TREND
CONSTRUCTION

Recovering from the Pandemic, the Construction and Renovation Sector Rethinks its Foundations

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After the first shocks linked to the Covid-19 pandemic, the construction of new buildings and the renovation of existing buildings resumed at full speed in the second half of 2020 in Europe and the United States, to the point of causing supply shortages and dramatic inflation in the prices of many building materials. However, the production of these materials is highly greenhouse gas-emitting, especially cement and steel. In recent years, initiatives have been implemented to give priority to renovation, and to take the "embodied carbon" into account in new constructions.

DATA OVERVIEW

Rapid recovery of construction projects puts pressure on material supply chains

The pandemic and the lockdowns that followed have brought many construction sites to a halt. As a result, emissions from the construction industry fell by 15% (from 3.6 $GtCO_2$ in 2019 to 3 $GtCO_2$ in 2020). Yet after these initial shocks due to Covid-19, the building and renovation sector bounced back quickly at the end of 2020 and in 2021 in many countries, boosted by the recovery plans that followed. Within the G20, at least 44 billion dollars were channelled into the building sector in the recovery plans.[1]

In Europe, after falling 25.4% in March and April 2020, building activity returned to 97% of its pre-pandemic level as early as May 2020, then stagnated without ever getting back to its February 2020 level.[2] In France, the sector saw an activity increase of 7% in the first quarter of 2021 compared to the same period in 2020 (when Covid had not yet struck).[3] The energy renovation market is up 3.3% in the first half of 2021 compared to the same period in 2019, undoubtedly due to the spread of remote working after the initial lockdowns, which increased time spent at home for some.[4]

In Asia, in 2020, building markets fell by 36% in Singapore, 20% in Malaysia, 30% in the Philippines, 3.3% in Indonesia. In 2021, they are expected to rise by 30% in Singapore and 11% in Malaysia. In contrast, the resurgence of the virus in the Philippines and Indonesia is keeping the sector at a low level in 2021. In China, after a 17.5% drop in the building market in the first quarter of 2020 compared to the same period in 2019, activity quickly picked up: the following quarters saw an increase of 7.8%, 8.1% and 6.6% compared to the same periods in 2019, totalling an overall growth of 3.5% over the year as a whole compared to 2019.[3]

In the United States, economic plans have boosted the building sector, which has reached levels not seen since 2007.[5] Over the first nine months of 2020, the total value of constructions increased by 4% compared to the same period the previous year.[6] Spending on construction increased more in the residential sector than in the non-residential sector. The cement sector illustrates this trend well: despite the interruption in the activities of many production projects in March-April 2020, the American cement industry slightly increased its production volumes over the year as a whole (from 89 Mt to 90 Mt).[6]

In the lumber sector which constitutes the main building material for family houses in the United States (90% of them had a wooden structure in 2019[7]), the impact of the rapid recovery has been significant. While the pandemic had shut down many sawmills and production plants, it also transformed the uses of housing by encouraging remote working, thereby inducing new requirements in renovation and construction. In Canada too: the number of building permits for residential buildings jumped to nearly 50,000 in June 2020, well above the 20,000 average of 2019.[8] This imbalance between supply and demand, combined with a spectacular rise in freight rates (**see Transport sector**) has led to high price inflation. In February 2021, the symbolic mark of $1,000 for 1,000 board

feet[a] of lumber was passed on the Chicago Stock Exchange, and a peak of $1,600 was even reached in early May, before it dropped just as sharply back to around $400, close to pre-crisis levels.[9] Thus, in May 2021, the price of building a wooden house had climbed by $35,000 in the United States,[7] and in Canada, the price of a new house was up by 9.1% in 2020, the largest increase in at least 30 years.[10] In a May 2021 survey conducted by the US National Association of Home Builders (NAHB), more than 90% of respondents said they faced shortages of structural lumber, oriented strand board, and plywood.[11]

In addition to wood, many building materials (steel, glass, cement) have also seen their delivery times increase and their prices skyrocket.[12] In mid-March 2021, steel, which cost $440/t on average in 2020, cost over $1,300/t in the United States – an all-time high.[13] In Canada, the price rose by 60% between the beginning of 2020 and May 2021[10]. This situation can be explained by a sharp drop in supply: except in China, steel production fell in all the main steel-producing countries in 2020, in India (-11 Mt), Japan (-16 Mt) and the United States (-15 Mt).[14] Overall, global steel production recorded one of its lowest growth figures since 2000 (+4 Mt in 2020), driven almost solely by the performance of the industry in China, which produced a record 1,065 Mt in 2020 (+70 Mt). In total, the steel industry accounts for nearly 15% of the country's greenhouse gases (GHG) emissions. Driven by the dynamic global building sector, and by high prices, production rose again in the first half of 2021, making the Chinese government's objective of capping its production at 2020 levels, to limit its emissions, difficult to achieve.[15] In France, the state has decided not to apply penalties for delays in public works projects as a result of the price of materials or shortages.[12]

In total, the construction market should grow by 5.7 % in 2021.[3] However, it is still very poorly supervised and regulated from an energy and climate point of view.

