MEASURING AND MANAGING WHOLE LIFE CARBON IN REAL ESTATE PORTFOLIOS

REFLECTIONS AND RECOMMENDATIONS FROM IIGCC ROUNDTABLES WITH INVESTORS

February 2023

CLIMATE STRATEGY & PARTNERS

IIGCC
The Institutional Investors Group on Climate Change

About IIGCC, “the investor voice on climate change”

The Institutional Investors Group on Climate Change (IIGCC) is the European membership body for investor collaboration on climate change and the voice of investors taking action for a prosperous, low carbon future. IIGCC has more than 390 members, mainly pension funds and asset managers, across 24 countries, with over €60 trillion in assets under management.

IIGCC’s mission is to support and enable the investment community in driving significant and real progress by 2030 towards a net zero and resilient future. This will be achieved through capital allocation decisions, stewardship and successful engagement with companies, policy makers and fellow investors. IIGCC works to support and help define the public policies, investment practices and corporate behaviours that address the long-term risks and opportunities associated with climate change.

About Climate Strategy & Partners

Climate Strategy & Partners (“Climate Strategy”) is a leading policy advisory and consulting firm in climate finance, innovation, energy efficiency investments and the corporate strategies and Government policies required to accelerate the Transition to a net-zero emissions economy. For 13 years, the Climate Strategy team has been providing global companies, banks and Governments advice on how to deliver the economic transition to a low carbon economy. Climate Strategy’s chief executive, Peter Sweatman, has authored or co-authored 19 white papers, and is rapporteur to the EU Commission and UN Environment Finance Initiative’s Energy Efficiency Financial Institutions Group (EEFIG). Climate Strategy has supported energy transition policy development at the G20 and in Spain, Mexico, France, and the UK and continues to implement leading low carbon business solutions for global clients. Climate Strategy also has a subsidiary called Energy Efficiency Capital Advisors which has structured and executed ten energy efficiency placements totalling over Euro 60 mm for Spanish cities, companies and buildings for international investors.

About this report

This report is written by Peter Sweatman, Chief Executive of Climate Strategy, with the support of Adriana Rodríguez as research assistant. The report is built upon the inputs of IIGCC property working group members and public stakeholder meetings held in 2022, yet the views and conclusions expressed herein are attributable only to Climate Strategy & Partners, and not to the supporting organisations nor reviewers. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the IIGCC nor Climate Strategy & Partners nor the authors concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries.

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Index

1. Chair's opening remarks

"It was a pleasure for me as co-chair of IIGCC's Real Estate Working Group to hear how so many of our members now include embodied carbon in their projects and portfolio decarbonisation commitments. While data availability and the level of influence which investors can exert are often constrained at project level, I'm certain that the leadership of our members has served to orient and accelerate overall market progress for embodied carbon considerations in 2022.

IIGCC is working to provide confidence to regulators that the investor community can step-up and accelerate the private sector contribution to ambitious economy-wide decarbonisation targets. The embodied carbon best practices, documented by IIGCC members in 2022, demonstrate how investors can deliver, as long as the regulatory bar is supportive of climate leadership and provides a level playing field for everyone.

IIGCC's Net Zero Investment Framework offers IIGCC members a series of steps to address operational carbon, and in 2023 the IIGCC Real Estate Working Group will develop a step-by-step guide offering guidance on measuring and managing embodied carbon in their climate action plans.

I thank the very many public and private sector contributors to our embodied carbon work, described here, the team at Climate Strategy, and I look forward to a full year where IIGCC members continue to raise the bar in climate action."

Aleksandra Njagulj
Global Head of Real Estate ESG at DWS and Co-Chair of IIGCC's Real Estate Working Group.

2. Executive summary

In a world where embodied carbon is invisible, investors can make investment and sustainability decisions that may be unwittingly harming the environment. This is why leading members of IIGCC's Real Estate Working Group are moving on the topic: "wait and see" is no longer an option.

This report documents IIGCC's series of roundtables hosted in 2022, providing "best practices" and examples from the series, where experts and leading investors explained how they are incorporating embodied carbon into their measurements and target setting. The key principles and approaches described here contain four key steps:

1. Identify and use Whole Life Carbon Assessments to assess the environmental footprint of materials used in projects;
2. set overall targets based upon individual asset pilots and expand up to the portfolio level;
3. have a portfolio-level strategy to deliver the targets that are set over multiple years; and
4. provide transparency and regular reporting to stakeholders.

Beyond the best practices of leading investors, there are an extended set of recommended areas to help ensure a level playing field and to make it easier for newer entrants to build embodied carbon into their sustainability strategies. This can be achieved through a clear and fair regulatory framework that considers embodied carbon; standardised, available and useful embodied carbon data; and a global set of standards in certification and awareness.

Supporting the needs of investors, building regulators need to lay-out a clear vision on how their national and regional building stock will meet national/EU climate goals, with explicit emissions reduction targets for 2030 and 2040, framed in whole-life-carbon terms (not just operational carbon). This will require a move beyond a simple definition of zero emissions buildings into a new definition that considers embodied carbon. Regulators must also prioritise access to data to improve knowledge on how to achieve these targets and develop benchmarks for countries and sectors.

To address a lack of common data and its availability, repositories of embodied carbon data for buildings are starting to be developed. Investors using these emerging datasets can now be more helpful to governments about what works and what doesn't, particularly around what data can, and should, be in the public domain and what needs to remain private.

Many investors, for example, welcome initiatives by member states where the law requires tenants and landlords to report on their operational emissions via a government website, and this practice can be extended to also drive transparency for embodied carbon within the supply chain to buildings. Environmental Product Disclosure (EPDs) documents and Whole Life Carbon (WLC) assessments still need to be made mandatory for material projects within distinct building classes, as embodied carbon remains more complicated than operating energy management. Whole Life Carbon considerations are critical to Europe's industrial decarbonisation and as soon as embodied carbon requirements are introduced, investors can begin to provide more help deliver Europe's decarbonisation targets.

Sustainable government and large project procurement is also critical to enable investors to gather the data needed to benchmark their portfolios and integrate whole life carbon and circularity into construction supply chains. In addition, a well-aligned taxonomy for circularity could help channel more public funding (national or EU recovery funds and energy transition funding) to renovation. Circularity requirements can also be leveraged through building regulations and thereby increase access to information and data and tools about how to reduce products and materials.

Recommendations summary

IIGCC members flagged the importance of a level playing field, without "free riders", in order to spur high quality rules and leaders that set the tone for incorporating embodied carbon into their decarbonisation strategies. Presently, the extra resource effort for including embodied carbon is not fully compensated and those not incorporating it are not being penalised. The language of WLC and embodied carbon needs to be used by certifiers and learned by the end consumers, through visible notification and inclusion in building certificate programmes.

A certain level of consistency among countries is also important as otherwise it becomes challenging for investors and companies working across borders. A level playing field is particularly important to global steel, cement and other commodity producers who demand carbon prices and/or border tax adjustments to create fair conditions and reduce the risks of first movers. Smart and proactive regulation can create this level playing field and provide the right financial motivation for a near-term, deal-level focus on decarbonisation from investors. This regulatory alignment and recommendations to facilitate embodied carbon management are described fully in Section 5.

As the language and definitions of “sustainable finance” become clearer and better regulated, the boundary to make a significant contribution to climate change mitigation will become harder to reach. In the EU the climate taxonomy rules and definitions are determined, and in the UK the FCA has started to build proposals for the UK taxonomy which will likely approximate the EU model. Embodied carbon is tangentially addressed through carbon intensity benchmarks for green construction materials, and while it is not yet a feature in new build or significant renovation, this is an area that should be developed.

Finally, the way companies report their non-financial activities and the regulation of sustainable investment and fund managers needs to include embodied carbon for new build and major refurbishments. Minimum energy performance standards will drive renovations, but these renovations need to consider embodied carbon, as IIGCC members’ case studies demonstrate, otherwise the carbon picture is only partial. Given this, the IIGCC Real Estate Working Group will be developing a timely step-by-step guide that builds on the work described in this report as a useful tool for other real estate investors that wish to accelerate their climate action in portfolio assets.

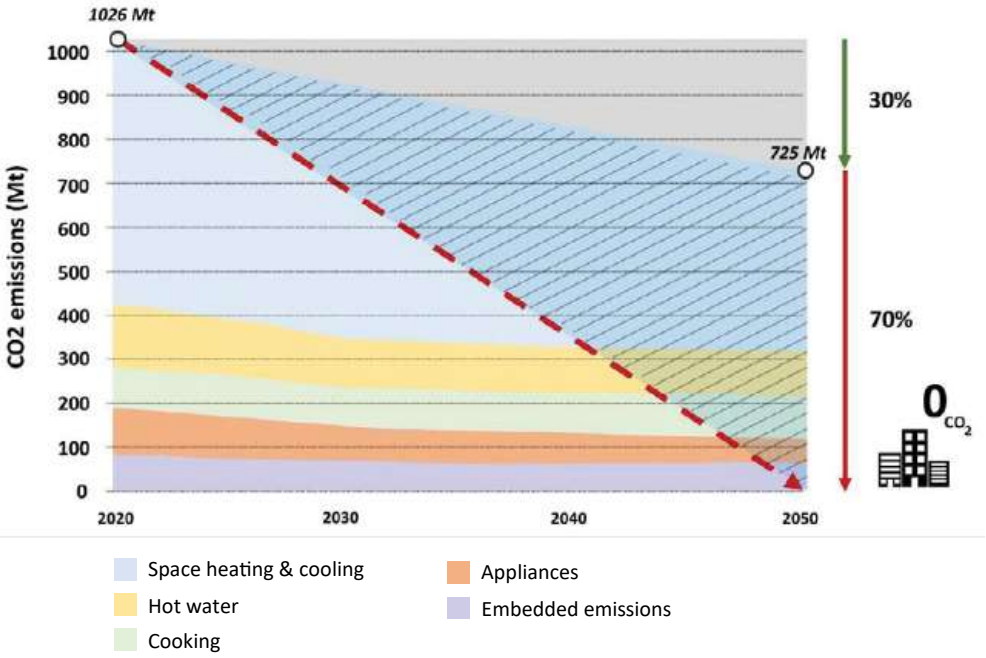
A new world of net-zero aligned and green construction materials and markets is just emerging. This will only be enhanced through an investor push for clearer carbon accountability, to provide focus on the carbon embedded in financial and project balance sheets and to drive more sustainable designs and construction. To enable decarbonisation to happen at scale in construction and major building renovations, a new collaborative approach is required that aligns incentives along the construction value-chain to financial close, through construction and between investors and occupiers.

