Carbon Transition Initiative - Real Estate Sector Investor Brief

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The Carbon Transition Initiative aims to study the impact of climate change in emerging markets and identify best practices available to the investment community to help assess and manage climate- and transition-related risks and opportunities. To achieve this objective, the initiative will focus on a series of 12 webinars complemented by investor research briefs on macro issues and sectors that are material to carbon transition.

Executive summary

Construction and operation of real estate assets make a significant contribution to energy-related GHG emissions compared to many other sectors. Dealing with embodied carbon is particularly challenging because it requires not only decarbonization of newly built buildings, but also calls for ensuring carbon-free refurbishment and eventual demolition of the existing real estate. Most of this carbon is linked to materials, some of which are not economically feasible to manufacture with no GHG emissions using currently available technologies.

Operational emissions depend, to a large degree, on the location of the building, its energy efficiency, as well as the carbon intensity of onsite fuel sources and offsite electricity supply. Operational carbon reduction by improvements in energy efficiency and wider use of renewable energy sources is now broadly supported by sustainable financing and regulatory incentives. Energy efficiency standards have been emerging all over the world, although they remain highly localized; therefore, investors should not blindly rely on them without understanding how a particular standard assesses buildings.

Investors can directly affect energy consumption and decarbonize their power use as tenants, thus cutting their Scope 1 and 2 emissions. They can have much greater leverage on their Scope 3 emissions as providers of capital, or as landlords if we are talking about private equity-type direct investors.

Investors acting as landlords may need to work with tenants using contractual KPIs / targets and various forms of regular monitoring and engagement. When the time comes for maintenance or refurbishment, it is important to utilize inputs with low or zero embodied carbon using materials' Environmental Product Declarations. At the end of life of a building, from the point of view of GHG emissions, refurbishment is usually preferable to demolition as during the latter significant amounts of CO2 may be released into the atmosphere.

As with other assets, climate mitigation plans and targets related to real estate should be in line with SBTi guidelines. In addition to climate mitigation strategies, in many areas adaptation is needed. To see whether such measures are necessary, today or tomorrow, investors would be advised to check the location of the buildings against flooding- and heatwave-prone areas.

This report's Appendix contains a list of tools, resources, and classifications that should be useful for real estate investors.

Introduction

The real estate sector, including buildings' construction and operation, is a major contributor to greenhouse gas emissions and hence to global warming. By helping the sector reduce its carbon footprint and prepare for new climate realities, investors contribute to climate transition mitigation and adaptation. Along with environmental considerations, this makes commercial sense. According to a recent report by the IFC, "green" buildings' operating costs are up to 37% lower, they generate a sales premium of up to 31%, and a rental income of up to 8% above the "non-green" buildings.[1]

Carbon emissions are released not only during the operational life of all built assets – buildings and infrastructure, but also during the manufacturing and transportation of materials, construction, and end-of-life phases. These sources of GHGs, commonly referred to as embodied carbon, have largely been overlooked historically, but contribute around 10% of all global carbon emissions (see Fig. 1). Carbon emissions released before the building or infrastructure begins to be used, sometimes called upfront carbon, will be responsible for half of the entire carbon footprint of new construction between now and 2050, threatening to consume a large part of our remaining carbon budget.[2] As operational carbon is reduced, embodied carbon will continue to grow in importance as a proportion of total emissions. While we must continue to focus on addressing operational carbon, we must now rapidly increase efforts to tackle embodied carbon emissions on a global scale, too.

The urgent need to go further and faster requires a new response and a new vision for this sector, which is in line with the IPCC's climate goals established in the Paris Agreement. To achieve this vision, we must take urgent action to tackle upfront carbon while designing buildings with whole life carbon in mind. Real estate investors have various tools at their disposal to make a positive impact, and they should be informed about the risks and opportunities arising from their investments in these assets.

[1] Green Buildings: A Finance And Policy Blueprint For Emerging Markets. (Accessed on February 16, 2022).
[2] Bringing Embodied Carbon Upfront (Accessed on June 6, 2022).

Key Terms[3]

Embodied Carbon - Carbon emissions associated with materials and construction processes throughout the whole lifecycle of a building or infrastructure, including the end-of-life stage. In the report, we refer to the embodied carbon of both buildings and infrastructure.

Passive House - a building that was designed and built to achieve a very high level of energy efficiency. Typically, heating and cooling energy consumption is at least 75% lower than the average level for a similar ordinary house.

Upfront Carbon - Carbon emissions released before the building or infrastructure begins to be used.

Operational Carbon - The emissions associated with energy used to operate the building or in the operation of infrastructure.

Life Cycle Assessment (LCA) - a systematic set of procedures for compiling and examining the inputs and outputs of materials and energy, and the associated environmental impacts directly attributable to a building, infrastructure, product or material throughout its lifecycle. It includes both embodied and operational carbon emissions.

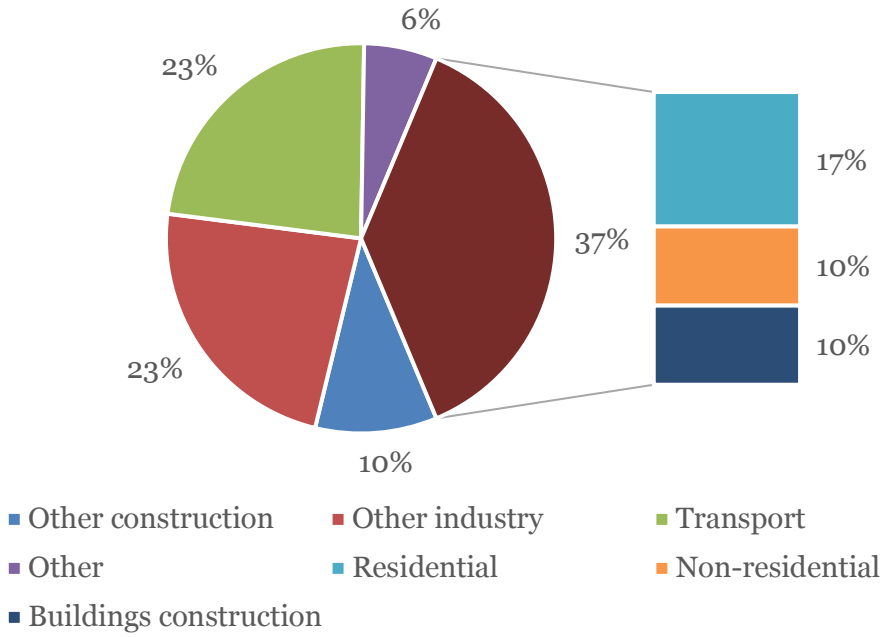
Environmental Product Declaration (EPD) - a declaration that quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. The EPD methodology is based on the Life Cycle Assessment approach.

