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Pathways to Net Zero Carbon Emissions in International Real Estate Investment

FULL REPORT

COMMISSIONED BY THE IPF RESEARCH PROGRAMME

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This Programme supports the IPF's wider goals of enhancing the understanding and efficiency of property as an investment. The initiative provides the UK property investment market with the ability to deliver substantial, objective and high-quality analysis on a structured basis. It encourages the whole industry to engage with other financial markets, the wider business community and government on a range of complementary issues.

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Pathways to Net Zero Carbon Emissions in International Real Estate Investment

Report

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There is broad consensus among climate scientists that the changes to global weather patterns, arising from a failure to achieve net zero carbon (NZC) emissions by mid-century, will impact all aspects of society and business. While the direct effects of a changed climate will vary in different parts of the world, the social and economic disruption faced by the worst affected areas will have a significant impact on all geographies. Consequently, there is an expectation of severe disruption to current business models and investment markets as local effects are transmitted through the highly connected and interdependent global economy.[1] Achieving net zero is no longer just the morally right thing to do, it makes socio-economic sense.

Progress is beginning to be made. Governments in major countries across the world have committed to reach net zero by target dates between 2030 and 2060, some binding this into law.[2] A growing number of net zero commitments have also been made at city and regional levels. In anticipation of a severely carbon-constrained future, global investors are looking at their portfolios to identify and address the underlying climate risks.[3]

Making a significant contribution to the climate crisis, the built environment and real estate industry have a crucial role to play in avoiding catastrophe. Yet this represents a monumental challenge, requiring exceptional levels of collaboration between stakeholders from a diverse range of professions, and alignment around a set of clear and consistent principles. In recent years, a significant number of real estate investors have committed publicly to reduce emissions from their portfolios to net zero before 2050. Alongside the increasing number of committed organisations is the growing number of schemes that are being used to make such commitments, each with different interpretations of what net zero means and how to get there. Basing its research on literature reviews, stakeholder engagements and case study analysis, this study examines the transition of the global real estate sector to NZC emissions and the issues surrounding the use and application of relevant net zero schemes.

Of the myriad net zero schemes available to the market, this study has identified 13 key schemes used by stakeholders in the real estate investment process. The majority of these have been launched within the last five years and offer a broad range of definitions, scopes and stringencies, yielding a convoluted outlook on the current market for asset owners, managers and investors to decipher. The rise of climate-related regulations, and the contradictions in approach between these and market-based net zero schemes, further complicates efforts to transition the real estate investment industry to NZC.

Stakeholders engaged in this study have experienced this confusion but highlighted the need for a variety of schemes to address the unique requirements of different asset types and locations. For example, the requirements of a multi-tenant shopping centre in France to achieve NZC will vary significantly from those of a single-tenant distribution warehouse in Australia. The underlying issues are the inconsistency of net zero definitions and the lack of clarity on differences between the available schemes within the market, which this report seeks to address.

Through the analysis of 18 case study buildings against their applicable scheme targets, this report highlights the widely varying net zero landscape presented to real estate investors and asset managers. This analysis shows that the difficulty of aligning with a net zero pathway is not only dependent on the asset type or location, but also the net zero scheme used to frame the pathway.

1 https://www.ipcc.ch/report/ar6/wg1/ IPCC AR6 Climate Change 2021: The Physical Science Basis
2 https://eciu.net/netzerotracker
3 https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/banking-and-capital-markets/ey-climate-change-and-investment.pdf

1. EXECUTIVE SUMMARY

Many other challenges in defining and delivering NZC in the real estate investment industry have been identified by this research. One key challenge is the limited evidence on costs of net zero retrofit projects in existing buildings. This will be addressed in time with the increase in costed case study examples of net zero transitions at the asset level, but will be further enabled by the incorporation of NZC into building valuations.

Another key challenge is the potential for unintended consequences that might result from the current industry interpretation of NZC. These include the trade-off between embodied carbon and operational carbon, the balance between disposal and retrofitting of buildings and the challenges associated with widespread electrification. It is recommended that all these potential consequences are considered in the deliberation of any NZC strategies within the real estate industry.

Based on the findings of this research, convergence around a set of core principles among asset owners, managers, and occupiers, is the key requirement for the industry's transition to NZC. This would allow the consistent, robust framing of net zero schemes and enable the real estate industry to normalise the pricing-in of carbon performance within asset values. A set of such principles, that may come to underpin NZC in real estate, have been proposed (Figure 1.1), followed by a set of recommendations for the market to integrate them into best practice (Figure 1.2).

Market participants do not need to wait for this integration, rather they can act immediately to support the transition of the industry to NZC. A set of recommendations has therefore also been outlined for real estate investors to implement the net zero principles throughout their own investment, development, and operational practices (Figure 1.3).

Figure 1.1: Nine Principles for NZC in Real Estate

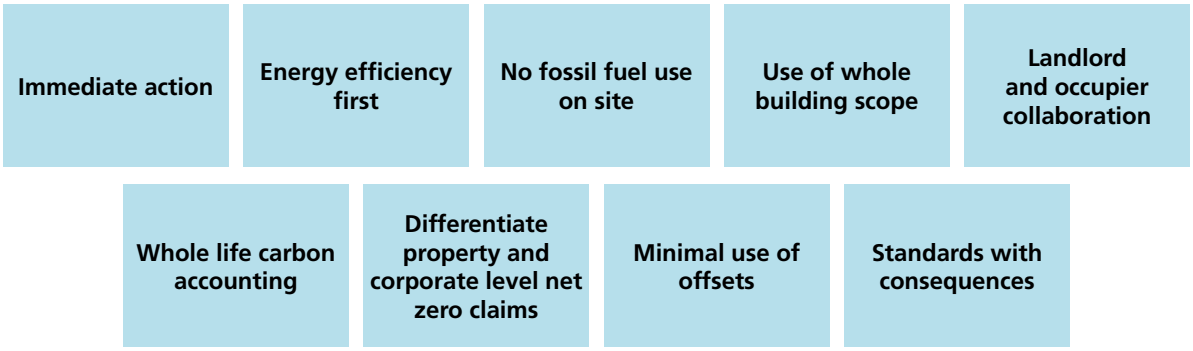


Figure 1.2: Five Recommendations for the Real Estate Investment Industry

1. EXECUTIVE SUMMARY

Table 1.1: Recommendations for Immediate Action by Real Estate Investors & Managers

Building Level

Acquisition	Development	Operation	Refurbishment	Disposal
Integrate net zero assessments into due diligence activities Integrate net zero principles into investment strategies Push vendors to supply operational energy data and NZC pathways, where available	Ensure whole life carbon impacts are measured, reduced and any residual is offset through carbon removal Apply an internal carbon price on whole life carbon to drive decision making 'Design in' renewable energy technologies and fossil fuel-free heating and hot water today	Identify 'Paris-aligned' energy demand reduction targets for each asset Pursue immediate, short-term payback measures to reduce energy demand by better control and management Drive suppliers to disclose and reduce their emissions by setting 'Paris-aligned' targets Support upskilling of the property operation and maintenance supply chain and acknowledge this through better rewards and earned prestige	Invest in fabric and plant improvements in anticipation of asset value premiums Invest in pilot retrofits to understand the commercial and technical challenges of net zero retrofit Apply an internal carbon price on whole life carbon to drive decision making Electrify or decarbonise heating and hot water supplies as soon as possible and incorporate building integrated renewable energy	Provide buyers with operational energy data information and planned/known net zero measures

Corporate Level

- Broaden GHG footprint to include all applicable Scope 1,2 and 3 emissions
- Set a corporate net zero target as well as asset/portfolio level targets
- Set 'Paris-aligned' short term targets: these require a halving of emissions every decade
- Use these targets as milestones in a published net zero pathway
- Prioritise reduction and minimise offsetting (to 10% of baseline carbon emission at most) in any net zero commitment

2. INTRODUCTION

This section provides the background context, objectives and target audience for this research. The built environment is one of the largest contributors to global carbon emissions. Consequently, a growing number of schemes are emerging to guide the real estate industry to 'net zero' carbon (NZC) emissions[4], each providing different interpretations of what net zero means and how to achieve it. This research identifies and examines the principal schemes in the market, their use in transitioning the global real estate sector to NZC, and the main challenges that the industry faces. Recommendations for the market and individual organisations are then provided, based upon these findings.

2.1 Project Context

In 2019[5] the buildings sector[6] was responsible for 38% of global carbon emissions. Additionally, the tangible size of the sector is expected to double by 2060.[7] With the scientific consensus showing the world must reach NZC emissions by mid-century or face catastrophic societal impacts,[8] the building industry can play a crucial role in in limiting damage from global climate change. However, the ability of the industry to play this positive role requires both a recognition of its potential and consensus regarding the broad actions required to reduce GHG emissions. After at least two centuries of increasing dependency on fossil-fuels, this represents a monumental challenge.

Many regions of the world are already experiencing damaging effects from extreme weather events and rising sea levels. It is predicted that these impacts will worsen during this century even if emissions are reduced to net zero by mid-century. The buildings sector is particularly vulnerable to these 'physical' climate risks.

In response to this challenge, governments in major countries across the world have committed to reach NZC emissions by target dates between 2030 and 2060, some binding this into law.[9] A growing number of net zero commitments have also been made at city and regional levels. A more recent development has seen the UK Government declare that financial institutions and large firms within the UK must publish how they intend to transition to net zero from 2023[10], a development that may soon be adopted in other leading countries.

In anticipation of a severely carbon-constrained future, global investors are looking at their portfolios to identify and address the underlying climate risks.[11] Real estate investors are appearing to lead the charge, with a significant and growing number of them having committed publicly to reduce emissions from their portfolios to net zero before 2050.

A commitment to achieve a state of NZC emissions is on face value unambiguous. However, with the breadth of emissions associated with any invested entity, it is not proving straightforward to reach consensus on who should take responsibility for them. In the case of real estate, carbon accounting can include emissions created directly by the operation of buildings (whether by landlords or occupiers); emissions arising indirectly from the use of electricity or heating and cooling in buildings; and embodied carbon[12] arising from development and refurbishment activities.

4 Please refer to the Terminology Section for the working definition of 'net zero' used in this study.
5 https://wedocs.unep.org/bitstream/handle/20.500.11822/34572/GSR_ES.pdf?sequence=3&isAllowed=y
6 Including elements associated with building construction
7 With respect to building floor area
8 https://www.ipcc.ch/report/ar6/wg1/ IPCC AR6 Climate Change 2021: The Physical Science Basis
9 https://eciu.net/netzerotracker
10 Following an announcement by Rishi Sunak at CoP26
11 https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/banking-and-capital-markets/ey-climate-change-and-investment.pdf
12 Embodied carbon refers to the GHG emissions associated with building construction, including those arising from extracting, transporting, manufacturing, and installing building materials, in addition to the operational and end-of-life emissions of the materials.

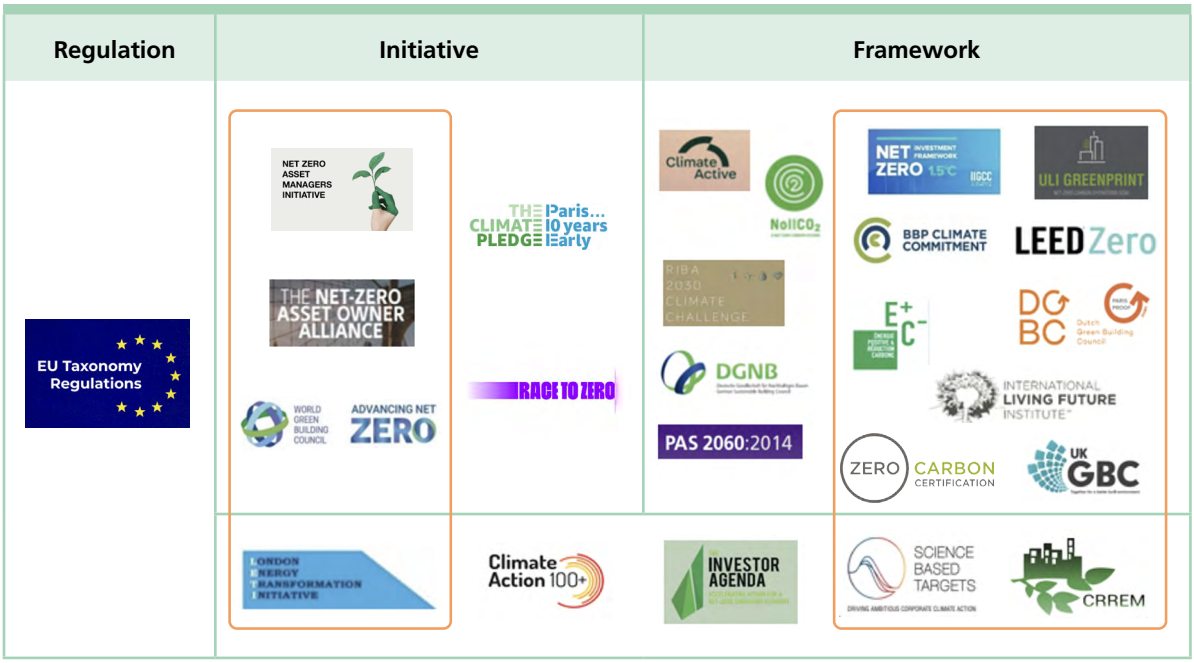
2. INTRODUCTION

It is therefore not surprising that there are a growing number of schemes emerging to guide the industry to NZC. These schemes can be generally attributed to one of three categories;

- **'Green' regulations** focussed on mandatory disclosure of climate performance;
- **Net zero initiatives** acting as vehicles for members/signatories to make collective commitments to reach NZC;
- **Net zero frameworks** that exist in the form of codified principles, rules and guidelines for translating headline commitments into tangible action. Some frameworks include hard targets (for example, the CRREM project) and others rely on principles and guidelines (for example, the BBP Climate Commitment).

Each of the individual schemes available in the market have different interpretations of what net zero means and how to get there. Some are tailored to individual countries while others are intended to have global reach. This research has identified a wide variety of such schemes, some emerging as the study progressed and most under rapid and continuous development. Figure 2.1 shows a selection of NZC schemes, applicable to those involved in real estate investment, which were explored as part of this study. The 14 schemes analysed in greater detail and presented throughout this report, are outlined in orange. More detail is provided on these schemes in Appendix A.

Figure 2.1: Examined NZC Regulations, Initiatives & Frameworks



Looking across the different approaches, there is considerable diversity in methodologies. Some apply net zero principles at the building-level, while others are designed to address wider corporate activities. Some are light on detail and involve a simple commitment to net zero or carbon neutrality by a given year. Others are more precise, setting out the measurable energy or carbon intensities to which buildings of different types must adhere, in order to be classified as NZC. Some focus on the requirements of investors looking to incorporate net zero schemes in their investment underwriting, while others are aimed at asset managers looking for standards and certifications that will influence valuation. There are also important differences in the way net zero schemes are applied across asset types and geographies.

2. INTRODUCTION

The multitude of net zero schemes is not on its own a barrier to success in achieving net zero. However, their diversity in terms of ambition and scope means that it is possible for two real estate businesses to commit to very different strategies – both labelled as 'net zero' - without the distinctions being clear. A potential risk is that without proper scrutiny, landlords and occupiers may gravitate towards schemes with the least stringent requirements. This may lead them to pursue strategies that do not lead to the deep cuts in GHG emissions needed and sufficiently mitigate transition risk. To enact meaningful change and perform a clear role in guiding industry activity, it is suggested that schemes need to be consistent, comprehensive, and appropriate.

2.2 Project Objectives

This study examines the current state of the market, with regard to existing net zero schemes, the issues surrounding the use and application of relevant net zero schemes, and the transition of the global real estate sector to NZC emissions. The study looks at the challenges the industry faces in delivering a true global net zero outcome, how these vary by market sub-sector, geography and other factors, and the potential for unintended consequences. Using the evidence from this research, nine key principles are outlined in Section 6.2, which should form the basis of the meaning of net zero in real estate. These are presented alongside a set of recommendations for real estate investors to drive these principles, once industry-wide agreement has been reached, into practise.

In order to frame the research, the following questions were identified for the project to answer:

1. What existing NZC schemes are being applied in the international real estate investment market and how are these expected to change in the future?
2. What is the role of offsetting in these NZC schemes?
3. How do the challenges of achieving NZC vary by asset type, geography and for different market actors?
4. How does the balance of a portfolio affect efforts to achieve NZC?
5. Are existing NZC schemes likely to lead to unintended consequences?
6. What practical insights for different key market actors can be drawn from the assessment of NZC schemes in the market today?

A series of research activities were used to assess these issues. These are outlined in the Methodology section.

2.3 Target Audience

While primarily targeted at real estate investors, investment managers and occupiers of real estate, the research is also relevant to policymakers and the administrators of net zero schemes.

3. METHODOLOGY

This section outlines the three main research activities used by Verco to gather evidence and develop insights for the study; a literature review, case study analysis and industry engagement. A list of challenges and limitations faced by the study team in developing this research is also provided in this section.

Literature Review

A desk-based review of a range of decarbonisation and net zero schemes, applicable to real estate, companies was undertaken. Published (English language) guidance materials were reviewed to extract information for comparison. This included the underlying definitions of NZC, scope (for example asset type, geography, emissions scope), decarbonisation targets and approaches to issues such as offsetting and third-party verification. Further targeted searches were conducted on specific areas relevant to the research questions.

Case Studies

18 case study buildings were developed to explore how net zero schemes differ in outcomes, when applied at the building-level. The case studies were selected across three geographic regions and six asset types to explore cross-cutting themes.

Industry Engagement

Industry experts were engaged to collect views on the issues within scope of this study. This comprised an industry survey, expert interviews, and workshops. The survey consisted of 16 questions engaging 40 responses from individuals operating within the real estate market. 15 experts were interviewed to gather views on the current state of the market and the challenges in transitioning the market to NZC. The survey and interview questions are provided inAppendix D and E. Interim findings were then presented to expert stakeholders during three workshops in September 2021. These workshops were tailored to three different market actor groups: investors, asset managers and occupiers.

In this report, commentary from industry experts ('stakeholders'), gathered through these engagement exercises, is referred to as "stakeholder feedback".

3. METHODOLOGY

Study Challenges & Limitations

The following challenges emerged in undertaking the research:

- **Fast moving pace of net zero schemes.** The number of schemes for NZC has increased significantly in recent months while many others are in the early stages of development. New schemes and changes to existing schemes are anticipated to arise after publication of this report. This may impact on the relevance of this study's conclusions over time. This research seeks to provide insights on the key principles of NZC, rather than solely focussing on the details of schemes in use by the market today. The findings of this research have also been updated shortly before publication (November 2021).
- **Bias towards UK/EU stakeholders and ESG experts.** The research identified that the UK, EU and Australian markets – relative to other areas – are currently (up to 2021) more active in the area of NZC. This may have led to bias, in that stakeholders from more engaged regions were more likely to participate in the research, which may limit the study's ability to draw globally relevant conclusions. Real estate professionals with remits in Asia-Pacific and the Americas were engaged but there was no significant engagement with professionals operating in the Middle East and Africa. Further to this, the research sought to engage real estate professionals for whom ESG is not part of their core responsibility, in order to mitigate a bias towards ESG specialists.
- **Challenges in engaging occupiers.** While a number of leading occupiers did engage with this study, it was found that, relative to other stakeholder groups, they were more challenging to engage. As discussed later in this report, this may be due to the fact that, for some occupiers, the emissions associated with leased buildings may be a relatively small proportion of their overall carbon impact and therefore not a focus area for their own net zero strategies. Occupiers will be crucial to the transition of the industry to NZC and hence one of the project's three workshops was targeted at this group.

4. NET ZERO CARBON IN INTERNATIONAL REAL ESTATE INVESTMENT

This section provides an overview of the current state of the real estate investment market in defining and delivering NZC. Key differences are described between the most common definitions of zero carbon within the industry, highlighting the requirements for carbon neutral, NZC and absolute zero carbon status (at the building level). The role of offsetting within these definitions is also discussed, with most stakeholders holding that definitions of NZC should not permit offsetting of Scope 1 emissions, but offsetting of Scope 3 emissions is necessary, while electricity grids and construction activities are decarbonised.

A variety of net zero schemes, which are widely used within the real estate investment industry, are then presented and compared. The majority of these schemes have been launched within the last five years and offer a broad range of definitions, scopes and stringencies. This yields a convoluted outlook on the current market for asset owners, managers and investors to decipher. The rise of climate-related regulations, and the contradictions in approach between these and current net zero schemes, further complicates efforts to transition the real estate investment industry to NZC. This section provides a breakdown and comparison of the most commonly adopted schemes in the market, in terms of their scope and applicability.

Throughout this section, key takeaways for real estate investors are outlined in boxes at the start of each sub-section to summarise the research findings.

4.1 Defining Net Zero Carbon in Real Estate

The basic idea of NZC is that the Greenhouse Gases (GHG) emitted to the atmosphere by the activities of a building, fund or company are balanced by the removal of an equivalent quantity of emissions over a given period of time. While a simple concept in principle, a lack of uniformity in definitions across the market means that two public commitments to net zero can mean very different things. Additionally, commitments to 'net zero' can be made at the building, fund, portfolio or company level, and in many cases, these commitments may only cover a limited proportion of the entity's GHG emissions. Stakeholder feedback noted that this lack of consistency was a source of confusion, even for the well-informed. This section defines the different levels of 'zero' carbon, as it relates to the real estate industry, based upon Verco's experience of the various terms in use by the market.

Key takeaways for real estate investors

- The most carbon-intensive emissions sources within the real estate industry are building energy use and embodied carbon.
- Carbon neutrality is the weakest net zero commitment with no obligation to reduce emissions prior to offsetting.
- Three levels of NZC definitions can be applied at the buildings level; NZC efficient, NZC ready and NZC.
- These three definitions are used interchangeably by some net zero schemes, but are quite different.

4. NET ZERO CARBON IN INTERNATIONAL REAL ESTATE INVESTMENT

4.1.1 GHG emissions scope

One important source of inconsistency in net zero definitions is the scope over which a net zero commitment or label is applied. The Greenhouse Gas (GHG) Protocol[13] defines three 'scopes' of GHG emissions:

- **Scope 1 emissions** most commonly refer to on-site fossil fuel combustion such as the burning of natural gas, or 'fugitive' emissions such as refrigerant leakage.
- **Scope 2 emissions** arise indirectly from purchased energy supplies (such as electricity or district heating/cooling).
- **Scope 3 emissions** are produced indirectly through an entity's wider value chain.

Historically, emissions abatement within real estate has been focussed on the operational energy use of the building. This covers Scope 1 and Scope 2 emissions for energy purchased by the landlord, plus the emissions of energy use in occupier-controlled areas (Scope 3), whether purchased by the landlord or the occupiers. However, it is now widely seen as appropriate for the landlord to also take responsibility for the embodied emissions of construction/refurbishment and maintenance materials (Scope 3).

Scope 3 emissions accounting can extend further to the transportation impacts of the building's users, such as employees commuting to offices or the public accessing retail or leisure facilities, among other categories, although this is not currently common practise.[14]

4.1.2 Zero carbon, net zero, or carbon neutral?

While such terms as 'Zero carbon', 'NZC', 'carbon neutral' and others may be used interchangeably to mean the same thing, their strict definitions are substantially different. At the building level, there are additional varieties of NZC status which are used within some net zero schemes to provide further detail relating to where a building lies on its transition to zero emissions.

'Carbon neutral':

Where a building's GHG emissions have been measured and countered with an equivalent quantity of off-site GHG reductions or removals, often in the form of offsets. There is no obligation to first deliver any emissions reduction or abatement, making this the 'weakest' of the commitments, in terms of climate ambition. In this example the building's operational and embodied emissions are offset in their entirety, but buildings can also be described as carbon neutral if only the operational carbon emissions[15] are offset. A prominent scheme adopted for the standardisation of approach to this definition is the PAS 2060 Standard.[16]

'Net zero carbon efficient':

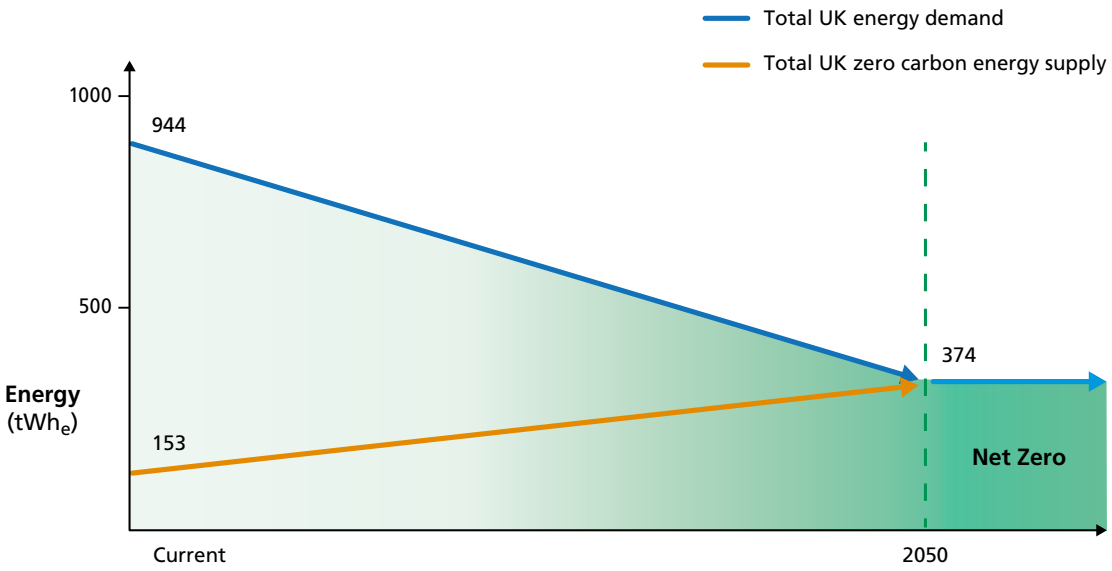
Where a building has undergone steps to improve energy performance and remove any inefficiencies. The principle of reducing the energy consumption of a building first, before turning to other measures, such as the use of renewable energy or offsetting, is often referred to as the energy (or mitigation) hierarchy. This is a core principle of many net zero schemes in the market, including the World Green Building Council's NZC Buildings Commitment (WGBC NZCBC).

13 https://ghgprotocol.org/
14 https://www.ukgbc.org/ukgbc-work/scope-3-reporting-in-commercial-real-estate/
15 GHG emissions associated with the operational stage of a building's lifecycle, mostly attributed to emissions from energy use
16 As this standard goes no further than carbon neutral status, it is not further referenced within this study

4. NET ZERO CARBON IN INTERNATIONAL REAL ESTATE INVESTMENT

A net zero strategy which prioritises energy reduction is central to the 'Paris proof' principle – a concept pioneered by the Dutch Green Building Council.[17] An economy seeking to be 'Paris proof' projects its expected zero carbon energy generation capacity in 2050. It then determines the extent of energy reduction required each year to ensure that, by 2050, its economy is consuming only the level of electricity that is expected to be produced from zero carbon sources (Figure 4.1). Due to limitations in projected zero carbon energy generation capacity, reducing energy demand from national building stocks is crucial if net zero is to be reached by 2050. 'NZC efficient' status is therefore a critical stepping-stone on the way to NZC.

Figure 4.1: Illustration of UKGBC's Approach to 'Paris-proof' Targets[18]



Some approaches to defining NZC advocate the use of the term 'net zero' at the 'NZC efficient' stage providing that the building has an action plan or trajectory in place to get there.[19] This is qualified with the advice that this represents the minimum level of performance that is acceptable for buildings wishing to claim such status, while still representing a notable departure from business as usual.