It’s this vision which defines IIGCC real estate ambition and activity in 2023.

3. Summary of the latest developments on measurement and management of embodied carbon by investors

This chapter provides an introduction to the webinar series launched by IIGCC and leading investors to help uncover best practices in managing embodied carbon. Authors have used case studies and research papers provided by IIGCC members, and the following provides an overview of these and an investor perspective on embodied carbon and some of the most recent developments from investors and the stakeholders involved in the embodied carbon debate.

Chart 1: Baseline annual CO_2 emissions of the EU residential sector
(*direct, indirect and embedded emissions)



Source: Röck, et al. (2020) & EC (2016)

3.1 What is embodied carbon?

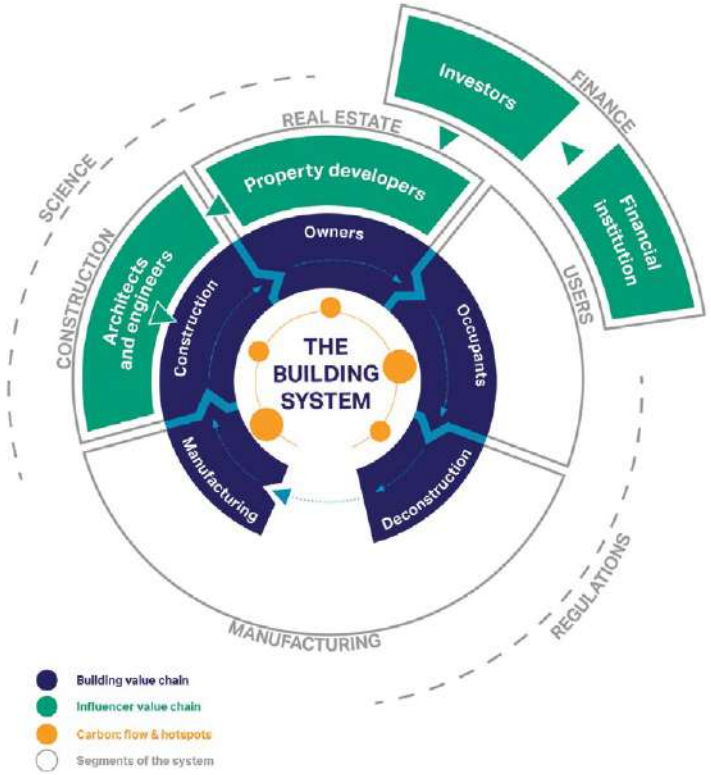
The real estate sector has one of the largest sectoral energy and carbon footprints across the world, representing 40% of energy consumption and 36% of GHG emissions in Europe. **While investors have historically focused on reducing the operational emissions of buildings (70% of emissions), sustainability leaders are turning their attention to embodied carbon.** This is especially important as an incentive to decarbonise the construction sector overall.

Not considering embodied carbon hides a significant portion of the whole life-cycle carbon footprint of a building, and hence an investment portfolio – especially considering substantial renovations and new developments. Globally, a major city's worth of new development takes place every year, mostly in developing countries, and this often requires significant amounts of carbon intensive energy and materials. The design and construction phases do not usually take into account existing building structures and low-carbon life-cycle options for retrofitting over demolishing buildings unless they are protected by national heritage.

An exclusive focus on either embodied or operational carbon can lead to entirely different solutions, which is why many investors are increasingly promoting the "whole life carbon" (WLC) approach. Different materials (eg. cement, steel, wood) perform differently under the WLC approach and also in the context of each specific project, and this creates useful information to developers.

Investors play an important role in accelerating carbon emissions reductions in the real estate supply chain, as shown in the “role of finance” chart 2 below. They mobilise capital for buildings and infrastructure and, as a result, can influence their design and construction, therefore offering powerful incentives to shape the activities in the building system and the behaviour of all market participants.[1] A new value paradigm is already underway where inaction risks a double-digit brown discount – a devaluation based on a lack of green credentials – in the value and liquidity of investors’ portfolios if they are blind to these issues. Leading investors have already identified this brown discount risk and are actively looking for managing solutions to avoid stranded assets.

Chart 2: The role of finance in the building system



Source: WBCSD, 2022

Regulatory progress, approaches and requirements for embodied and operational carbon emissions

Different regulatory initiatives in the EU and the UK are aiming to facilitate the measurement and management of embodied and operational carbon emissions. While these initiatives will reward and support the frontrunner investors that are already looking into integrating a WLC approach to their real estate portfolios, they also aim at incentivising and even requiring the "laggards" to begin this process.

Both the EU and the UK aim to implement **Minimum Energy Performance Standards** (MEPS) for residential and non-residential buildings to mobilise low-carbon renovation, grow the supply chains that support renovation and create the conditions for innovation and investments. While MEPS negotiations in the EU are still underway, the UK has set the target to ensure that all existing homes have an Energy Performance Certificate (EPC) level C or above by 2035. Additionally, the UK aims to introduce standards for **zero carbon buildings** from the point of construction and the EU is also negotiating a definition and criteria for zero emissions buildings.

In order to ensure effective implementation of all these new obligations, they need to be accompanied by a greater accessibility to buildings' embodied and operational emissions data. The **lack of quality and comparable data is the first barrier** that front-runners have highlighted (see section 2.3 for a more detailed discussion on this challenge).

From the investors' perspective, the development of green finance to support these decarbonisation objectives will be key given the significant cost of required renovations. At the same time, these regulatory approaches must also facilitate the process of creating such financial instruments. **Investors have warned about the lack of data on the actual performance of buildings and whether this will lead to stranded assets in their portfolios.** EPCs only measure theoretical performance and the quality of these certificates depends to a large extent on the professionals producing them.

Real-time digitalisation, centralisation and harmonisation of data could be the quickest way to reduce emissions in buildings. The EU is currently negotiating the inclusion of new provisions on **information and data exchange** in its "Fit for 55" legislative files that touch upon buildings. Additionally, **new tools like CRREM,**[2] **AI-based models that estimate buildings' performance and new technologies like smart meters,** have been developed to assist investors in this process. For instance, CRREM is the tool that has been deeply embedded in DWS asset management policies for purchasing or understanding assets to plan out interventions. The tool would also be useful if it was integrated in governmental policies and regulations.

Transparency and reward

Another challenge that relates to the gathering of data is the **access to tenants' energy data**. Sharing this data is a requirement included in some contracts, especially new leases, but some tenants may not want to disclose the information. The tenant controlled area of a buildings' emissions is between 15% to 20%, so the availability of this data is critical to understanding the impact of the overall asset. Without this information, investors are only practically scratching the surface. In the UK, new regulation would be welcome in this regard: tenants and data owners should **report information to the government and together identify improvements to the building's performance**. France plans to adopt a similar requirement[3].

All these regulatory approaches also need to **take into consideration incentives to reduce embodied carbon**. The current framework incentivises demolition over refurbishment, due to the lack of a whole life carbon approach. Some regulatory tools like carbon taxes could be used to de-incentivise demolition over refurbishment.

Other best practice initiatives highlighted in the IIGCC webinar series were the creation of a UK **Green Home Finance Accelerator** to develop green home products and catalyse the wider market. In Spain, the **role of renovation coordinator has been announced**, as determined in its Recovery and Resilience Plan, to work with SMEs and financial institutions to unpick barriers to uptake. Finally, **large scale government communication campaigns** would be key to bring about behavioural change among consumers. These campaigns are also taking place at investor level, for example DWS has undertaken a communications campaign in the UK to encourage consumers to lower temperatures in boilers (which could save up to 6% of energy).

Regulation needs to **reward and not disincentivise first movers**. Currently, leading investors may be put at a disadvantage by customers who may not want to be subject to their sustainability due diligence processes and as a result may turn to other investors or lenders that do not adhere to the same high standards.

3.2 Embodied carbon in the real estate value chain

A set of emerging tools and resources to help investors reduce their real estate portfolio's emissions are being developed, as existing approaches are either too general or have only focused on operational emissions of buildings. These are increasingly important as **policy shifts to take into account the whole life carbon of buildings and forward-looking investors begin to address embodied carbon**. For instance, at a European level, the recast Energy Performance of Buildings Directive (EPBD) currently under legislative negotiations sets deadlines for the regulation of whole life carbon, beginning with measurement and disclosure and continuing with limit values set by member states with the support of the European Commission.[4]

Additionally, **the buildings' supply chain has started to work on low carbon solutions** to accelerate the drive to reduce embodied carbon in buildings. Given the diverse array of actors in the construction process and supply chain, standards must be set at the start of the process and certainly can be established by a cornerstone investor. In fact, the real estate investor has the power to accelerate progress by setting standards that require the use of more sustainable and lower embodied carbon products to drive-up demand and reduce the green premia. Construction accounts for between 40% and 50% of global steel demand, and its decarbonisation is critical to delivering net-zero carbon buildings.