[3] 2019 World Green Building Council Bringing_Embodied_Carbon_Upfront

GHG emissions in buildings and construction

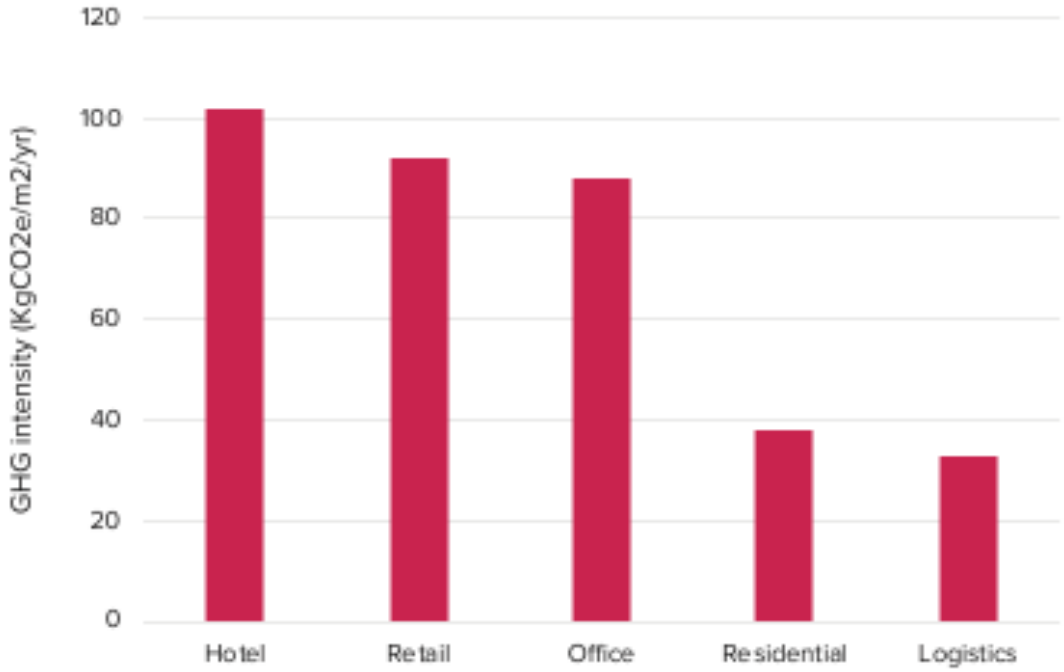
In 2020, 37% of all energy-related carbon dioxide emissions came from the construction and operation of buildings.[4]

Fig. 1. The share of buildings and construction in energy-related CO2 emissions, 2020



In terms of operational GHG emissions intensity, different property types vary greatly as we can see from Fig. 2 below.

[4] 2021 Global Status Report for Buildings and Construction (Accessed on January 19, 2022).



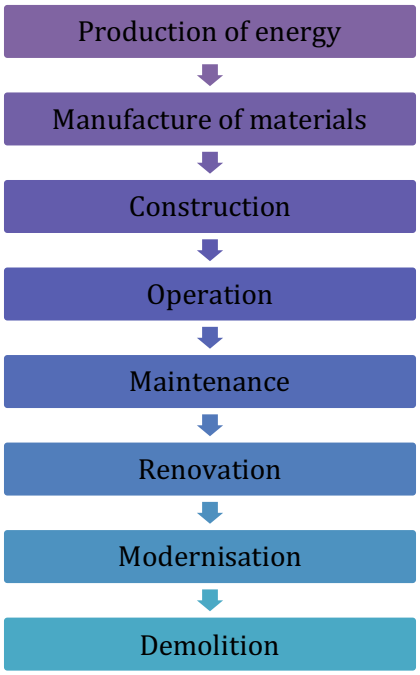
Source: Managing Climate Change-Related Risks in Global Real Estate

Future increase in demand for buildings is almost certain on the back of economic and population growth across emerging economies. Some estimates (see the Global Status Report for Buildings and Construction) expect the floor area of the global buildings sector to double by 2060. Hence, the industry is facing a two-pronged challenge of building emission-free new buildings and refurbishing the existing real estate to eliminate its GHG emissions. Moreover, as most of the currently built houses will still stand in 2050 and beyond, they need to be ready to face the changing climate and the ensuing demand for cooling and other additional resilience measures.

The whole-life carbon footprint of real estate can be broken down into two large categories: embodied carbon and operational carbon. The former refers to construction materials and processes, including a building's renovation and demolition.

Fig. 3. LCA stages of a real estate asset[5]

[5] EBC Annex 31 Project Summary Report (Accessed on February 18, 2022).



About 80% of a building's embodied carbon is from structural materials.[6] Accordingly, the use of low-carbon options (e.g., green concrete, recycled steel, timber/natural fiber insulation) for materials that typically have high levels of embodied carbon (e.g., traditional concrete, steel, and synthetic insulation) should be key considerations when designing a new structure. Specifically, concrete (made with cement mix) alone produces about 8% of global carbon emissions.[7] Globally more than 4.4 billion tons of concrete are produced every year, and that number is expected to go up to 5.5 billion by 2050.[5] Other factors to consider when designing new buildings include reducing total materials used and repurposing used materials to lower embodied carbon.