'Net zero carbon ready':

Where a NZC efficient building has replaced any fossil-fuel driven heating, hot water or catering services with low carbon equivalents. These equivalents can be in the form of on-site electric technologies, such as heat pumps, or low carbon off-site energy provisions, such as green hydrogen or district heating.[20] The building is 'ready' for the final step – the total decarbonisation of the electricity grid.

'Net zero carbon':

A building that is NZC ready and based in a location with a fully decarbonised electricity grid. This is already the case in certain countries, including Iceland, Switzerland, Norway and Sweden, where the electricity supply is already at or very close to zero-carbon.[21] As the burden of this definition lies with policy makers and operators of national electricity grids, the terms NZC and 'NZC ready' are often used interchangeably.

17 https://www.dgbc.nl/nieuws/paris-proof-commitment-measuring-actual-energy-use-makes-climate-goals-more-achievable-1985
18 https://www.ukgbc.org/wp-content/uploads/2020/01/UKGBC-Net-Zero-Carbon-Energy-Performance-Targets-for-Offices.pdf, Figure 1: UK trajectory to a net zero economy
19 https://www.ukgbc.org/wp-content/uploads/2021/03/Net-Zero-Carbon-levels-of-performance.pdf
20 Provided the municipal scheme either is utilising 100% renewable energy, or will in future
21 https://ember-climate.org/commentary/2021/05/14/oecd-zero-carbon-electricity/

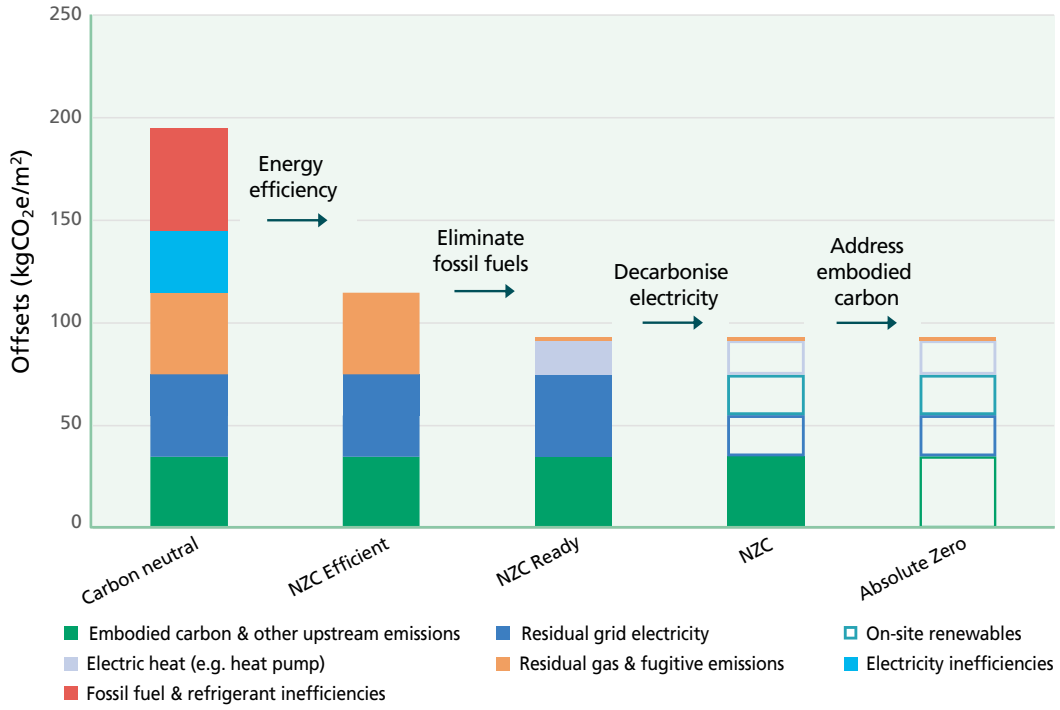
4. NET ZERO CARBON IN INTERNATIONAL REAL ESTATE INVESTMENT

'Absolute zero':

In all of the above definitions, the residual emissions are to be countered with an equivalent quantity of off-site GHG reductions or removals, often in the form of offsets. A building which is absolute zero has eliminated all Scope 1, 2 and 3 emissions with no offsetting. Some unavoidable fugitive emissions may still exist under this definition (due to refrigerant leakage from heat pumps) but these can be minimised through the use of refrigerants with low global warming potential. A further challenge here lies in the total elimination of embodied carbon emissions associated with the manufacture of construction materials. There are comparatively few real estate investors with commitments to absolute zero. Some businesses choose to go further than NZC to deliver net carbon removals. This is referred to as **'net positive'**[22] or **'climate positive'**.[23]

Figure 4.2 graphically illustrates the differences in the above definitions and highlights the quantities of carbon offsets[24] required under each status. The coloured segments in this graphic refer to different sources of emissions while the transparent segments indicate that the building's energy intensity is unchanged but the associated carbon emissions have been eliminated on the supply side of the building's value chain.

Figure 4.2: Variances in Building-level 'Zero Carbon' Definitions[25]



The various schemes assessed in this study align with a variety of the above terms. Some cut across these different framings by including or excluding particular emissions sources, most commonly within Scope 3.

22 http://sustainability.hammerson.com/347/our-net-positive-targets.html
23 https://www.grosvenor.com/news-and-insight/all-articles/grosvenor-britain-ireland-makes-zero-carbon-commit
24 In units of carbon intensity ($kgCO_2$ equivalent per unit floor area). Please see the following section for a definition of carbon offsets.
25 The values in this figure are illustrative and represent a generic building

4. NET ZERO CARBON IN INTERNATIONAL REAL ESTATE INVESTMENT

4.2 The Role of Carbon Offsetting and Green Tariffs in Net Zero Carbon

To differing extents, the definitions provided in Figure 4.2 are all (bar 'absolute zero') dependent on the use of carbon offsets. This section defines the term offsetting in more detail and presents stakeholder feedback on what should constitute industry best practice, in the approach to carbon offsetting. The main conclusions drawn from stakeholders and wider market sentiment, on the use of offsetting and green energy tariffs in net zero schemes, are outlined below:

Key takeaways for real estate investors

- A definition of NZC should not permit offsetting of Scope 1 emissions.
- The use of offsets and green tariffs are to be pursued only after reductions are made to energy consumption and electricity grid demand and should therefore be a minimal part of any 'true' net zero position.
- Offsetting of Scope 3 emissions will be necessary while electricity grids and construction products and processes are decarbonised.
- Where offsetting is used it should be conducted to the highest levels of robustness and quality (permanent carbon removal) with a carbon price that reflects the true societal cost of carbon.

4.2.1 Carbon offsetting

Offsetting refers to actions taken by a business or entity to compensate for GHG emissions released into the atmosphere. Offsetting is a means of paying for another party to reduce or avoid emissions, or absorb atmospheric CO_2 to compensate for one's own emissions. This might include activities such as tree-planting, supplying energy-efficient cooking stoves to communities in developing countries, or carbon capture and storage.

Schemes that follow the mitigation hierarchy place offsetting last on the list of actions to be pursued, after other carbon reduction steps, but many do not specify the thresholds or criteria any further. Those schemes that do provide any additional detail vary in their requirements (Section 4.4.2 includes further detail on this). Some examples of these requirements are as follows:

- The WGBC and ILFI require certain certifications[26] to be held by any purchased offsets, in order to standardise the approach to net zero status.
- The Dutch, French and German GBCs do not permit the use of offsets in their building level net zero definitions.
- The Net Zero Investment Framework (NZIF) does not permit the use of offsets to achieve emissions reduction targets at the portfolio level and cautions investors on the use of offsets within decarbonisation goals of the assets within their portfolios.
- The Science Based Targets initiative (SBTi) does not permit the use of offsets for near-term targets but allows a limited use (10% of emissions) within the Corporate Net Zero Standard.[27] The SBTi differentiates between emission 'neutralisation' – permanent carbon removal or sequestration within the supply chain – and 'compensation' – actions or investments that mitigate GHG emissions beyond those mitigated by either a science-based or net zero target. Compensation is not permitted as part of a net zero claim.

26 A variety of internationally recognised certifications exist to allow offsetting schemes to verify their positive environmental impact (for example, Gold Standard, VCS, VER Plus or Plan Vivo offsets).

27 It should be noted that this is a general limit set by the SBTi for the corporate level. The maximum offsetting allowance differs for sector specific pathways, which require a minimum of 98% reduction in emissions from service buildings and a 95% reduction from residential buildings - https://sciencebasedtargets.org/resources/files/Net zero-Standard.pdf

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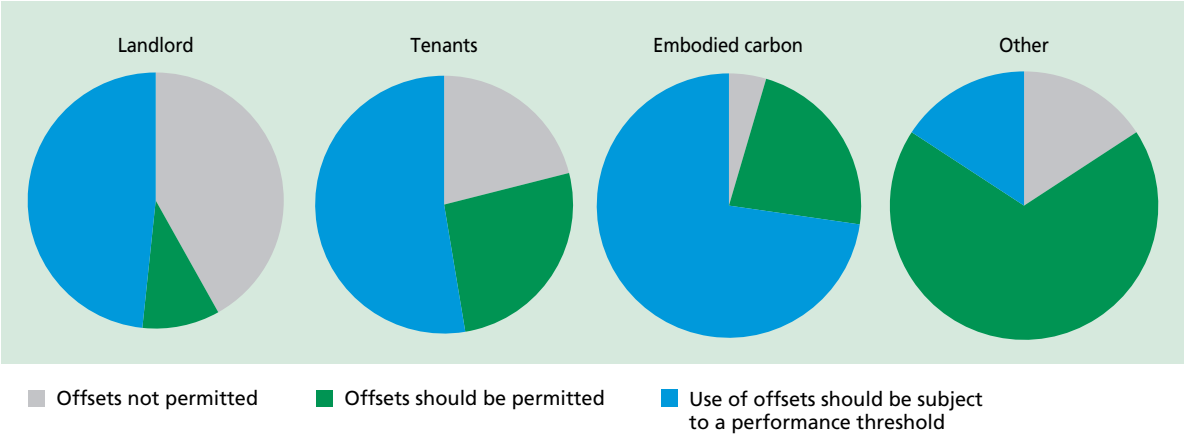
For those schemes that provide minimal guidance on offsetting, stakeholder feedback advocated the use of two UK developed 'best practice approaches', which provide guidance on how offsetting may be used at both the organisation and building levels; the Oxford Offsetting Principles[28] and the UKGBC Renewable Energy and Offsets Procurement report.[29]

Stakeholder feedback on the application of offsets was diverse. Most hold that offsetting should play a minimal part of any net zero position and therefore no definition of NZC should permit offsetting of Scope 1 emissions. However, some view offsetting as 'a necessary evil' in the transition to NZC, given that truly zero carbon construction materials are experimental and not widely available, and few countries across the world have a truly zero carbon energy system. For this reason, the majority of stakeholders believe that the use of offsets for building energy use and embodied carbon should be subject to the achievement of performance thresholds, rather than fully prohibited (Figure 4.3).

Figure 4.3: Stakeholder Feedback on Permissibility of Building-level Offsets[30]



Other stakeholders – occupiers in particular – see offsetting schemes as an important part of broader socio-economic responsibilities, providing a means for businesses to finance innovative projects with a wide range of co-benefits, including community health, biodiversity and food and water security. Consequently, the question was raised of where offsetting projects should be located, in relation to the purchasing entity? Some believe that offsetting projects should be in the country within which the entity is based, to maintain consistency with national carbon budgets and avoid international double counting. Others believe that offsets should be focussed on developing countries, to help fund their transition to NZC and provide other socio-economic benefits.

Stakeholder feedback generally perceived offsets to be too cheap to '…accurately capture the economic and social costs of carbon'. The prices of offsets are forecast to increase substantially over the next 30 years[31] but the market sentiment is that this increase is not being realised soon enough to prevent companies using offsets as a 'get out of jail free card'. Some felt that companies may use offsets to 'put off' addressing the direct carbon impacts of their operations and not take the necessary steps to reduce emissions.

28 https://www.smithschool.ox.ac.uk/publications/reports/Oxford-Offsetting-Principles-2020.pdf
29 https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2021/03/05144141/Renewable-Energy-Procurement-Carbon-Offsetting-Guidance-for-Net-Zero-Carbon-Buildings.pdf
30 'Other' refers to other Scope 3 emissions relevant to real estate, such as purchased services, business travel and employee commuting
31 https://trove-research.com/wp-content/uploads/2021/06/Trove-Research-Carbon-Credit-Demand-Supply-and-Prices-1-June-2021.pdf

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4.2.2 Green tariffs

An alternative method of mitigating Scope 2 carbon emissions, without direct abatement, is the purchase of electricity from off-site renewable energy sources, either through a market mechanism such as 'green tariffs' or Power Purchase Agreements (PPAs), or through direct 'private wire' arrangements.

From a GHG accounting perspective, organisations claiming zero emissions using these mechanisms must be the sole beneficiary of the renewable energy procured (typically evidenced through ownership of certificates which guarantee the renewable origin of the energy) to avoid multiple entities relying on the same renewable energy source. However, this risk of double counting presents problems for the 'Paris proof' approach, in which it is assumed that all large-scale renewable generation is held as part of a common stock that all buildings have an equal claim to.

Consequently, the schemes identified within this report take diverging views on the use of green tariffs as a means of mitigating Scope 2 emissions in any reduction targets or strategies. However, most schemes agree that the use of renewable energy, backed with 'guarantee of origin' certificates are to be pursued only after reductions in energy demand, in the same way as traditional 'offsetting' is used to support a 'NZC Ready' claim.

4.3 The State of the Market: Existing Net Zero Schemes

Recognition, within the real estate industry, of the importance of addressing GHG emissions and achieving NZC has grown substantially since the signing of the Paris Agreement (2015). Concurrently, the number of schemes emerging with the aim of guiding the transition of the real estate industry (and other sectors) to NZC has greatly increased, at both the building and corporate level. This section presents the confusing landscape that has arisen from the myriad options available to real estate market actors and identifies the main schemes currently used by stakeholders.

Key takeaways for real estate investors

- An explosion of net zero schemes since 2015- at both the building and corporate level – have created a convoluted picture for all market participants.
- The key net zero schemes used in the market today are diverse in their nature, definitions, and applicability. Combined with the number of national and city level commitments this poses a significant challenge for investors and managers of diverse portfolios, looking to transition to net zero carbon.
- The market is complicated further by a regulatory focus on theoretical performance when most voluntary zero carbon schemes are based on actual measured data.
- The diversity of the real estate industry means that no single scheme will satisfy all requirements, but convergence is needed on a set of net zero principles to provide a consistent framing of NZC for all schemes.
- Building Passports would harmonise the approach to building classification, in terms of both theoretical and actual performance, ensuring both compliance with policy and real emissions reductions.

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4.3.1 A convoluted picture

Stakeholder feedback, from all types of market actor, was unanimous that achieving NZC is an absolute imperative for the industry, highlighting a significant shift in industry sentiment toward NZC in recent years – particularly during 2020 and 2021. Many stakeholders believe that the COVID-19 pandemic has enhanced the focus on ESG within the real estate industry, with NZC expected to grow further as a key component of future occupier and investor priorities.

While the urgency of achieving NZC emissions is increasingly being recognised across the industry, there is clear divergence in how asset owners, managers and investors plan to get there, with each party able to use a variety of different net zero schemes to frame their transition. The myriad options available and lack of transparency in the scope of these commitments makes peer comparison difficult and potentially exacerbates the misalignment of NZC strategies. Further confusion is provided by the overlapping nature of market schemes, with certain industry bodies being involved in the development of multiple initiatives, which then rely on the same frameworks or targets, but to differing extents.

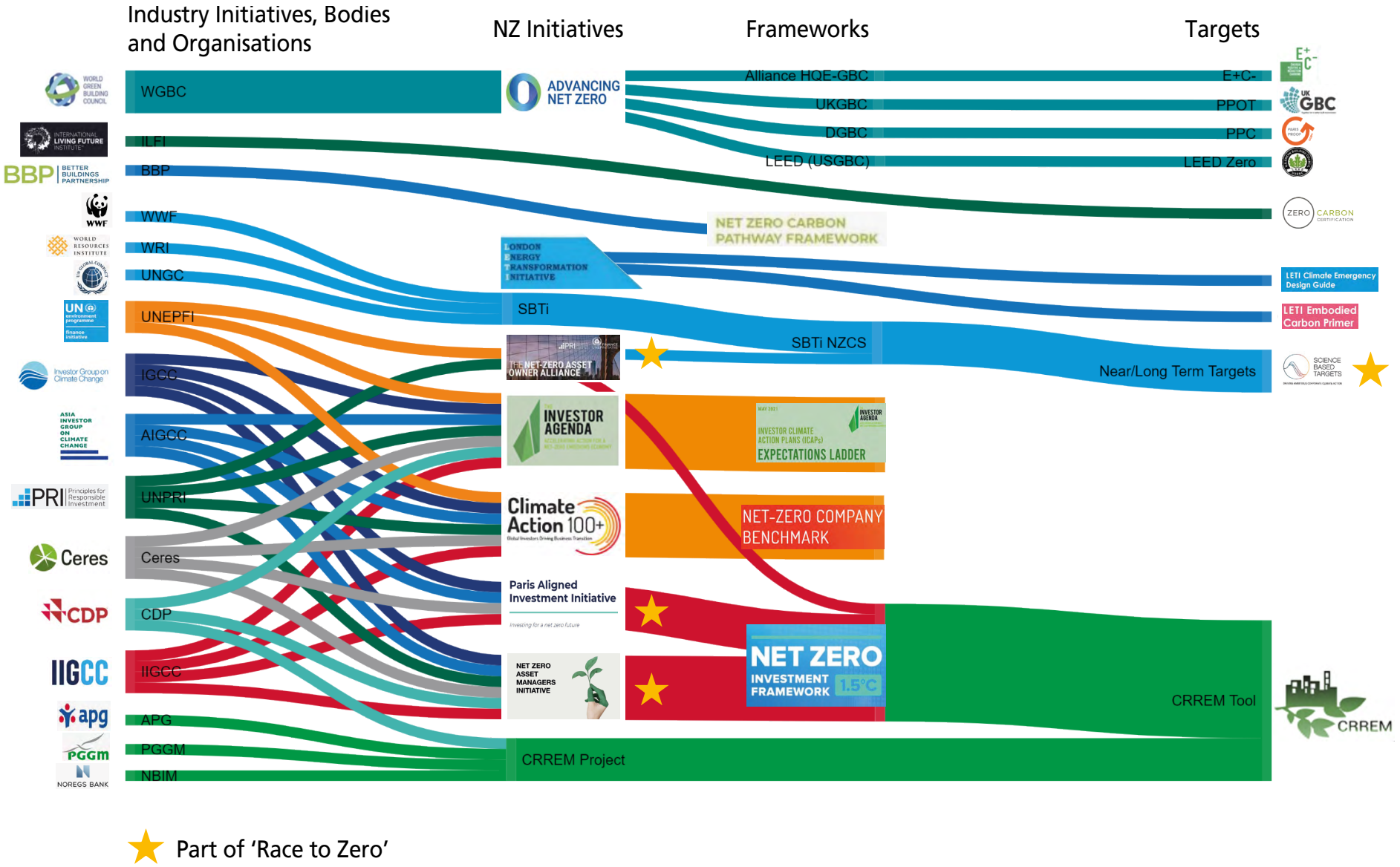
Figure 4.4 is a representation of various net zero schemes used by stakeholders within the real estate industry, and their inter-relations. The diagram differentiates between net zero initiatives and frameworks (as outlined in Section 2.1), net zero targets (where frameworks quantify clear targets for transitioning to NZC), and industrial bodies, initiatives and organisations (entities which fund or facilitate the development of NZC schemes).

It is worth noting that this figure does not include an exhaustive list of such schemes; those that go beyond a high-level commitment to achieve NZC have been prioritised and initiatives such as The Climate Pledge[32] and Transform to Net Zero,[33] both of which have been signed by a number of real estate companies and occupiers, have therefore been excluded. Four prominent (and relatively unique) national GBCs have been included for their relevant framework publications and NZC targets. There are currently 13 other GBCs who are subscribed to the WGBC's ANZ programme, with less detailed frameworks/targets, which are not referenced specifically within this study.[34]

A further complicating feature of the landscape – not referenced in Figure 4.4 – is the interconnectivity of schemes. For example, the Net Zero Asset Owner's Alliance (NZAOA) has pledged to work with and enhance other existing initiatives, such as the SBTi, Climate Action 100+ and The Investor Agenda.[35] Broad schemes, such as the UN Race to Zero Campaign (included in Figure 4.4) and Mark Carney's Glasgow Financial Alliance for Net Zero (not included in Figure 4.4), utilise and collaborate with a variety of schemes referenced in this study. However, they are not included in the further analysis of NZC in real estate, due to their broader applicability beyond the industry.

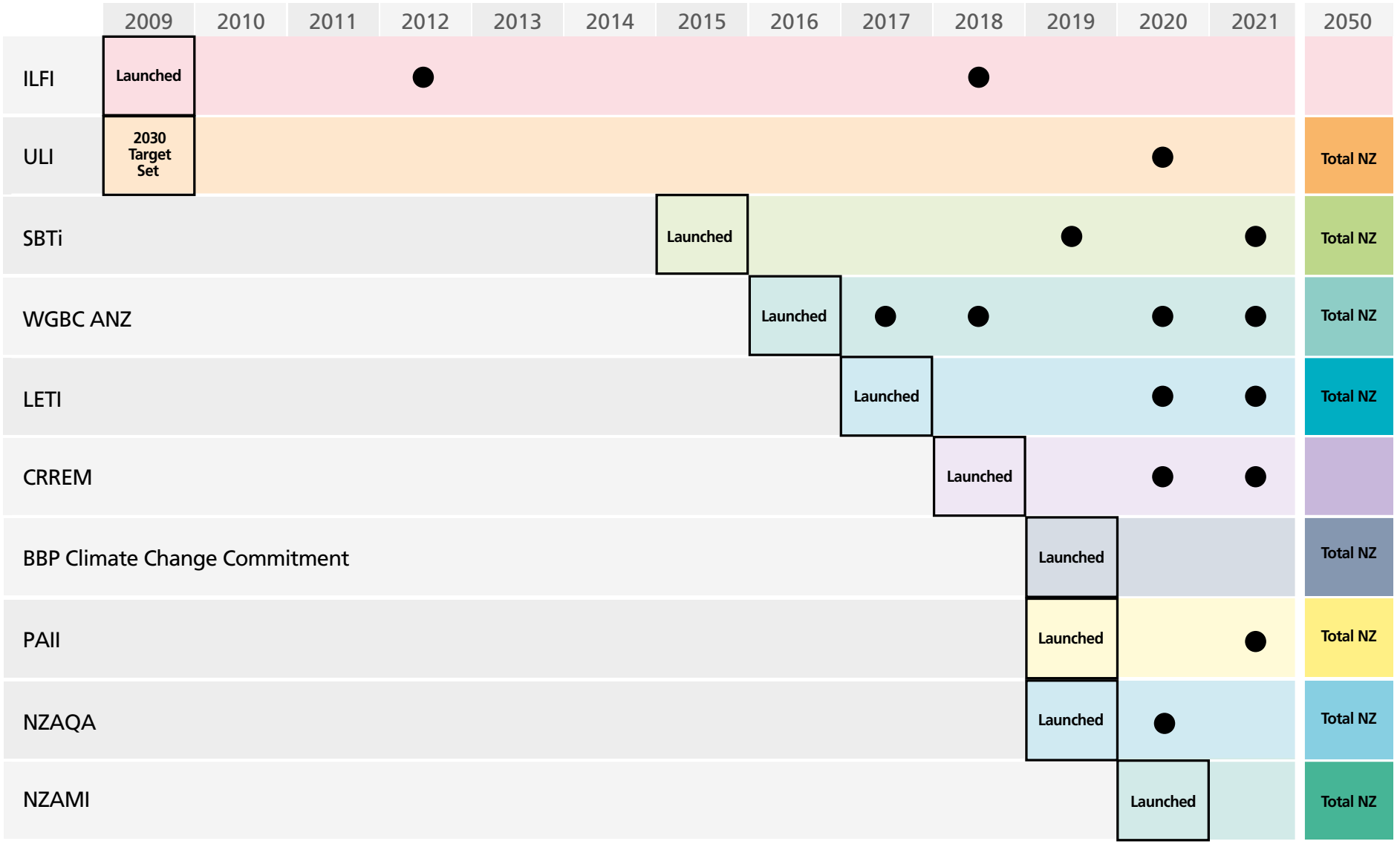
32 https://www.theclimatepledge.com/us/en/the-pledge
33 https://transformtonetzero.org/
34 https://www.worldgbc.org/advancing-net-zero/net-zero-around-world
35 https://www.unepfi.org/wordpress/wp-content/uploads/2019/09/AOAbrochure.pdf

Figure 4.4: Key NZC Schemes and Developers/Sponsors[36]



36 All acronyms are included in the terminology section at the end of the report

Figure 4.5: Timeline of Major NZC Schemes in Real Estate



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Many net zero schemes have been established very recently, and most remain in live development. Figure 4.5 is a timeline of 10 major net zero schemes which are specifically applicable to the real estate industry, as identified from stakeholder feedback.[37] With each circle in the figure symbolising a key milestone or publication, it is apparent how the market's position on NZC has accelerated since the signing of the Paris Agreement (2015). Details of these milestones and publications are provided in Appendix B.

4.3.2 Key net zero schemes

As well as the variety of voluntary net zero schemes available for use in the market, investors and asset managers must also consider applicable NZC strategies which are mandated by city-level commitments and national/international regulations. This section provides an outline of the requirements of net zero schemes available to the real estate market and provides commentary on the further complications that may be presented by city-level commitments and sustainability disclosures.

a. Market schemes

Currently, high-level initiatives often consist of a commitment to net zero by a distant target date with no requirement for signatories to commit to short term action. These schemes are broadly applicable and therefore are insufficiently detailed to influence meaningful change; providing minimal guidance on how commitments are to be achieved or how progress towards targets is to be verified. Even detailed frameworks do not cover the full range of different activities within the real estate sector and most focus on certain asset types or locations as a result.

The diversity of the real estate industry means that no single scheme will satisfy all requirements and the schemes which are most used in the industry therefore have broad differences. Table 4.1 provides a high-level overview of the 12 most commonly referenced and well-subscribed net zero schemes used in the real estate industry, across a range of distinguishing criteria relating to their NZC approach. Two national GBC schemes have been added to those presented in Figure 4.5 (LEED Zero[38] and the UKGBC NZC Buildings Framework) and NZAMI has been excluded as the Initiative's guidance is based on the NZIF. The colour coding illustrates the extent of the coverage of each criterion by the various schemes. An outline of each scheme's definition of NZC is provided in Appendix A, accompanied by some general information on each scheme.