Case Study 1: ArcelorMittal

ArcelorMittal (AM) is the world's second largest steel company and it is on a mission to lead the sector in decarbonisation. ArcelorMittal has a target to be net zero by 2050 and a **target to reduce emissions intensity by 25% in 2030. In Europe the target is a 35% reduction in emissions intensity.**

In 2018, AM launched its Steligence® brand to drive material efficiency and longevity with innovative steel solutions. Using Steligence® together with a design that takes into account carbon emissions, **a building's carbon footprint can be reduced by up to 50%.** If, on average, a new office building uses 50kg of steel per square metre and low carbon steel has a price premium of €100/tonne, the total cost increase on the final price of the finished construction is only €5 per sqm. **A €5 per square metre "green premium" can deliver a 50% reduction in embedded CO_2.**

ArcelorMittal identified a **growing demand from customers for low carbon solutions**. Two years ago it also launched its XCarb® brand, which brings together all of ArcelorMittal's reduced, low and zero-carbon projects and steelmaking activities, as well as wider initiatives and green innovation projects, into a single effort focussed on achieving carbon-neutral steel. XCarb® Recycled and Renewably Produced steel is made in an electric arc furnace fueled by renewable electricity, and it can lead to a CO_2 intensity as small as 300 kg CO_2/ton of steel product. This will strongly support construction stakeholders to achieve their embedded carbon reduction targets in buildings and infrastructures.

One major barrier to decarbonising ArcelorMittal products is the lack of renewable electricity generation capacity. Two thirds of the investment required for near-zero steel is in the enabling infrastructure. Transforming 100 million tonnes of primary steel-making capacity to near-zero emissions would require half of Europe's current installed renewable capacity (and they estimate cost in the region of $5 trillion).

Example of the Union Station Tower in Chicago

- Grade 80ksi* steels developed by Global R&D and Long Products, and produced at Differdange, Luxembourg
- Superior strength of Grade 80 steel enables building design to use nearly 20% less structural steel, reducing costs and embodied CO_2 of the building

CO_2 ↓ 38% Due to 20% reduction in structural steel as well as strong CO2 performance

3.3 Resolving the key steps for investors identifying embodied carbon risks

The first step, and main obstacle that investors identify, is collecting accurate data to build a baseline and establish a decarbonisation pathway to net-zero for their buildings portfolios. A Ramboll[5] study found that high-quality data is largely lacking and is a significant initial barrier. Ramboll's work identifies only five European countries (France, Finland, Belgium, The Netherlands and Finland) where more than 50 cases of Life Cycle Analysis (LCA) data could be identified.[6] When data was available, Ramboll concluded that it often lacked quality, compatibility, and representativeness in the sample.

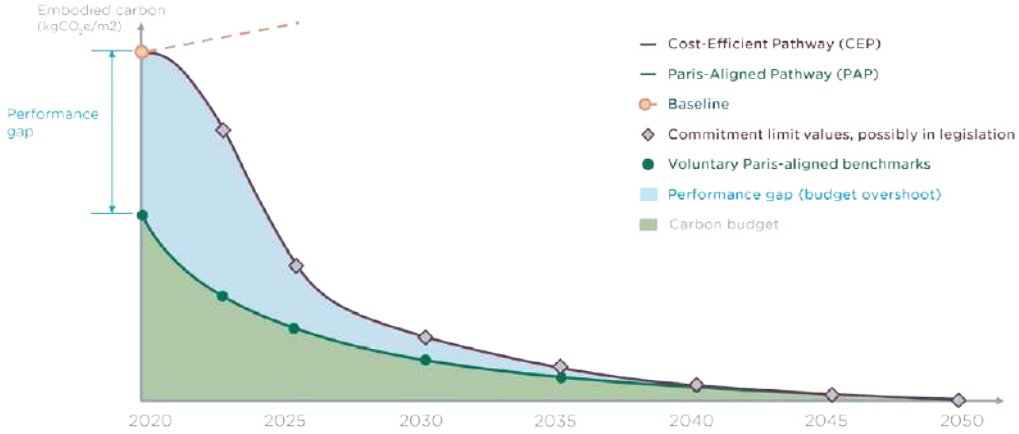
The aim of Ramboll's study was to establish a performance system for embodied emissions at the building level that can provide relevant guidance for policymakers and the buildings industry. While the embodied carbon depends on the building type and the different design techniques (e.g. wood vs concrete), among different categories of buildings similar results could be found. Differences do exist, such as between multifamily houses and single family houses, with the latter producing more emissions, raising questions about the equity and sufficiency of the allocation of the building space. Based on the data it identified, Ramboll estimated that, on average, **600 $kgCO_2eq/m2$ of embodied carbon is typical for a "traditional" building**, with 2/3rds of this amount emitted before the building is put into use.[7]

To complement this estimated building-level baseline, Ramboll also developed a set of **carbon budgets that determine the remaining embodied carbon emissions budget** in the building sector in Europe to comply with the Paris Agreement. This can then be used by the industry to set targets for embodied carbon according to the available carbon budget in Europe.

For investors, budget-based targets inform the climate impacts of investment decisions in new real estate assets. As investors' assets are often dispersed over different countries, a global budget and related pathways are highly beneficial to defining the carbon budget share of an investor. As Ramboll's report explains: "Budget-based targets communicate the amount of embodied carbon that can be emitted in line with the carbon budget and are therefore consistent with the Paris Agreement on limiting global warming. Such targets set at building level are highly relevant as a reference for the speed and scale of decarbonisation efforts in the construction sector. Considering the complexity of the value chain at play, they would constitute a strong signal for the demand side (investors, owners), and would subsequently be passed on further down the value chain (designers, producers)."[8]

The Ramboll report proposes a way to define a carbon budget, then set targets along the budget trajectory for Paris-aligned embodied carbon levels for upfront embedded emissions from new buildings per square metre (m2). This method is already being used by some IIGCC members.

Chart 3: Embodied carbon pathways and performance gap



Source: Ramboll, 2022

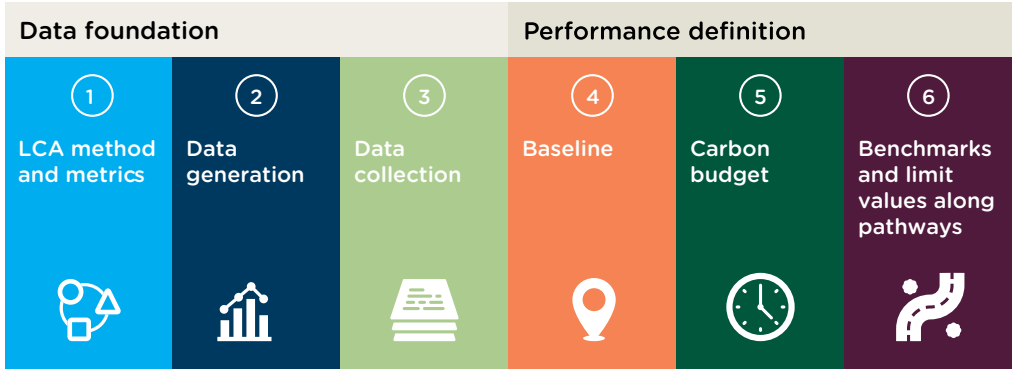
A key challenge reported by Ramboll was downscaling the global carbon budget to specific numbers for embodied carbon in an asset-specific or national context. This issue was addressed by using a five step approach that focuses on a national GHG budget and allocates a share of this budget to embodied carbon, scaled to buildings in square metres, as illustrated in Figure 4.[9] The diagram shows what a sustainable building looks like when compared with a specified carbon budget based on the 1.5° IPCC scenario. This approach clearly enables investors to project emissions from future activities in their building portfolios.

Chart 4: Approach used by Ramboll for upfront embodied carbon budgets

Source: Ramboll, 2022

Finally, investors can consider a **performance framework** based upon recommended data and an approach that identifies processes for data generation and use (which is already in-place in some EU countries, notably France). The performance definition would be based on the calculated baseline and carbon budget and can then be used to set benchmarks and limits to align with a 1.5°C pathway.

Chart 5: Embodied carbon performance framework by Ramboll



Source: Ramboll, 2022

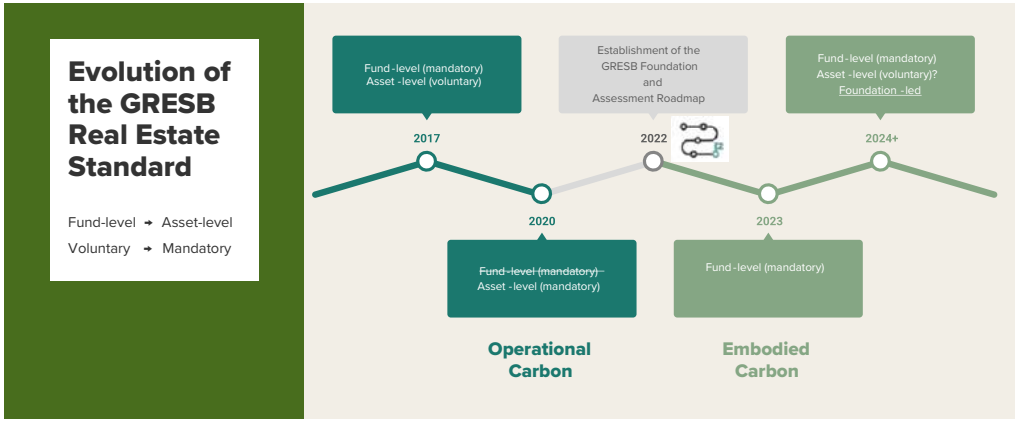
Another initiative to **establish benchmarks aligned with a credible pathway** is offered by the Science Based Targets initiative (SBTi), who is working with Ramboll to produce a practical tool for companies and financial institutions to calculate their buildings' embodied emissions and then set their targets. SBTi works with the Carbon Risk Real Estate Monitor project (CREEM)[10] to offer operational emissions pathways aligned with 1.5°C, which are based on calculating a global carbon budget, then deriving country-specific pathways and, finally, establishing building-specific pathways. **SBTi is expected to develop pathways for embodied emissions and provide accounting and target-setting guidance, by country and building type**.