Fig.4. Materials Choices to Reduce Embodied Carbon

[6] Urban Land Institute Greenpoint Embodied Carbon in Building Materials for Real Estate report (Accessed on March 10, 2022).
[7] Can concrete, a major CO2 emitter, be made greener? (Accessed on March 10, 2022).

Traditional Material		Good Replacement	
Concrete	For each ton of concrete produced, 0.5 tons of carbon are emitted, and concrete accounts for around 7% of global GHG emissions. Concrete is highly polluting due to the dirty process of creating cement, which uses large amounts of fossil fuels to heat kilns that release chemical pollution during firing.	Green concrete	Green concrete can greatly reduce the embodied carbon of a project just by slightly increasing the recycled content of concrete mix.
Steel	For each ton of steel produced, 1.83 tons of carbon are emitted, and steel accounts for around 7% to 9% of global GHG emissions. Mining and processing of steel is an energy-intensive enterprise that degrades the environment and relies on fossil fuels for heating furnaces.	Recycled steel	Readily available in the U.S. market, recycled steel avoids the raw materials extraction component of traditional steel.
		Cross-laminated timber (CLT)	CLT is an innovative mass timber material that makes construction with wood a safe, low-carbon alternative to traditional structural materials. It uses forest waste to make lightweight, strong, and seismically safe modular wooden pillars and sheets that require less labor to piece together on a shorter timeline. Construction also produces less on-site waste by designing out the need for excess materials.
Synthetic insulation	Petroleum-based synthetic insulation requires high levels of energy to manufacture	Low-carbon insulation	Mineral wool batt and fiberglass batt have a significantly lower embodied-carbon impact than rigid insulation and spray foams do. Mineral wool batt, in particular, is a lower-carbon alternative to extruded polystyrene, expanded polystyrene, and polisocyanurate (polyiso) insulation for wall assembly.
		Bio-insulation	Natural alternatives to synthetic insulation include sheep's wool, dense-pack cellulose, cork, and straw bale, all of which are also considered to be carbon-sequestering.

Source: Urban Land Institute (ULI) Greenprint "Embodied Carbon in Building Materials for Real Estate" report

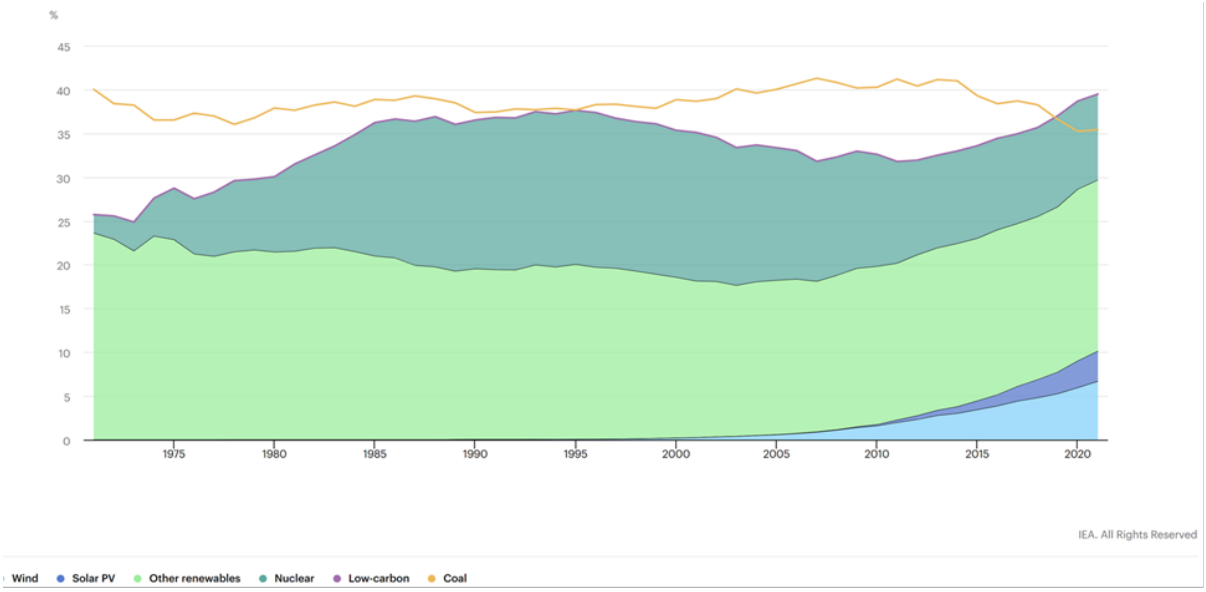
Operational carbon is produced as a result of the building's utilization (heating, cooling, lighting, etc.). As noted in Fig. 1, approximately 27% of all energy-related carbon dioxide emissions in 2020 was attributable to the operation of buildings (residential and non-residential). Operational emissions depend, to a large degree, on the location of the building, its energy efficiency, as well as the carbon intensity of onsite fuel sources and offsite electricity supply. Regarding the latter, the majority of CO2 emissions from fossil-fuel combustion attributed to commercial and residential buildings are indirect emissions from electricity generated offsite to power buildings versus direct emissions from onsite fossil-fuel combustion (e.g., fuel oil, natural gas, etc.) for space heating and cooling, water heating, cooking, leaks, etc.[8] Consequently, efforts to decarbonize buildings should focus on transitioning to renewable energy sources to generate electricity as well as increasing the electrification of building equipment (e.g., boilers, furnaces, water heaters, generators, etc.).

The share of renewables in global electricity generation was approximately 29% in 2020, up from 27% in 2019, according to the International Energy Agency (IEA).[9] Solar photovoltaic (PV) and

[8] Decarbonizing U.S. Buildings (Accessed on March 28, 2022).
[9] IEA Global Energy Review 2021 (Accessed on March 28, 2022).

wind continued to be the main drivers of growth in renewables. Although renewables kept gaining market share in 2021 (i.e., the all-time high exceeding 8,000 TWh), the agency noted that coal's share of total generation rebounded above 36% last year. That year, China and India were adversely impacted by supply disruptions and commodity price spikes, which resulted in higher coal demand.[10] Notably, coal-fired generation in emerging markets is much more prevalent relative to advanced economies, particularly in China and India where coal accounts for more than 60% and 68%, respectively. For the other BRIC countries, hydropower makes up a significant share of electricity generation in Brazil (66% in 2020, for example[11]), while gas/coal accounts for more than 40%/15% in Russia, according to the IEA.