37 The Science-based Targets Initiative has been included as it is very widely subscribed to by all types of real estate market participants.
38 A certification lead by the USGBC

Table 4.1: Overview of Major NZC Schemes in Real Estate Investment

Net Zero Schemes	SBTi 1.5° pathway	LEED Zero	ILFI ZC Certification	UKGBC NZC Buildings Framework	SBTi – Net Zero Standard	WGBC NZCBC[39]	CRREM	NZAOA	LETI	ULI Greenprint NZG	NZIF	BBP Climate Commitment[40]
Launch year	2016	2018	2018	2019	2021	2016	2018	2019	2019	2020	2021	2019
Coverage	Global	USA[41]	Global	UK	Global	Global	Europe and Selected Other Countries	Global	UK	Global	Global	Global
Standard / Performance criteria / Commitment[42]	Standard	Standard	Standard	Standard	Standard	Performance criteria[43]	Performance criteria	Performance criteria	Performance criteria	Performance criteria	Performance criteria	Commitment[44]
Emissions scope	All Scope 1, 2 and 3	Operational carbon and carbon from occupant transportation	All Scope 1, 2 and 3	Scope 1, 2 and partial Scope 3	All Scope 1, 2 and 3	Scope 1, 2 and partial Scope 3	None (operational energy only)	All Scope 1, 2 and 3	All Scope 1, 2 and 3	Scope 1 and 2	All Scope 1, 2 and partial Scope 3	All Scope 1, 2 and partial Scope 3
Organisation / building-level	Both	Building	Both	Building	Both	Both	Building	Org.	Building	Building	Org.	Both
Operational / embodied carbon	Both	Operational	Both	Both	Both	Both	Operational	Reverts to SBTi	Both	Operational	Reverts to CRREM	Both
Existing / new build	Both	Existing	Both	Both	Both	Both	Both		Both[45]	Existing		Both
Asset types covered	All	All	All	All[46]	All	All	Multiple[47]		Residential, Offices, Schools	All		All
Targets	Carbon reduction	No targets	Carbon reduction	Absolute energy target (offices)	Carbon reduction	Embodied carbon reduction	Absolute carbon and energy targets		Absolute energy and (embodied) carbon targets	Carbon reduction		No targets
Follows mitigation hierarchy (i.e. reduction first, offsetting last)	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes
Purchasing of off-site renewable energy permitted?	Yes	Yes	Yes	Yes[48]	Yes	Yes	Yes		Yes	Yes		Yes
Short term action necessary?[49]	No	No	No	Yes	Yes	Yes	Yes		Yes	Yes	Yes	No
Offsetting guidance	No more than 10% of baseline emissions	Green-e Climate certified (or equivalent)	CER, VER. Not RECs	Gold standard, CER (both recommended, not mandated)	Not permitted	CERs (not ICERs, tCERs or nuclear CERs), VERs, VCUs and RMUs	n/a[50]		Permitted (not for operational carbon)	Permitted	Permitted	Permitted (not for operational carbon)
Key market users	Asset owners	Developers	Asset owners	Asset managers	Asset owners	Asset managers	Investors	Asset owners	Developers	Asset managers	Asset owners	Asset managers

39 The WGBC's NZC Building Commitment was launched in 2018 as part of their Advancing Net Zero Initiative. This commitment reaches beyond national GBCs and has a large number of organisational signatories, including real estate investment trusts (REITs), real estate property funds, advisors, developers and construction companies

40 Signatories of this commitment are supported by the NZC pathway framework - https://www.betterbuildingspartnership.co.uk/net-zero-carbon-pathway-framework

41 While globally applicable, LEED certifications are most commonly used in North American, Asian and Pacific regions, due to competition from other certifications (such as BREEAM) in Europe

42 This refers to whether the scheme is a standard (with certification process), set of guiding performance criteria or a simple high-level commitment to net zero

43 All signatories are required to report two years after signing up.

44 The BBP ultimately has discretion as to which organisations are included in the Climate Commitment group

45 The LETI Climate Emergency Retrofit Guide for residential property launched in October 2021.

46 UKGBC Paris proof energy use intensity targets only cover offices currently but the framework definition is more widely applicable

47 Retail, Office, Distribution Warehouse, Hotel, Leisure Healthcare, Multi-family and Single-family Residential

48 The UKGBC require that an energy reduction threshold is first met before relying on off-site renewable energy or green tariffs

49 This refers to the extent to which the scheme requires signatories to commit to or evidence interim reductions in carbon emissions before the net zero date – for example through interim (2030/2040) targets

50 CRREM does not yet have net zero definitions of their own and the use of offsets is therefore irrelevant under the framework

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b. City-level commitments

In addition to the schemes noted above, there are an increasing number of city policies and initiatives that are being introduced which include mechanisms to drive the delivery of NZC buildings. These are extremely diverse in nature and often combine measures to address climate change mitigation with other ESG outcomes, including improving air quality, biodiversity or wider social and environmental issues. From a climate perspective, city-level regulation typically mandates carbon or energy intensity thresholds, offsetting for new developments or requires buildings to obtain green certification, such as LEED, ENERGY STAR or Passive House standards.

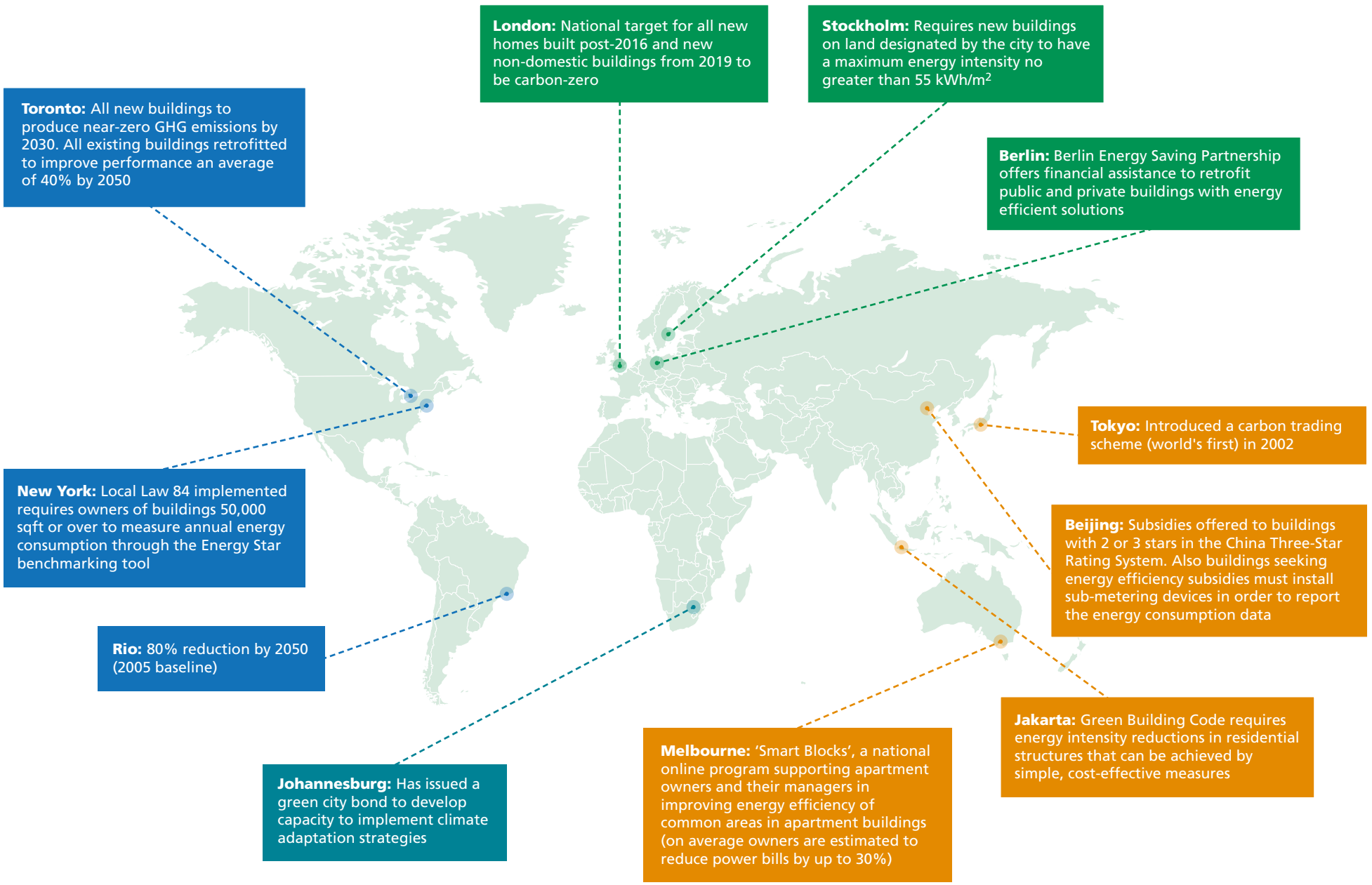
As the creator of the NZC Buildings Declaration, the C40 Cities initiative is an active facilitator of city-level commitments.[51] The Declaration has 28 signatories (including Cape Town, Helsinki, London, Los Angeles, Melbourne, Paris and Tokyo) which have pledged to enact regulations and/or planning policy to ensure operation of new buildings is NZC by 2030 and all buildings by 2050.

Figure 4.6 shows a selection of city-level measures across the world. Examples include:

- **Stockholm, Sweden:** Since 2012, Stockholm has limited the energy consumption of new buildings on municipally allocated land to a maximum of 55 kWh/m^2, which means that energy use by the city's new buildings is on average 30% below the values set at the national level.[52] Sweden's Planning and Building Act already provides a target of 80 kWh/m^2 for non-residential premises.[53]
- **Sydney, Australia:** Since 2019, new office developments in the Central Business District must have a NABERS 5.5 star Commitment Agreement.
- **Portland, USA:** The Portland Climate Action Plan[54] includes provision to reduce the total energy use of all buildings built before 2010 by 25% and achieve NZC emissions in all new buildings and homes by 2030.[55]
- **Vancouver, Canada:** The Zero Emissions Building Plan[56] includes an embodied carbon reduction of 40% by 2030.
- **Masdar City, UAE:** this planned city project aim is to reduce embodied carbon of building materials by 30% and achieve a target of 550kgCO_2/m^2 for building construction embodied carbon.[57]
- **Jakarta, Indonesia:** The Green Building Code requires energy intensity reductions in residential structures that can be achieved by simple, cost-effective measures
- **Rio de Janeiro:** Committed to reduce the level of emissions from the city by 80% by 2050 compared with 2005.
- **London, UK:** The London Plan[58] requires all major developments to achieve a 35% on-site carbon improvement on minimum standards for energy uses subject to national Building Regulations with any shortfall offset through a Local Planning Authority carbon offset fund. The Plan has also introduced a requirement for major new developments to predict, report and disclose for five years post-occupancy whole building energy use and carbon emissions (verified by measurement).

51 https://www.c40.org/other/net-zero-carbon-buildings-declaration
52 https://www.ren21.net/wp-content/uploads/2019/05/REN21_Cities2021_Fact-Sheet_Sweden.pdf
53 https://unfccc.int/sites/default/files/resource/LTS1_Sweden.pdf
54 https://www.portland.gov/sites/default/files/2019-07/cap-2015_june30-2015_web_0.pdf
55 https://www.portlandoregon.gov/bps/index.cfm?&c=49989#:~:text=Portland's%20Climate%20Action%20Plan%20(CAP,(compared%20to%201990%20levels).
56 https://vancouver.ca/green-vancouver/zero-emissions-buildings.aspx
57 https://www.worldgbc.org/sites/default/files/WorldGBC_Bringing_Embodied_Carbon_Upfront.pdf
58 https://www.london.gov.uk/sites/default/files/2020_carbon_offset_survey_monitoring_report.pdf

Figure 4.6: Selection of City-Level Commitments



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c. Regulations

The number of climate-related disclosure frameworks is also growing. Most prominent are the European Union's Sustainable Finance Disclosure Regulation (SFDR) and the Financial Stability Board's Task-force on Climate-related Financial Disclosures (TCFD). As it is a regulation, the requirements of the SFDR must be satisfied by all asset owners marketing products within the EU and can therefore be utilised by investors globally. The TCFD is not yet mandatory on a global level but certain governments[59] have begun to mandate its use in recent policies. Some detail is provided on these two frameworks below with commentary on their relevance to real estate investors engaging in the NZC transition.

Taskforce for Climate-related Financial Disclosure

The Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD) aims to develop consistent climate-related financial risk disclosures for voluntary use by companies.[60] The TCFD's objective is to provide investors, lenders, insurers and other decision-makers with climate-related information that is consistent, comparable, reliable, clear and efficient. TCFD disclosure, covering both transition and physical climate related risks, will become a mandatory requirement in the UK for all listed companies and asset owners by 2022. Whilst not expressly a net zero scheme, TCFD is expected to be a significant feature of climate reporting for investors. Some net zero strategies mention TCFD in their requirements – the BBP's Climate Commitment, for instance, requires signatories to prepare a climate resilience strategy in line with industry standards, including the TCFD, for disclosure by 2022.

Sustainable Finance Disclosure Regulation (SFDR) and EU Taxonomy (EUT)

The SFDR applies mandatory ESG disclosure obligations for asset managers marketing sustainable investment products within Europe from March 2021. The EU Taxonomy Regulation provides a detailed definition of a sustainable investment product – one which makes a 'significant contribution' to one of six sustainability objectives, including climate change mitigation, and does 'no significant harm' to the other five. A series of Technical Screening Criteria, relating to these six sustainability objectives, are used to assess whether a product can be classified as a sustainable investment product. Some of these criteria relate to energy performance in buildings, others relate to building fabric, and each criteria distinguishes between new builds, existing builds and renovation/refurbishment projects.

Unlike many net zero schemes identified in the preceding sections of this report, the EU Taxonomy allows for the definition of sustainable buildings to be based on modelled energy consumption (through the use of Energy Performance Certificates – EPCs). This approach lacks identification of actual energy use and consequently risks the focus on upgrading EPC ratings, rather than operational energy performance improvements.[61] The EU Taxonomy does also provide the opportunity to classify a building as a sustainable product through the use of Primary Energy Demand (PED) indicators and other national Nearly Zero Energy Building (nZEB) thresholds.[62] However, the definition of a PED indicator and other criteria used to determine an nZEB are bespoke to each Member State[63] and are often also based on theoretical estimations. These factors further blur the requirements of a 'sustainable' building for investors and asset managers.

59 For example, New Zealand and the UK
60 https://www.fsb-tcfd.org/
61 Non-domestic building EPC grades and actual energy consumption for the same building show no statistical relationship – https://www.betterbuildingspartnership.co.uk/real-estate-environmental-benchmark-2019-energy-snapshot
62 This involves comparison of the performance of the asset to the performance of the national or regional stock built before 31 December 2020 and at least distinguishes between residential and non-residential buildings.
63 https://www.bpie.eu/publication/nearly-zero-a-review-of-eu-member-state-implementation-of-new-build-requirements/

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Some markets are starting to address the balance between theoretical performance disclosure and real emissions reductions:

- In Australia and the UK, a regulatory shift in focus towards operational performance is under way, driven by the Design for Performance project,[64] and NABERS Australia and NABERS UK[65] benchmarking schemes.
- The UK Government has also recently consulted on Mandatory Performance-Based Ratings for commercial buildings.[66] This approach is expected to expand into Europe, in which case, pan-European real estate investors should follow a two-pronged strategy: improving building theoretical performance to comply with regulation, while also delivering the operational performance outcomes that will drive real emissions reduction and maintain alignment with net zero schemes.

Some market participants have started advocating the use of Building Passports, which cover theoretical and measured performance as well as planned actions towards NZC. Broad adoption of this tool will harmonise the approach to building classification (covering both theoretical and operational energy performance data) and help to facilitate the pricing-in of carbon in the valuation process.

4.4 Comparison of Net Zero Schemes

Having presented the confusing landscape which market participants face, this section seeks to bring a level of clarity to the requirements of each major net zero scheme being used within the real estate industry. Specific comparisons are made between 13 schemes, using four determining factors; applicability, emissions scope, geographic relevance and asset type.

This stage of the research also discusses stakeholder feedback on other options for market segmentation of net zero schemes, and compares the technical potential for carbon reduction[67] of 18 case study buildings, against their applicable scheme targets.

The 13 schemes have been selected for review under the following reasoning:

- Those schemes which were most commonly cited by stakeholders (Table 4.1), apart from NZAOA (which was excluded due to its dependency on the SBTi).
- A further two influential GBCs (Netherlands and France), which have released frameworks in line with the WGBC ANZ initiative, for greater breadth of comparison (Netherlands and France).

64 https://www.betterbuildingspartnership.co.uk/our-priorities/design-performance
65 https://www.bregroup.com/nabers-uk/
66 https://www.gov.uk/government/consultations/introducing-a-performance-based-policy-framework-in-large-commercial-and-industrial-buildings
67 Achieved through energy efficiency measures, heat decarbonisation and on-site renewable energy installation.

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The main conclusions drawn from the objective review of these schemes, for each of the four determining factors are presented below, alongside the key takeaways from the further market segmentation and case study analyses:

Key takeaways for real estate investors

Applicability

- 6 of the 13 schemes were considered applicable to occupiers, asset managers and investors, although none are commonly used by all three.
- Asset managers use the most diverse range of schemes to satisfy their requirements, combining different schemes to address NZC at the building, portfolio and corporate levels.
- Occupiers often set NZC commitments at the corporate level with little consideration of building level impacts, presenting a potential source of misalignment in net zero definitions.

Emissions scope

- 8 of the 13 schemes provide specific, quantifiable reduction targets for operational energy attributed to a building landlord, while only three directly address embodied carbon with equivalent 'hard' targets.
- Primary data limitations presents a challenge in carbon accounting for Scope 3 emissions.
- Stakeholder feedback suggests that best practice is to focus on the building's whole life carbon impact, however this is not currently being realised as only 2 of the 13 schemes consider whole life carbon, neither of them with 'hard' targets.
- It is likely that in the future, many schemes will require provision and verification of real data to ensure that stated emissions reductions are being achieved.

Geographic relevance

- Stakeholder feedback highlighted Europe and Australia as leading regions currently in identifying and setting pathways to NZC in real estate while regions including Asia-Pacific and the Americas were further behind but beginning to take action.
- The extent of the challenge of achieving NZC is significantly influenced by electricity grid carbon intensity. Consequently, assets located in regions which rely heavily on fossil fuels for electricity generation will find it more difficult to reach NZC status.
- CRREM is one of the only schemes to have distinct NZC targets for different locations.
- It is important for market actors to be aware of the net zero definitions and schemes of the national Green Building Councils in each invested country – as well as city, state and national regulation – to avoid any misalignment of definitions.

Asset type

- Most schemes (7 of the 13) provide only general targets with no asset type specificity. Of the schemes investigated, the CRREM project has the broadest consideration of specific targets by asset type.
- The diversity of energy use intensity in real estate arising from differences both in energy efficiency and intensity of use, even within specific building types, means that single energy use intensity targets by country and/or asset type may not be wholly appropriate.

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Further market segmentation

- Stakeholders felt that new buildings should be held to higher standards around operational energy and carbon performance than existing buildings.
- Stakeholders were cautious about creating too much granularity which could lead to the delay of action while market participants wait for the perfectly applicable scheme to emerge.

Case studies

- Warehouse assets can achieve the greatest level of reductions in grid energy demand, while assets with more energy-intensive services, such as hotels and shopping centres, can achieve more limited reductions.
- The comparison of current performance against net zero targets highlighted the wide variation in requirements for reductions by 2030 and the very challenging requirements of 2050 targets.
- Significant energy and carbon savings can be realised through immediate implementation of simple control and management measures, before more capital intensive and disruptive measures must be implemented to maintain alignment with NZC pathways.

4.4.1 Applicability

One of the reasons for the proliferation of NZC schemes is the diverging needs of different market actors:

- Investors are looking to meet their fiduciary responsibilities and quantify potential carbon-related risks. To do so, they are incorporating net zero schemes in their investment underwriting.
- Asset managers need standards or certifications that can be applied at an asset level and influence valuation.
- Occupiers are mostly looking to set NZC at the corporate level, with less consideration of building level emissions.

However, collaboration of all parties is required to achieve NZC and ensure that strategies are fully aligned.

Figure 4.7 illustrates the relevance of 13 net zero schemes to the three groups outlined in the points above, based on the findings from the research activities. Dark green indicates that a particular scheme is commonly adopted by a given user group. Mid-green indicates that it is applicable in principle but rarely used. Light green indicates that the scheme is unlikely to be applicable. Of the 13 schemes included within the comparison, only 6 are broadly applicable, but none are commonly used by all three groups.

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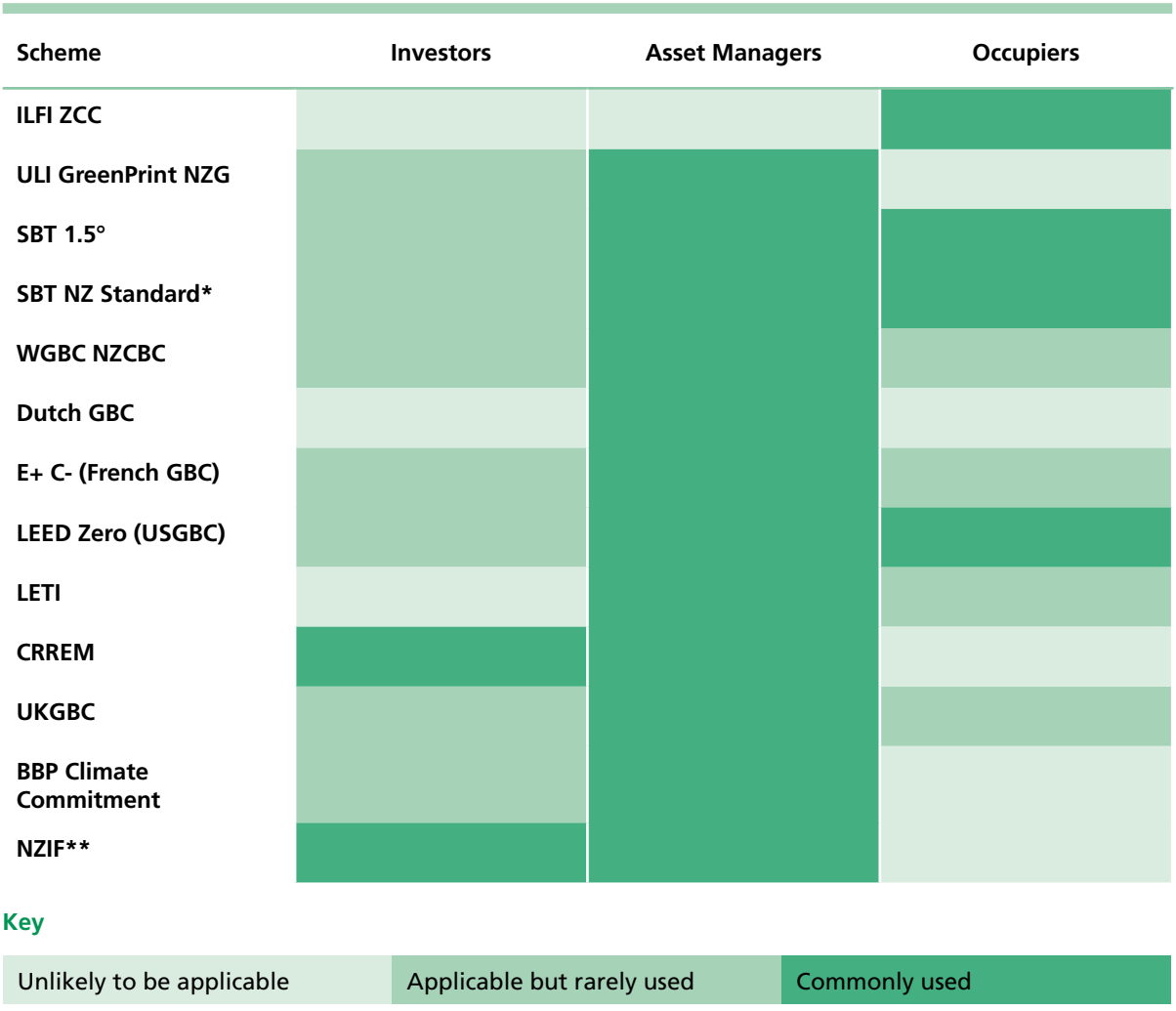
Figure 4.7: Comparison of Net Zero Schemes by Relevance to Market Actor Groups



* This is a very new scheme and the predicted adoption by market actors is based on the uptake of the SBTi near-term targets
** Uses CRREM as main tool for real estate investments

Conclusions for each of the market actor groups can be characterised as follows:

Investors

Investors principally engage with multi-asset class schemes, designed to steer NZC across diverse investment portfolios. The NZIF is a prominent framework used by this stakeholder group, providing transition advice for different asset classes including, sovereign bonds, listed equities and real estate. Investors are also engaged in efforts to understand high-level regulation, such as the SFDR and EU Taxonomy in Europe, with implications across multiple asset classes. Investors are typically less likely to be applying net zero definitions that are tailored to real estate or buildings specifically. One exception is CRREM, which is familiar to (and in some cases sponsored by) leading investors.[68]

68 https://www.crrem.eu/global-decarbonisation-pathways/

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Asset managers

Real estate asset managers are typically engaging with a mix of schemes that address NZC at the portfolio, company or fund level. This group handles the greatest diversity of net zero schemes (12 of the above 13), many of which differ significantly in scope and stringency. Many asset managers approach the diversity of net zero schemes by combining them. For example, several businesses have a commitment to net zero through the BBP Climate Commitment, underpinned with a short-term science-based reduction target (approved by the SBTi) and are using building-level net zero definitions, such as CRREM or relevant national GBCs. Managing agents and property managers are more interested in understanding what net zero means at the building level. The translation of net zero principles into actionable concepts, such as energy use intensity targets, is therefore important to these stakeholders.

Occupiers

Occupiers are often taking a different approach to NZC, signing up to building-specific or non-real estate specific schemes, such as the SBTi, The Climate Pledge [69] or the Race to Zero programme.[70] For some occupiers, particularly those whose core business is in energy-intensive manufacturing or industrial activities, the carbon impact of their leased buildings may be a fraction of their organisational carbon footprint. These occupiers are less likely to engage with their landlord to collaborate or share information on sustainability, causing a potential misalignment in NZC strategies. Therefore, understanding the schemes adopted by occupiers is a crucial first step in aligning the industry's transition to NZC.

There are a few examples of occupiers engaging with net zero schemes designed specifically for buildings (LEED Zero, ILFI NZ Certification). In the October 2021 update of the fast-food chain McDonalds' sustainability strategy, the business committed to use the UKGBC NZC Buildings Framework for both the operational and embodied impacts of offices and restaurants.[71] For some occupiers, there are relevant net zero vehicles representing the wider industry they operate in.[72]

4.4.2 Emissions scope

In real estate, the most material sources of emissions are operational energy and embodied carbon. However, the breadth of other emissions sources across an organisation, or building, value chain allows for significant divergence in the scope of emissions covered by net zero schemes. The inclusion of specific emissions sources within net zero schemes is not always apparent without greater knowledge of the specific scheme methodology.

Moreover, some net zero schemes employ a 'comply or explain' principle, enabling investors with diverse portfolios of ownership, leasing structures and management arrangements to exclude areas of carbon impact, most often where primary data is not available. Other net zero schemes allow signatories to use their own methods of estimation to quantify Scope 3 emissions sources, when access to primary data is limited. Stakeholder feedback suggests that it will be critical to move to measured data if emissions are to be tracked over time, otherwise carbon accounting processes will simply repeat the same estimates each year.

69 https://www.theclimatepledge.com/us/en/the-pledge
70 https://unfccc.int/climate-action/race-to-zero-campaign
71 https://www.mcdonalds.com/gb/en-gb/our-plan-for-change/our-plan/defining-net-zero.html
72 https://brc.org.uk/news/corporate-affairs/retail-to-hit-net-zero-by-2040/

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Figure 4.8 compares the emissions scope coverage of the 13 schemes under review. The dark green shade indicates that a particular emission source is addressed by a given scheme with specific, quantifiable reduction targets, such as carbon/energy intensities or a percentage reduction. The mid-green shade indicates that an emission source is within scope with a high-level reduction goal. The light green shade indicates that it is implied as being within scope but no further details are given. The column furthest to the right indicates the degree to which offsetting rules are detailed in the scheme. Of the 13 schemes included in this comparison, eight provide 'hard' targets for operational energy attributed to a building landlord and only three directly address embodied carbon in an equivalent manner.