PCAF[11] Guidance already exists to help allocate finance-related operational emissions, such as mortgages, and SBTi aims at developing its own guidance building upon the carbon accounting work of PCAF. PACTA is another initiative that is working to provide a free, open-source methodology and tool that measures financial portfolios' alignment with various climate scenarios consistent with the Paris Agreement.[12] Both PCAF and the Paris Agreement Capital Transition Assessment (PACTA) methodology – the leading decarbonization tools for investors – currently focus on operational carbon.[13]

Many of the existing tools available to investors focus on operational carbon, with no tools currently identified for embodied carbon. Investor and industry initiatives are, however, **building greater collaboration and exchange of information on embodied carbon in buildings, as well as promoting voluntary commitments to reduce these emissions** through robust decarbonisation plans. GRESB is an independent investor-led initiative that collects data on ESG performance from real assets portfolios, validates this data, and provides the analytics to the portfolio managers. GRESB provides critical independent evaluation of institutional investors ESG performance to benchmark themselves against their peers and use the information to improve their sustainability decisions.

In 2023, GRESB will start **requiring the collection of embodied carbon data for all portfolios at fund level**, which will naturally lead to a requirement for asset level reporting. The GRESB embodied carbon assessment will focus on new buildings and major renovations.

Chart 6: Evolution of the GRESB Real Estate Standard

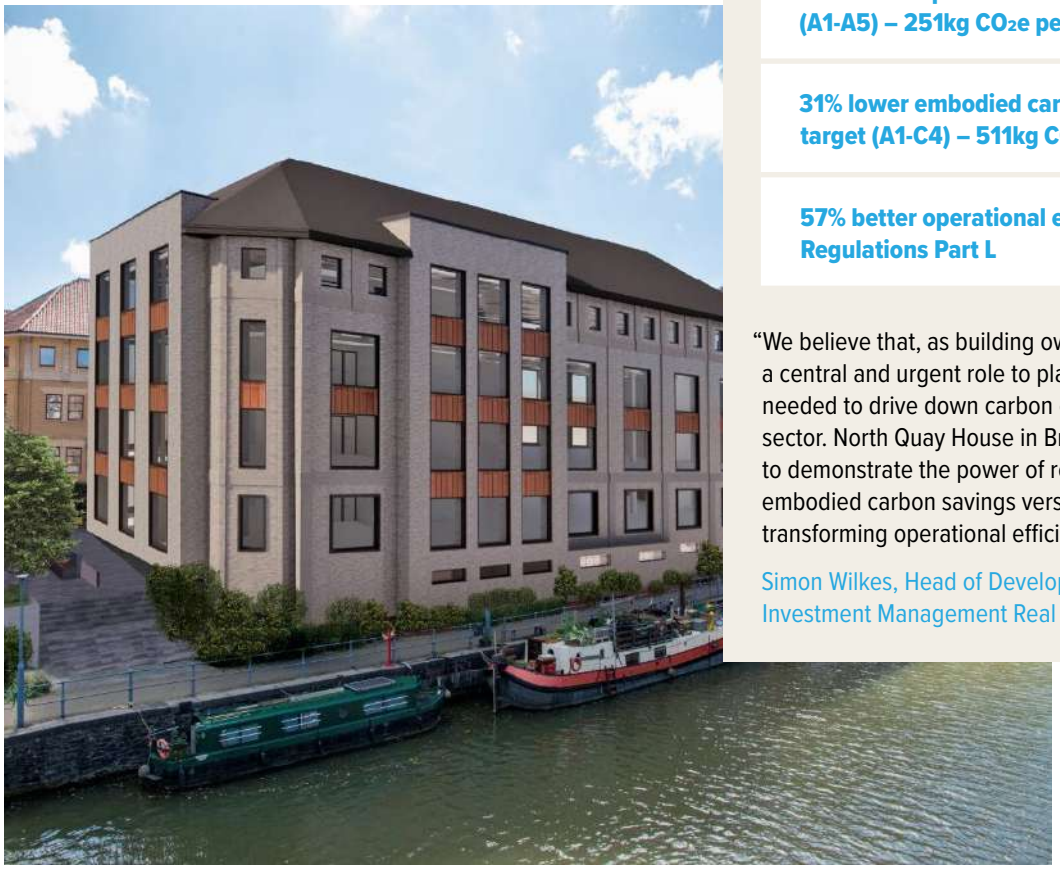


Source: GRESB, 2022

Additionally, the World Business Council for Sustainable Development (WBCSD) and the Better Buildings Partnership (BBP) have developed **guidelines with steps for investors to report and reduce their emissions in line with 1.5°C commitments**. The companies that are members of the WBCSD have committed to achieving net zero before 2050 and reducing 50% emissions before 2030 across the lifecycle of the built environment, for which WLC is crucial as well as system collaboration among all key stakeholders. BBP's commercial property owners (all 35 of them) have also made a climate commitment to publish a net zero pathway that includes both operational and embodied carbon emissions.[14]

3.4 Investor action to address the challenges of embodied carbon

Leading IIGCC members have started taking steps towards addressing the challenge of embodied carbon data to subsequently establish reduction targets and actions to achieve them. Among these members, 14 have signed BBP's Climate Commitment15 launched in 2019, which represents over £400 billion in assets under management and over 11,000 properties. From these leaders, 76% of the signatories are undertaking Whole Life Carbon Assessments, 59% are setting embodied carbon targets, 65% have included occupier-controlled fit outs and 47% refer to their plans to address tenant-controlled fit outs.



Case Study 2 of best practices: Legal & General outperforms industry targets on lifecycle carbon at North Quay House

North Quay House in Bristol is the latest refurbishment by Legal & General Investment Management (LGIM) Real Assets to undergo a detailed lifecycle carbon assessment. This revealed that the project is on track to achieve embodied emissions well below industry targets, evidencing the carbon benefit of retaining and renewing existing structures rather than building new. Planned upgrades to the building fabric and systems will also substantially reduce operational emissions, accelerating progress to net zero carbon.

28% lower upfront carbon than LETI 2030 target (A1-A5) – 251kg CO_2e per m2

31% lower embodied carbon than RIBA 2030 target (A1-C4) – 511kg CO_2e per m2

57% better operational efficiency than Building Regulations Part L

"We believe that, as building owners and operators, we have a central and urgent role to play in delivering the changes needed to drive down carbon emissions in the real estate sector. North Quay House in Bristol is our latest project to demonstrate the power of refurbishment to deliver embodied carbon savings versus redevelopment, while transforming operational efficiency."

Simon Wilkes, Head of Development, Legal & General Investment Management Real Assets

Situation

LGIM Real Assets is one of the UK's largest investors in real estate. As a founding signatory to the BBP Climate Commitment, LGIM has pledged to achieve net zero carbon for its real estate platform by 2050 or sooner. It has set science-based targets to reduce operational carbon and energy intensity of landlord-controlled areas (Scope 1 & 2) by 60%, with science-based targets for embodied carbon and other Scope 3 emissions being finalised.

LGIM has been progressively carrying out lifecycle carbon studies on its developments since 2016, following the success of its first embodied carbon study at 245 Hammersmith Road in London. This identified interventions that reduced embodied emissions by over 10%, proving the value of considering carbon during design.

At North Quay House in Bristol, LGIM is completing a major refurbishment of an existing office building. This will add a four-storey extension, creating a double-height reception and increasing floor space. It will also involve the refurbishment of all existing internal areas, refurbishment of the external brick façade, new curtain walling and windows, and replacement of all mechanical and electrical services.

Drivers for net zero include the huge rise in interest in ESG from investors and occupiers, particularly around carbon and climate. There are also regulatory drivers, such as the UK Government's 2050 carbon targets, Minimum Energy Efficiency Standard, Building Regulations and local planning requirements. In addition, occupiers are increasingly showing greater interest in low carbon buildings.

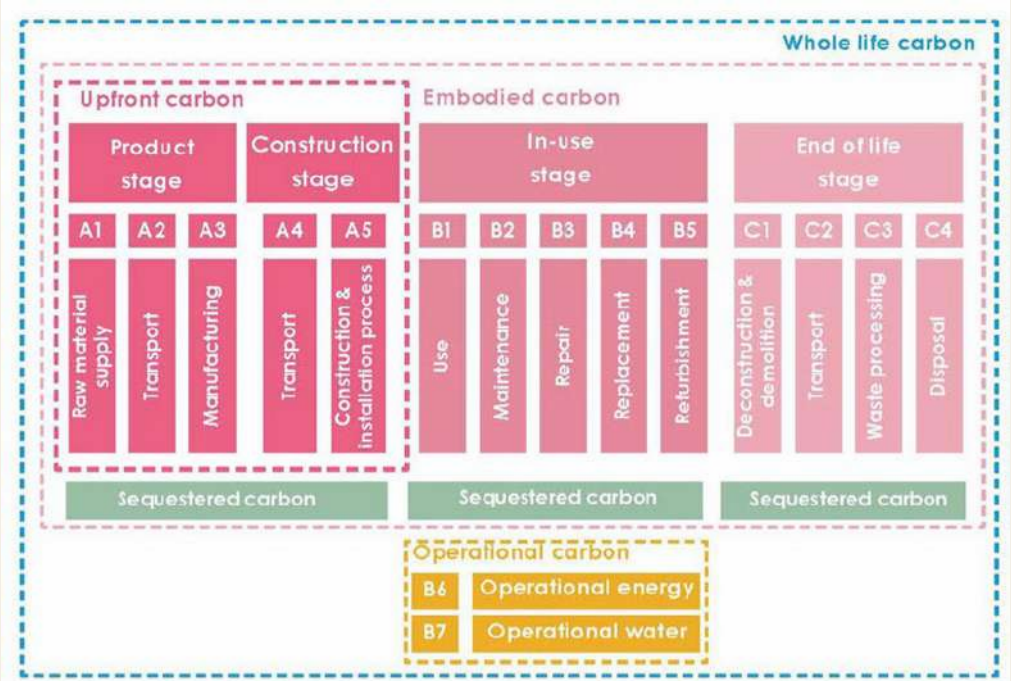
Actions

As set out in LGIM Real Assets' Sustainability Brief for Works, the project team at North Quay House is focusing on:

- **Minimising embodied carbon:** including low carbon materials choices, such as high recycled content, procuring locally to reduce transport emissions, and retaining and reusing wherever possible.
- **Minimising operational carbon:** including improving building fabric, upgrading insulation, retrofitting high efficiency equipment, installing renewables and updating building management system controls.
- The team is also considering in-use embodied carbon, such as maintenance, repair and replacement emissions, and end of life carbon, including deconstruction and demolition.