The adoption of specific regulatory instruments promoting energy efficiency in buildings continues, but at a slow pace. By the end of 2021, building energy codes[b] were in place in 80 countries, around ten more than in the previous year.[16] Many of them only cover certain types of buildings (public, residential, commercial), are not compatible with a 2050 carbon neutrality target, and only about half are mandatory. The recovery plans adopted by states to respond to the initial shocks of the Covid-19 pandemic nevertheless demonstrate an effort to intensify decarbonisation and increase the energy efficiency of buildings. Of the 44 billion dollars committed by the G20 countries to stimulate the recovery of the building sector in the second half of 2020, only the 9 billion granted by Turkey lacks energy or climate considerations.[17]

According to REN21, it is mostly local governments that have taken initiatives and adopted policies to accelerate the decarbonisation of buildings.[18] A census carried out in 2020 by CDP, a climate action reporting platform, counted nearly 2,400 decarbonisation actions planned, currently being implemented or already implemented by 336 cities, in the buildings sector.[19] These actions often relate to the installation of renewable energy production systems (typically, the obligation to install solar panels) or the introduction of energy efficiency thresholds for new buildings.

However, both at national and local level, these codes have shortcomings that sometimes make them ineffective in reducing emissions. For the most part, they apply only to new constructions: few countries have building codes that cover the existing building stock, according to the Global Alliance for Building and Construction (GABC).[20] In addition, most often, only "operational" emissions from buildings (i.e. greenhouse gases generated in their use) are regulated, without taking into account the emissions resulting from their construction. To overcome these shortcomings and improve the effectiveness of building codes, public initiatives are being implemented, mainly in Europe and the United States.

THE OBSERVATORY'S LENS

Renovate more, build better: life cycle analysis, a new approach to accelerate the decarbonisation of buildings

More and more public policies to stimulate renovation

In the United States, more and more local governments are trying to transform local legislation on renovation: in July 2021, Indianapolis joined[21] the forty or so American cities were reviewed by the *Building Rating* platform,[22] which are introducing benchmarking and transparency requirements for the energy performance of existing buildings (**fig. 1**). These requirements can then serve as a basis for the development of Building Performance Standards (BPS), legislations defining short, medium and long-term energy performance thresholds for existing buildings, and leaving it up to the owners to decide on how and when carry them out. The city of Tokyo had adopted the first mechanism similar to a BPS in 2010, the second phase of which (2015-2019) had made it possible to reduce the emissions of the 1,200 buildings concerned by nearly 21.9 $MtCO_2$, mainly thanks to the installation of more energy-efficient equipment and the supply of renewable electricity and heat.[23] The most recent in the United States, the Colorado BPS, adds to those of New York City, Washington, DC, St. Louis and Washington State.[24] It plans to set up a task force in October 2021 to set energy performance standards in order to reduce greenhouse gas emissions from buildings by 7% between 2021 and 2025, and by 20% by 2030.