Figure 4.8: Comparison of Net Zero Schemes by Emissions Scope

Scheme	Landlord Operational Energy	Tenant Operational Energy	Embodied Carbon	Other Emissions Sources	Use of Offsets
ILFI ZCC					
ULI GreenPrint NZG					
SBT 1.5°					
SBT NZ Standard			*	*	
WGBC NZCBC					
Dutch GBC					
E+ C- (French GBC)					
LEED Zero (USGBC)					
LETI				**	
CRREM					
UKGBC					
BBP Climate Commitment					
NZIF***					

Key

Out of scope	In scope with minimal detail	In scope with 'soft' targets	In scope with 'hard' targets

* Not explicitly included but SBTi encourages high inclusion threshold for Scope 3
** Use of sold products/end of life emissions
*** Uses CRREM as main tool for real estate investments

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Schemes tend to be either broad in scope without specific reduction requirements or interim targets (beyond a net zero by 2050 goal or similar), or they are focussed on particular emissions sources with specific targets. None of the schemes available currently provide hard targets for all emissions sources relevant to real estate. The SBTi NZ Standard sets 'hard' targets for the most material Scope 3 emissions as a whole, but the emissions sources are not specified.

All existing schemes address operational carbon in some form but a smaller number address the second most carbon intensive emissions source within the built environment – embodied carbon. This sentiment was reflected by stakeholder feedback, based on their experience of industry approaches to carbon in real estate. There are a small number of schemes providing embodied carbon and whole life carbon targets. For example:

- The **WGBC NZCBC** recently expanded its scope to include embodied carbon but does not provide specific targets beyond a goal of a 40% reduction in whole life carbon (WLC) emissions by 2030.
- Under the **ILFI Zero Carbon Certification** scheme, the embodied carbon emissions of primary materials must be reduced by 10% compared to a baseline building of equivalent size, function, and energy performance and the total embodied carbon of the project building may not exceed 500kg CO_2e/m^2.
- **LETI** provides a WLC best practice benchmark of 600 $kgCO_2e/m^2$ for offices and 500 $kgCO_2e/m^2$ for residential buildings.[73]

The number of schemes providing detail on embodied carbon is anticipated to increase rapidly over the next decade due to a combination of improved data availability and increasing awareness of the importance of this carbon intensive emissions source.[74]

Emissions beyond operational and embodied carbon are even less well addressed by market schemes, highlighting a lack of consideration for the whole life carbon of buildings. As such, only two schemes analysed include an approach for whole life carbon, neither of which adopting 'hard' targets. This sentiment is again reflected by stakeholder feedback on their industry experience with one interviewee remarking that *"no frameworks appear to address the 'Downstream Sold Assets' Scope 3 category"*. In the context of real estate, this category refers to emissions associated with the lifetime energy use of a building constructed for sale.[75] These are very rarely included in GHG accounts by commercial real estate companies but are seen as material by, for example, large house building companies.

The majority of schemes that permit offsetting promote a range of principles around their use, including; additionality, permanence, independent verification, uniqueness and measurability. As the only scheme setting 'hard' targets for offsetting, the SBTi's Corporate Net Zero Standard takes the most stringent position around their use, requiring a 90% reduction in Scope 1, 2 and 3 emissions before being able to 'neutralise' residual emissions and claim net zero status. This is at odds with many real estate companies' current interpretation that net zero can be claimed by neutralising emissions once they achieve, or are on track to achieve, nearer term science-based targets, which typically represent a 25-50% reduction depending on timeframes and ambition levels.

73 Compared to a baseline of 800$kgCO_2e/m^2$ and 1000$kgCO_2e/m^2$ respectively today. See https://www.leti.london/ecp
74 For example, 2021 has seen the release of the UKGBC's Whole Life Carbon Roadmap and LETI's retrofit guidance.
75 The UKGBC's Guide to Scope 3 Reporting recommends a 60-year period should be modelled.
See https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2019/07/05150714/Scope-3-guide-for-commercial-real-estate.pdf

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4.4.3 Geographic relevance

Due to the dependency of current, and future, building carbon emissions on national electricity grids, asset location is a key factor in determining decarbonisation pathways. As previously mentioned, some countries already have an electricity supply that is at, or very close to, zero-carbon[76] but others are still operating off relatively 'dirty' grids which are largely serviced by fossil-fuel derived electricity.

Figure 4.9 shows the geographic coverage of the net zero schemes reviewed, with respect to five key economic regions of the globe. Nine of the 13 schemes are, in principle, relevant to real estate investments around the world. The SBTi and ILFI are universally applicable, and the WGBC net zero definition is intended for application globally, through national GBCs (of which there are currently 70).[77] CRREM is applicable in 44 countries and is likely to expand this list further in future. However, there are few global schemes that are available in non-English formats, which potentially poses a challenge to widespread use.

Figure 4.9: Comparison of Net Zero Schemes by Geography

Scheme	Europe	Asia	Pacific	Americas	Africa
ILFI ZCC					
ULI GreenPrint NZG					
SBT 1.5°					
SBT NZ Standard					
WGBC NZCBC					
Dutch GBC					
E+ C- (French GBC)					
LEED Zero (USGBC)					
LETI					
CRREM					
UKGBC					
BBP Climate Commitment		*	*	*	*
NZIF**					

Key

No Coverage	National Coverage Only	Partial Coverage	Full Coverage

* Applicable, in theory
** Uses CRREM as main tool for real estate investments

76 https://ember-climate.org/commentary/2021/05/14/oecd-zero-carbon-electricity/
77 https://www.worldgbc.org/our-green-building-councils

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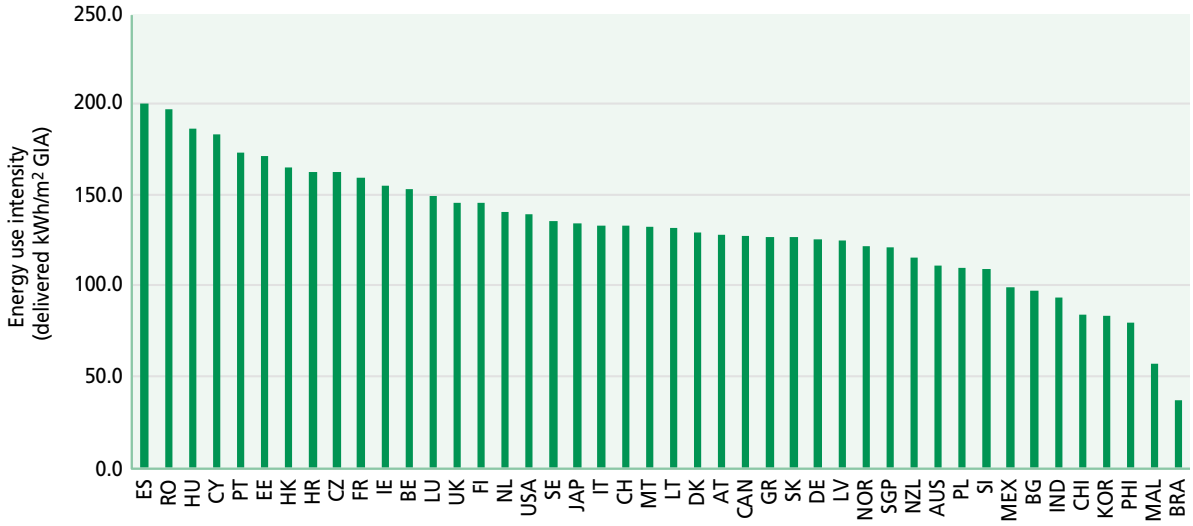
A small number of countries have seen more advanced guidance being developed, tailored to the local building stock or energy mix. These include the Dutch and UK GBC 'Paris-proof'-led approaches, the LEED certification scheme in the US and the 'E+C-' scheme in France. [78] Further specific national guidance around net zero exists in Australia (NABERS and the Climate Active Carbon Neutral Standard),[79] Brazil,[80] Canada (the Zero Carbon Building Standard),[81] Germany (the DGNB certification, which also extends to Denmark, Austria, Switzerland, Spain and Croatia),[82] South Africa (the NZC certification Scheme),[83] Sweden (NollCO_2, covering both operational and embodied carbon),[84] India,[85] Indonesia,[86] Singapore,[87] the UAE[88] and many other countries. As outlined in Section 4.3.2, many city-level commitments also exist to shape regional definitions of net zero buildings. An awareness of these national, regional and city-level requirements will avoid any misalignment of definitions and strategies for asset owners and managers operating in these locations.

The carbon intensity of electricity grids across the world varies significantly. Some net zero building performance targets address this by providing more stringent reduction targets on those countries with 'dirtier' grids. The CRREM project is one of few schemes available in the market that clearly distinguishes between targets for different locations, on this basis. For example, CRREM requires buildings in Malaysia to reduce their energy intensity to almost a third of the level that it requires of buildings in France, if they are not to be counted as 'stranded assets' by 2030. This is driven by the significant proportion of energy derived from coal in Malaysia's energy mix. Figure 4.10 expands upon this point, showing that there is a factor of six between the highest and lowest targets.

Figure 4.10: CRREM 2030 EUI Targets for Commercial Offices following 1.5° Pathway



78 http://isobioproject.com/wp-content/uploads/2019/01/Nicolas-Dutreix_Decarbonising-construction-in-France.pdf
79 https://www.industry.gov.au/data-and-publications/climate-active-carbon-neutral-standard-for-organisations
80 https://www.worldgbc.org/news-media/gbc-brasil-launches-net-zero-building-certification-through-worldgbc-project
81 https://www.cagbc.org/CAGBC/Zero_Carbon/The_CaGBC_Zero_Carbon_Building_Program.aspx
82 https://www.dgnb.de/de/aktuell/pressemitteilungen/2021/partnership-in-croatia?
83 https://www.worldgbc.org/news-media/green-building-council-south-africa-launches-net-zero-building-certification
84 https://www.sgbc.se/certifiering/nollco$_2$/
85 https://igbc.in/igbc/html_pdfs/IGBC%20Net%20Zero%20Energy%20Buildings%20Rating%20System_%20Pilot_Nov%20_2018.pdf
86 https://www.worldgbc.org/sites/default/files/GBC%20ANZ%20Snapshot_Indonesia_FINAL_25062020.pdf
87 https://www1.bca.gov.sg/buildsg/sustainability/super-low-energy-programme
88 https://www.worldgbc.org/news-media/uae-ready-mainstream-nearly-zero-energy-buildings-finds-new-report

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The principle of applying more stringent targets to countries with 'dirtier' grids appears reasonable from the perspective of encouraging investment towards lower carbon assets. The motivation would be to cast light on countries where greater supply side measures are needed to boost renewable investment. However, this is an ethically complex area, posing questions, such as:

- Is it fair to apply more stringent targets to countries that are developing and unable to invest in renewable infrastructure to the same degree as more developed economies?
- Would a consideration of historic emissions, rather than current emissions of the energy system, be a fairer approach and reflect the benefits that developed countries have derived from decades of fossil fuel dependency in their energy system?
- From the point of view of a real estate investment manager or developer, how workable is it to have widely diverging energy performance targets across countries, requiring very different build, fitout and operation standards and strategies?

Another important aspect of determining an asset's pathway to NZC is the maturity of the market in which it is located, with regards to low carbon real estate. Stakeholder feedback highlighted Europe and Australia as leading regions in identifying and setting pathways to NZC in real estate. In these markets it is likely that carbon will be priced-in to the valuation process sooner than regions which are further behind. Greater maturity, with regards to carbon, will therefore decrease the risks posed by the challenges outlined in Section 5 of this report. Asia-Pacific and the Americas were identified as being further behind Europe and Australia currently but beginning to take action.

4.4.4 Asset type

The final key factor in this comparison is building type. The broad range of different buildings and their respective energy requirements, makes setting a uniform carbon/energy reduction target across all building types relatively meaningless. For example, to keep within national carbon budgets, the carbon reduction required from a busy restaurant is going to differ substantially from that of an ambient temperature warehouse. Segmentation by asset type is therefore highly important for the production of decarbonisation targets.

Other than CRREM, the net zero schemes reviewed in this study do not segment asset type beyond the following classification; office, retail, industrial, residential and 'other'. Figure 4.11 illustrates the coverage of each of these asset types by the 13 net zero schemes. The darker green shade indicates that a given scheme provides specific, measurable targets for a given asset type. The lighter green shade indicates applicability but that reduction targets tailored to that asset type are not provided. A grey cell indicates that the approach is not currently applicable to that asset type. Most schemes (seven of the 13) provide general targets with no consideration of asset type specificity and only CRREM gives full[89] coverage of asset type specific target.

89 Within the five categories identified.

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Figure 4.11: Comparison of Net Zero Schemes by Asset Type

Key

Not currently applicable	Applicable, no specific targets	Applicable, specific targets

* Reduction pathway specified for commercial buildings but not for specific asset types
** Education & healthcare
*** Education
**** Uses CRREM as main tool for real estate investments

The need to differentiate net zero performance by asset type has been recognised by many existing schemes but is only directly put into practise, with the provision of multiple asset type specific targets, by three of the existing schemes. The baseline energy performance of office, retail, industrial or residential buildings differ fundamentally with factors including the energy intensity of activities in the building, the building occupancy hours and density, typical heating systems and the relative split between landlord and occupier-controlled space.

The office segment of the market has seen the greatest development of specific net zero schemes, particularly in the UK, Netherlands and Australia. Stakeholder feedback identified retail assets as being the most challenging building type to transition to NZC, due to the lack of homogeneity (even within sub-sector categories), independent occupier fitouts and lack of landlord control. Of the 13 schemes analysed, retail assets were also the least covered by specific targets (alongside industrial assets).

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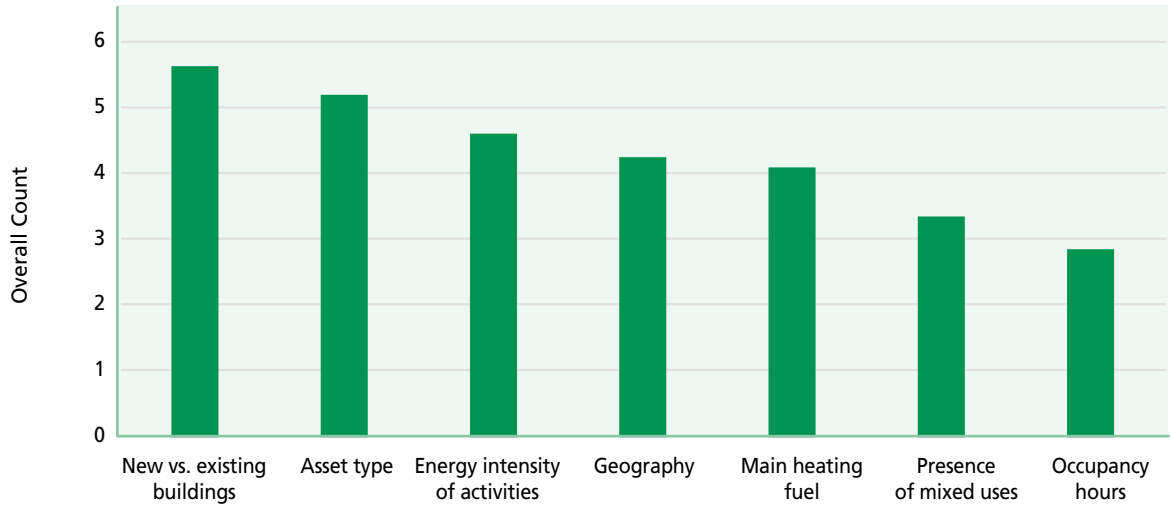
A challenge in segmenting by asset type lies in the level of granularity that net zero schemes should use and the fact that one single scheme cannot capture all of the underlying diversity of domestic, commercial and industrial buildings. The CRREM project, for example, does not differentiate between food retail (hypermarkets, supermarkets, etc.) and non-food retail within the Retail Warehouse or Shopping Centre property types. Moreover, the energy intensity of hotels can vary significantly between a 3-star and 5-star hotel, based on the presence of energy-intensive facilities, such as restaurants and swimming pools. Therefore, the use of a single energy intensity target by asset type (and/or country) may not be whole appropriate. Stakeholder feedback suggested that a rating system that considers other factors, such as occupancy, may be a more appropriate way forward for addressing the broad diversity of asset types.

4.4.5 Further market segmentation

Stakeholder feedback was generally supportive of segmenting the market by asset type and location, but there were suggestions for extending the segmentation to further building characteristics, to reflect the diversity of the building stock. Stakeholders were, however, cautious of creating too much granularity, which risks giving actors the opportunity to delay action while waiting for the perfectly applicable scheme. The challenge of striking the right balance between simplicity and capturing the nuances of different building types is therefore significant.

There were diverging views on which specific characteristics of buildings should be used to differentiate the meaning of net zero performance. Figure 4.12 shows the results of a relevant question from the survey on segmentation. The term 'Overall Count' refers to a total score obtained by each response, based on where survey participants ranked the answer. The higher the count, the greater priority the response was given by most stakeholders.

Figure 4.12: Stakeholder Feedback on Major Differentiators for NZC Performance[90]



90 Source: IPF-Verco Survey (2021), 23 participants. Survey question read "Please rank the characteristics you believe should be used to differentiate what NZC performance means"

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Further information on each of the responses, not yet discussed in the above sections, are provided below:

New versus existing buildings. Participants felt that new buildings should be held to higher standards around operational energy and carbon performance than existing buildings. The level of opportunity to influence energy performance standards at the development stage was generally considered higher than in the operational phase – noting the documented challenge of the 'performance gap' between design and actual performance. Some net zero schemes treat new and existing buildings differently, but not all.

Energy intensity of activities. This is connected to asset type, with asset type being the main determinant of the typical energy intensity of a building's activities.

Main heating fuel: Few net zero schemes currently assume full electrification of heating systems within their targets.[91] While the main heating technologies of buildings can be a material determinant of carbon intensity, few interviewees felt it necessary to segment the market in this way.

Occupancy hours: Few net zero schemes currently take account of occupancy hours, despite the immediate impact this has on building energy use.[92] This approach can avoid penalising landlords and occupiers using space efficiently, with greater occupancy density and reduced operating hours. Similarly, whole building and tenancy ratings make allowances for the density of occupants.[93]

4.4.6 Case studies

Alongside the above qualitative comparison, a series of net zero schemes were compared quantitatively, using a set of building case studies. This analysis was conducted using the following 18 building archetypes.[94,95]

Table 4.2: Case Study Archetypes

Asset Type	Europe	North America	Asia
Office	Netherlands	USA	Australia
Retail, Shopping Centre	Sweden	Canada	China
Retail, Warehouse	Portugal	Canada	China
Industrial, Distribution Warehouse	Poland	Canada	South Korea
Residential, Multi-family	UK	USA	Japan
Hotel	Germany	USA	Australia

Key

Existing build	New build

91 An example is the UKGBC Paris proof targets for commercial offices
92 An example is the NABERS base building rating scheme (used in Australia, New Zealand and the UK, with pilot certifications for buildings in India in 2015, and Hong Kong and Indonesia in 2017)
93 https://files.bregroup.com/nabers/Guide_to_Design_for_Performance.pdf
94 The two highlighted archetypes within this table are assumed to be new builds – built to current best practice standards – while the remainder are assumed to be existing building.
95 While CRREM provides some city-based targets for the United States, this list is not exhaustive and the project does not distinguish between individual states within the US and Australia, which have different grid intensities based on the energy mix.

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For each archetype, a summary description was created using a combination of anonymised real building data and various industry benchmarks, including the UK Building Energy Efficiency Survey[96] and the Cornell Hotel Sustainability Benchmarking Index.[97] Table 4.3 provides an example of these details for one case study.

Table 4.3: Profile of Archetype One

City	Amsterdam
Country	Netherlands
Asset type	Office
Floor area (m^2)	1500
Main heating fuel	District Heating
Occupier activities	85% Office, 15% Retail
Energy intensity	75 kWh/m^2 (district heating) 135 kWh/m^2 (electricity)
Additional information	No air conditioning and no existing PV array

The baseline energy and carbon intensity[98] for each building was compared to the 2030 and 2050 performance metrics set by applicable net zero schemes. Using data from Verco's building analysis and auditing work, the typical carbon-savings that can be achieved by a series of measures were modelled for each archetype. Comparing the baseline, technical potential and net zero performance for each asset, the archetypes that might pose the greatest challenge in the pathway to NZC were identified. The conclusions from this analysis are outlined below, but for those readers looking for a more detailed comparison of net zero schemes, the full case study analysis is presented in Appendix C.

Figure 4.13 shows the whole building energy use intensity of each case study archetype, with the height of each bar representing the typical baseline energy performance. Potential reductions in grid energy demand were identified for each case study, including energy efficiency measures, heat decarbonisation and on-site renewable energy installation. These reductions (combined in the green segment of the figure) are highly dependent on asset type. However, analysing the reduction potential of each building emphasised the significant energy and carbon savings that can be realised through immediate implementation of simple control and management measures. Figure 4.13 also shows how the energy intensity targets set by CRREM vary by location and asset type. While many of the 2030 targets are believed to be achievable, the 2050 targets are in most cases, not achievable with current technologies, even with more capital intensive and disruptive measures.

Figure 4.14 compares the 2030 carbon intensity targets, provided by a selection of net zero schemes, with the typical baseline performance of commercial office buildings in the Netherlands, USA and Australia. This figure shows the wide variation in requirements for carbon reductions by 2030 under different net zero schemes. This further highlights the lack of market consensus on the necessary stringency of short term/interim targets and the further challenges that are presented to managers of diverse funds.

96 https://www.gov.uk/government/publications/building-energy-efficiency-survey-bees
97 https://ecommons.cornell.edu/handle/1813/74089
98 Expressed in kWh delivered energy /m^2 Gross Internal Area

4. NET ZERO CARBON IN INTERNATIONAL REAL ESTATE INVESTMENT

Figure 4.13: Technical Potential of Case Studies (Energy Basis)

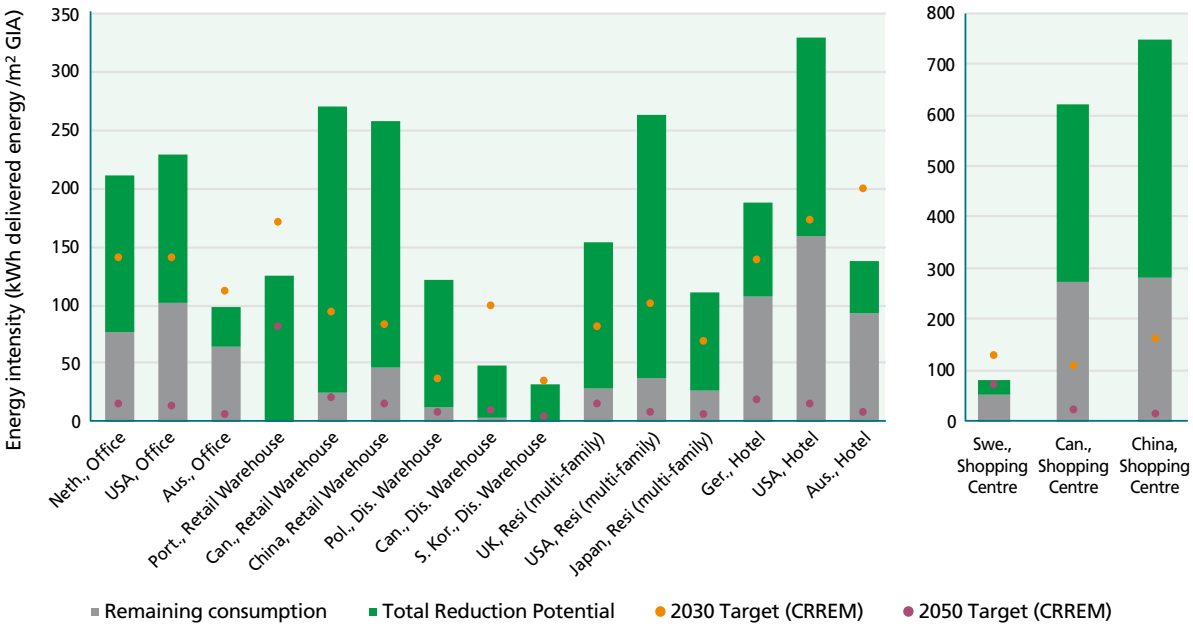
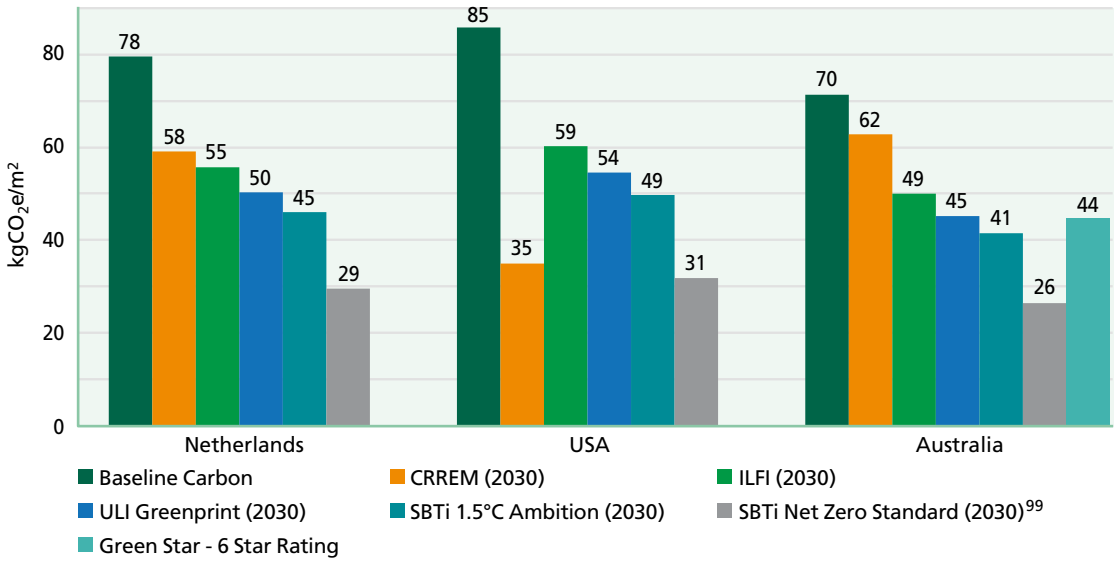


Figure 4.14: Regional Differences for Commercial Office Carbon Intensity Targets



99 Reduction for commercial buildings differs from the near-term 1.5°C ambition for 2030
https://sciencebasedtargets.org/resources/files/SBTi-Net-Zero-Standard-Corporate-Manual-Criteria-V1.0.pdf - pg 16

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Further findings from this analysis include:

- In terms of technical potential for grid energy demand reductions, warehouse assets – often with significant roof-space – can achieve reductions of up to, or in excess of, 80-90%. Offices can typically realise savings of 30-50%. For assets with more energy-intensive services, such as hotels and shopping centres, savings can be limited to 20-40%.
- As illustrated by Figure 4.14, the 2030 targets set out by the various net zero schemes are somewhat inconsistent (ranging from 30% to 60% reduction in carbon, on a 2020 baseline) but achievable with today's technologies.
- The 2050 energy intensity targets proposed by CRREM, and the 98% reduction in carbon emissions from non-domestic buildings proposed by the SBTi Net Zero Standard[100], are significantly challenging to achieve with today's technologies, and may not be cost-effective to deliver at scale in some geographies.
- While specific energy or carbon intensity targets may be subject to change in the future, use of the CRREM tool – combined with other net zero benchmarking approaches – should allow asset managers to categorise assets into cohorts based on risk; those furthest from the performance requirements may be candidates for more substantial intervention, while for those deemed low risk, more incremental changes may be sufficient. Although useful as a means of assessing risk within diverse property funds, CRREM does not provide any significant guidance on achieving the reductions required to reach their targets.
- Whichever net zero scheme is followed, the best strategy in the short term is to move ahead with sensible interventions to improve the quality and quantity of data collected and deliver 'no regrets' measures to reduce energy demand by better control and management.
- The sooner that asset managers are able to electrify buildings and install on-site renewable energy generation, the better. As well as aligning with the 'Paris-proof' principle, these measures will greatly contribute to achieving reduction targets.