LGIM appointed Method Consulting as a services engineer and embodied carbon advisor at North Quay House early on. Method Consulting completed a lifecycle carbon study, working with the architects Stride Treglown. They used the common set of carbon definitions developed by the Whole Life Carbon Network (WLCN) with LETI and RIBA in 2021. These are outlined in Figure 1.

Figure 1: WLCN 'Carbon Definitions for the Built Environment, Buildings and Infrastructure' lifecycle diagram



The North Quays House lifecycle carbon study estimated emissions and benchmarked performance against LETI and RIBA 2030 targets, as shown in Figure 2. The analysis will be rerun at project completion, using final construction data.

Figure 2: Estimated carbon content

Lifecycle carbon (tonnes CO_2e)		LETI scope: Upfront carbon (A1-A5)	RIBA scope: Embodied carbon (A1-C4)
Superstructure	Windows and doors	174	345
	Frame	107	107
	External walls	62	65
	Roof	25	29
	Internal walls	23	31
	Upper floor	20	20
	Stairs and ramps	0.36	0.37
Substructure		105	107
Finishes		88	461
Building services		228	634
External works		9	9.2
Other		114	114
Total embodied carbon (tonnes CO_2e)		**954**	**1923**

Lifecycle carbon (tonnes CO_2e)	LETI scope: Upfront carbon (A1-A5)	RIBA scope: Embodied carbon (A1-C4)
Embodied carbon intensity (kg CO_2 per m2)	**251***	**511**
Industry targets for 2030 (kg CO_2 per m2)	**<350**	**<750**
Difference versus industry targets	**28% lower**	**31% lower**

* 251kg CO_2 per m2 GIA excluding external works, as per LETI scope. 253kg CO_2 per m2 including external works.

The lifecycle carbon study also identified potential interventions to further reduce embodied carbon, as outlined in Figure 3.

Figure 3: Potential interventions to reduce embodied carbon

Element	Interventions	CO_2 savings (kg)
Superstructure	• Switching from aluminium windows to aluminium and timber hybrids. • Using steel frame with 40% recycled content, rather than 20%. • Replacing the proposed EQUITONE and zinc cladding systems with Corium.	48,746
Substructure	• Using concrete with 50% GGBS, rather than 30% GGBS, for ground floor slab, pilings, pile caps, ground beams and basement retaining wall. • Sourcing concrete within 20km of the site, instead of 60km.	15,715
Building services	• Switching to glass wool insulation, from phenolic pipe insulation, for heating, ventilation and hot and cold water distribution.	14,996
Internal finishes	• Paint finishes with a service life of 15 years, up from 10 years. • Carpets with a service life of 20 years, up from 15 years.	3,267
External works	• Recycled sub-base.	358
		83,082

To optimise operational efficiency, LGIM Real Assets carries out much more extensive energy modelling at the design stage than Building Regulations require. At North Quay House, this includes Design for Performance analysis and CIBSE TM54 modelling. In addition to identifying opportunities to improve operational efficiency, as shown in Figure 4, this also sets a performance benchmark for the property team to target in running the building.

Figure 4: Interventions to improve operational efficiency

Element	Interventions	CO_2 savings (kg)
Energy efficiency measures	• Inclusion of efficient cooling and ventilation systems, with provision for metering for lighting and systems, including BMS alerts for 'out of range' values. • Addition of intelligent and energy efficient lighting design, with LED lighting and daylight sensors to make the most of natural light.	70,427
Renewables	• Air source heat pump, which extracts most of the energy produced from the surrounding air. It also uses variable refrigerant flow (VRF) technology, so the system operates efficiently under low demand. • Photovoltaic panels with an electrical output of 14.2 kWp installed on all viable roof space (in addition to the existing 25 kWp array).	16,512
		86,939

CIBSE TM54 modelling at North Quay House revealed that base building energy use intensity is ahead of 2030-35 UKGBC targets. LGIM is now working with the contractor to further reduce operational energy consumption, with the aim of achieving the 2035-50 UKGBC Paris Proof target. Occupier fit-out represents a large proportion of whole building energy use. As a speculative office development, there is a large degree of uncertainty in this prediction. LGIM will work with occupiers to minimise their impact on whole building energy use.

Financial

Undertaking a refurbishment, rather than a redevelopment, can deliver fantastic modern architecture and a Grade A office product, with the added benefit of significant cost and carbon savings.

The professional fees for sustainability and low carbon studies at North Quay House came to £60,000. Where there are costs to cut embodied and operational carbon, these are generally now treated as business as usual. One additional cost was £230,000 for openable aluminium timber hybrid windows, which saved approximately 38 tonnes of CO2.

Benefits

Accelerating progress towards LGIM Real Assets' net zero carbon goal:

- 28% lower upfront carbon than the LETI 2030 target of 350kg of CO_2e per m2 GIA (A1-A5).
- 31% lower embodied carbon than the RIBA 2030 target of <750kg of CO_2e per m2 GIA (A1-C4).
- 57% better operational efficiency than Building Regulations Part L.
- 83.1 tonnes of potential CO_2 savings on embodied carbon identified through the lifecycle carbon study.
- 86.9 tonnes of CO_2 savings on operational carbon planned as part of the refurbishment.

Additional benefits

- Better risk management and driving long-term value for investors.
- Increasing market appeal for occupiers, keen to occupy low carbon spaces.

CHALLENGES AND ACHIEVEMENTS

CONSISTENCY

How do you improve consistency of definitions to avoid comparing 'apples with pears'?

LGIM Real Assets has been carrying out embodied carbon studies on development and refurbishment projects since 2016, progressively reaching smaller scale projects. Due to the high number of studies, they work with multiple partners, including Method Consulting, Cundalls, Hoare Lee and Hilson Moran. LGIM engages closely with these consultants to drive consistency, trying to ensure that everyone is talking the same language and using comparable methodologies. The new carbon definitions, published by the Whole Life Carbon Network, LETI and RIBA in May 2021, have helped to provide clarity. However, there is still further to go across the industry, both in standardising definitions and improving understanding of embodied carbon to drive change.

LIFECYCLE

How do you balance operational and embodied carbon?

Traditionally, the carbon focus in real estate has been on operational efficiency. However, in making interventions to drive down operational carbon, there are often significant embodied impacts. For instance, if you increase insulation and change glass to drive down operational emissions, the carbon payback can be exceedingly long, due to the embodied impact. This is part of the reason why it is so important to look at whole life carbon. Currently, occupiers are particularly focused on operational carbon, in terms of their impact in occupying and running space. However, with rising interest in whole life carbon, focus on embodied emissions is likely to increase. As illustrated at North Quay House, LGIM is well positioned for this shift.

4. Key principles and approaches for investors measuring embodied carbon, and steps to reduce embodied carbon that can be undertaken or influenced

This chapter outlines the existing principles and practices recommended in the webinar series, the literature and being undertaken by leading IIGCC members.

4.1 Whole Life Carbon (WLC) assessments

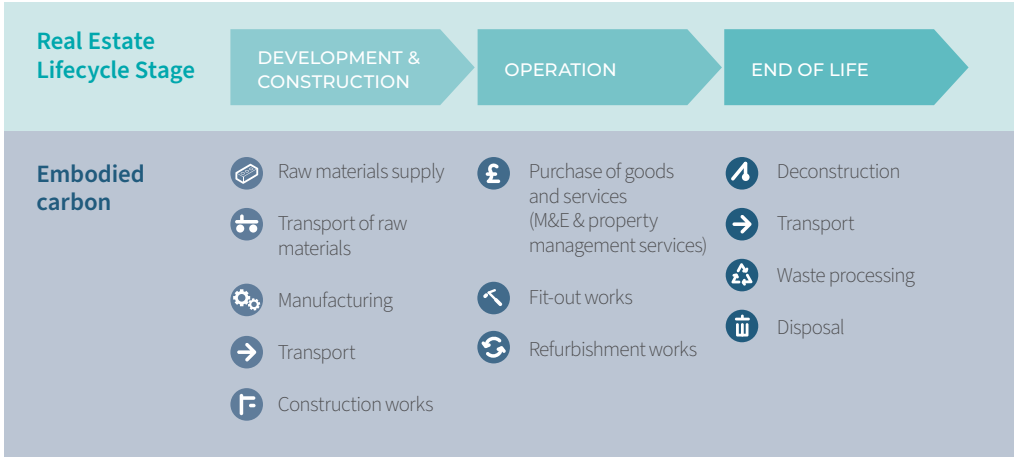
Both WBCSD's and BBP's recommendations to reduce embodied carbon provide a set of common key principles and steps. They start recommending investors to undertake and collect **whole life carbon assessments** to measure emissions and understand the "hotspot" layers of the building responsible for the most material ones (whether that is the structure of the building at first, or the repairment of equipment later on, etc.).

Measurement should be done transparently and clearly to facilitate reporting and using a common language and set of indicators across the building system, including carbon intensity and benchmark data. This is demonstrated by British Land, a member of BBP, who have implemented a software system to track embodied carbon from their standing assets.

Using **Environmental Product Declarations (EPDs)**[16] is another important data-centric element that can improve the data from the buildings value chain and complement Life Cycle Assessments, assisting investors in measuring their embodied emissions.

These tools are key to ensure a common language across the value chain, which has been called for by those involved in the real estate value chain, including the likes of Saint Gobain and Hochtief, to enable comparability among projects and product alternatives.

Chart 7: Source of emissions at each life cycle stage of buildings



Source: BBP, 2022

4.2 Setting targets

Clear and explicit targets for embodied carbon[17] should then be developed based on the building baseline and published, indicating a **net zero carbon pathway within the determined carbon budget** (as described by Ramboll and SBTi) with a valid residual emissions approach. This should include:

- Operational carbon covering whole building performance;
- Embodied carbon of development, refurbishment and fit out works;
- The principles of the energy hierarchy (see below for more detail on LETI's Embodied Carbon Reduction Hierarchy).