Fig.5. Share of low-carbon sources and coal in world electricity generation, 1971-2021

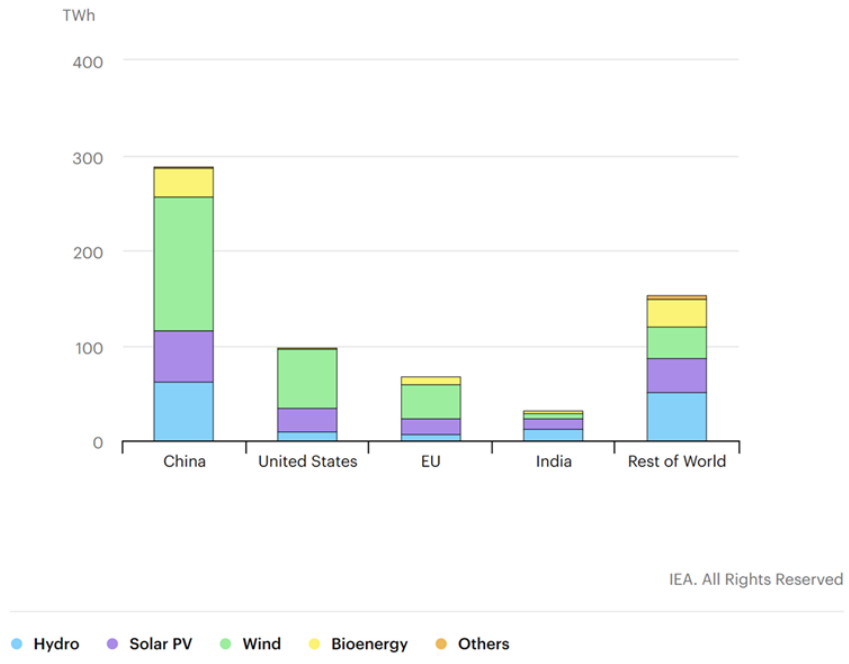


Source: IEA (2021), Global Energy Review 2021, IEA, Paris https://www.iea.org/reports/global-energy-review-2021

[10] IEA Global Energy Review: CO2 Emissions in 2021 (Accessed on March 28, 2022).

[11] US Energy Information Administration (Accessed on June 29, 2022).

Fig.6. Renewable electricity generation increase by technology, country, and region, 2020-2021



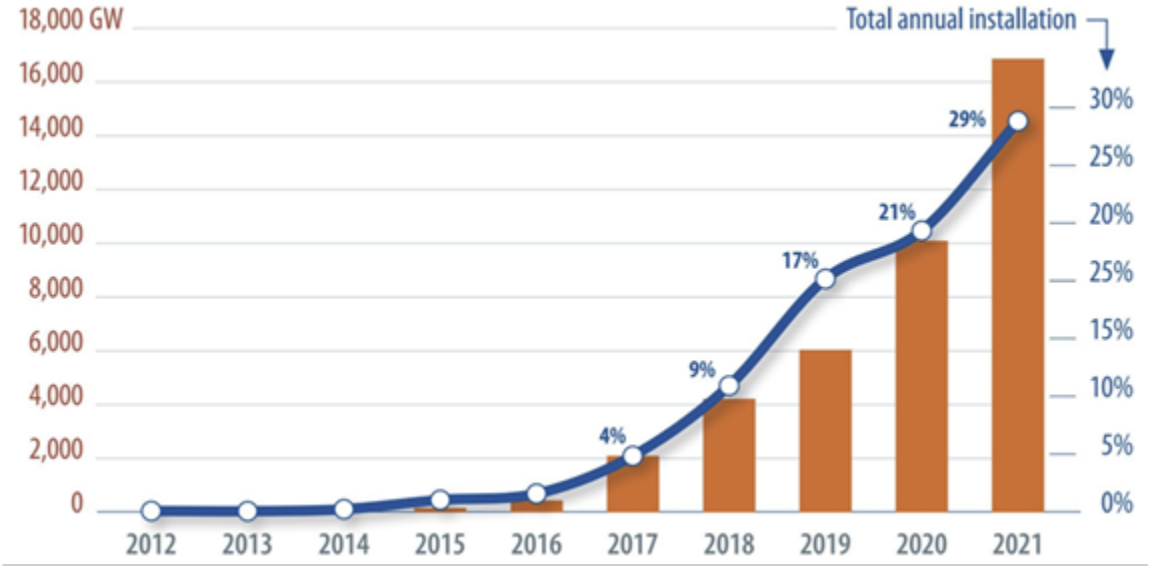
Source: IEA (2021), Global Energy Review 2021, IEA, Paris https://www.iea.org/reports/global-energy-review-2021

Given heightened concerns and focus on environmental issues, residential households as well as commercial and industrial companies are switching to clean energy sources for the assets they own such as buildings and vehicles, and lowering the carbon intensity of the electricity they use. As companies step-up their commitments to reduce carbon emissions, there will likely be massive growth in corporate demand for renewable energy – especially for solar energy-based systems.