100 https://sciencebasedtargets.org/resources/files/Net zero-Standard.pdf - pg 18

5. CHALLENGES IN TRANSITIONING THE REAL ESTATE INDUSTRY TO NET ZERO CARBON

This study identified a series of challenges that face the transition to NZC in real estate. Stakeholder feedback suggested that the three main challenges facing the transition are inconsistent net zero definitions, industry skill gaps and limited evidence on costs of net zero retrofit. Verco's experiences in delivering NZC within real estate have highlighted three more important challenges that have also been investigated. A series of actions have been outlined in this section, with the aim of supporting the market and investors in navigating these six key challenges to move the industry toward NZC.

The research also highlighted the potential for inadvertent impacts that may arise in the journey to net zero. Five potential unintended consequences are outlined in the second half of this section, alongside potential responses that could mitigate each risk. The most prominent of these unintended consequences is the trade-off between embodied and operational carbon, stressing the need for a carbon pricing system that truly reflects the societal impact of carbon.

5.1 Challenges and Actions

Stakeholder feedback highlighted many challenges that the real estate investment industry faces, in the transition to NZC. Figure 5.1 shows a compilation of the most cited challenges, with those most frequently mentioned featuring at top of the table. Combined with Verco's experiences of challenges in achieving NZC within real estate, the six most material challenges facing the industry have been identified and outlined in this section. Table 5.1 summarises the findings of this section, presenting the actions that can be taken by the market, and individual real estate investors, to help overcome each challenge presented.

Figure 5.1: Stakeholder Feedback on Challenges of NZC in Real Estate

Inconsistent net zero definitions		Industry skill gaps		Limited evidence on costs of net zero retrofit	
Misalignment of landlords and occupiers	Lack of net zero certification scheme		Lack of government policy support		Lack of primary data for GHG footprinting
Lack of financing mechanisms	Ineffective legislation based on theoretical performance	Gap between operational and theoretical performance	Decarbonisation of heat	Lack of future proofing within net zero frameworks	Unclear responsibility around Scope 3 emissions

5. CHALLENGES IN TRANSITIONING THE REAL ESTATE INDUSTRY TO NET ZERO CARBON

Table 5.1: Key Challenges and Actions

Challenge	Action from the Market	Action from Real Estate Investors
Inconsistent net zero definitions	• Highlight differences between net zero schemes • Define core principles of net zero as a basis of future certification schemes	• State clear, measurable net zero/carbon neutral goals and commitments • Disclose verified performance metrics • Support adoption of consistent net zero principles
Misaligned approaches to net zero from landlords and occupiers	• Document examples of landlord-occupier collaboration on net zero projects and buildings • Delineate responsibility between 'base building' and occupier energy performance benchmarking	• Identify misalignment between schemes used by occupiers and investors • Engage in owner-occupier forums • Engage with managing agents to better collaborate with occupiers
Skills gap around net zero concepts and practices	• Work with relevant industry bodies and providers to develop specific training courses • Incorporate content on NZC within key professional qualifications	• Integrate training on net zero concepts into induction materials • Utilise external courses to upskill current workforce on sustainability concepts • Implement skill sharing strategies between sustainability experts with wider business
Limited evidence on costs of net zero retrofit	• Develop costed examples of asset level net zero transitions • Incorporate NZC into the valuation process	• Improve interdisciplinary collaboration to gain a rounded picture of transition costs • Advocate merits of net zero property to prospective occupiers and valuers
Lack of primary data for GHG footprinting	• Include a wider scope of emissions in commitments, derived from primary data • Mandate data sharing between landlords and occupiers	• Amend procurement specifications and green leases to include the sharing of energy and emissions data • Encourage greater landlord-occupier collaboration, incentivise data sharing and advocate the value of green clauses • Provide support to suppliers on carbon accounting and disclosure
Lack of government leadership	• Introduce performance-based policy frameworks for rating buildings at base building, tenant, and whole building levels • Introduce requirements to disclose embodied carbon of new developments and major refurbishments	• Provide pressure and support to governments through consultation responses and lobbying • Engage in industry forums designed to develop best practice to help steer policymakers

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5.1.1 Inconsistent net zero definitions

Stakeholders reported that the abundance of net zero commitments in the market creates confusion about the real meaning of net zero and makes comparisons difficult. Third-party verification is a crucial aspect of a standardised, comparable approach, yet this form of verification for net zero claims is not commonplace in the market.[101] The lack of a widely used and standardised net zero verification, or certification, for all asset classes and locations is seen as an inhibitor of commercial value aligning with the net zero agenda.

Typical quotes from stakeholder interviews on this challenge included:

"We need a consistent and transparent way in measuring/reporting emissions across portfolios, otherwise what do net zero targets mean?"

"We need to consider how we communicate net zero to the market and occupiers. Most may not appreciate the difference between NZC claims."

"We need clarity around NZC for buildings. How do you truly state your asset is NZC?"

Some schemes exist that begin to address this challenge concerning commercial value and a standardised, verified approach;

- The ILFI Zero Carbon Certification, launched in 2018, represented the first worldwide Zero Carbon third-party certified standard, at the building level;
- The SBTi's Corporate Net Zero Standard, released in late 2021, represents the first external, independent verification of individual corporate net zero targets;
- The NABERS scheme – originating in Australia but now active in New Zealand and the UK for commercial offices – has shown evidence of creating a commercial differentiation in Australia. A 5-star NABERS energy rating has been shown to deliver a 9% green premium in value, with a 2-3% premium for a 3 to 4.5 star NABERS Energy rating;[102]
- BREEAM certification has been shown to correlate with a rental premium in some markets;[103,104]
- LEED-certified buildings have shown some evidence of a rental premium compared to non-certified buildings, although this has been disputed;[105]
- Both LEED and BREEAM look at a broad range of environmental impacts. One stakeholder noted that current certifications are not directly affecting valuations but are helping to make sustainable performance more transparent, which may speed up transactions for certified assets.

A lack of a consistent net zero certification methodology was not seen as the only friction to the 'pricing in' of NZC performance. The way in which buildings are currently valued is seen by stakeholders as a more 'backward-looking' process, rather than a forward view on transaction potential. A 2021 report by the property stock exchange IPSX noted that valuers typically look at historical trends rather than forward-looking expectations.[106]

101 In October 2021, the UKGBC released their conclusions from a market analysis on the use of NZC building verification schemes, which provides further information on the recommendations for such a scheme.
102 https://www.certifiedenergy.com.au/benefits_of_nabers/
103 https://www.scopus.com/record/display.uri?eid=2-s2.0-84938962296&origin=inward&txGid=adcacbd23da0833c5771d5b3b67d8859
104 https://www.sciencedirect.com/science/article/pii/S2212609016300322#b0140
105 https://www.mdpi.com/2071-1050/12/7/2729/pdf
106 https://www.ipsx.com/news/net-zero-and-asset-valuation-carbon-intelligence/

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More mature markets are beginning to see evidence of carbon performance being incorporated into the valuation process, through the use of EPC ratings.[107] However, EPC ratings provide little information in the form of actual energy use, meaning that real carbon performance is still yet to be widely included within asset valuation. Accelerating change in the valuation perspective also requires a shift in occupiers' attitude to net zero, towards demanding it in their agreements to lease.

While it is in principle possible for the industry to agree on a consistent framing of net zero, it is noted that the specific energy or carbon intensity targets that fall out of this will always be subject to change as they are forward predictions of a complex and unpredictable picture. Carbon budgets, renewable capacity projections and structural changes in the economy will need to be continually updated to reflect new evidence. The challenge will therefore be aiming at a 'moving target'.

Actions to overcome the challenge

- Publish research outlining the differences between net zero schemes and exploring their real-world implications. This is one of the core aims of this report.
- Converge on a set of definitions and key principles for NZC, especially in areas where there is currently divergence between schemes, such as when offsetting might be used.
- Integrate net zero principles into all building certification schemes, aiming also to penetrate non-English language examples. Clear classification of buildings as 'in transition to net zero' (i.e. carbon neutral, NZC efficient or NZC ready), net zero or absolute zero will help bring clarity to the market around key terms, making it harder for ambiguous net zero claims to be made and potentially facilitating the 'pricing in' of net zero performance.
- Use clear, measurable commitments/goals and frequent disclosure of measured performance against targets to accommodate the constantly changing requirements of the net zero agenda.

5.1.2 Misaligned approaches to net zero from landlords and occupiers

Occupier activities often comprise the majority of a building's total operational footprint,[108] meaning that effective collaboration between landlords and occupiers is required if NZC is to be achieved at a 'whole building' level. This poses a particular challenge in multi-tenant assets such as shopping centres. The relationship between a landlord and occupier is fundamentally a commercial one with potential for 'split incentives'. This was regarded by stakeholders as an inhibitor of progress. The 'institutional lease' model was deemed by one interviewee as *"unfit for purpose when viewed through a NZC lens"*. Other industry commentators have noted challenges with this model in relation to progress on ESG issues.[109,110]

107 https://www.blackrock.com/uk/intermediaries/literature/whitepaper/natwest-blackrock-nzc-uk-real-estate-en-uk-pc-whitepaper.pdf
108 https://www.egi.co.uk/news/collaborating-for-climate-change-transforming-the-owner-occupier-dynamic-is-key/
109 https://www.nortonrosefulbright.com/en/knowledge/publications/f7aa95cd/rip-it-up-and-start-again-how-the-traditional-lease-model-must-evolve
110 https://lpscdn.linklaters.com/-/media/digital-marketing-image-library/files/01_insights/publications/2021/april/gc22441_real_estate_talking_points_flexible_leasing_1pp_a4_flyer_final_screen.ashx?rev=c06b4de9-07bb-4e16-b26a-4ac472827fd2&extension=pdf&hash=337CF145F961254BD0403E6388703EFE

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Even in instances where both parties are aligned on the objective of net zero at a corporate level, a series of commercial, technical and cultural trade-offs can inhibit collaboration:

- **Commercial:** Capital expenditure for energy efficiency measures may come from the landlord but the savings may accrue to the occupier. Conversely the occupier may incur increased service charges to pay for these measures when their tenancy expires before the benefits have been realised.
- **Technical:** The landlord may need to access occupier space in order to make substantial HVAC or fabric improvements, which may not align with the occupier's preferred timeframes.
- **Cultural:** Some occupiers are not comfortable sharing sub-metered energy consumption data on the basis that this is commercially sensitive or does not offer any advantage to them for the time investment required. This was deemed especially notable for assets under leases in which the landlord does not have management responsibility or leases where all liability falls to the occupier. Retail buildings were cited as particularly challenging with landlords often having less control over the occupier fitout and individual retailers in multi-let shopping centres sometimes having their own sources of power / heating that are not centrally controlled.

Actions to overcome the challenge

- Align landlords and occupiers on the principles of NZC, as it relates to buildings. If landlords and occupiers make net zero commitments with different scopes, different or unclear rates of decarbonisation and differing approaches to offsetting, they will struggle to reach agreement on tangible next steps.
- Engage in owner-occupier forums, such as the Observatoire de L'immobilier Durable in France and those set up by National GBCs, to facilitate collaboration through knowledge-sharing platforms. Participation in these forums can be made a contractual requirement as part of green lease arrangements – alongside more standard clauses requiring occupiers to share energy data with their landlords.
- Use managing agents as facilitators between landlords and occupiers (one interviewee referred to agents as the 'linchpin').
- Delineate responsibility. While a 'whole building' approach is essential for the achievement of NZC, the use of both 'base building' and landlord energy performance benchmarking can somewhat reduce the pressure on landlord-occupier collaboration.

5.1.3 Skills gap around net zero concepts and practices

The integration of NZC principles across investment and development processes will require upskilling across the industry. The skills gap around zero carbon in the real estate sector has been well-documented by organisations in the UK, including the Engineering Construction Industry Training Board[111] and the Institute for Public Policy Research.[112] Some gaps relate to specific technologies (for example, in the UK 1.6 million gas boilers are currently being installed per annum, compared to 20,000 heat pumps).[113] The skills gap extends to the data and technical solutions to deliver NZC – a 2021 report from the CFA Institute in the US found that

111 https://www.ecitb.org.uk/blog/2020/03/04/skills-and-training-critical-to-meet-net-zero-targets-says-new-report/
112 https://www.edie.net/news/6/Green-skills-gap--could-derail-net-zero---major-UK-construction-firms-tell-Government/
113 https://www.aldersgategroup.org.uk/latest/detail:skills-deficit-needs-to-be-urgently-tackled-to-get-to-net-zero

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while seven out of every 10 investment professionals use ESG data only one in 10 are confident that they are equipped to understand it.[114]

More broadly, while there is continued uncertainty and competing ideas in the market about what 'net zero' means, these issues can be challenging for non-ESG experts to engage with. This was found to be especially so in North America and Asia, where ESG and net zero are less mature concepts than in Europe and Australia, for example.

Typical quotes from stakeholder interviews on this challenge included:

"There is a skills gap for retrofit, design and low carbon identification - particularly on the residential side."

"Most REITs have a few in-house experts but fail to develop skills for key positions such as technical managers, developers or acquisition analysts"

"Even ESG-focussed people in investment / fund management are still learning"

For some stakeholders, ESG is an area of personal interest and not part of their 'day job'. The challenge facing the industry is that the majority of future decision-makers around net zero buildings will not be sustainability professionals and they will need clear principles to guide them in this complex area.

Key actions to overcome this challenge

- Integrate training on net zero and related concepts into induction materials. This will be particularly important for those job roles at the critical points in an asset's lifecycle (including acquisition, construction and development), as well as wider research and strategy teams.
- Integrate ESG and sustainability experts into wider teams and job descriptions will ensure that key concepts are shared. The roles of individuals central to delivering net zero should be recognised by their rewards and service conditions, creating an aura of prestige and helping to attract the best applicants.
- Use external training courses designed to address the interface between ESG and real estate investment. Such training courses should be developed with relevant industry bodies, such as the BBP's programme specifically for real estate professionals, focused on integrating ESG into the property investment management process.[115] Professional qualifications centred on NZC can also then be developed.

114 https://www.cfainstitute.org/-/media/documents/survey/future-of-sustainability.ashx
115 https://www.betterbuildingspartnership.co.uk/our-projects/esg-training-course-real-estate-professionals

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5.1.4 Limited evidence on costs of net zero retrofit

There was a perception among stakeholders that the process of costing the transition to NZC at a building level suffered from imperfect and incomplete information. There is a general lack of information in the market about the costs to deliver NZC buildings, with few costed case studies enabling comparison of the relative cost effectiveness of different measures in different types of building. External advisors and consultants, often employed to produce roadmaps to NZC, are detached from internal finance teams within real estate client businesses, leading to further reliance on estimations and misalignment in costing approaches and investment strategies.

One interviewee noted that where net zero transition plans for assets were being costed, this exercise often overlooked the costs due to loss of income associated with retrofit work. Furthermore, the upsides of investments to deliver net zero performance – in the form of rental premium or increased asset valuation – are not yet strongly evidenced in literature, with the exception of mature markets, such as the central London office market,[116] or Australia. In an April 2021 report, JLL compared an example scenario of a 2030 net zero standard refurbishment to a basic refurbishment and found a potential increase in ungeared internal rate of return of 106 basis points.[117] A greater volume of such evidence is required however to incentivise investment at scale.

Typical quotes from stakeholder interviews on this challenge included:

"There is challenge in retrofitting the current building stock, and how to fund this."

"We need more collaboration between sustainability consultants producing roadmaps and internal financial teams to see how this works in practice and understand how much money is required for each milestone of the roadmap. This is currently a grey area."

"We need the financial involvement of investors to help implement net zero strategies"

Actions to overcome this challenge

- Increase the number of published case study examples, costing net zero transitions at the asset level. This will allow for a more sophisticated approach to acquisition due diligence and enable investors to better balance risks against opportunities associated with the cost of a NZC transition. Improving these acquisition due diligence processes (to capture the potential costs of net zero measures) will also enable the incorporation of NZC into the valuation process. This will be further enabled by the increasing appetite of occupiers to demand net zero space. Real estate investors can influence both of these factors by advocating the merits of net zero property and highlighting the importance of climate risk to valuers.
- Encourage collaboration between consultants and internal finance teams to enable a more rounded picture of the transition costs (and upsides) and avoid a one-sided view.

116 https://www.jll.co.uk/en/trends-and-insights/research/the-impact-of-sustainability-on-value
117 https://www.jll.co.uk/en/views/valuing-net-zero-esg-for-offices

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5.1.5 Lack of primary data for GHG footprinting

The accurate measurement of the whole life carbon impact of buildings is crucial to reaching net zero. However, a number of challenges in obtaining the primary data, necessary for defining whole life carbon impact, were identified through this research:

- Occupiers were cited as hesitant to share energy data in some cases, requiring landlords to use benchmarks or estimation methods to fill the gap. This was especially the case in retail and industrial buildings.
- Very few developers and asset managers are currently quantifying the embodied carbon impacts of their schemes. The use of lifecycle assessments in construction projects is not widespread, while only a minority of construction materials have an Environmental Product Declaration (EPD).[118] As a result, where investors and investment managers outsource developments, they are unlikely to be able to obtain primary carbon data on the embodied carbon impacts of the materials.
- Real estate companies seeking to quantify emissions from their suppliers – ranging from accountants, marketers, property managers and auditors to security, cleaning and transport firms – find it challenging and labour-intensive to gather emissions figures for inclusion in their Scope 3 footprint. Where this data is available, it is generally limited to the largest suppliers with the relevant internal capacity and skills, often with their own commitments to decarbonisation.

While a move towards greater measurement and disclosure will be beneficial, there is a need to identify where the 'law of diminishing returns' becomes relevant. Some sources of Scope 3 emissions can be immaterial and/or difficult for real estate investors to reasonably influence. Stakeholder feedback supported the view that operational and embodied carbon were priority areas, with other areas of Scope 3 often more suited to a corporate definition of NZC.

Actions to overcome this challenge

- Use/develop net zero schemes that mandate a wider scope of emissions to be included in commitments and derived from primary data. This will be further enhanced by the introduction of national regulations that mandate data sharing between value chain parties (particularly landlords and occupiers)
- Amend procurement specifications and green leases to include sharing of energy and emissions data by suppliers and occupiers.
- Convene owner-occupier forums to encourage greater landlord-occupier collaboration, incentivise data sharing and advocate the value of green clauses.
- Provide training to suppliers on carbon accounting, and encouragement to disclosure via platforms such as CDP.[119]

118 A document that transparently communicates the environmental performance or impact of any product or material over its lifetime.
119 https://www.cdp.net/en

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5.1.6 Lack of government leadership

Currently only Sweden, Denmark, France, Hungary, New Zealand and the UK have passed NZC or carbon neutrality laws.[120] A further five countries have legislation in development, including Canada, Chile, Fiji, South Korea and Spain (in addition to the EU as a bloc). As only a minority of governments globally have incorporated net zero into law, stakeholders saw government leadership as a large challenge to transitioning the market. While net zero schemes provide a vehicle for market leaders to forge a path ahead, government leadership will be required to ensure minimum standards are met by the rest of the market. In particular, the introduction of performance-based policy frameworks (for rating the energy and carbon performance of commercial and industrial buildings) will be necessary to drive consistency in the market.

Governments also play an important role in ensuring there will be sufficient zero carbon electricity supply to meet demand and replace existing fossil fuel fired electricity generation, a crucial foundation of the 'Paris proof' approach to NZC, championed by the Dutch Green Building Council.

Actions to overcome this challenge

- Introduce market-lead, performance-based frameworks for rating the energy and carbon performance of commercial and industrial buildings. Within these frameworks will be distinctions between base building, tenant, and whole building performance, as well as requirements to disclose embodied carbon of new developments and major refurbishments. These will help facilitate the development of meaningful government policy frameworks.
- Provide pressure and support to governments through consultation responses and lobbying, as well as engagement in industry forums designed to affirm best practice to help policymakers set the appropriate market direction.

5.2 Unintended Consequences of Net Zero

There are likely to be unintended consequences of moving to NZC, as net zero goals come into conflict with other priorities and objectives. Many of these may not be realised until it is too late but stakeholder feedback highlighted five notable areas where unintended consequences might arise. However, the materiality of each possibility, and the interaction between these actions and the changes required, is uncertain. The questions that could outline these five unintended consequences are presented in Figure 5.2. Detailed explanations of each are provided below, along with responses to mitigate the potential risks.

120 https://www.visualcapitalist.com/race-to-net-zero-carbon-neutral-goals-by-country/

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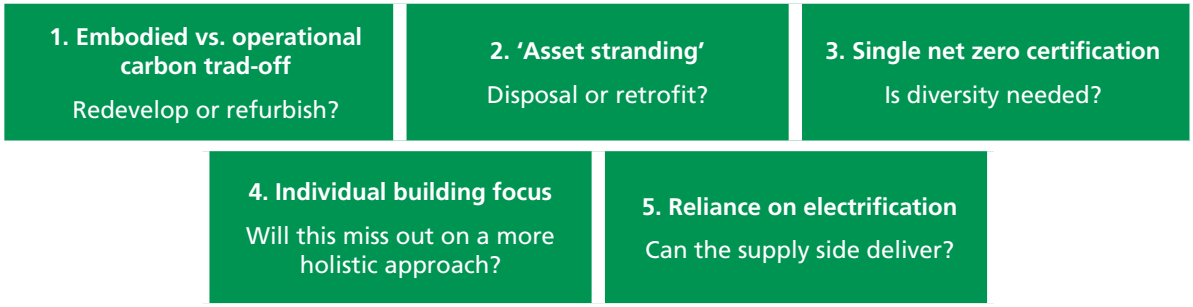
Figure 5.2: Unintended Consequences of NZC in Real Estate



5.2.1 Embodied versus operational carbon[121] trade-off – redevelopor refurbish?

The journey to operational NZC emissions will involve the implementation of energy efficiency upgrades, on-site renewable energy systems and low carbon heating systems. While delivering a reduction in operational carbon, the embodied carbon associated with the manufacture and installation of these technologies can be significant. Therefore, a failure to consider both operational and embodied carbon may mean that efficiency measures do not offer a carbon 'payback' – analogous to the commercial payback associated with energy saving measures.

Studies show that the embodied carbon of some measures can be significant. Circular Ecology found that the embodied carbon associated with installing crystalline photovoltaic (PV) panels on a notional 10,000m^2 UK office building could add almost 50% to the original embodied carbon of the building and take more than 20 years to pay back.[122] This creates a paradoxical 'chicken and egg' situation – in order to decarbonise it will be necessary to invest in more renewables, but this requires consideration of the embodied carbon impact. This paradox is particularly applicable to situations involving a choice between a full rebuild or a minor refurbishment and raises a number of questions:

- If a full rebuild will yield a significantly improved energy or carbon performance, but cost a significant amount of carbon to do so, what is the right decision from the point of view of achieving NZC?
- Should poorly performing buildings be demolished and rebuilt to high levels of performance, or retained?
- Which technologies offer the best return on investment from a whole life carbon point of view?

Currently the main barrier to informed answers to these questions is a lack of data on embodied carbon impacts. Manufacturers of technologies, such as heat pumps or solar panels rarely measure and disclose the embodied carbon of their products, although there is a growing body of academic literature on this matter.[123] A study by OneClickLCA found the average cost of outsourcing an EPD was between US$10,000 - 30,000.[124] Life-Cycle Assessment (LCA) tools such as OneClickLCA – which has the largest available EPD database in the world – has very few EPDs for heat-generation equipment, compared with construction materials.[125]

121 Carbon emissions associated with the operational stage of the asset lifecycle – mostly attributed to emissions from energy use in buildings.
122 https://circularecology.com/solar-pv-embodied-carbon.html
123 https://www.sciencedirect.com/science/article/pii/S0378778817323101
124 https://www.oneclicklca.com/ebook-epd-how-to-make-environmental-product-declaration/
125 https://www.elementaconsulting.com/wp-content/uploads/2019/08/Whole-Life-Carbon-of-heat-generation-April-23.04.19.pdf

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In anticipation of potential future regulation and/or carbon taxes affecting the embodied carbon associated with new developments and major refurbishments, some real estate companies are choosing to use an internal carbon price to drive more sustainable choices around build specification. Such carbon prices can avoid sub-optimal investment decisions, from a net zero perspective, which may arise from a total operational carbon focus.

Possible mitigants:

- Greater pressure placed on suppliers and construction companies by real estate developers to undertake whole life carbon assessments of the materials and equipment being installed, initiating a shift toward low carbon materials and processes.
- Employment of lifecycle assessment[126] tools during the design stage to compare the embodied carbon impacts of design choices.
- Implementation of internal carbon pricing – at a level reflecting the true societal costs of carbon – to provide an internal price signal and drive net zero optimal build specification choices.
- Development of net zero materials and equipment by suppliers to the construction industry (e.g. steel, cement and glass).

5.2.2 'Asset stranding' – disposal or retrofit?

A term coined by the CRREM project[127] to assess carbon risk; an asset may become 'stranded' if action is not taken to decarbonise it in line with predicted requirements and timelines. The incipient devaluation of assets that pose a greater carbon risk may lead to widescale disposal of risky asset classes. This reallocation of carbon liability could divert investment away from low carbon retrofits and result in a higher carbon outcome as assets are demolished and rebuilt. This is of particular concern for asset types with wide underlying variability in energy performance – less well suited to a single intensity target.

Stakeholder feedback showed little concern that certain buildings might genuinely become stranded assets, at risk of irredeemable devaluation. As carbon performance and asset value become more aligned, the market is expected to price in this risk. Vendors may have to accept a lower price, based on an assessment of the investment required to align the asset with net zero performance. This may create openings in the market for opportunistic investors looking to transition distressed assets to net zero and reposition them in the market. However, there is a close link between this outcome and the aforementioned challenge, regarding limited evidence on the costs of net zero carbon retrofitting.

Yet, some stakeholders expressed concern that an excessive focus on carbon stranding may lead to negative social impacts, as buildings with important social utility may become less desirable to the market.

126 A methodology used to calculate the whole life carbon of a product.

127 Hirsch, Jens; Lafuente, Juan José; Recourt, Rik; Spanner, Maximilian; Geiger, Peter; Haran, Martin; McGreal, Stanley; Davis, Peadar; Taltavull, Paloma; Perez, Raul; Juárez, Francisco; Martinez, Ana Maria; Brounen, Dirk. (2019): Stranding Risk & Carbon. Science-based decarbonising of the EU commercial real estate sector. CRREM report No.1, 2019, Wörgl, Austria.

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Possible mitigants:

- Improvement in the understanding of the capital costs of delivering net zero performance for existing buildings, through NZC audits and exemplar projects.
- Incorporation of NZC assessments into acquisition due diligence, and balancing of risks against opportunities associated with the cost of a NZC transition.
- Acceptance of a lower rate of return on capital used to transition to NZC, to protect future returns.
- Application of an internal carbon price in decision making around disposals, refurbishments and developments.
- Consideration of other aspects of ESG strategies when reacting to carbon risk, to avoid 'carbon tunnel vision'

5.2.3 Single net zero certification – is diversity needed?

Stakeholder feedback was generally supportive of a net zero certification for buildings. However, some raised concerns that the convergence of the market around a single NZC certification scheme will put the industry at risk of 'putting its eggs into one basket', particularly if the scheme is later found to be ineffective. Some stakeholders felt that a diversity of net zero schemes in the market may actually be positive or necessary, given the spectrum of stakeholders involved.