Many IIGCC members already use IIGCC's Net Zero Investment Framework (NZIF)[18] to set targets for operational carbon that align their assets with a 1.5° pathway towards net zero using the CRREM methodology. While NZIF does not currently require the need to address embodied carbon, some investors have already begun to collect the data for general portfolio targets are moving towards sector-specific and stage-specific targets, with separate targets being set for residential and non-residential, and for refurbishments[19] and new buildings.

With regards to whether to use **physical emissions methods vs financial emissions methods**[20] for expressing embodied carbon targets, the recommendations follow the best practice for operational carbon and point at the physical method as the most precise measure. Additionally, it is recommended to use the m2/emissions metric because it is commonly used and hence the data is easier to be found.

Chart 8: BBP matrix that shows the activities that need to be included in the net zero targets of its signatories

✓ = activities that should be included within Signatories net zero carbon target.

Activities which generate GHG emissions for real estate investments (directly or indirectly)	Activities controlled and managed by landlords*	Activities controlled and managed by occupiers	Corporate / Head Office
Energy to operate buildings (electricity, fuels & heat networks)	✓	✓	●
Water to operate buildings	✓		●
Waste generated during operation	✓		●
Refrigerants (Fugitive emissions)	✓		●
Purchase of goods and services (M&E & property management services)**	✓		●
Business travel (excluding that associated with development works)			●
New development works	✓		●
Refurbishment works	✓	✓	●
Fit-out Works	✓	✓	●
End of life***			

Source: BBP, 2022

Case Study 3 of best practices: British Land

British land develops, finances and manages retail and office locations in the UK with £13 billion of assets under management. As a signatory to BBP's Climate Change Commitment, British Land has already set embodied carbon targets: a 50% reduction in embodied CO_2e per sqm in office developments by 2030 and a 50% reduction in 'in-use' embodied CO_2e per sqm from new developments by 2030 (office, retail and residential).

To support these goals, in 2020 they launched a sustainability brief with the following strategy:

1. In construction:

a. Whole life carbon assessments for all new developments, refurbs and cat A fit-outs

b. Establish internal carbon price for investment decisions

c. Pilot innovative uses of low-carbon materials

d. Consider REGO-backed power on developments

2. In new developments:

a. Implement software to track embodied carbon and embed it in existing procurement and maintenance systems

b. Train property managers and other relevant staff to log embodied carbon in-use when equipment/furnishing is replaced

3. Looking to build targets for customer fit outs and landlord refurbishments after 2025

Case Study 3 of best practices: British Land

Example: 100 Liverpool Street

Instead of demolishing the building, the decision was to retain 50% of the existing structure. As a result of this and other low carbon choices, 100 Liverpool Street achieved an embodied carbon intensity of just f 389 kg per m2, compared to the 2020 industry average of 1,000 kg per m2.

Some of the advantages of taking this approach are: reducing costs, shortening the program life, value creation because of the high quality of existing structure and lower risks as there was no need to work on the foundations.

4.3 Set a strategy to deliver the targets

Based on this, a **decarbonisation strategy** should be developed taking a whole life cycle carbon approach, and include specific steps to reduce embodied carbon emissions. IIGCC's Net Zero Investment Framework outlines a series of steps to address operational carbon that include: 1) portfolio construction to assess data gaps and screen new investments, 2) investment/management plans for direct investments to align assets through retrofits and increase renewable energy use and 3) engagement with tenants and stewardship.

A similar approach can be taken with embodied carbon. A report by WBCSD[21] has identified over 50 carbon-reduction policies and best practices that investors and developers can adopt for their projects and guidance on how to use them. These measures apply to the different phases of a project: a) project owner's internal policies and processes, b) concept design phase requirements, c) detailed design phase requirements, d) construction and procurement phase. They have been grouped into 5 categories (the policies can be viewed in detail in Annex 1):

- 8 policies to create a **carbon framework** that sets out consistent requirements for all projects to follow.
- 9 policies to set **targets and transparency requirements** for projects to meet across all their phases.
- 7 policies to **prioritise circularity** – that is, less new building and more reuse and refurbishment.[22]
- 20 policies for **design optimization** to use less material and to choose materials with a low carbon footprint.
- 9 policies for a **low-carbon procurement** that ensures acquisition of materials with a low carbon footprint.

Case Study 4 of best practices: Cadogan

Cadogan covers around 93 acres of commercial and residential premises and historic premises with £4.8 billion of assets under management. As a signatory to the BBP Climate Change Commitment, it has set embodied carbon targets for non-residential and residential buildings and, within these categories, specific targets for minor and major refurbishments and for new builds. To achieve these targets, a net zero pathway has been established that consists of:

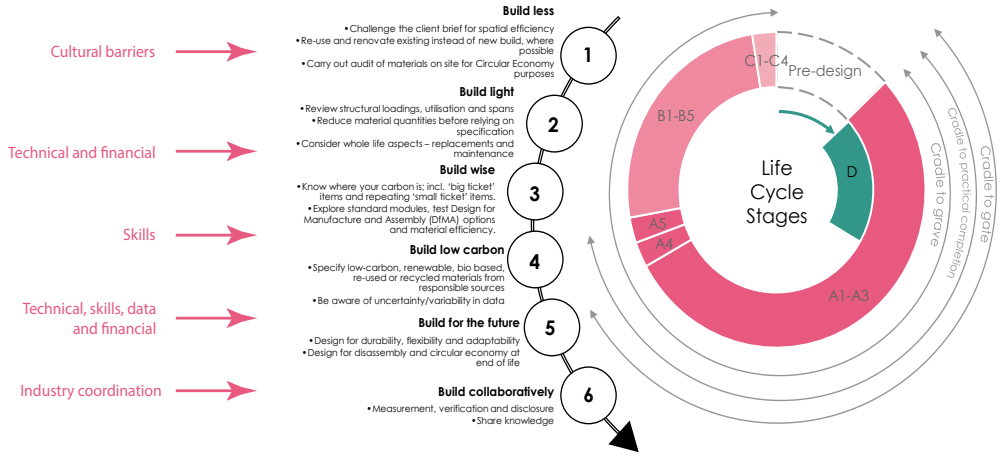
1. **New design standards:** for all new development projects will cover embodied carbon targets as well as opportunities arising from circular economy models.
2. **Supply chain engagement:** proactive engagement with partners and suppliers regarding sustainability expectations and their own environmental performance will continue, sharing best practice and supporting suppliers
3. **Improved data and reporting:** new tracking of embodied carbon for every development. Supply chain tracking and reporting.

Example: 1 Sloane Gardens

This previously mixed-use site is being developed into a 30- bedroom hotel with a new rooftop restaurant, scheduled to open in 2022. 42% of the existing structure by volume has been retained, specifically the foundations and façade on three elevations, preserving the historic character of the site and significantly reducing the carbon embodied in the structure. Low carbon concrete has been used and some materials reused, including bricks, stonework and railings.

The LETI **embodied carbon reduction hierarchy** (see graph below) is also a good illustration of the **steps** that investors can take to reduce embodied carbon emissions in their portfolios. These recommendations were presented by JLL on an IIGCC webinar, specifying: limited demolitions, use of low Carbon construction materials (timber, low-carbon concrete, etc.), frugal interior design, onsite and offsite reuse and recycle, biobased and local materials. JLL highlighted that embodied carbon can be reduced by 25% with traditional refurbishment or even 50% when renovating instead of building a new construction.

Chart 9: LETI embodied carbon reduction hierarchy



Source: BBP, 2022

IIGCC members participating in the webinars noted that when starting out on the journey of assessing embodied carbon in a portfolio, it can be overwhelming for investors to do their whole portfolio at the same time. It is therefore important for investors to define the key levels and materiality, with initial focus being on new construction and major refurbishment.

In addition, investors need to understand how they can promote innovation in their supply chains for low embodied carbon materials, and use these opportunities to undertake risk mapping. Saint Gobain (see box below) shows that climate leaders are already innovating to develop zero-carbon construction products, and investors can play an important role in setting the requirements for new developments and refurbishments, boosting the demand for such new products.

Case study 5: Saint Gobain

Saint Gobain is a multinational company founded in 1665 in Paris. Originally a mirror manufacturer, it now produces a variety of construction and high-performance materials. Saint Gobain's ambition is to be a worldwide leader in light and sustainable construction products. In the six pillars of Saint Gobain's sustainability strategy, climate change and circularity are key. The strategy works in two areas, maximising impact for customers and minimising the CO_2 footprint.

Saint Gobain's objective is to be net zero by 2050. The company has a Science-Based Target for 2030 (33% reduction in Scope 1 + 2 emissions and 16% reduction in Scope 3). The solutions that Saint Gobain provides can help decarbonise two-thirds of building-related emissions, including one third of embodied emissions.

To deliver its net zero roadmap, the company has identified three levers:

1. **Offering energy efficient solutions and lighter products.**
2. **Using circular, recyclable materials.**
3. **Driving a low carbon energy switch through renewable electrification and overall decarbonisation of the energy supply.**

Saint Gobain is working on a roadmap at group level and every business unit is being asked to work on their own contributions based on these approaches:

- **Optimal design of products**, which includes using less material, looking into how the material is produced (energy use, recycling, etc.) and how the energy is purchased.
- **Disruption beyond 2030**. Saint Gobain is investing in many diverse proofs of concept to ensure it has zero carbon options for all processes:
  - The company announced the first Net-Zero Carbon gypsum plasterboard factory in Norway (2023), followed by another in Canada in 2024. These will be fully electrical plants in scope 1 and 2 of emissions supplied by 100% renewable electricity.
  - Advanced industrial trials have been carried out with biomass and hydrogen in flat glass factories – with the first production happening in France for a full week. This is a potential opportunity provided there's enough renewable electricity or green hydrogen at scale and at a competitive price.
- **Accounting of scope 3** – purchase of raw materials and transportation of goods. For this it is necessary to:
  - Engage major suppliers to disclose their carbon footprint and work on their own roadmap.
  - Implement management tools like an internal carbon price.
  - Shaping the industry agenda.