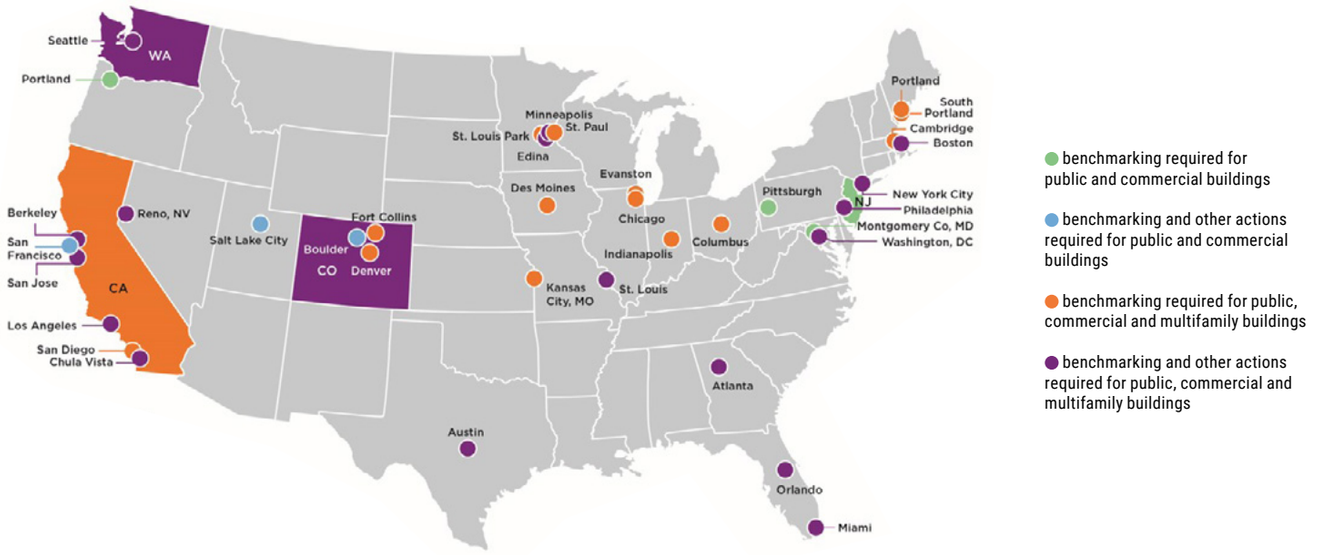
a The board foot is a volume measurement unit used for wood, primarily in the United States and Canada. 1,000 board feet are equivalent to approximately 2.36 m^3.

b National energy codes or standards for buildings, whether mandatory or voluntary, make it possible to set standards for the construction of buildings, offering better energy performance. They are one of the tools favoured at national level for reducing energy consumption, and therefore greenhouse gas emissions from buildings.

FIGURE 1

AMERICAN CITIES, COUNTIES AND STATES THAT HAVE ADOPTED A POLICY OF BENCHMARKING, TRANSPARENCY AND MORE FOR EXISTING BUILDINGS

Source : Institute for Market Transformation, 2021



These initiatives made their mark on the 2020 US presidential campaign: on their campaign website, Joe Biden and Kamala Harris said they want to extend the introduction of BPS to the whole of the United States.[25] The Build Back Better Act, the national plan to invest $7 trillion in the economy and infrastructure, has settled, for the moment, for earmarking $300 million to encourage US states and local governments to adopt building energy codes that comply with the "zero-energy" standards of the International Energy Code Council, a provision that has been met with strong opposition from the National Association of Home Builders (NAHB), which fears a repercussion on construction prices.[26]

The European Union, for its part, launched its Renovation Wave strategy last year, which aims to double the energy renovation rate, currently at 1% per year, with the aim of reducing buildings' GHG emissions by 60% by 2030. For several years now, Europe has been the continent where investments favouring energy efficiency are the highest, and mainly concern renovation projects (**fig. 2**). In 2020, the increase of $20 billion in renovation investments worldwide (thus reaching $184 billion in total) is almost entirely attributable to Europe, and above all to Germany where the public bank KfW has doubled its energy efficiency programme (from 15 to 30 billion euros), a decision taken before the outbreak of Covid-19.[27] According to the Building Performance Institute Europe, however, the rate of "deep renovation" (which reduces a building's energy consumption by at least 60%) in Europe is stagnating at 0.2% per year, whereas it needs to be 3% to achieve the European Commission's objective.[28] The institute therefore calls on the Commission to use the review of the *European Performance of Buildings Directive*, scheduled for the end of 2021, to raise its ambitions.[29]

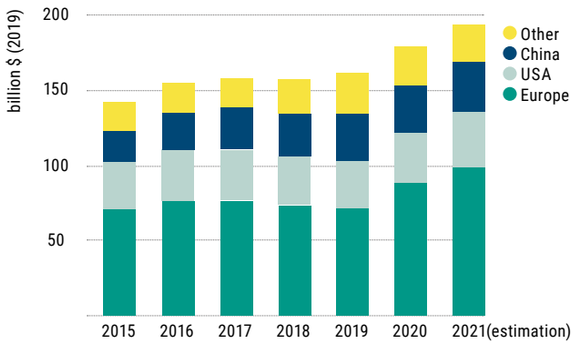
Finally, China, in its 14th Five-Year Plan (2021-2025), the first since the announcement of its objective to be carbon neutral by 2060, is highlighting the importance of building "low-carbon cities" and setting itself the objective of favouring renovation over demolition-construction (which emits more GHGs and consumes more resources), and of using "green" building materials for construction and renovation.[30]