Possible mitigants:

- Convergence on a robust and lasting set of net zero definitions and principles that can underpin and standardise a diverse range of net zero schemes in the market.

5.2.4 Individual building focus – will this miss out on a more holistic approach?

Net zero schemes generally consider a building independently from any wider systems, such as energy networks or wider municipal regions. This may cause asset managers to miss opportunities to collaborate with wider stakeholders seeking to deliver NZC at the city or district level. For example, a landlord may invest heavily in electrifying a building and miss the opportunity to join a local heat network that has a plan to deliver zero carbon heat more quickly than the grid.

On the other hand, investors could find their assets are locked into district networks supplied by high carbon sources; increasing the risk of stranding. Barriers to resolution may lie at city, state or national level, depending on the country.

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Possible mitigants:

- Engagement, by asset owners and managers, with city and district governments to identify opportunities for holistic approaches.

5.2.5 Reliance on electrification – can the supply side deliver?

Many net zero definitions and standards have an implicit assumption that heating, hot water and catering systems in buildings will be electrified over time in order to benefit from decarbonisation of the electricity grid. Combining this with the widespread electrification of transport, will require a significant increase in national generation capacities. This is expected to require a significant increase in electricity generation capacity. In the UK, the National Grid's Future Energy Scenarios 2021 consider an increase in installed electricity generation capacity from c.100 GW to between c.240-360 GW by 2050. This will require major investment and significant distribution network reinforcement to accommodate the additional renewable energy generation and storage, and demand side flexibility. There are many further consequences and uncertainties of wide-scale electrification, including (but not limited to):

- Switching from gas boilers to heat pumps, with current energy tariffs in most countries, will have a long payback without government subsidy. Re-engineering heat distribution systems throughout a building and/or enhancing the energy efficiency of the building's fabric to improve the performance of a heat pump can extend these paybacks.
- The efficiency of heat pumps varies with the temperature gradient between the inside and outside air. On the coldest days of the year, the efficiency of the heat pump will be lower. This exacerbates the effect of the increased heat demand and means a proportionally larger increase in local distribution networks and generation capacity, especially where buildings are not well insulated.
- The widespread installation of heat pumps increases the risk of significant quantities of fugitive emissions associated with refrigerant leakage.

Possible mitigants:

- Disclosure of operational energy performance to allow governments to base infrastructure investment on more accurate data.
- Identification, by governments, of the potential impacts of wholesale electrification of heating, hot water and catering to understand the measures and investments that will be necessary to address generation capacity, network reinforcement and heat demand profile changes.

6. FINDINGS AND RECOMMENDATIONS

6.1 Key Messages

This project identified five key messages relating to the transition of real estate investment to NZC:

1. Demand for NZC property is increasing, as a growing number of governments, investors and occupiers make public commitments to NZC.
2. Misaligned definitions of NZC (and how to reach it) creates a source of confusion in the market. This is due to the myriad of market driven and regulatory schemes being used for public commitments, and the large differences in scope, stringency and demands for short term action.
3. Convergence on a common definition of NZC from asset owners, managers and occupiers is required to provide a robust framing of net zero. This will support the alignment between net zero schemes and the appropriate allocation of capital for carbon reduction.
4. Several challenges exist for the industry to overcome, including a skills gap around net zero concepts and practices, limited evidence of the costs of net zero retrofit and a lack of primary data to quantify the carbon impact of some aspects of real estate investment.
5. Further challenges are posed by the potential unintended consequences of the NZC transition, including high embodied carbon impacts from retrofits and redevelopment, and the social and economic impacts of asset 'stranding' due to perceived climate risk.

A set of principles has been developed from the research, to underpin the meaning of net zero in real estate. These are outlined below, followed by a set of recommendations for the market to integrate them into best practice.

Market participants do not need to wait for this integration, rather they can act immediately to support the transition of the industry to NZC. A set of recommendations has therefore also been outlined for real estate investors to implement the net zero principles throughout their own investment, development, and operational practices.

6.2 Key Principles of Net Zero Carbon in Real Estate

Immediate action

Requirements for signatories of NZC schemes to take short term actions to reduce their carbon footprint will make commitments more robust and give a greater level of accountability.

Energy efficiency first

A robust and well-managed approach to delivering net zero by 2050 means matching building energy demand with a realistic expectation of each nation's renewable energy capacity.

No fossil fuel use on site

The transition of all buildings to electrified heating, hot water and catering options is critical. Designing-in these features to all new buildings now will avoid the continuation of fossil fuel driven infrastructure and provide the opportunity for the market to address the skills gap in heat pump installation.

Use of whole building scope

Considering net zero from a whole building perspective will give greater insight into transition requirements, even if the performance of landlord- and occupier-controlled energy uses is better benchmarked separately.

6. FINDINGS AND RECOMMENDATIONS

Landlord and occupier collaboration

Greater landlord-occupier collaboration to overcome technical, commercial, and cultural barriers will be an essential component of success. The sharing of information and alignment of strategies between landlords and occupiers are key enablers, which will extend to the choice of net zero schemes. Agents such as valuers and building managers acting for each party will also need to participate in and reinforce this collaboration.

Whole life carbon accounting

Carbon accounting within the built environment should require the consideration of whole life carbon impacts as well as operational emissions (which are most commonly accounted for currently). This will encourage real estate developers and asset owners to incorporate carbon into decision making processes throughout the asset lifecycle.

Differentiate property and corporate level net zero claims

Robust NZC standards or definitions are required at the property level for the market to effectively price in premiums or discounts. Corporate NZC schemes address overall transition strategies and cover a broader scope of emissions; the more carbon sources included, the more robust the commitment. The difference between these two levels of net zero claims should be transparent to all stakeholders.

Minimal use of offsets

Limiting offsetting to the most hard-to-abate areas, accounting for a minority of baseline emissions, encourages a focus on emissions reduction. Where offsetting is used, it should be conducted to the highest levels of robustness and quality (i.e. permanent carbon removal), at a price that reflects the true societal cost of carbon.

Standards with consequences

Building level net zero certifications and corporate net zero standards should have a mechanism to rescind certifications if positive progress towards the target is not evidenced, or estimated data is not superseded with real data in a given timeframe.

6.3 Recommendations for the Real Estate Investment Market

Certify NZC

While some net zero certifications already exist, the real estate investment industry has the ability to drive the integration of the net zero principles outlined above into all building certification schemes. Clearly classifying buildings as ‘in transition to net zero’ (carbon neutral, NZC efficient or NZC ready), net zero or zero carbon will bring clarity to the market, make it harder for ambiguous net zero claims to be made, and facilitate the ‘pricing in’ of net zero performance.

Measure, don’t guess

Basing property level net zero reporting on measured data, not estimations, will make for more credible and meaningful targets. This will require an industry-wide push for greater landlord-occupier data sharing and collaboration including development of best practice guidance.

6. FINDINGS AND RECOMMENDATIONS

Develop passports for buildings

Building Passports covering theoretical and measured performance as well as planned actions towards NZC should be standardised across the industry and used for both policy compliance and market transactions.

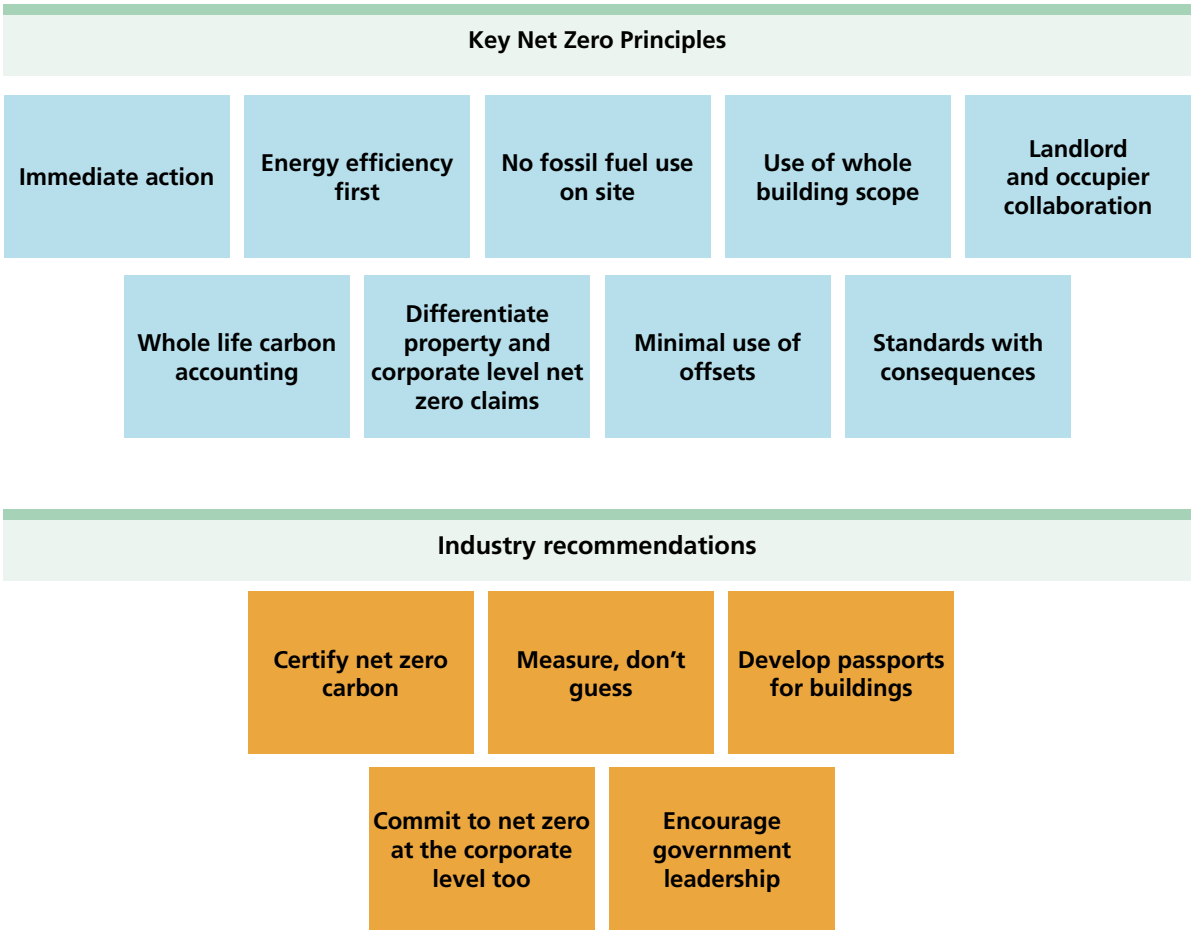
Commit to net zero at the corporate level too

A corporate NZC standard will also be necessary (the SBTi Corporate Net Zero Standard is the current frontrunner) to cover the full scope of emissions associated with real estate investment. The industry should work with existing frameworks to ensure that they meet the needs of the sector.

Encourage government leadership

Government leadership is necessary to introduce performance-based policy frameworks for rating the energy and carbon performance of commercial and industrial buildings, and disclosing embodied carbon emissions associated with new developments. This will drive consistency in the market. Annual ratings and mandatory disclosure of data are a pre-cursor to a net zero market transformation.

Figure 6.1: Key Net Zero Principles and Industry Recommendations



6. FINDINGS AND RECOMMENDATIONS

6.4 Recommendations for Real Estate Investors

While the above driving forces are required at an industry level to transition to NZC, it is imperative that real estate investors and asset managers act without delay to apply the findings of this research to their investment and management strategies. The following key actions have therefore been identified for these stakeholders at both building (categorised by each of the five main stages of an asset lifecycle) and corporate levels:

Asset Level

Acquisition

- Integrate net zero assessments into due diligence activities.
- Integrate net zero principles into investment strategies.
- Push vendors to supply operational energy data and NZC pathways, where available.

Development

- Ensure whole life carbon and whole life carbon impacts are measured, reduced, and any residual is offset through carbon removal.
- Apply an internal carbon price on embodied carbon to drive decision making.
- 'Design in' renewable energy technologies and fossil fuel-free heating and hot water today.

Operation

- Identify 'Paris-aligned' energy demand reduction targets for each asset.
- Pursue immediate, short-term payback measures to reduce energy demand by better control and management.
- Drive suppliers to disclose and reduce their emissions by setting 'Paris-aligned' targets.
- Support upskilling of the property operation and maintenance supply chain and acknowledge this through better rewards and earned prestige.

Refurbishment

- Invest in fabric and plant improvements in anticipation of asset value premiums.
- Invest in pilot retrofits to understand the commercial and technical challenges of net zero retrofit.
- Apply an internal carbon price on embodied carbon to drive decision making.
- Electrify or decarbonise heating and hot water supplies as soon as possible and incorporate building integrated renewable energy.

Disposal

Provide buyers with operational energy data and NZC pathway information including planned/known measures.

6. FINDINGS AND RECOMMENDATIONS

Corporate Level

- Broaden GHG footprint to include all applicable emissions sources.
- Set a corporate net zero target as well as asset/portfolio level targets.
- Set 'Paris-aligned' short term targets: these require a halving of emissions every decade.
- Use these targets as milestones in a published net zero pathway.
- Prioritise reduction and minimise offsetting in any net zero commitment.

6.5 Concluding Statement

The built environment is one of the largest contributors to global carbon emissions. However, there is a significant lack of alignment within the current real estate industry as to the definition of NZC and how the market can effectively transition to net zero. There is little regulatory leadership and minimal evidence of carbon consideration within the valuation process. This situation can be improved through the adoption of a set of key principles but there is no single scheme that currently includes all elements recommended by this research. Establishing these across the global industry, will enable the certification of building performance, against a consistent set of NZC metrics, harmonising the market and allowing for the pricing-in of carbon within building valuations. While action is needed at the industry level, market participants can set and implement their own net zero strategies immediately, using the recommendations within this study.

7. ACKNOWLEDGEMENTS

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Fidelity International
Fiera Real Estate
Frasers Group
Gecina
Grosvenor Group
Groupama Immobilier
Heitman
Hillbreak
ICAEW
Invesco
Investcorp
IPSX : The property stock exchange
Jones Lang LaSalle
John Lewis Partnership
LaSalle Investment Management
Lendlease
Lambert Smith Hampton
M&G
McArhurGlen Group
Next plc
Norma Capital
Nuveen
Orchard Street Investment Management LLP
Patrizia
Primonial REIM
Savills
Workman LLP

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A1. Approaches to Specific Decarbonisation Trajectories

Most net zero schemes require a high-level commitment to net zero before 2050. Others go further and require signatories to meet specific decarbonisation trajectories at the building, portfolio or corporate level. Among those that require specific decarbonisation trajectories, there are three main types of approach:

1 **A 'top-down' approach based on national carbon targets.** Several NZC schemes use an approach of distributing global or national carbon budgets within countries, economic sectors or sections of the built environment. These include the SBTi and CRREM. In the experience of Verco, the challenges with this method are achieving a fair and equitable allocation of carbon budget between countries and, equally, in achieving a fair allocation for buildings as a proportion of the overall national economy out to 2050.

2 **A 'top-down' approach based on national 2050 renewable energy supplies.** These align with the Paris proof principle to ensure that future demand does not overwhelm the growth capacity of renewable energy supplies. This approach was pioneered by the Dutch Green Building Council. In the experience of Verco, the key challenge with this approach is identifying a robust, credible and objective projection of national renewable energy capacity up to 2050.

3 **A 'bottom-up' approach based on perceived technical potential for energy efficiency.** This approach is designed to set more 'achievable' targets based on the perceived minimum viable energy use buildings need to provide an acceptable level of servicing. In the experience of Verco, a challenge with this approach is that it is often disconnected from the real atmospheric limits of GHG emissions, while there is often a tendency for the process to be constrained by cultural norms around building servicing.

There is often a gap between the reduction targets set by 'bottom-up' and 'top-down' approaches. It is worth noting that some net zero schemes take a hybrid approach – combining both 'top-down' and 'bottom-up' methods.[128]

A2. Review of Net Zero Schemes

This section describes a range of net zero schemes reviewed as part of this study, which fall under any one of the above categories. Each scheme description starts with an outline of how they define net zero (where applicable), highlighting the breadth of definitions that are currently confusing the market.

128 Including the UKGBC NZC energy performance targets for offices and net zero whole life carbon roadmap

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.1 WGBC NZC Buildings Commitment (NZCBC)

NZC definition

"Our definition for a net zero operational carbon building is a highly energy efficient building that is fully powered from on-site and/or off-site renewable energy sources and offsets.

"A net zero embodied carbon building (new or renovated) is highly resource efficient with upfront carbon minimised to the greatest extent possible and all remaining embodied carbon reduced or, as a last resort offset in order to achieve net zero across the lifecycle."[129]

The WGBC NZC Buildings Commitment was launched in September 2018 and originates from Advancing Net Zero, WGBC's global project to "accelerate uptake of NZC buildings to 100% by 2050".[130] The NZCBC covers both operational and embodied carbon emissions under direct control. This does not cover other sources of Scope 3 emissions. The Commitment requires that by 2030, signatories pursue two goals:

- Reduce energy consumption of existing buildings and eliminate emissions from energy and refrigerants, removing fossil fuel use as fast as practicable. Where necessary, residual emissions are compensated.[131]
- New developments and major renovations are built to be highly efficient, powered by renewables, with a maximum reduction in embodied carbon and compensation of all residual upfront emissions.

As of October 2021, there are 109 organisations signed up to the commitment, including real estate investment trusts (REITs), real estate property funds, advisors, developers and construction companies, alongside 28 cities and 6 states and regions. In September 2021, the WGBC expanded the scope of the NZCB Commitment to include embodied carbon. From January 2023, signatories will be required to account for whole lifecycle impact of all new buildings and major renovations, and to track and report business activities that influence the indirect reduction of whole life carbon emissions.[132]

129 https://www.worldgbc.org/thecommitment
130 https://www.worldgbc.org/news-media/worldgbc-announces-18-new-signatories-net-zero-carbon-buildings-commitment
131 Following the definition set out by the SBTI, compensation refers to measures that companies take to help society avoid or reduce emissions outside of their value chain.
132 This forms part of the WGBC's vision that by 2030, all new buildings, infrastructure and renovations will have at least 40% less embodied carbon with significant upfront carbon reduction, and all new buildings will be net zero operational carbon.

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.2 Science-based based Targets Initiative (SBTi)

NZC definition

"Net zero emissions are reached when anthropogenic (i.e. human-caused) emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.

"A company will be considered as reaching net zero under the SBTi Corporate Net Zero Standard when it has achieved its long-term science-based target. A company cannot balance its emissions with removals ahead of that and claim to be net zero.[133]

"Long-term science-based targets indicate the degree of decarbonization companies need to ultimately reach in order to achieve net zero. We expect most companies to make emission reductions of at least 90 - 95 percent to reach net zero."

The SBTi is a partnership between CDP, the UN Global Compact, WRI and the WWF. The SBTi provides methodologies for businesses to set decarbonisation targets that are considered 'science-based' i.e., in line with the rate of decarbonisation under the Paris Agreement (2015). As of October 2021, there are 98 real estate companies globally that have committed to setting science-based targets, of which 67 have had their targets approved. Targets are set at the organisational level. The carbon reduction targets of applicant businesses are reviewed and categorised as '1.5° aligned', 'Well below 2° aligned' or '2° aligned' if they meet the SBTi's requirements.

The majority of SBTi-approved real estate businesses set 'absolute' reduction targets.[134] The '1.5° aligned' pathway requires a 4.2% per annum reduction in emissions between a base year and target year. In simple terms this approximates to a halving in emissions every 10 years. The SBTi also provides an option for businesses to set intensity-based targets – using metrics such as floor area – although these are rare in the real estate sector (with the exception of housebuilders). A typical real estate science-based target will include all Scope 1 and 2 emissions (from energy use in landlord controlled areas) and at least 66% of Scope 3 emissions – typically this includes energy use by occupiers (termed 'downstream leased assets' in the GHG Protocol), embodied carbon from developments and refurbishments and emissions from purchased goods and services.

In October 2021, the SBTi released the first science-based global standard for corporate net zero targets.[135] Businesses that meet this standard can claim to be 'in transition to net zero'. The SBTi is also developing a sector-specific approach to target-setting for financial institutions, including asset owners and managers, which follows the floor area normalised Sector Decarbonisation Approach. It is expected that this upcoming guidance will be more applicable to other investment asset classes, such as mortgages or loans.

133 https://sciencebasedtargets.org/blog/what-is-good-net-zero
134 A commitment to reduce emissions in absolute terms by a given date.
135 https://sciencebasedtargets.org/net zero

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.3 Carbon Risk Real Estate Monitor (CRREM)

The CRREM project is an EU-funded research project that aims to '…accelerate the decarbonization and climate change resilience of the EU commercial real estate sector". CRREM does not have a specific definition of NZC, instead it aims to support the industry in tackling carbon-risk factors associated with premature obsolescence and potential depreciation and encourage investment in energy efficiency so that assets avoid non-compliance with future energy efficiency standards.

In April 2020, the CRREM published a set of Paris-aligned decarbonisation (GHG intensity) and energy reduction (energy intensity) trajectories from 2020 to 2050 for a range of different asset classes and geographies, including all EU countries and other major economies, including the US, Canada and Australia. While the CRREM project does not have its own published net zero definition, the decarbonisation pathways use the statistical framework of the SBTi's Sectoral Decarbonisation Approach. The trajectories can be used by asset managers to benchmark the current and future performance of commercial real estate assets.

Many leading EU-based fund managers engaged in this study referenced CRREM as a tool being used or reviewed in their businesses. A number of other net zero aligned schemes in this study recommend the use of CRREM as a benchmarking tool (for example, the NZIF and ULI Greenprint). Investors with over €450 billion of real assets under management and a total floor area of c.23 million m² have made use of the CRREM tool.[136] Through integration with GRESB – a global platform that assesses and benchmarks the ESG performance of real assets – GRESB-disclosing businesses can now populate the CRREM Tool with the asset-level performance data uploaded to the GRESB Asset Portal. Plans for further integration, including integration of asset- and portfolio-level assessment are under way.[137]

136 https://cinea.ec.europa.eu/news/carbon-risk-real-estate-monitor-crrem-new-tool-reduce-stranded-investments-and-guide-energy_en
137 https://gresb.com/carbon-risk-real-estate-monitor/

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.4 Net Zero Investment Framework

NZC definition

"Companies that have current emissions intensity performance at, or close to, net zero emissions with an investment plan or business model expected to continue to achieve that goal over time."[138]

Released at the start of 2021, the Net Zero Investment Framework (NZIF) was delivered as part of the Paris Aligned Investment Initiative (PAII); an investor-led, global forum enabling investors to align their portfolios and activities to the goals of the Paris Agreement (2015). The Framework was developed through the engagement of 118 investors, representing $34 trillion in assets, and proposes an investment strategy that focusses on achieving two objectives:

- Decarbonising investment portfolios in a way that is consistent with achieving global net zero GHG emissions by 2050.
- Increasing investment in the range of 'climate solutions' needed to meet that goal.

Guidance is provided within the Framework on how best to achieve these targets for a variety of asset classes. The Framework assesses real estate using the CRREM tool to determine alignment with the 1.5° pathway. As the PAII is a formal partner of the UNFCCC's Race to Zero Campaign, the Framework allows investing institutions to join the campaign. Currently 22 asset owners, representing $1.2 trillion in assets, have used the Framework to commit to achieve net zero alignment by 2050 or sooner.[139]

The producers of this framework (predominantly the Institutional Investors Group on Climate Change – IIGCC) have also collaborated with other industry bodies to launch the **Net Zero Asset Managers Initiative (NZAMI).** Launched in 2020, this initiative now utilises the Framework to provide guidance to its membership on how best to achieve net zero by 2050. Alongside this framework, signatories to NZAMI are provided with several other mechanisms for guidance on best practice and methodologies. This initiative has 87 signatories that manage $37 trillion assets.

138 https://www.parisalignedinvestment.org/media/2021/03/PAII-Net-Zero-Investment-Framework_Implementation-Guide.pdf
139 https://www.iigcc.org/news/global-framework-for-investors-to-achieve-net-zero-emissions-alignment-launched-8-trillion-investors-put-it-into-practice/

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.5 Net Zero Asset Owners Alliance (NZAOA)

NZC definition

The members of the Alliance commit to transitioning their investment portfolios to net zero GHG emissions by 2050 consistent with a maximum temperature rise of 1.5° above pre-industrial temperatures, taking into account the best available scientific knowledge including the findings of the IPCC, and regularly reporting on progress, including establishing intermediate targets every five years in line with Paris Agreement Article 4.9.[140]

Founded in 2019 by the United Nations' Environmental Programme - Finance Initiative (UNEPFI) and the Principles for Responsible Investment (PRI), the NZAOA aims to help asset owners reach NZC by 2050 (in alignment with the 1.5° pathway). The alliance has a membership of 49 institutional investors, representing over $7 trillion AUM.

The alliance works with existing initiatives to provide toolkits and guidance on how to achieve this commitment. This collaboration includes the **Climate Action 100+** and **The Investor Agenda,** but most prominently focuses on the SBTi's approach to GHG emissions reductions. A recent publication made by the Alliance is the Inaugural 2025 target setting protocol, a position document on the coronavirus recovery and sectoral pathways for net zero emissions.

140 https://www.unepfi.org/wordpress/wp-content/uploads/2021/02/04-UN-AOA-Commitment-doc-D11-0021.pdf

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.6 Climate Action 100+ Initiative (CA100+)

Climate Action 100+ is another investor-led initiative focused on mitigating investment exposure to climate risk and securing ongoing sustainable returns for investors' beneficiaries. With 615 investors, the Initiative represents market actors responsible for $55 trillion AUM who are engaging companies on improving climate change governance, cutting emissions and strengthening climate-related financial disclosures. The Initiative also targets some of the private sector's largest emitting companies with 83 of 167 'focus companies' having committed to net zero targets.

In early 2021, CA100+ released a Net Zero Company Benchmark[141] that provides a disclosure framework that can be used to assess companies' alignment with 10 indicators, relating to carbon performance. While having no set definition of NZC, these indicators reflect the commitment priorities of the Initiative.

141 https://www.climateaction100.org/wp-content/uploads/2021/03/Climate-Action-100-Benchmark-Indicators-FINAL-3.12.pdf

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.7 International Living Future Institute (ILFI) Zero Carbon Certification

NZC definition

One hundred percent of the operational energy use associated with [a building] must be offset by new on- or off-site renewable energy. One hundred per cent of the embodied carbon emissions impacts associated with the construction and materials of the [building] must be disclosed and offset.[142]

The ILFI Zero Carbon Certification claims to be the first "worldwide Zero Carbon third-party certified standard". Projects seeking Zero Carbon certification must meet an energy efficiency target over a 12-month performance period. The targets are specified based on building type, size and location. New buildings must evidence a 25% reduction in energy use intensity (EUI) from an equivalent new building that would comply with ASHRAE 90.1-2010.[143] Existing buildings must demonstrate a 30% reduction in EUI from a typical existing building of an equivalent type, size and location. No new sources of combustion may be installed and all of the operational energy use must be provided by new on- or off-site renewable energy. ILFI offers the Certification either for single buildings or for an entire portfolio of buildings/projects.

From an embodied carbon perspective there are three requirements. The embodied carbon emissions of primary materials must be reduced by 10% compared to a baseline building of equivalent size, function, and energy performance. The total embodied carbon of the project building may not exceed 500 $kgCO_2e/m^2$. Finally, all of the embodied carbon emissions impacts associated with the construction and materials of the project must be disclosed and offset through on-site carbon-sequestering materials or by a one-time purchase of carbon offsets from an ILFI-approved source.