4.4 Provide transparency in regular reporting

Progress against these net zero targets and climate resilience strategies should be disclosed annually with consistent and transparent data that enables high quality decision-making. These reports need to disclose the energy performance of the real estate portfolios, at a minimum at a geographical level and ideally at property level.

Achieving **system-wide collaboration** among all organisations and stakeholders will support the development of industry benchmarks and ensure consistent industry disclosure on climate change risks. In the UK, a key initiative in this space is the development of a UK net zero building standard,[23] to define what net zero carbon means for real estate. It will set out metrics by which net zero carbon performance is evaluated, as well as performance targets that need to be met. Timing of action will also be key – it is much easier to influence a project before it starts, so getting this knowledge to the point of designers, contractors, suppliers etc. would be the best strategy.

Finally, to ensure the effective implementation of the embodied carbon strategy, the **education and training** of professionals across the value chain is essential. This will facilitate the use of new tools and instruments to measure and report on embodied carbon.

5. The way forward: Recommendations and potential steps for investors to incorporate embodied carbon into measurement and target setting

Clearly, the topic of embodied carbon is a critical one for leading real estate and property investors, as shown by the numerous case studies and as highlighted by multiple stakeholders in IIGCC's 2022 webinar series. In a world where embodied carbon is invisible, investors will make poor sustainability decisions and – potentially – even those which they may think are good, can end up in fact doing net harm to the environment. However, the embodied carbon in building and renovation is also an emerging field of work that contains imperfect information and new processes. Given this reality investors and their associations are showing leadership and moving on the topic of embodied carbon, sending a clear signal that "doing nothing" is no longer an option.

Best practices to incorporate embodied carbon

There are a series of "best practices" that experts and leading investors who are incorporating embodied carbon into their measurements and targets are using. These key principles and approaches are described in detail in chapter 3, and contain four key steps:

1. Identify and use Whole Life Carbon Assessments to see the environmental footprint dimension to materials used in projects;
2. Set overall targets based upon individual asset pilots and expanded to portfolio level;
3. Have a portfolio-level strategy to deliver the targets that are set over multiple years; and
4. provide transparency and regular reporting to stakeholders.

Beyond the best practices of leading investors, there are an extended set of recommended areas of focus which leading investors are focused upon improving to ensure a level playing field and to also make it easier for newer entrants to build embodied carbon into their sustainability strategies. These can be resolved into three main areas:

1. A clear and fair regulatory framework to consider embodied carbon;
2. Standardised, available and useful data; and
3. The creation of a global level playing field.

Regulatory recommendations to facilitate embodied carbon management

The World Green Buildings Council, a participant in the IIGCC sessions, offers a simple set of actions to policymakers and key value chain actors from its work, that can be summarised as:

- Building regulators need to define and lay-out a clear vision on how their national or regional building stock will meet national/EU climate goals with explicit emissions **reduction targets for 2030 and 2040, and framed in whole-life-carbon terms** (not just operational carbon). This would require a move beyond a simple definition of Zero Emissions Buildings into a new definition that considers embodied carbon.
- **Prioritising access to data to improve knowledge** on how to achieve these targets and develop benchmarks for countries and sectors.
- **Include circularity requirements in buildings regulations** and increase access to information and data and tools about how to reduce products and materials.
- **2030 is far too late for WLC and embodied carbon requirements to be introduced**. To deliver Europe's decarbonisation targets the markets (including the drive for collection of data and creation of limit values) must happen sooner.
- **Sustainable procurement** – expand this requirement to include all public buildings and integrate whole life carbon and circularity.
- **Sustainable finance** – channel more public funding (National or EU recovery funds and energy transition funding) to renovation and define a well-aligned taxonomy for circularity.

IIGCC members also underscored the need to accelerate the building of renewable energy generation (mainly wind and solar at utility scale) across Europe to provide the decarbonised raw input for decarbonising construction materials, green hydrogen and other transition enablers. For example, two thirds of the investment required for near-zero steel is in the enabling infrastructure, and transforming 100 million tonnes of primary steel-making to near-zero would require half of Europe's current installed renewable capacity. Renewable electricity sits at the base of the energy transition in Europe and investors play a crucial role in funding and supporting the transition.

Key steps and tools to overcome the data challenge

To address the lack of common data and its availability, repositories of buildings embodied carbon data are starting to be built. Investors using these emerging datasets can be more vocal to governments about what works and what does not, and where the divide is between what can be in the public domain and what needs to remain private. Embodied carbon is more complicated than simple operating energy, and therefore Environmental Product Disclosure (EPDs) documents and WLC assessments need to be mandatory across certain building classes.

In France, the law requires tenants and landlords to report on their operational emissions via a government website and this practice can be extended into embodied carbon within the supply chain to buildings. The France example extends to:

- Beginning this year, **French regulations require a CO_2/m2 budget** for all new buildings, including the private sector.
- The budget dramatically **decreases every year up to 2030**, which means that by 2026, the design approach to buildings in France will have to change.

It is recommended that... We **create a level playing field which compensates the leaders.**

A fair environment with no "free riders" is also required, and can be created by high quality rules and standards where industry leaders can set the tone. The extra resource effort for including embodied carbon today is not fully compensated: those not doing so are not being penalised. Furthermore, the language of WLC and embodied carbon needs to be learned by certifiers and the end consumer, through visible notification and inclusion in building certification programmes.

Some level of harmonisation and consistency across countries is also important, as without this it becomes challenging for investors and companies working across borders. Public entities can lead through example by integrating embodied carbon considerations into their procurement processes. A level playing field is particularly important to global steel, cement and other commodity producers who demand carbon prices and/or a carbon border adjustment mechanism to create fair conditions and reduce the risks for industry first movers.

Further developing reporting requirements and benchmarks to incorporate embodied carbon

As the language and definitions of "sustainable finance" become clearer and better regulated, the boundary to make a significant contribution to climate change mitigation will become harder to reach. In the EU the climate taxonomy rules and definitions are determined, and in the UK the FCA is consulting on proposals for the UK taxonomy which will likely approximate the EU model. Embodied carbon is tangentially addressed through carbon intensity benchmarks for green construction materials, and while it is not yet a feature in new build or significant renovation, this is an area for future inclusion.

Finally, the way companies report their non-financial activities and the regulation of sustainable investment and fund managers needs to include embodied carbon for new build and major refurbishments. Minimum energy performance standards will drive renovations, but these renovations need to consider embodied carbon, as IIGCC members' case studies demonstrate, otherwise the carbon picture is partial with emissions going unaddressed. Given this, the IIGCC Real Estate Working Group will be developing a timely step-by-step guide that builds on this work, and working with members to develop a useful tool for real estate investors to accelerate climate action in real estate portfolios.

A new world of net-zero aligned and green construction materials and markets is emerging. This will only be enhanced through an investor push for clearer carbon accountability, More focus on the carbon embedded in financial and project balance sheets, and more sustainable designs and construction. To enable decarbonisation at scale in construction and major building renovation, a new collaborative approach is required; one that aligns incentives along the construction value-chain to financial close, through construction and between investors and occupiers.

Annex 1: WBCSD's recommended policies for a robust climate strategy grouped into the different project phases

A. Project owner's internal policies and processes summary

#	Measure	Requirement	Carbon	Cost
A01	Carbon policy	Create embodied carbon-related requirements for all projects. Include embodied carbon aspects in overall sustainability/ project briefs.	○ - ●● Varies	$
A02	Carbon policy	Provide a financial incentive for improving final embodied carbon. Create a financial incentive for improving results above the minimum required.	● - ●● Varies	+$ - $$ Varies
A03	Carbon policy	Apply carbon pricing to optimize a project's overall carbon and cost. Set an internal price for carbon to ensure impacts are priced into projects.	○ - ●● Varies	+$ - $$ Varies
A04	Carbon policy	Make embodied and life-cycle carbon part of project funding reviews. Include carbon information in project funding reviews alongside costs.	○	Neutral
A05	Carbon policy	Estimate cost difference for delivering each project at net-zero carbon. Require cost evaluation of additional measures to achieve net-zero carbon.	○	+$
A06	Carbon policy	Prioritize design teams with materials efficiency and carbon experience. Require a team with experience in materials efficiency, circularity and carbon.	●	Neutral
A07	Carbon policy	Appoint a project sustainability advisor with a focus on carbon. Appoint a specialized sustainability advisor for the project.	○	+$
A08	Carbon policy	Use a green building rating system for embodied carbon reductions. Choose a system prioritizing embodied carbon and require relevant credits.	●	+$
A09	Targets and transparency	Report embodied carbon alongside other carbon emissions annually. Public disclosure of embodied carbon as part of total emissions reporting.	○	+$
A10	Targets and transparency	Set a mandatory embodied carbon target for all projects. Set mandatory, effective carbon targets (by type) for all projects to meet.	○ - ●● Varies	+$ - $$ Varies
A11	Circularity	Evaluate the possibility of refurbishing existing buildings. Consider brownfield sites with existing buildings that could be refurbished.	● - ●●	+$
A12	Circularity	Commission a pre-demolition audit for any asset to be deconstructed. Ensure that materials reuse potential is analysed well ahead of project start.	○	+$
A13	Design optimization	Evaluate buildability and accessibility prior to securing land. Consider a site's geotechnical condition and mass transit access prior to buying.	○	Neutral
A14	Design optimization	Commission a detailed geotechnical survey for the site prior to design. Increase resolution of test drilling to reduce uncertainty and cost of building.	●●	-$$ on CAPEX
A15	Design optimization	Evaluate zoning carbon impacts and consider rezoning if necessary. Review parking, massing and others and apply for rezoning if high carbon.	○ - ●●	-$$ on CAPEX