Solar is the fastest growing generation resource globally. The record pace of growth is mainly due to government-led financial incentives and declining costs. Analysts anticipate outsized growth in installed residential, commercial, and industrial (i.e., onsite/non-utility scale) solar capacity globally. This is still a largely untapped market with a low penetration rate. According to Sunrun, Inc., (the #1 residential solar market leader in the U.S.), the penetration rate is approximately 4% of homes in the U.S. currently and will only reach 17% over the next ten years

assuming 15% annual industry growth.[12] IHS Markit noted that China, which is the largest residential PV market, has also experienced a tremendous increase in residential PV demand. Growth over the past three years in the region was primarily driven by government incentives/subsidies.[13]

Fig. 7. China mainland residential solar demand trends[10]

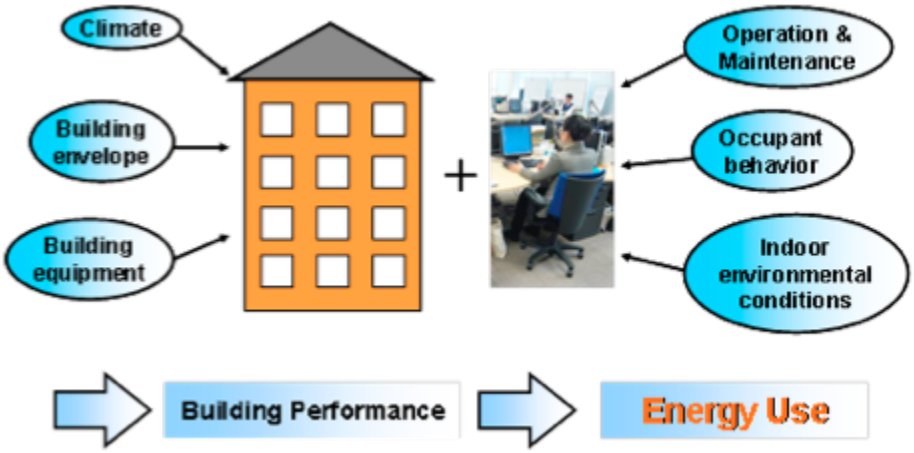


Source: IHS Markit

Historically, a number of factors have led to embodied carbon being less of a focus for investments. Operational carbon reduction by improvements in energy efficiency and wider use of renewable energy sources is more widely supported by sustainable financing and regulatory incentives. This results in embodied carbon reduction being postponed to later periods, which is far from ideal.

[12] SUNRUN Investor Presentation (Accessed on March 31, 2022).
[13] The evolution of residential PV in China (Accessed on March 31, 2022).

Fig. 8. The main elements of energy use in buildings[14]



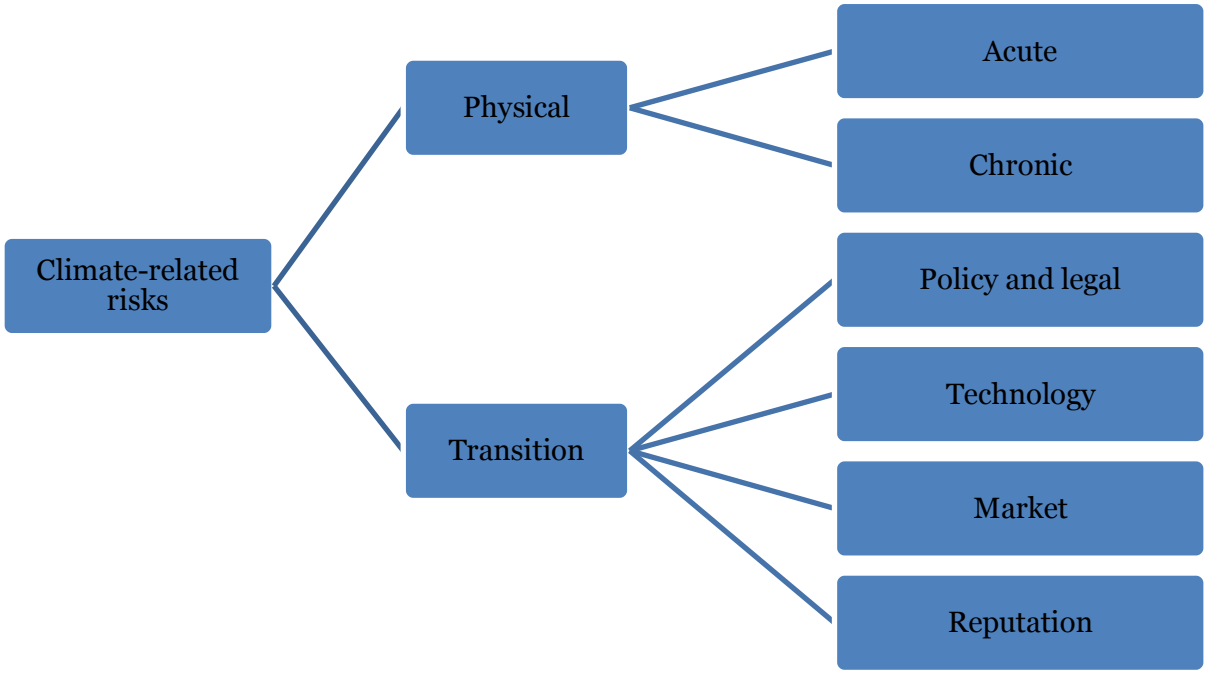
When assessing operational emission reductions, investors should note that renovation of buildings to achieve higher energy efficiency standards often leads to more embodied carbon, which can be largely mitigated by utilizing the existing building structure. Therefore, it is important to use the whole-life approach to avoid efficiency improvement measures leading merely to shifts between the embodied and operational carbon.

Furthermore, as additional countries apply operational energy efficiency requirements to new and renovated buildings, the role of embodied carbon and its relative share in the whole-life footprint is bound to grow. Tackling embodied carbon is likely to take more time as it is highly complicated and involves the entire construction value chain. Some of the links in this chain generate emissions with no currently commercially viable technologies to reduce them. Embodied carbon is also more difficult to measure and track.

[14] EBC Annex 53 Project Summary Report (Accessed on February 18, 2022).

Climate risks for real estate

Fig. 9. Climate-related risks



Source: TCFD Recommendations

Physical risks constitute the most obvious threat for buildings and include potential submersion and coastal erosion, heatwaves, floods, and fires. The probability and magnitude of these risks have been growing at an accelerated pace. For example, according to the U.S. National Oceanic and Atmospheric Administration,[15] the sea level along the U.S. coastline is going to rise 30 cm in the next 30 years – as much as it has risen over the last 100 years.

These risks can be alleviated through adaptation measures and insurance. The increasing probability and magnitude of physical threats to buildings inevitably leads to accumulating pressure on the insurance industry, which in turn, will have to increase insurance premiums and/or limit coverage.