142 https://living-future.org/zero-carbon-certification/#requirements
143 https://www.ashrae.org/technical-resources/bookstore/standard-90-1

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.8 Better Buildings Partnership Climate Commitment

NZC definition

"NZC" is when the carbon emissions emitted as a result of all activities associated with the development, ownership and servicing of a building are zero or negative.[144]

The UK Better Buildings Partnership Climate Commitment was launched in September 2019. The Commitment has an objective of delivering net zero buildings by 2050. This incorporates operational and embodied carbon for direct and indirect investments, as well as other Scope 1, 2 and 3 emissions. The Commitment is aimed at real estate asset owners and managers.

Signatories must state their net zero target date that covers the full scope and boundaries of the Commitment. The investment boundary of commitments can vary depending on business structure, (for example, whether they are a property company, REIT or fund manager) and the real estate investment vehicles they manage. The Climate Commitment does not specify any near-term or interim decarbonisation targets but includes a commitment to the use of Energy Use Intensities to track performance. A total of 27 businesses have joined the BBP Climate Commitment, representing over 11,000 properties worth over £375 billion. Signatories commit to publishing a NZC pathway document, disclosure of energy performance of portfolios and convening an owner and occupier forum, among other commitments.

144 https://www.betterbuildingspartnership.co.uk/sites/default/files/media/attachment/BBP_Net-zero%20Carbon%20Framework_May21.pdf

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.9 UKGBC NZC Buildings Framework Definition

NZC definition

NZC – operational energy: When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A NZC building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset.

NZC – construction: When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy when the building is in operation.

The UK Green Building Council released the *NZC Buildings Framework Definition* in April 2019.[145] It followed the launch of the WGBC NZC Buildings Commitment and exemplifies how WGBC operates a federal arrangement, whereby in-country GBCs transpose global WGBC initiatives to national level schemes applicable to the local context and maturity of net zero action. Supplemented by guidance on the levels of energy performance that offices should target to achieve net zero,[146] published in January 2020, and the *Renewable Energy Procurement & Carbon Offsetting guidance,* published in March 2021, this evolving package advises real estate and construction companies on the steps that should be taken to deliver NZC buildings in construction and operation, consistent with the concept of the mitigation hierarchy.

The framework document provides templates for real estate companies to publicly disclose information related to the buildings covered. The UKGBC recommend that this is subject to a third-party audit by an organisation with relevant expertise. The UK GBC began consulting in June 2021 on a proposed net zero verification scheme.[147] This is based on the 'Paris proof' principle. In October 2021, the UKGBC published the *Commercial New-Build Policy Playbook*, which advocates the mitigation hierarchy for new developments.[148]

Another recent development from the UKGBC was the 2021 consultation on a potential net zero verification scheme.[149] At an event in October 2021, they shared the key findings from this market analysis, concluding that for a net zero verification scheme to operate successfully in the current market it must be independent and transparent, with clear governance, low barriers to entry and global relevance. The UKGBC has also developed a **Net Zero Whole Life Carbon Roadmap,** for launch at CoP26, that supports the complete decarbonisation of the built environment in the UK by 2050.

145 https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition/
146 https://www.ukgbc.org/wp-content/uploads/2020/01/UKGBC-Net-Zero-Carbon-Energy-Performance-Targets-for-Offices.pdf
147 https://www.ukgbc.org/news/ukgbc-releases-a-survey-on-verification-for-net-zero-carbon-buildings/
148 https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2021/10/12132154/Commercial-Playbook-without-Bruntwood.pdf
149 https://www.ukgbc.org/news/ukgbc-releases-a-survey-on-verification-for-net-zero-carbon-buildings/

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A2.10 London Energy Transformation Initiative (LETI)

NZC definition

Net Zero Operational Carbon: Where a building does not burn fossil fuels, is 100% powered by renewable energy, and achieves a level of energy performance in line with national climate change targets. No carbon offsets can be used to achieve this status.

NZC (Whole Life): Where the sum total of GHG emissions and removals over an asset's lifecycle[150] are minimized, meets local carbon targets[151] and equals zero when combined with additional offsets.

Launched in 2019, LETI is a network of over 1,000 professionals working toward the transition of the UK's built environment to NZC. LETI provides recommendations to policy makers and has developed a Climate Emergency Design Guide as part of this process to outline the requirements for new buildings to ensure the UK's climate change targets are met.[152] While developed for UK policy makers, the guidance is not bespoke to the UK and could be utilised elsewhere.

The Climate Emergency Design Guide provides guidance for whole life carbon of new builds, detailing a range of specifications required to facilitate zero carbon operation. Supplementary guidance is also provided to address embodied carbon (LETI's Embodied Carbon Primer).[153] This includes best practice targets, which must be achieved before offsets may be relied upon for NZC status:

- Upfront embodied carbon targets;
- Proportions of materials that are from re-used sources; and
- Proportions of materials that can be re-used in future buildings.

LETI have taken a view that circularity is more relevant than offsets for the design team and for policy makers. However, LETI appreciates offsets can be seen as a means to reduce residual emissions of embodied carbon and gives a dispassionate review of offsetting, looking at the advantages, disadvantages and technical and societal challenges to its effective implementation.

In November 2021, LETI released a public survey, in collaboration with CIBSE, on net zero definitions.[154] Within this survey, a number of views on how these organisations would define net zero have been presented for public commentary. For example, they have proposed that offsetting should not be allowed for emissions associated with energy use and all requirements for reduction in this area should be met by efficiency improvements and renewable energy sources (procurement or on-site generation). A number of definitions have also been proposed to certify different stages of a building's transition to NZC.

150 Modules A1-A5, B1-B5 and C1-C4
151 Based on the Embodied Carbon Target Alignment document: https://www.leti.london/carbonalignment
152 https://www.leti.london/cedg
153 https://www.leti.london/ecp
154 https://b80d7a04-1c28-45e2-b904-e0715cface93.filesusr.com/ugd/252d09_e52dcb52fafe44658eaa8dc7a863157a.pdf

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.11 Urban Land Institute (ULI) Greenprint Net Zero Goal

NZC definition

Greenprint follows the World Green Building Council definition of net zero, which is a building portfolio that is highly efficient and fully powered by on-site and off-site renewable energy sources.

The Urban Land Institute is a non-profit research and education organisation founded in 1936 and primarily located in North America. As part of their Climate and Energy research, the ULI developed Greenprint in 2009 as an alliance of real estate owners, investors and strategic partners committed to improving the environmental performance of the global real estate industry. The membership has been working towards a 50% reduction of GHG emissions by 2030 (from its inception in 2009) to reach NZC operations by 2050. This covers Scope 1 and 2 emissions and does not include occupier energy consumption. ULI provides benchmarking and knowledge sharing platforms to aid in the implementation of best practice throughout the real estate industry. As of May 2021, the membership includes 17 global organisations that have committed to their Net Zero Goal by 2050 (or sooner).

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A2.12 LEED Zero

Another building certification scheme, noted as being well known by various stakeholders, is the United States LEED certification. Similar to BREEAM certification, LEED assesses the broader sustainability performance of buildings and development projects. The USGBC have also developed LEED Zero, a scheme that complements LEED certifications to verify the achievement of net zero goals in existing buildings. The LEED Zero certification encompasses carbon, energy, water and waste goals. While currently focussing on emissions from energy consumption and occupant transportation, the Zero Carbon certification will be expanded in the future to incorporate water consumption, waste generation and embodied carbon.

APPENDIX A: NET ZERO CARBON SCHEME SUMMARIES

A2.13 BREEAM

A globally prominent, sustainability assessment method mainly used for development projects at the design stage. BREEAM certifications are widely used throughout the real estate industry as a means of assessing an asset's environmental credentials beyond just energy and carbon. BREEAM In-Use is available to assess operational outcomes.

Although widely used, BREEAM has not been included in this study as it does not yet have any NZC certification. However, this is one of several areas considered to be a key component of the next generation of BREEAM, having been examined in detail in the Building Back Better initiative launched by BRE in 2020.[155] This next generation of BREEAM certification will potentially include mapping against CRREM or other carbon reduction pathways.[156]

155 https://files.bregroup.com/breeam/BREEAM_BBB_BRE_115439_HIRES.pdf
156 https://www.designingbuildings.co.uk/wiki/Building_Back_Better:_Net_zero_carbon_and_BREEAM

APPENDIX B: NET ZERO SCHEME MILESTONES AND PUBLICATIONS

B1. Introduction

In Section 4.3.1, a timeline of milestones and publications is displayed to show how the market has accelerated in recent years in relation to NZC. Appendix B gives a detailed breakdown of each of those milestones highlighted within Figure 4.5.

2009

- The **ULI Greenprint Center for Building Performance** was one of the first vehicles for net zero commitments in real estate. In 2009, Greenprint members set a collective goal to reduce GHG emissions 50% by 2030.[157]
- Similarly, the **International Living Futures Initiative (ILFI)** was one of the first certification schemes to work toward zero carbon at the building level, launching their zero energy certification in 2012.

2015

- The **Science-based Targets Initiative (SBTi)** launched in 2015. While early signatories were not expected to make a commitment to net zero emissions explicitly, the SBTi provided methodologies for businesses to set science-based carbon reduction targets to support the move to net zero emissions. The first adopters in the real estate sector included Landsec (December 2016), Kiwi Property Group (March 2017) and Gecina (October 2017).[158]

2016

- In September 2016, the **WGBC** launched the **Advancing Net Zero (ANZ)** project.[159] 10 national Green Building Councils (GBCs) began developing or adopting voluntary NZC building rating systems in their own markets.

2017

- The WGBC called for the built environment to promote two goals: a) for all new buildings to operate at NZC from 2030, and b) for all buildings (new and existing) to operate at NZC by 2050.[160]
- The **London Energy Transformation Initiative (LETI)** was launched alongside their Net Zero Guidance.

2018

- The WGBC's NZC Buildings Commitment advocates for the halving of emissions from the building and construction sector by 2030 and the total decarbonisation of the sector by 2050.[161]
- The **Carbon Risk Real Estate Monitor (CRREM)** project, with funding from the EU's Horizon 2020 programme, launched in 2018 with the goal of providing commercial real estate managers and investors with tools to align global assets and portfolios with the goals of the Paris Agreement and avoid 'stranded assets'.[162] The Sectoral Decarbonisation Approach pioneered by the SBTi in 2015 lies at the core of the CRREM methodology.
- Also in 2018, ILFI launched the **Zero Carbon Certification** - the 'first worldwide Zero Carbon third-party certified standard'.

2019

- The UK's **Better Building Partnership (BBP)** launched the Climate Change Commitment, with 23 of the UK's leading commercial property owners committing to deliver NZC global real estate portfolios by 2050.[163]
- The SBTi introduced their 1.5° aligned targets.

157 https://americas.uli.org/research/centers-initiatives/greenprint-center/greenprint-resources-2/uli-greenprint-goals/
158 https://sciencebasedtargets.org/companies-taking-action
159 https://www.worldgbc.org/advancing-net-zero
160 https://www.worldgbc.org/news-media/thousands-billions-coordinated-action-towards-100-net-zero-carbon-buildings-2050
161 https://www.worldgbc.org/thecommitment#:~:text=WorldGBC's%20Net%20Zero%20Carbon%20Buildings,whole%20life%20carbon%20by%202050.
162 The CRREM project defines stranded assets as properties that will not meet future energy efficiency standards and market expectations and might be increasingly exposed to the risk of early economic obsolescence.
163 https://www.betterbuildingspartnership.co.uk/node/877

APPENDIX B: NET ZERO SCHEME MILESTONES AND PUBLICATIONS

- The **Paris Aligned Investment Initiative (PAII)** was launched, seeking action from investors to decrease the carbon impact of their portfolios.

2020

- The **Net Zero Asset Owner Alliance (NZAOA)** launched their Inaugural 2025 Alliance Target Setting Protocol with the aim of advising investors on transitioning their portfolios to net zero.
- 11 Greenprint members committed to reduce the operational carbon emissions of buildings under their control to net zero by 2050, a number that has been increasing through 2021.[164,165]
- The release of a framework definition under the WGBC's ANZ programme, which was subsequently updated in September 2021 to include embodied carbon as well as operational.[166]
- LETI published their Climate Emergency Design Guide.
- The CRREM project launched their global decarbonisation pathways for different asset types across many developed economies

2021

In **2021**, a number of further developments have been underway or in consultation:

- The SBTi launched its global **Net Zero Standard** for businesses in October 2021, after a pre-launch public consultation opening in September 2021. In November 2021, the SBTi also released a draft of their Foundations of Net-Zero for Financial Institutions for public consultation.[167] This guidance is scheduled to be formalised and released in 2023.
- LETI published their Climate Emergency Retrofit Guide. Additionally, in collaboration with CIBSE, they released a public survey on net zero definitions in buildings.
- The CRREM project has evolved to phase II for continuation, after the end of the EU project funding in January 2021. It has expanded the initial EU-centric CRREM tool to include derived pathways and the corresponding carbon budgets on a global level. Countries now included are from Europe, North America, Asia and Australasia for the residential and commercial real estate sector. The study team is also aware of efforts by the CRREM project to develop and expand their approach including an ongoing project to update their global asset-level pathways, expand engagement in Canada, US, and South Pacific and consult with bodies at a national level to align on methodologies.
- Alongside the PAII, the **Net Zero Asset Managers Initiative (NZAMI)** helped to produce the N**et Zero Investment Framework (NZIF)** – a prominent framework, now used by investors across a range of asset classes.
- The International Organization for Standardization (ISO) is also developing a global standard against which buildings can be certified as carbon neutral.[168] Due to be published in 2022, the standard will provide an internationally recognised benchmark for carbon neutrality and provide clarity on the difference between carbon neutral and net zero.
- The UKGBC released their Net Zero Whole Life Carbon Roadmap at CoP26 to help guide UK construction and building operation to NZC.

164 https://americas.uli.org/201009netzero/
165 https://americas.uli.org/210510netzerotwo/
166 https://www.worldgbc.org/news-media/net-zero-carbon-buildings-framework-definition
167 https://sciencebasedtargets.org/news/net-zero-financial-institutions-draft-for-public-consultation
168 https://www.dezeen.com/2021/09/17/iso-standard-international-guidelines-carbon-neutral-buildings/

APPENDIX C: CASE STUDIES

Table C1: Archetype profiles

Case Study 1	
Asset type	Office
Country	Netherlands
City	Amsterdam
Floor area (m^2) - GIA	1500
Main heating fuel	District Heating
Occupier activities	85% Office, 15% Retail
Energy intensity	75 kWh/m^2 (district heating) 135 kWh/m^2 (electricity)
Additional comments	No air conditioning and no existing PV array

Case Study 2	
Asset type	Office
Country	USA
City	Washington DC
Floor area (m^2) - GIA	1500
Main heating fuel	Direct Electricity
Occupier activities	80% Office, 10% Café, 10% Retail
Energy intensity	35 kWh/m^2 (gas) 190 kWh/m^2 (electricity)
Additional comments	No air conditioning and no existing PV array

Case Study 3	
Asset type	Office
Country	Australia
City	Sydney
Floor area (m^2) - GIA	1500
Main heating fuel	Heat Pump
Occupier activities	90% Office, 10% Retail
Energy intensity	98 kWh/m^2
Additional comments	New build

Case Study 4	
Asset type	Retail, Shopping Centre
Country	Sweden
City	Stockholm
Floor area (m^2) - GIA	15000
Main heating fuel	District Heating
Occupier activities	50% Non Food Retail, 25% Food Retail, 25% Restaurants & Cafes
Energy intensity	20 kWh/m^2 (district heating) 60 kWh/m^2 (electricity)
Additional comments	New build - 100 MWH/yr PV array

Case Study 5	
Asset type	Retail, Shopping Centre
Country	Canada
City	Toronto
Floor area (m^2) - GIA	15000
Main heating fuel	Direct Electricity
Occupier activities	50% Non Food Retail, 25% Food Retail, 25% Restaurants & Cafes
Energy intensity	160 kWh/m^2
Additional comments	5 MWh/yr existing PV array

Case Study 6	
Asset type	Retail, Shopping Centre
Country	China
City	Shanghai
Floor area (m^2) - GIA	15000
Main heating fuel	Direct Electricity
Occupier activities	50% Non Food Retail, 25% Food Retail, 25% Restaurants & Cafes
Energy intensity	330 kWh/m^2
Additional comments	5 MWh/yr existing PV array

APPENDIX C: CASE STUDIES

Table C1: Archetype profiles (cont'd.)

Case Study 7	
Asset type	Retail, Warehouse
Country	Portugal
City	Lisbon
Floor area (m^2) - GIA	2300
Main heating fuel	Heat Pump
Occupier activities	90% Warehouse, 10% Office
Energy intensity	130 kWh/m^2
Additional comments	No heating or cooling in warehouse, 10 MWh/yr existing PV array

Case Study 8	
Asset type	Retail, Warehouse
Country	Canada
City	Montreal
Floor area (m^2) - GIA	2300
Main heating fuel	Gas Boilers
Occupier activities	90% Warehouse, 10% Office
Energy intensity	121 kWh/m^2 (gas) 153 kWh/m^2 (electricity)
Additional comments	10 MWh/yr existing PV array

Case Study 9	
Asset type	Retail, Warehouse
Country	China
City	Beijing
Floor area (m^2) - GIA	2300
Main heating fuel	Gas Boilers
Occupier activities	90% Warehouse, 10% Office
Energy intensity	81 kWh/m^2 (gas) 182 kWh/m^2 (electricity)
Additional comments	10 MWh/yr existing PV array

Case Study 10	
Asset type	Industrial, Distribution Warehouse
Country	Poland
City	Lodz
Floor area (m^2) - GIA	22400
Main heating fuel	Gas Boilers
Occupier activities	80% Warehouse, 10% Office, 10% Cold Store
Energy intensity	50 kWh/m^2 (gas) 75 kWh/m^2 (electricity)
Additional comments	50 MWh/yr existing PV array

Case Study 11	
Asset type	Industrial, Distribution Warehouse
Country	Canada
City	Vancouver
Floor area (m^2) - GIA	22400
Main heating fuel	Gas Boilers
Occupier activities	80% Warehouse, 10% Office, 10% Cold Store
Energy intensity	30 kWh/m^2 (gas) 20 kWh/m^2 (electricity)
Additional comments	No heating or cooling in warehouse, 50 MWh/yr existing PV array

Case Study 12	
Asset type	Industrial, Distribution Warehouse
Country	South Korea
City	Seoul
Floor area (m^2) - GIA	22400
Main heating fuel	Direct Electricity
Occupier activities	90% Warehouse, 10% Office
Energy intensity	35 kWh/m^2 (electricity)
Additional comments	50 MWh/yr existing PV array

APPENDIX C: CASE STUDIES

Table C1: Archetype profiles (cont'd.)

Case Study 13	
Asset type	Residential, Multi-family
Country	United Kingdom
City	London
Floor area (m^2) - GIA	8000
Main heating fuel	Gas Boilers
Occupier activities	100% Residential
Energy intensity	100 kWh/m^2 (gas) 50 kWh/m^2 (electricity)
Additional comments	No existing PV array

Case Study 14	
Asset type	Residential, Multi-family
Country	USA
City	Atlanta
Floor area (m^2) - GIA	8000
Main heating fuel	Gas Boilers
Occupier activities	100% Residential
Energy intensity	120 kWh/m^2 (gas) 140 kWh/m^2 (electricity)
Additional comments	No existing PV array

Case Study 15	
Asset type	Residential, Multi-family
Country	Japan
City	Tokyo
Floor area (m^2) - GIA	8000
Main heating fuel	Heat Pump
Occupier activities	90% Residential, 10% Retail
Energy intensity	110 kWh/m^2
Additional comments	No existing PV array

Case Study 16	
Asset type	Hotel
Country	Germany
City	Berlin
Floor area (m^2) - GIA	15800
Main heating fuel	District Heating
Occupier activities	100% Hotel
Energy intensity	80 kWh/m^2 (district heating) 110 kWh/m^2 (electricity)
Additional comments	No existing PV array

Case Study 17	
Asset type	Hotel
Country	USA
City	Los Angeles
Floor area (m^2) - GIA	11600
Main heating fuel	Gas Boilers
Occupier activities	100% Hotel
Energy intensity	125 kWh/m^2 (gas) 200 kWh/m^2 (electricity)
Additional comments	No existing PV array

Case Study 18	
Asset type	Hotel
Country	Australia
City	Melbourne
Floor area (m^2) - GIA	25500
Main heating fuel	Gas Boilers
Occupier activities	100% Hotel
Energy intensity	35 kWh/m^2 (gas) 100 kWh/m^2 (electricity)
Additional comments	No existing PV array

APPENDIX C: CASE STUDIES

C1 Case Study Analysis

This section outlines the performance requirements of a range of net zero schemes and provides a quantitative comparison of these schemes, as they apply to a set of 18 building archetypes (outlined in Table C1).

This analysis largely focuses on CRREM targets due to its applicability to different asset types and geographies, as well as it being the only prominent scheme within the market to provide both energy and carbon targets for operational performance. Less than half of the archetypes defined within the analysis outperform the CRREM carbon targets for the year of this report's publication, however stakeholder feedback confirms that this degree of 'stranding' is not yet being realised in the valuation process.

The technical potential for reducing energy use is presented for each archetype (in terms of energy efficiency measures, on-site renewable capacity and heat decarbonisation) and the impact of electricity grid decarbonisation is presented under a 'do nothing' scenario.

C2 CRREM Comparison

CRREM is unique among the net zero schemes in scope for this study in that it provides tailored EUI targets for each of the 18 case study assets outlined in Section 4.4.6. In this subsection the CRREM requirements by country and asset type are compared and the implications for investors are considered.

Figure C1 shows the whole building energy use intensity[169] of 18 case study assets selected for modelling. The height of each bar represents the typical baseline energy performance of each building. This is based on anonymised energy data, supplemented with benchmarks for asset types or locations where necessary.

The coloured sections represent the savings that can typically be realised using today's low-carbon technologies, such as energy efficiency interventions, low carbon heating and cooling systems and on-site renewables. The reductions achieved by these interventions varies by building type. Distribution warehouses and retail warehouses – often with significant roof-space – can achieve reductions of up to, or in excess of, 80-90% in grid demand energy intensity. For offices, savings of 30-50% can typically be realised. For assets with more energy-intensive services, such as hotels and shopping centres, savings can be limited to 20-40%. The orange circles represent the CRREM whole building EUI targets for 2030.[170] The purple circles represent the CRREM 2050 EUI targets.

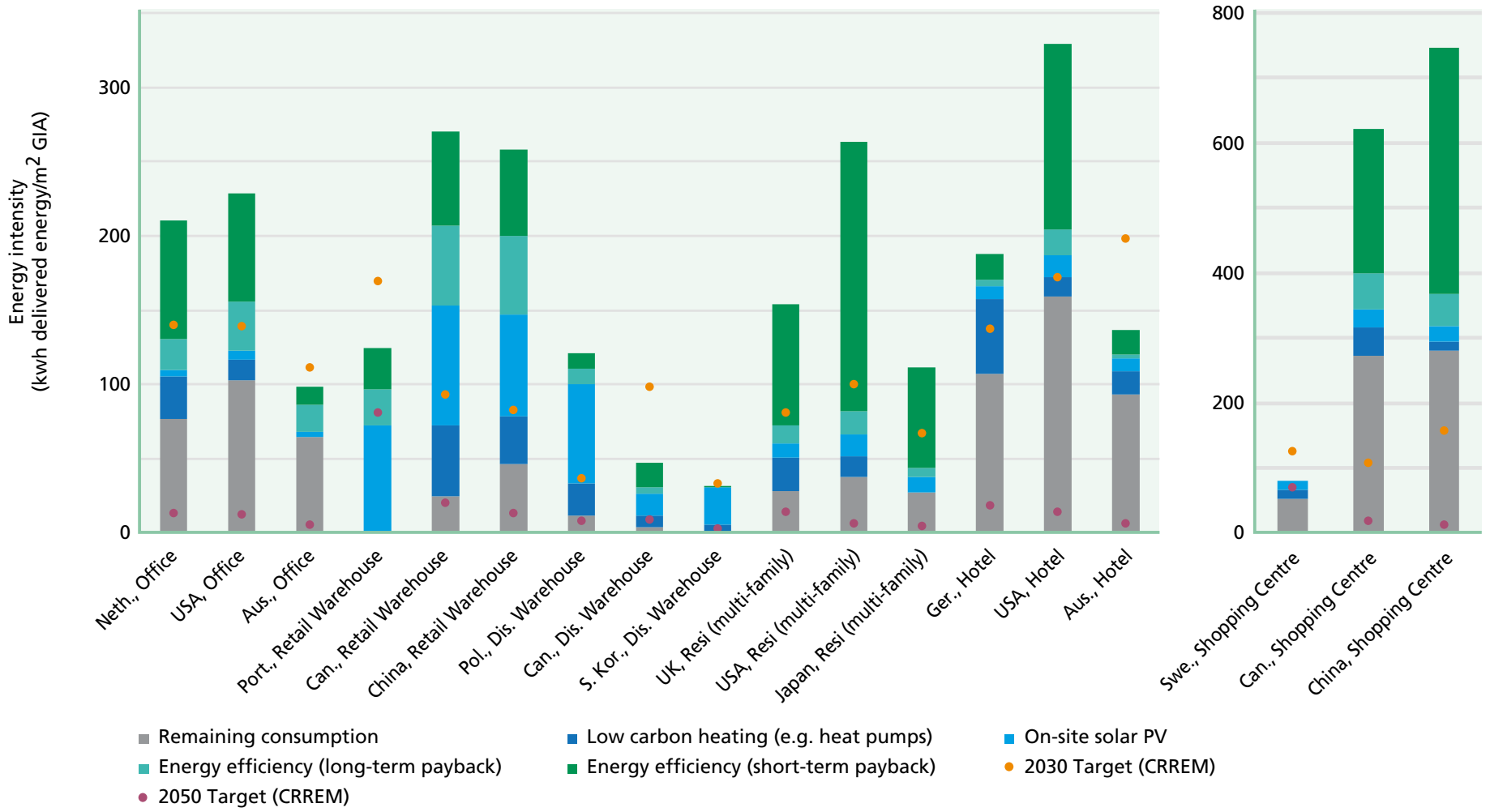
Figure C2 shows the baseline carbon intensity for each case study. The green segment indicates the level of decarbonisation that would be delivered through grid decarbonisation alone[171] – effectively the carbon savings that would arise from implementing no additional measures to reduce energy consumption. The table (in Figure B) indicates the year in which each building archetype becomes 'stranded' in this 'do nothing' scenario. Key observations that can be drawn from these two figures are included below.

CRREM focuses on operational carbon and, as such, this exercise does the same. It must be noted that, as per the commentary in Section 5.2, there is a requirement for the consideration of embodied carbon as well as operational. This is a shortfall of the CRREM pathway, if used as a framework for achieving NZC, and poses a particular challenge for the highly stringent 2050 targets, which will require a significant level of carbon intensity, building fabric upgrades.