B. Concept design phase requirements summary

#	Measure	Requirement	Carbon	Cost
B01	Targets and transparency	Propose a life-cycle carbon or embodied carbon target for the project. Create an embodied carbon baseline value and use it to set a carbon target.	●● - ○ Varies	+$ - $$ Varies
B02	Targets and transparency	Screening-level embodied carbon assessment to identify hotspots. Require an early phase carbon estimation to focus carbon reduction efforts.	○	+$
B03	Targets and transparency	Benchmark building design options for embodied carbon. Benchmark retained design and alternatives to average market carbon data.	○	+$
B04	Circularity	Optimize the reuse of existing facilities (on-site and off-site). Optimize the reuse of what is already on-site and what is available nearby.	●	Varies
B05	Circularity	Optimize building adaptability during its lifetime. Require the design to consider changing building use or users over time.	●	-$ on lifecycle
B06	Circularity	Require design for deconstruction for structural and key elements. Require that designers design the building for deconstruction, where possible.	●	Neutral (but novel)
B07	Targets and transparency	Investigate the suitability of low-carbon structural material options. Require evaluation of structural materials with a significant carbon reduction.	●●	+$
B08	Targets and transparency	Develop alternative designs and carbon and cost evaluations. Require that the design team present quantified alternative designs.	○	+$
B09	Targets and transparency	Optimize building form for site topography and properties. Use a building form matching the site properties and constraints (as applicable).	●●	-$ on CAPEX
B10	Design optimization	Design adaptable/reversible parking with optimized capacity. Optimize parking to the extent permitted and ensure reversible/adaptable design.	●	-$ on CAPEX
B11	Design optimization	Space efficiency and right sizing. Design for high space use efficiency and right size building program.	●●	-$$ on CAPEX
B12	Design optimization	Investigate ways to reduce unnecessary systems or materials. E.g., use shading or exposed thermal mass to reduce cooling load and finishes.	●	-$ on CAPEX
B13	Design optimization	Incorporate climate resilience measures into the building design. Design building to resist and perform during severe climate events.	●	+$
B14	Design optimization	Require landscaping to consider carbon removal opportunities. Use trees and other plants that bind carbon to the soil in landscaping.	○	+$
B15	Design optimization	Investigate the use of carbon negative, absorbing or storing materials. Require evaluation of the applicability of carbon negative or storing materials.	●	+$$
B16	Low-carbon procurement	Investigate the applicability of circular procurement models. Evaluate the applicability of leased or otherwise circular systems.	●	Varies

C. Detailed design phase requirements summary

#	Measure	Requirement	Carbon	Cost
C01	Targets and transparency	Demonstrate meeting embodied carbon targets with updated quantities. Use updated quantities and specifications to update the carbon target.	○	Varies by level
C02	Targets and transparency	Materials efficiency report. Collect detailed quantities data from all relevant fields of design and report.	○	Neutral
C03	Circularity	Design materials installation practices to allow for their future reuse. Design structures and materials connections for disassemble and reuse.	●	-$ on lifecycle
C04	Design optimization	Materials efficiency optimization. Systematic evaluation of materials efficiency opportunities in the project.	●●	-$ on CAPEX
C05	Design optimization	Embodied carbon and cost factored detailed design options. Use updated quantities and data to create new optimization options.	●	+$
C06	Design optimization	Appoint a reviewer for the building's structural material efficiency. Appoint a specialist reviewer to review and optimize material efficiency.	●	-$ on CAPEX
C07	Targets and transparency	Require mechanical design optimization for life-cycle carbon reduction Require optimization to consider energy efficiency, refrigerants and materials.	○ - ●●	Neutral
C08	Low-carbon procurement	Evaluate alternatives for the top ten highest carbon products. Evaluate alternatives and propose product specific carbon limits.	● - ●●	Neutral to +$
C09	Low-carbon procurement	Plan, design and specify low-carbon concrete solutions. Ensure that design, scheduling and specification supports low-carbon concrete.	●●	on CAPEX
C10	Low-carbon procurement	Communication between structural engineers and material suppliers. Require coordination between designers specifying products & key suppliers.	○	Neutral
C11	Low-carbon procurement	Deliver an embodied carbon optimizing specification for the project. Create a specification that optimizes products using embodied carbon	●	Neutral to +$

D. Construction and procurement phase requirements summary

#	Measure	Requirement	Carbon	Cost
D01	Targets and transparency	Demonstrate meeting embodied carbon targets with updated quantities. Use updated quantities and specifications to update the carbon target.	○	Varies by level
D02	Targets and transparency	Require independent third-party verification of carbon performance. Carry out a third-party audit of actual carbon performance.	○	Neutral
D03	Circularity	Require Environmental Product Declarations (EPDs) for key products. Require EPDs for the top ten carbon materials and ten additional ones.	○	-$ on lifecycle
D04	Design optimization	Deconstruction to remove unwanted existing elements. Require deconstruction and use or sale of the recovered materials.	●	-$ on CAPEX
D05	Design optimization	Design for disassembly specifications shall be followed. Require that connections and systems are built for disassembly, where possible.	●	+$
D06	Design optimization	Minimize and recycle construction and demolition waste (CDW). Minimize waste and require that at least 90% of the CDW is not landfilled.	●	-$ on CAPEX
D07	Targets and transparency	Minimize waste and require that at least 90% of the CDW is not landfilled.	○	Neutral
D08	Low-carbon procurement	Evaluate alternatives for the top ten highest carbon products. Evaluate alternatives and propose product specific carbon limits.	●	Neutral to +$
D09	Low-carbon procurement	Contractor to buy and install materials meeting set carbon limits. Require procurement of use of materials that meet set carbon limits.	○	on CAPEX
D10	Low-carbon procurement	Project to implement a materials takeback program. Require that suppliers/partners agree to take back unused, unspoiled goods.	●	Neutral
D11	Low-carbon procurement	Contractor to use near zero zero-emission construction machinery. Require that 90% of all site construction machinery uses green electricity	●	Neutral to +$

Endnotes

1 https://www.wbcsd.org/contentwbc/download/12455/185688/1

2 https://www.crrem.eu/

3 https://www.shlegal.com/insights/france-implements-the-obligation-to-undertake-actions-to-reduce-energy-consumption-in-commercial-use-buildings

4 https://www.bpie.eu/wp-content/uploads/2022/09/WLC-and-EPBD-policy-briefing_v9.pdf

5 https://fs.hubspotusercontent00.net/hubfs/7520151/RMC/Content/EU-ECB-5-all-in-one-report.pdf

6 "Each case represents a building where LCA data was available which could be used to provide information on the current level of embodied carbon in buildings." https://fs.hubspotusercontent00.net/hubfs/7520151/RMC/Content/EU-ECB-5-all-in-one-report.pdf

7 The embodied carbon depends on the building type and the different design techniques. Among different categories of buildings similar results could be found, but the more the detail the more variations, especially between the category of residential and non residential buildings. A big deviation exists between multifamily houses and single family houses, with the latter producing more emissions. This raises questions about the equity and sufficiency of the allocation of the building space. The variation depends on the building design choices – for instance, a wood framed building emits 1/3rd less than a concrete building.

8 https://fs.hubspotusercontent00.net/hubfs/7520151/RMC/Content/EU-ECB-5-all-in-one-report.pdf

9 Ramboll applied a combination of different allocation principles for the GHG budget to countries: "Global emissions are allocated to countries based on an equal per capita (EPC) principle. The share of embodied carbon resulting from new construction is determined in two ways. First, allocation is based on a utilitarian (U) principle that assesses the contribution to national welfare through multi-regional input-output (MRIO) models. Second, a grandfathering allocation (GF) based on the current share in the national emissions inventory is undertaken. Future construction is forecasted based on national economic activity (EA) in the construction sector. As this combines all building construction activity, a differentiation between building purposes (e.g. residential, non-residential) is not possible in this approach. Rather, all buildings are included in the resulting targets." https://fs.hubspotusercontent00.net/hubfs/7520151/RMC/Content/EU-ECB-5-all-in-one-report.pdf

10 https://www.crrem.eu/about-crrem/

11 An industry-led partnership to facilitate transparency and accountability of the financial industry to the Paris Agreement (https://carbonaccountingfinancials.com/about)

12 https://2degrees-investing.org/resource/pacta/

13 https://carbonaccountingfinancials.com/files/consultation-2022/202205-public-consultation-real-estate.pdf

14 Progress on embodied carbon, however, still lags behind operational carbon: while 94% of signatories have set targets for operational energy, only 56% have set targets for embodied carbon.

15 https://www.betterbuildingspartnership.co.uk/member-climate-change-commitment

16 https://www.eco-platform.org/epd-facts-figures.html is used in the US

17 Embodied and operational carbon targets should be elaborated at the building design level and separately to inform design decisions, giving the signal to lower both as much as possible.

18 https://www.iigcc.org/download/net-zero-investment-framework-implementation-guide/?wpdmdl=4425&refresh=637e4015516eb1669218325

19 BBP has identified a need to define a common language around what is minor or major refurbishment and have asked the UK's GBC to look into this issue.

20 The financial intensity of carbon would be based on the rental income of an asset whereas a physical method would be an area-based intensity. Using a financial method would lead the focus on assets that have the lowest rental income and as a result the highest carbon intensity. However, the focus should be on those assets that in real life are physically most carbon intensive. Reporting and policy for real estate should be adjusted to physical assets.

21 https://www.wbcsd.org/Programs/Cities-and-Mobility/Sustainable-Cities/Transforming-the-Built-Environment/Decarbonization/Resources/Decarbonizing-construction-Guidance-for-investors-and-developers-to-reduce-embodied-carbon

22 An example of this best practice from the BBP members: 100 Liverpool Street example – instead of demolishing, they reused the existing structures which allowed for significant reduction of embodied carbon - by almost 2/3rds. Advantages: reducing costs, shortening the program, value creation because of existing structure and lower risks and they didn't need to work on foundations.

23 https://www.nzcbuildings.co.uk/

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