[15] 2022 Sea Level Rise Technical Report (Accessed on February 18, 2022).

Adaptation measures to decrease physical risks to real estate assets are mostly taken at the stage of design and construction or renovation. These risks also depend on the surrounding environment and such factors as city planning, design of stormwater and sewage systems, security and flexibility of utilities providers.

Real estate projects are also subject to policy and legal transition risks, which are particularly relevant for investors given the typically long tenure of required financing. Governments across the world are coming up with new climate-related regulations, and this is likely to increase going forward. For example, some countries (such as the UK) have already implemented restrictions on the minimum energy performance level below which buildings cannot be re-leased. Therefore, it is important for real estate investors to look into the future and to make sure buildings are ready for net-zero targets and for steadily increasing requirements for GHG emissions curtailment, water and waste management. Otherwise, these properties may turn into stranded assets (i.e., assets that have suffered from unanticipated or premature write-downs, devaluation, or conversion to liabilities[16]). According to some estimates, the value of these stranded assets is close to $7.5 trillion.[17]

Real estate assets may also become stranded as a result of market risks. As the average energy efficiency will likely be improving, buildings that are relatively more costly to run will see lower demand from tenants and buyers. This is another form of transition risk that is relevant for real estate assets.

Current state of affairs

Some progress has been achieved in recent years in lowering CO2 emissions from buildings, with the COVID-19 pandemic helping. While in 2015, 88 countries included real estate in their Nationally Determined Contributions (NDCs) under the Paris Agreement, this number grew to 136 by 2020. More than 80 countries have adopted building energy codes. Annual investments in buildings' energy efficiency has climbed from $129 bn to $180 bn during this period (with Europe being the main driver of growth). However, this is not enough, especially as economies rebound after the pandemic, and more needs to be done to reach the Paris Agreement's targets by 2050.

[16] Stranded Assets The transition to a low carbon economy (Accessed April 11, 2022).
[17] Climate risk and the opportunity for real estate (Accessed February 8, 2022).

Fig. 10. Building energy codes by country

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

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

Source: IEA 2021e. All rights reserved.

As we can see from the map, countries with only voluntary or no existing codes are where most of the future growth in population is expected. Europe is the global leader in implementing mandatory building standards, while Africa and a significant part of Asia are lagging in this regard.

On a global basis, government regulations and standards on embodied carbon are currently even less advanced than policies focused on operational carbon. For example, the UK is at a beginning stage with its initiatives. Authorities in the UK recently commented that they were considering whether it would be "appropriate" to introduce some regulatory requirements for introducing embodied carbon targets in building.[18] In February 2022, the Carbon Emissions (Buildings) Bill was introduced to the UK Parliament, which would require for the first time that new buildings calculate and reduce embodied carbon. "If passed into law, the Carbon Emissions (Buildings) Bill would require building regulations to be amended to limit the roughly 50 million tonnes of CO2 that are emitted from the materials and construction of buildings in the UK every year." [19] On a

[18] UK government considering need for embodied carbon standards (Accessed April 11, 2022).

[19] MP Duncan Baker launches bill to cap embodied carbon in UK buildings (Accessed April 11, 2022).

promising note, there are policy initiatives in place at some governments, states, and cities. As noted by the World Green Building Council (GBC), policies have been set at a national level in France, the Netherlands, Sweden, and Finland.[20]

Fig. 11. E+C- voluntary labelling scheme (France) [18]

Description	Key characteristics
France's National Low Carbon Strategy (2015) aims to achieve nationwide roll-out of positive energy buildings and to reduce GHG emissions from the building sector by 50% in 2030 relative to 2015 and by 87% in 2050. For buildings, France launched the E+C- voluntary labelling scheme, which adopts a collective and shared approach to ensuring that buildings of the future will be energy-positive and low-carbon throughout their entire lifecycle. The first stage in this approach is to carry out a trial phase, commissioning firms to construct buildings with higher performance ratings than those stipulated in current legislation, and then gathering feedback from the experience. The scheme represents an expansion of focus from solely energy to all environmental impacts and from solely the use phase to all lifecycle phases.	• Environmental performance of buildings is determined by an LCA of the building. Objectives are to: 1. reduce GHG emissions and other negative environmental impacts 2. encourage systematic assessment of buildings' environmental footprint 3. promote the use of bio and waste-based materials 4. provide a density bonus to high performers meeting the carbon performance requirement by granting additional gross floor area rights[35]. • The second goal is supported by Ademe's Energy-Carbon Building Objective[36], a financing support instrument for building competencies in the area of LCA, refining a national LCA methodology, and collecting data on projects. • LCA results from E+C- pilot projects will inform performance based requirement levels to be included in the new environmental regulation of 2020.

The World GBC also noted that there has also been progress in the State of California in the U.S. and in cities like Vancouver in Canada and Oslo in Norway to regulate embodied carbon.

[20] Bringing embodied carbon upfront (Accessed April 11, 2022).

Fig. 12. State of California Buy Clean Act (USA) [18]

Description

The Buy Clean California Act was developed to address climate change through the power of procurement. It targets the embodied carbon of construction materials used in infrastructure projects such as roads, bridges, and public buildings. The Buy Clean California Act is the first in the nation to be signed into law.

Key characteristics

- Eligible construction materials are structural steel, rebar, flat glass and mineral wool board insulation.
- Environmental product declarations will be used to identify the GWP to produce the material.
- Beginning 1 July 2021, contracts will require eligible construction materials to have a GWP equal to or lower than a level established by state standards.

Fig. 12. City of Vancouver Zero Emissions Building Plan (Canada) [18]

Description

In 2016, the City of Vancouver published its Zero Emissions Building Plan, establishing specific targets and actions for achieving zero emissions in all new buildings by 2030.

In April 2019, the City of Vancouver approved the Climate Emergency Response report which amplifies and builds on past progress to reduce carbon pollution, to improve energy efficiency, and to help transition to renewable energy.

