increase awareness and drive the availability and specification of low-carbon materials.

The ambitions for the sector should be extended by committing to and instituting policies that increase the scope and coverage of building energy codes for all building types, to increase the performance standards for building envelopes, heating, cooling, ventilation systems and appliances, and to ensure that decarbonization is integrated from the outset in urban planning. But even where buildings are not explicitly mentioned, countries need to harness the sector's transformative potential for achieving the energy transition, increasing the resilience of regions and unlocking green finance.

Building certifications play a key role, especially in regions where mandatory building energy codes are not (yet) in place. While uptake of green building certification increased 13.9 per cent in 2020 compared to 2019, countries should consider using certification systematically for all building types (residential and public) to drive improvements in design and delivery and to support unlocking investment for decarbonizing buildings.

While the recent increase in global investment on energy efficiency was welcome, it occurred among a handful of countries that already have well-established programmes and markets for improving building energy performance. In the coming five years, investment in efficiency will need to double its rate of growth to more than 3 per cent annually, and will need to expand beyond direct government investment, to private investors. Regulatory efforts in Europe and strengthened partnerships between global investors and financial institutions within fast-growing economies will ensure that greater access to capital is available to ever more building and user types.

Energy demand in the buildings and construction sector is likely to rebound as economic recovery efforts take hold and as pent-up demand continues to unfold. However, this increased demand must occur carefully and quickly, without a corresponding rise in emissions. Governments will need to use this moment to commit to further decarbonizing the power supply as well as the heating and cooling supply and put forward efforts to increase access to and use of clean and renewable energy.

ADAPTATION AND MITIGATION NEED TO BE PURSUED SIMULTANEOUSLY

The growing impacts of the changing climate are visible around the world and have serious consequences for buildings and their occupants. Over time, changing climates and extreme weather events will substantially impact the performance of buildings and the energy consumption of the sector. A typical building constructed today will still be in use in 2070 and beyond, but the climate that it encounters will have changed significantly. Thus, there is a clear need to implement effective, low-carbon policies and to enable cost-effective investments in a net zero building stock to decarbonize buildings along their life cycle while addressing resilience.

So far, few countries are reviewing their building or energy codes to embed adaptation and resilience links. New buildings should be specified accordingly, while the necessary interventions to reduce the climate impact of existing buildings should be combined with investing in adaptation and resilience measures. Overall, efforts to increase the resilience of buildings to extreme weather events such as sea-level rise, heatwaves, droughts and cyclones will have to be increased, so that buildings provide safe, reliable and healthy shelters during extreme events of any nature and the sector avoids "locking" emissions in inefficient and unsafe built environments.

HEADING TO 2030 AND 2050

To achieve the Paris Agreement goals, the United Nations Framework Convention on Climate Change's Marrakech Partnership for Global Climate Action Human Settlements Pathway, co-led by GlobalABC and also adopted by the #BuildingToCOP26 Coalition, has set the following goal: *"By 2030, the built environment should halve its emissions, whereby 100 per cent of new buildings must be net-zero carbon in operation, with widespread energy efficiency retrofit of existing assets well underway, and embodied carbon must be reduced by at least 40 per cent, with leading projects achieving at least 50 per cent reductions in embodied carbon. By 2050, at the latest, all new and existing assets must be net zero across the whole life cycle, including operational and embodied emissions."*

By 2030, to be on track to achieving a goal of net zero operational emissions by 2050, the International Energy Agency suggests that direct CO_2 emissions from buildings would need to decrease by 50 per cent and indirect emissions from the sector would need to decline through a 60 per cent reduction in power generation emissions by 2030. In doing so, building sector emissions would fall by around 6 per cent annually from 2020 to 2030. Energy efficiency needs to support decarbonization, and renovation rates must increase. The energy demand of buildings per square metre needs to drop 45 per cent by 2030, which is five times faster on an annual basis than what it did over the past years. GlobalABC's *Global Buildings and Construction Roadmap* and regional roadmaps for Asia, Africa and Latin America have set out the pathway to implement the policies and technologies supporting the 2030 goal, including a materials pathway, addressing embodied carbon.

Stakeholders including donors and recipients increasingly recognize the potential of forging such pathways. These regional pathways are now being cascaded to the national and local level, working with ministries and cities to develop decarbonization and resilience strategies for buildings along their whole life cycle, while considering the urban planning context. More than 20 such national decarbonization roadmap processes are under way or about to be launched. Such efforts – especially where they address building energy codes, NDCs, renewable energy and certification – also mean a better outlook for the Global Buildings Climate Tracker to be on track.

With careful planning and focused effort, the buildings sector can achieve these ambitions. This *Global Status Report for Buildings and Construction* presents an overview of the status and tracks the efforts as the world moves beyond recovery towards a path for securing prosperity.

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