Indeed, both renovation and construction require the manufacture of high GHG emitting materials. This "embodied carbon" is far from negligible: it is typically between 250 and 400 $kgCO_2e/m^2$ during the construction of a building. It can go up to 200 $kgCO_2e/m^2$ in case of a major renovation, thus taking several decades to be offset by the emissions avoided through renovation. By choosing low-carbon materials and carbon-free energy sources, this offset period can be shortened to three years.[31]

FIGURE 2

INVESTMENTS IN THE ELECTRIFICATION AND ENERGY EFFICIENCY OF BUILDINGS

Source : IEA, 2021



Thus, failure to take into account the carbon embodied in materials can lead to a significant under-estimation of their climate impact. The share of embodied carbon in the carbon footprint of buildings is more than a quarter, mainly due to steel and cement manufacturing. With the renovation actions of the coming years, which would reduce the "operational" emissions resulting from the energy consumption of a building during its use phase, embodied carbon could end up being the main source of GHG emissions from buildings constructed over 2020-2050.[32] According to the World Green Building Council, to comply with the Paris Agreement, all new buildings, infrastructure and renovations must have 40% less embodied carbon by 2030, and must have close to zero embodied carbon by 2050.[33] In addition to the mention in the Chinese government's plan, many initiatives have emerged in recent years to take better account of these "hidden" emissions. In August 2020, for example, New Zealand adopted the *Building for Climate Change* programme to improve the energy performance of existing and new buildings, which includes a framework for action to reduce emissions embodied throughout buildings' life cycles.[34] Nevertheless, it's in Europe and the United States that this dynamic is most vigorous.

Increasing consideration of embodied carbon in the United States and in Europe

As with the introduction of energy codes for buildings and the electrification of heating systems (**see Electrification trend**), local governments in the US are taking the lead. The Carbon Leadership Forum, a partnership between companies and researchers initiated by the University of Washington, identified two states, two counties and ten cities that have adopted legislations that take embodied carbon into account.[35]

Colorado recently passed a law to limit the carbon footprint of construction materials used in public works (public buildings, roads, bridges, etc.).[36] These limits will come into effect for projects starting on or after January 1 2024, and will be reviewed and adjusted every four years. This approach has also been adopted by the Buy Clean California Act, passed in 2017, which is expected to come into force in July 2022. It is also being considered at federal level.[37] Similar laws have been drafted in the states of Oregon, Washington and Minnesota, but have not been passed.

Cities in the United States have also taken measures in this regard. In its Green Building Programme, the city of Austin (Texas) encourages the use of low-carbon materials for new constructions. In California, the cities of San Francisco, Los Angeles, Oakland, Dublin and Albany have drawn up climate plans that take embodied carbon into account. In Portland, Oregon, a limit on the carbon footprint of materials for public works projects has been set.

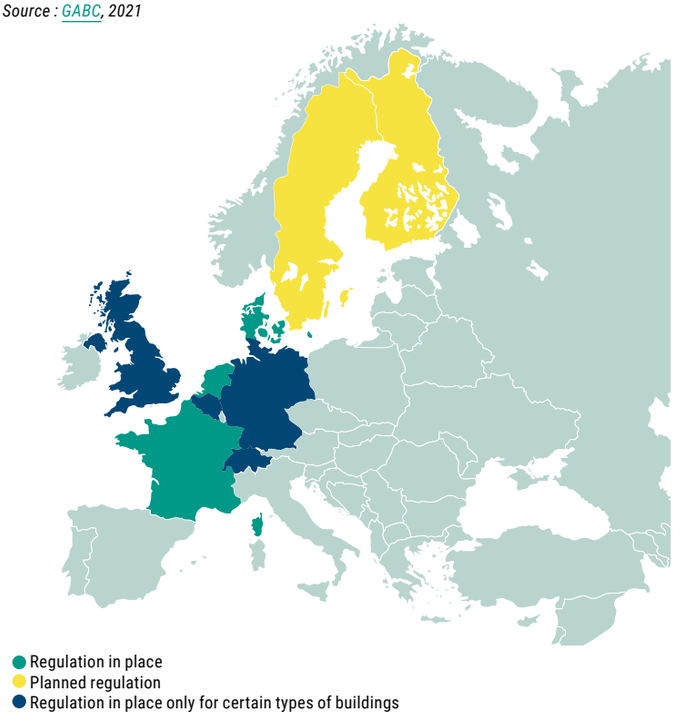
In the European Union, nine countries have introduced (or plan to introduce) a life cycle analysis approach, taking embodied carbon into account in their regulations for new buildings (**fig. 3**).[38]