Key characteristics

- Zero Emissions Building Plan sets out four strategies for its zero emissions new buildings target for 2030:
  - Limits – establish GHG and thermal energy limits
  - Leadership – city-led building projects to lead from the front where viable
  - Catalyse – develop tools to spur leading private builders and developers
  - Capacity building – build industry capacity through information sharing tools, sharing of knowledge, and development of skills
- Set a target of reducing embodied emissions by 40% by 2030, as part of the city council's declaration of a climate emergency. The council believes the ambitious target will encourage innovation in construction materials, design and engineering while helping to position local industries as leaders in low carbon construction.
- The City of Vancouver's green building policy for rezoning requires projects to conduct a Whole Building Lifecycle Assessment (WBLCA) and to disclose the LCA results as part of their rezoning submission.

One of the challenges on the path to net zero for the real estate industry is a lack of reliable and comprehensive data, especially in developing countries. This problem exists at the stage of

construction (for example, no proper modeling of future energy consumption) as well as during the life of buildings (no real-time monitoring of energy consumption, no uniform classification of buildings etc.). The availability of data differs significantly from country to country. As a result, non-specialist real estate investors may have to incur additional costs in order to assess the climate-related risks of potential acquisition targets.

Green building certification

A uniform global classification of buildings into "green" or "not green" would help investors immensely; unfortunately, it does not yet exist. The width and thresholds of the certification regimes vary in different countries. Only some of these regimes cover embodied carbon, focusing primarily on operational emissions.

The EU appears to be a pioneer in creating such a certification. Based on the EU taxonomy, the buildings shown in Fig. 13 can be considered "sustainable."

Fig. 13. Technical screening criteria under the EU taxonomy[21]

Type of activity	Technical screening criteria
Construction of new buildings	Primary energy demand of new construction is at least 10 per cent lower than nearly zero energy building requirements in national measures. Energy performance is certified by an energy performance certificate. For buildings greater than 5 000 square meters, life-cycle global warming potential is calculated, and the level of performance is tested post-construction, with both disclosed to investors and clients.

[21] 2021 Global Status Report for Buildings and Construction (Accessed on January 19, 2022).

Renovation of existing buildings	As applicable in national regulations for major renovations, or reduction of primary energy demand of at least 30 per cent.
Acquisition and ownership of buildings	Buildings built before December 2020 are at least EPC class A, or within the top 15% of national building stock expressed in primary energy demand. Buildings built after December 2020 meet criteria for "construction of new buildings." Large non-residential buildings with HVAC output greater than 290 kilowatts are operated efficiently through energy performance monitoring and assessment.

The EU has also introduced a nearly zero-energy buildings (NZEB) classification, mandating all new construction to fall into this category starting from 2021. The concept was first defined in 2010, and the current criteria is for an NZEB to have a very high energy performance. The very low amount of energy required should to a very significant extent be covered by renewable sources of energy. This definition is rather broad, and does not include embedded carbon. Given the steady strengthening of GHG emission reduction targets in the EU, this definition is currently being reviewed for potential modification. It is worth noting that EU member states have more specific NZEB requirements that differ from country to country.

The EU is certainly not the only entity setting standards for reduction of carbon emissions in buildings. For example, in 2007, the U.S. Congress passed the Energy Independence and Security Act that mandates all new and renovated Federal government buildings to be fossil fuel free starting from 2030. Other countries are moving in the same direction, albeit at varying speeds.

In addition to national government-led certification rules, there exist a large number of international systems. According to the IFC,[22] the most popular among them are BREEAM, DNGB, EDGE, Green Star, and LEED (see Appendix for more information). We would like to highlight EDGE as the system of certification that has been designed specifically for emerging

[22] Green Buildings: A Finance And Policy Blueprint For Emerging Markets. Accessed on February 17, 2022.

markets, and it takes into account embodied carbon, while most other systems focus on operational carbon.

Guidelines for investors

There are several groups of players that can—and should—influence, directly or indirectly, the transition of buildings toward a more sustainable future. These include investors, developers, builders, manufacturers of materials, asset managers, lenders, regulators, tenants, and landlords. Each of them has a different ability to affect the construction and operation of a building at various stages, and their incentives to reduce carbon emissions also differ.

Furthermore, the role of these players depends on their location. Emerging markets are, in general, falling behind in their efforts to adopt environmentally friendly construction practices. Their typical obstacles include lack of knowledge and advanced technologies, weak regulation and implementation institutions, and a need to provide large amounts of affordable housing quickly in a situation of limited financial resources.

The players that are involved in the real estate industry can act in three major ways in order to reduce GHG emissions:

1. Decrease energy consumption by improving efficiency and using less energy;
2. Decarbonize the power supply by electrification and switching to renewable sources;
3. Trim emissions from materials and construction processes (embodied carbon).

Each of the aforementioned groups of players has a different ability to impact GHG emissions in these ways. Investors can directly affect energy consumption and decarbonize their power use as tenants, thus cutting their Scope 1 and 2 emissions. They can have much stronger leverage on their Scope 3 emissions as providers of capital, or as landlords if we are talking about private equity-type direct investors.

Investors acting as landlords should keep in mind that energy efficiency has both technical and behavioral factors. The latter is in the hands of the building's tenants. Hence, it is up to the landlord to work with them to improve energy efficiency. This may include contractual KPIs/targets and various forms of regular monitoring and engagement.

Investors, especially those that own buildings over a long period of time, are likely to face a need to use new materials during maintenance, renovations, and upgrades. In such situations they should look for inputs with low or zero embodied carbon. EPDs are becoming more widely available, and investors may need to ensure their contractors are aiming for minimization of embodied carbon and of their own emissions during the renovation or maintenance process.

As any real estate asset ages, a question inevitably arises: to demolish or to refurbish? Any financial cost-benefit analysis should be complemented with carbon considerations. From the point of view of GHG emissions, refurbishment is usually preferable, as during a demolition, significant amounts of CO_2 may be released into the atmosphere. Remaining materials will contain carbon that may find its way out, so it is important to understand what happens with these materials and whether they can be reused or recycled without GHG being emitted.