Finland and Sweden planned carbon impact limits for new builds for 2025 and 2027 respectively. Belgium has also introduced a database to assess the carbon impact of building materials, with the intention of passing laws in this regard in the coming years. In the Netherlands, it has been mandatory to calculate and publish the carbon impact of the entire life cycle of buildings over 100 m^2 since 2017. In early 2021, Denmark adopted a new law which sets a maximum threshold for GHG emissions for new buildings from 2023 onwards, throughout their entire lifecycle. Set at 12 $kgCO_2e/m^2$/year, this limit will be gradually lowered to 7.5 $kgCO_2e/m^2$/year in 2029.[38]

FIGURE 3

NATIONAL REGULATIONS ON BUILDINGS TAKING INTO ACCOUNT THEIR ENTIRE LIFE CYCLE

Source : GABC, 2021



In France, in January 2022, a new environmental regulation for buildings (RE2020), which includes a section on the carbon footprint of buildings throughout their entire life cycle, will come into force. This new regulation replaces the RT2012 regulation, which focused on energy efficiency. This new approach could favour electric heating over gas heating, which is a concern for the historical French gas supplier Engie, worried about the economic repercussions of such a measure,[39] adopting an argument very similar to that used in the gas sector's battle against the electrification of heating systems in the United States (**see Electrification trend**). With just months to go before its implementation, data on certain materials is still lacking to perform precise life cycle analyses.[40] Anticipating an increase in demand, the French giant Bouygues Construction set up its subsidiary WeWood in 2020, with the aim of having 30% of all of their construction projects with wood by 2030, and the whole lumber industry is gaining ground (**Signals**).[41]

Germany, Switzerland and the UK have each recently adopted building lifecycle carbon impact guidelines for public buildings.[7] In the UK, the Architects Climate Action Network recently petitioned the government to encourage it to extend this measure to all buildings.[42]

These new regulations are sometimes based on existing certification programmes that already take embodied carbon into account. In France, for example, the E+C- label (Positive Energy Building with Carbon Reduction) was set up by the State in collaboration with the HQE-GBC alliance, the French branch of the World Green Building Council (WGBC). Other national branches have implemented such certifications, such as Canada ("Zero Carbon"), Ireland ("House Performance Index"), Germany ("DGNB System"), Australia ("Green Star Performance") and Sweden ("NollCO_2"). The Swedish NollCO_2 certification goes even further, and imposes a limit on the carbon embodied in buildings and allows these emissions to be "offset" through the production of renewable energy on site. In the Netherlands, Brazil and India, the "Paris Proof", "Zero Energy Standard" and "Net Zero Energy Buildings" labels, respectively, will soon be updated in order to take embodied carbon into account in their criteria.

Through the Advancing Net Zero initiative, the WGBC aims to create "net-zero" programmes, certifying buildings with high energy efficiency and of which the total energy, consumed during their life cycle comes from renewable energy (where possible taking embodied carbon into account). A total of 804 buildings have had certified "net-zero" through the initiative's certification programmes in June 2021, twice as many as in the previous year. The initiative now has 141 signatories (up from 95 last year), the majority of which are companies. There are also 28 cities (Paris, Copenhagen, Johannesburg, London, New York, Medellin, Sydney, etc.) among the signatories.

Soon, taking embodied carbon into account could spread to other European countries and cover even renovation, since the Renovation Wave intends to look into "*life cycle thinking and circularity*".[43] However, Europe and the United States are not the regions where most construction is going to be carried out over the coming years. Africa, China and India will in fact account for more than half of the surface area built in the world between 2017 and 2060. In total, the GABC estimates that two thirds of the buildings that will be built in the coming years will be in a country that does not yet have an energy code.[44]

KEY TAKEAWAYS

From the second half of 2020 onwards, construction sites reopened as quickly as they had closed at the beginning of the year, and the construction sector ended the year with overall growth. After the outbreak of the pandemic, the building industry has split the world in two. On the one hand, the constructed surface area in Africa, China and India will double or even triple by the middle of the century. However, there are still only few regulatory instruments in these countries to regulate building projects, in terms of either materials or energy efficiency. Recent actions by the Chinese government, however, gives us reason to hope for a more ambitious framework in the coming years. On the other hand, existing buildings will account for most of the built environment in 2050 in the countries of the Global North, and the challenge is therefore to reduce emissions arising from their use. The pandemic recovery is going strong in these countries, supported by recovery plans that target investments in energy renovation, and local laws that appear, particularly in the United States, to make certain renovations compulsory. However, the pace still seems too slow for the challenges. In addition, many initiatives are arising to consider the carbon impact of the manufacture of constructions and renovation materials, primarily cement and steel.

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