Using renewable sources of energy in a building's operations is one of the most obvious ways to reduce its carbon footprint. In doing so, it is preferable to use local electricity generation as opposed to a procurement deal with a remote generator. This allows for better control, avoidance of potential double counting or greenwashing, and leads to lower losses of electricity in transmission lines.

It is not enough to blindly rely on a green certificate of a building, especially in a developing country. Certification standards are local and thus differ, so it is important to get under the hood to understand how strict and comprehensive the certificate is. The Appendix includes some of the best examples of certification systems that can be used as reference points.

It is also important to keep in mind that certifications are often focused on the design of buildings. In real life, how occupants use the building is equally important. Their actual behavior can easily eliminate any potential energy savings and carbon emissions reductions that have been incorporated into the building's design. Green performance certificates can help investors to assess the real situation. An example of such a tool is the EU's Energy Performance Certificate.

Does the owner have an emissions reduction program in line with SBTi guidelines? Emission reduction pathways are highly specific, depending on the property type and country. The CRREM tool that is referenced in our Appendix can be used to compare an asset's pathway with its science-based benchmark.

As for buildings, to achieve the Paris Agreement goals, the UNFCCC'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."[23]

In addition to climate mitigation strategies, in many areas adaptation is already needed. To see whether such measures are necessary, today or tomorrow, we advise investors to check the location of buildings against flooding- and heatwave-prone areas. Given the expected rise in sea level and growing probability of heat waves in new territories, investors should look at projected maps, not the historic ones. Such maps may be available at local governments or from sources like NOAA Climate.gov or the EU's Water Information System for Europe.

[23] 2021 Global Status Report for Buildings and Construction (Accessed on January 19, 2022).

Conclusion

Carbon transition is going to have a complex and multi-faceted effect on real estate assets and investors. It starts from materials used in construction, the construction process itself, as well as buildings' refurbishment, operations, and demolition. Investors can play different roles at various stages of life of these assets, and need to be aware of several associated risks and checkpoints. Their work is further complicated by the localized regulatory environment, a lack of unified standardization, poor data availability, and many other challenges. Our research brief contains a broad overview of the state of affairs in the real estate industry and suggests some guidelines for investors. The Appendix refers to several useful resources including relevant organizations and certification standards. We hope this report will be of practical use to our members who are looking at this asset class and want to be prepared for its transition to a new climate reality.

Appendix of Initiatives, Frameworks, and Standards

General

GRESB is one of the most widely used benchmarks for real estate assets and investment portfolios, covering not only real assets, but listed companies and REITs, too.Investors can compare and assess their portfolios along the dimensions of climate change risks, energy and carbon performance and targets, effects of new developments and refurbishments, and others. GRESB is a partner of CRREM (please see below), so its users can assess their portfolios against the CRREM pathways.

Global Alliance for Buildings and Construction (GlobalABC) – the organization was founded at COP21 in 2015 to develop and implement policies and initiatives that support the transition of buildings and construction to net zero. GlobalABC publishes *The Global Status Report for Buildings and Construction,* which provides an annual overview of the current status and progress towards net zero. The organization's website also contains a number of ad-hoc reports on topics related to climate change and real estate.

World Green Building Council is an association of Green Building Councils around the world whose mission is to transform the building and construction sector across the areas of climate action, health and wellbeing, and resources and circularity. The website contains a directory of building rating tools administered by Green Building Councils, as well as other reports produced by the organization.

Global Cement and Concrete Association is an industrial body that imposes certain requirements on its members to promote the sustainability of their business. In addition to a number of articles on a range of topics related to the sustainability of the cement and concrete industry and to these materials in general, the association describes several relevant KPIs that can be used to assess companies from this industry.

Carbon Risk Real Estate Monitor (CRREM) is a project funded initially by the EU and then by the Laudes Foundation, which has produced a tool that can be used to assess required operational carbon reduction pathways at an asset or portfolio level. The tool covers a number of EM countries and is based on the Science Based Targets initiative (SBTi) guidelines.

Partnership for Carbon Accounting Financials (PCAF) has issued **The Global GHG Accounting and Reporting Standard for the Financial Industry. First edition.** The

document contains a section on commercial real estate and mortgages providing guidelines for loan providers and investors on how to calculate and report financed emissions.

Certification Systems

BREEAM - BREEAM (Building Research Establishment's Environmental Assessment Method) is a sustainability assessment method for master-planning projects, infrastructure, and buildings. It recognizes and reflects the value in higher performing assets across the built environment lifecycle through third party certification of an asset's environmental, social, and economic sustainability performance, using standards developed by BRE group.

DNGB System - The German Sustainable Building Council System offers a variety of options for buildings, indoor environments, and districts – not only for new buildings but also for existing ones. The DGNB System works like a planning and optimization tool, providing help with raising the tangible sustainability of building projects. The DGNB System is based on life cycle assessment, a holistic approach, and an emphasis on performance, setting the approach apart from other certification systems in the market.

EDGE - EDGE (Excellent Design for Greater Efficiencies) is a green building certification system that allows design teams and project owners to assess the most cost-effective ways to incorporate energy and water saving options into homes, hotels, hospitals, offices, and retail spaces. Projects that achieve a 20% projected reduction in use of energy, water, and embodied energy in materials compared to conventional buildings are eligible for EDGE certification.

Green Star - Founded by Green Building Council of Australia in 2003, Green Star is a sustainable certification system, which offers a roadmap to reach social and environmental targets, a pragmatic approach to adopting sustainability practices, a method to show building occupants' peace of mind that they are in a healthy environment, and a mechanism to "future-proof" assets to long term regulatory change, climate change impacts, and changing trends.

LEED - LEED (Leadership in Energy and Environmental Design) is a certification system founded by the U.S. Green Building Council in 1993. To achieve LEED certification, a project earns points by adhering to prerequisites and credits that address carbon, energy, water, waste, transportation, materials, health, and indoor environmental quality. Projects go through a verification and review process by GBCI and are awarded points that correspond to a level of LEED certification: silver, gold, or platinum.