169 Expressed in kWh delivered energy/m² Gross Internal Area
170 https://www.crrem.org/pathways/, dated 19th July 2021
171 Based on the combined heat and electricity factors predicted by The CRREM Project

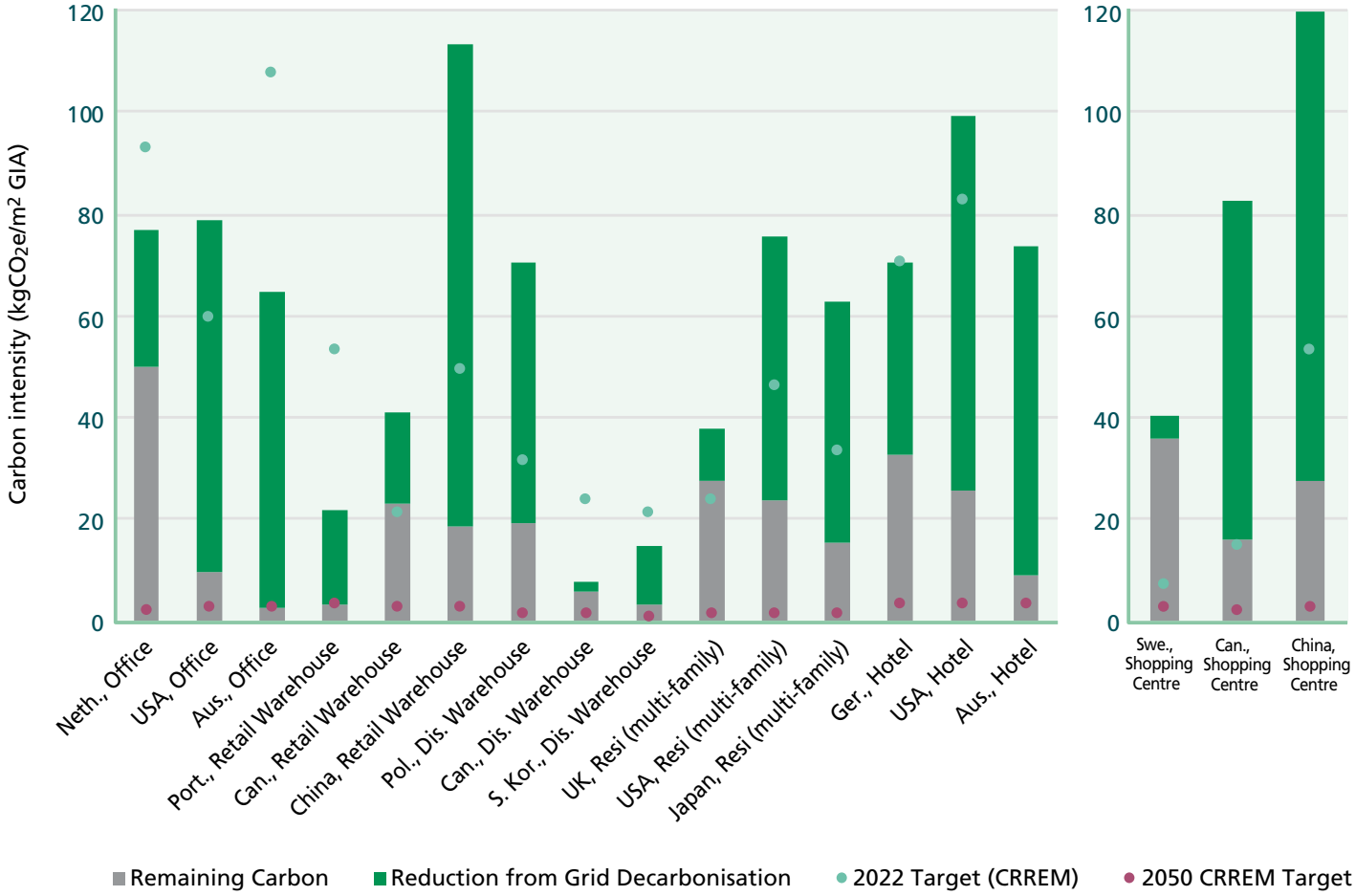
APPENDIX C: CASE STUDIES

Figure C1: Technical Potential of Case Studies (Energy Intensity)



APPENDIX C: CASE STUDIES

Figure C2: 'Do Nothing' Case Study Analysis (Carbon Intensity)



	Stranding Year
Neth., Office	2022
USA, Office	2022
Aus., Office	-
Swe., Shopping Centre	2022
Can., Shopping Centre	2022
China, Shopping Centre	2022
Port., Retail Warehouse	2049
Can., Retail Warehouse	2022
China, Retail Warehouse	2022
Pol., Dis. Warehouse	2022
Can., Dis. Warehouse	2039
S. Kor., Dis. Warehouse	2044
UK, Resi (multi-family)	2022
USA, Resi (multi-family)	2022
Japan, Resi (multi-family)	2022
Ger., Hotel	2022
USA, Hotel	2022
Aus., Hotel	2047

APPENDIX C: CASE STUDIES

Key observations

- The 2030 CRREM targets vary considerably between geographies. For the same asset type there can be a factor of 2-3 between two countries.[172] This presents a challenge to diverse portfolios and funds, particularly inhibiting the consistency and scalability of energy reduction strategies.
- Basing targets solely on asset type and location – not accounting for opening hours, occupancy or other factors – may limit the usefulness of the target to certain asset classes, such as hotels or shopping centres, that demonstrate large underlying diversity.
- The CRREM 2030 EUI thresholds can generally be met with today's technologies across all building types. Shopping centres and hotels are more challenging, although the typical technical potential is sufficient to meet the CRREM 2030 requirements.
- The level of intervention necessary to achieve the 2030 CRREM targets varies across the case studies. In some instances, investment in short payback energy efficiency measures is expected to be sufficient. These costs may be recoverable to the landlord through the service charge or may offer a long-term financial upside in the form of reduced operating costs. In others – for example, hotels and shopping centres – it may be necessary to exploit the potential for on-site renewable generation and replacement of heating systems with low carbon alternatives, such as heat pumps.
- The 2050 CRREM targets require significant reductions in energy intensity to an average of 24 kWh/m^2 across the 18 case studies. These are significantly lower than those recommended by comparable industry schemes and represents under half the minimum quantity of energy required to currently power best practice commercial buildings. Achieving these targets will therefore only be possible with novel technologies being developed in the future for application during the 2030s.
- In countries with more carbon intensive grids (such as Australia), the CRREM target for commercial offices in 2050 is as low as 4 kWh/m^2. This appears impossible to achieve for a large proportion of the building stock – particularly for high rise buildings in city centres, where there may be limited surface area per unit floor area with solar access.
- The cost effectiveness and embodied carbon implications of delivering the 2050 CRREM targets –- compared to the alternative of greater investment in renewable energy generation in each country – is a major challenge. There can be diminishing financial returns involved in the most invasive energy efficiency interventions in what is often termed a 'deep retrofit'.[173] The embodied carbon associated with such measures is not currently considered by the CRREM project.
- One interpretation of the CRREM pathways is that they simply highlight the inadequacy of policy in certain geographies to deal with the supply side challenges of decarbonisation, i.e., ensuring there is sufficient zero or low carbon energy to power buildings and the wider economy. The CRREM pathways should therefore act as a wake-up call to governments to increase ambition and supply the energy required to operate buildings at efficient levels of servicing.

172 The CRREM energy use intensity targets have been derived primarily on the basis of the projected carbon intensity of a country's electricity grid. The study team understand that the CRREM project's access to base data for non-EU countries is restricted, and that this data does not extend to the state-level in countries, such as the USA and Australia where there are material difference at both the state and federal levels.

173 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/972027/deep-literature-review.pdf

APPENDIX C: CASE STUDIES

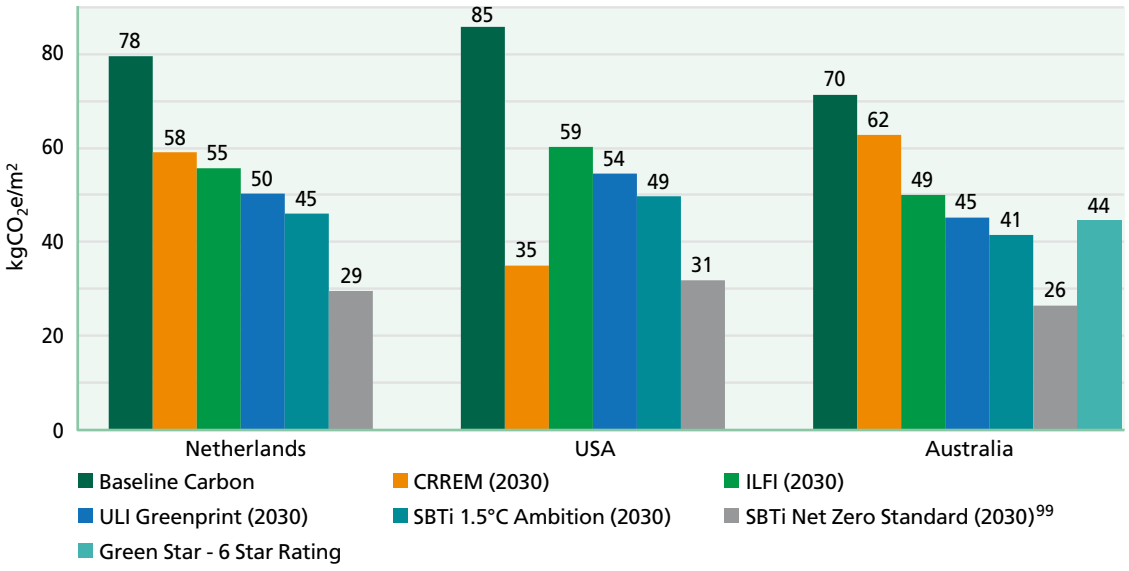
- The CRREM project refers to assets below the performance targets as being 'stranded'. Figure B shows that the majority of assets are already at risk of stranding. Only eight of the 18 case study archetypes outperform the targets set by CRREM in the year of this report's publication. Two of these have been modelled as new builds – built to best practice standards. This highlights the stringency with which the CRREM project has set its targets and the need for action that is predicted by the project.
- All case studies, bar one, become stranded before 2050 without any intervention. The Portuguese warehouse performs so well due to the lack of heating and cooling adopted in the space, a detail that is not accounted for within the single asset type approach taken by CRREM.

C3 Multi-scheme comparison

Offices

Figure C3 compares the carbon intensity targets inferred by a selection of net zero schemes, with the typical baseline performance of a notional commercial office in the Netherlands, USA and Australia. The chart shows the required carbon intensity benchmark set out by a range of relevant net zero schemes.

Figure C3: Comparison of Carbon Intensity Targets for Commercial Offices: Netherlands, USA and Australia

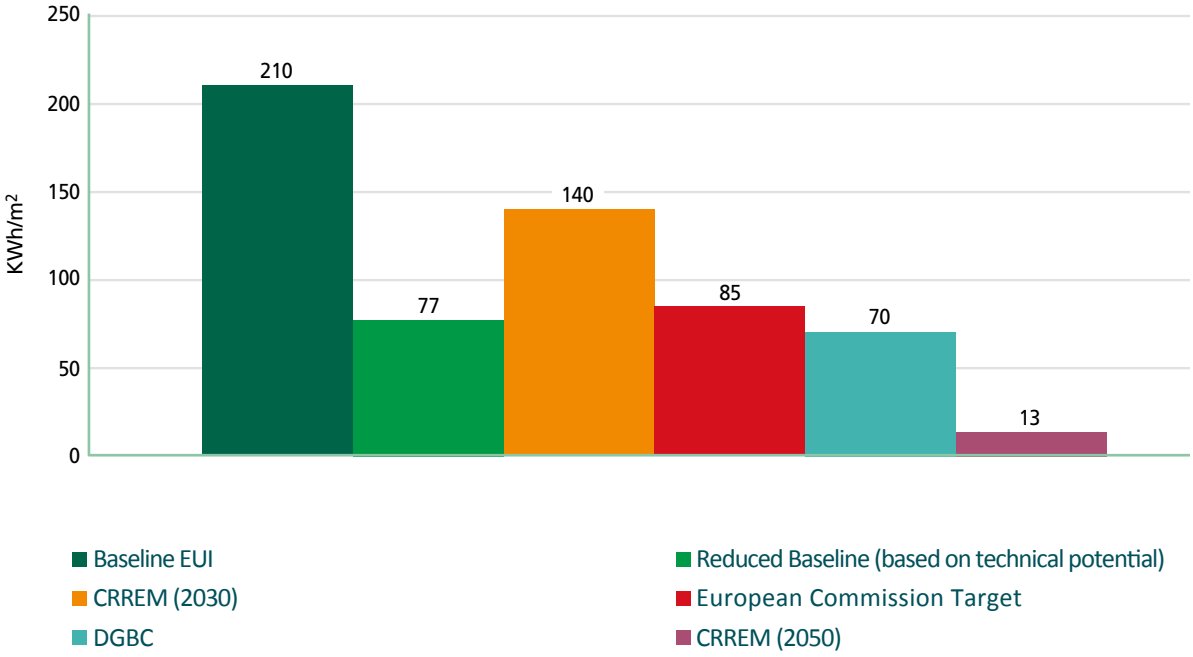


This figure shows that the schemes place quite different expectations for carbon reduction on each building:

- In the Netherlands, the 2030 targets set out by CRREM, ILFI, ULI and the SBTi range from a 20% to a 50% reduction for carbon intensity from the baseline. These levels are all feasible with today's technologies.
- In the USA, the CRREM 2030 targets appear more stringent and require the building to reduce carbon intensity by more than 50% in eight years.
- In Australia, the picture is similar to the Netherlands, although in the CRREM 2030 target is even closer to being achieved by the baseline performance, as this archetype was modelled as a new build – built to best-practice standards.

APPENDIX C: CASE STUDIES

Figure C4: Comparison of Energy Intensity Targets for Dutch Offices



Further dissonance is provided by the varying emphasis on carbon or energy reductions in market schemes. A focus on reducing carbon directly addresses the issue of GHG emissions but fails to address the need for reductions in energy demand to meet national limits of renewable energy generation (The 'Paris proof' concept). While carbon is directly related to energy use, the translation between these two metrics differs by asset type (by virtue of different energy use allocations) and location (due to differing carbon intensities of electricity networks). Of the schemes investigated within this research, few provide both carbon and energy targets.

Figure C4 provides an insight into how this dual approach presents further confusion for investors in Dutch commercial offices. Additional to the carbon reduction targets shown in Figure C3, a number of energy use targets exist for this asset type; the Dutch Green Building Council's Paris proof targets methodology recommends a target of 70 kWh/m^2 of usable surface area. The CRREM project provides a target energy use intensity of 140kWh/m^2 by 2030 and 13kWh/m^2 by 2050. The European Commission has also developed a set of regional thresholds, relating to primary energy use within offices and single family houses, in order to provide Member States with guidance on developing PED indicators for nZEB definitions.[174]

Other asset types

Figures C5 to C9 show similar comparisons of carbon targets for the rest of the building archetypes. Similar to Figure C3, each of these figures demonstrates the range of expectations for carbon reduction placed on each building type. Most percentage reduction targets (ILFI, ULI, SBTi) are consistent across all asset types and geographies – apart from the sector specific target set within the SBTi Net Zero Standard for residential builds, which is less stringent than non-domestic buildings, and is consistent with the 1.5° ambition near-term target[175].

174 https://www.bpie.eu/wp-content/uploads/2021/06/Nearly-zero_EU-Member-State-Review-062021_Final.pdf.pdf
175 https://sciencebasedtargets.org/resources/files/SBTi-Net zero-Standard-Corporate-Manual-Criteria-V1.0.pdf

APPENDIX C: CASE STUDIES

The CRREM 2030 targets are more variable, due to their dependency on both geography and asset type:

- While more strict for shopping centres in Canada and China, the target for Swedish shopping centres requires much less of a reduction to meet, due to the high requirements of national building standards.
- The performance of the Canadian industrial distribution warehouse and Portuguese retail warehouse, against the CRREM 2030 targets, is due to the lack of heating and cooling within these archetypes. This highlights one issue with high-level targets based on non-contextual asset types, as well as the difference between top-down targets[176] (such as CRREM) and absolute reduction targets.
- Similarly, the CRREM carbon targets for the three modelled hotels are less consistent with absolute reduction targets and baseline performance, particularly in Australia. This is potentially due to the diversity of facilities that can be present within hotels of differing standards.

Figure C5: Comparison of Shopping Centre Carbon Intensity Targets: Sweden, Canada and China

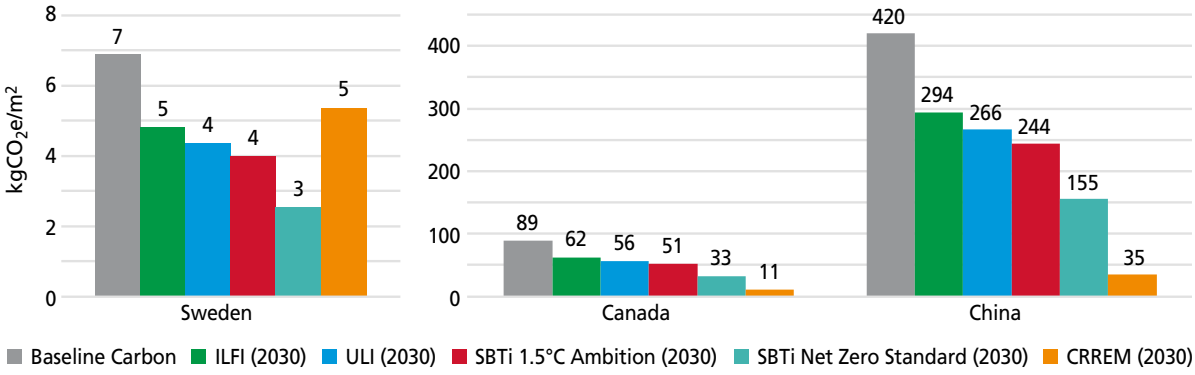
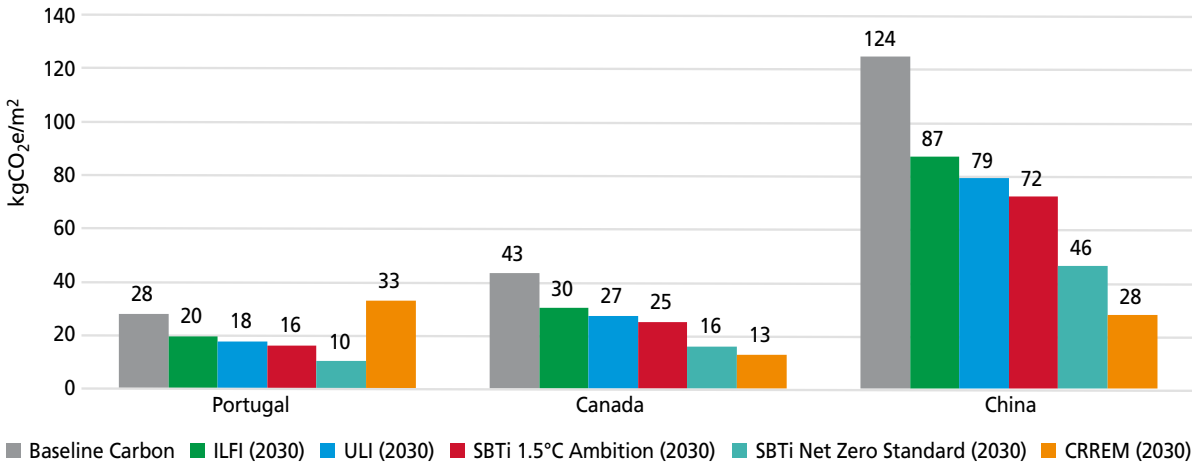


Figure C6: Comparison of Retail Warehouse Carbon Intensity Targets: Portugal, Canada and China



176 An approach to national carbon targets based on distributing global or national carbon budgets within countries, economic sectors or sections of the built environment.

APPENDIX C: CASE STUDIES

Figure C7: Comparison of Industrial Distribution Warehouse Carbon Intensity Targets: Poland, Canada and South Korea

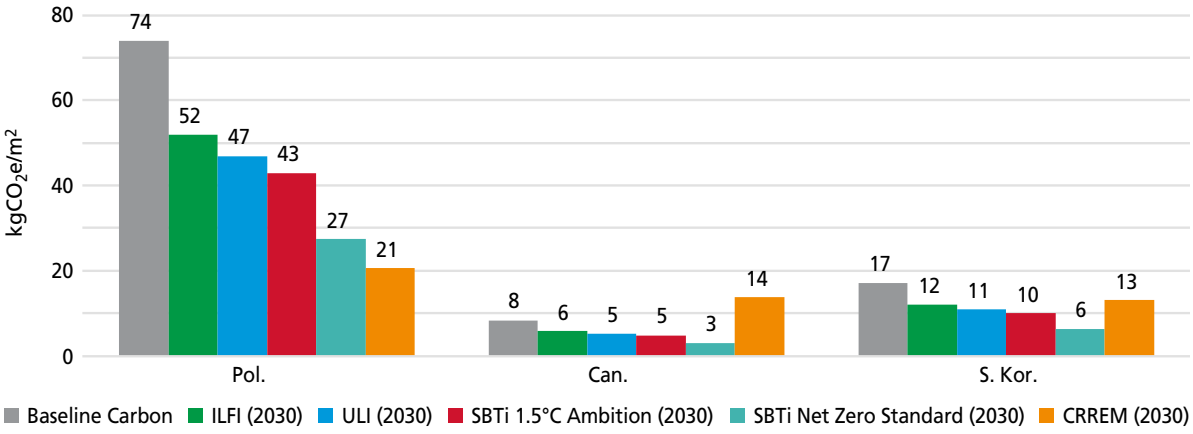
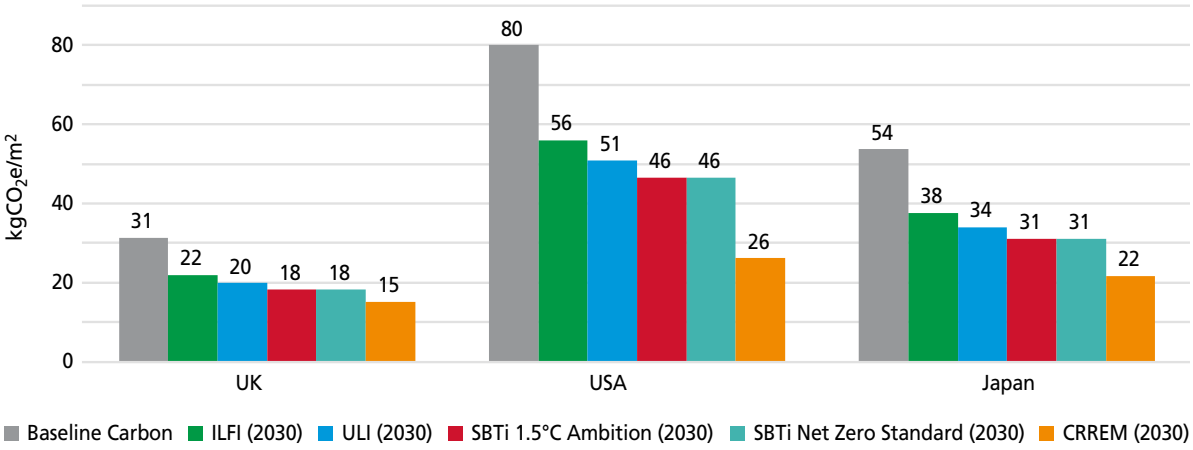
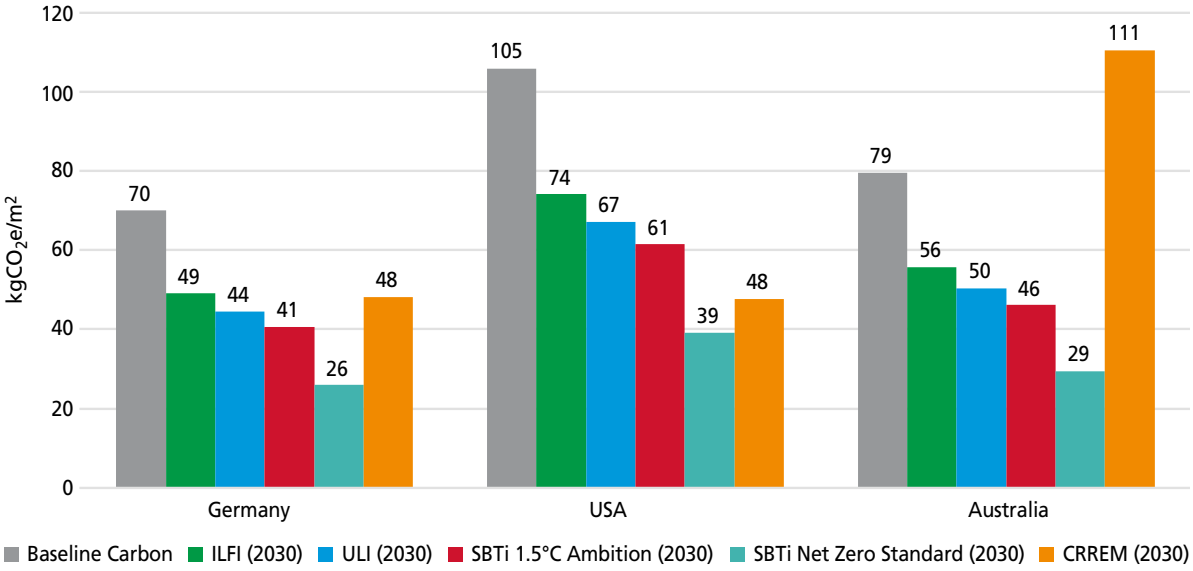


Figure C8: Comparison of Multi-Family Residential Building Carbon Intensity Targets: UK, USA and Japan



APPENDIX C: CASE STUDIES

Figure C9: Comparison of Hotel Carbon Intensity Targets: Germany, USA and Australia

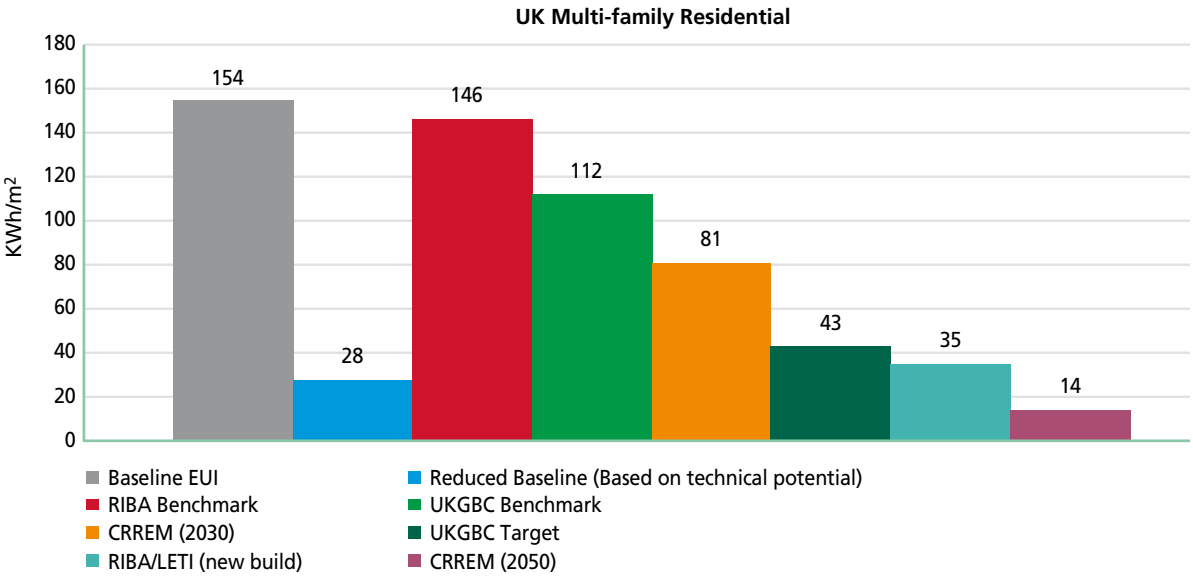


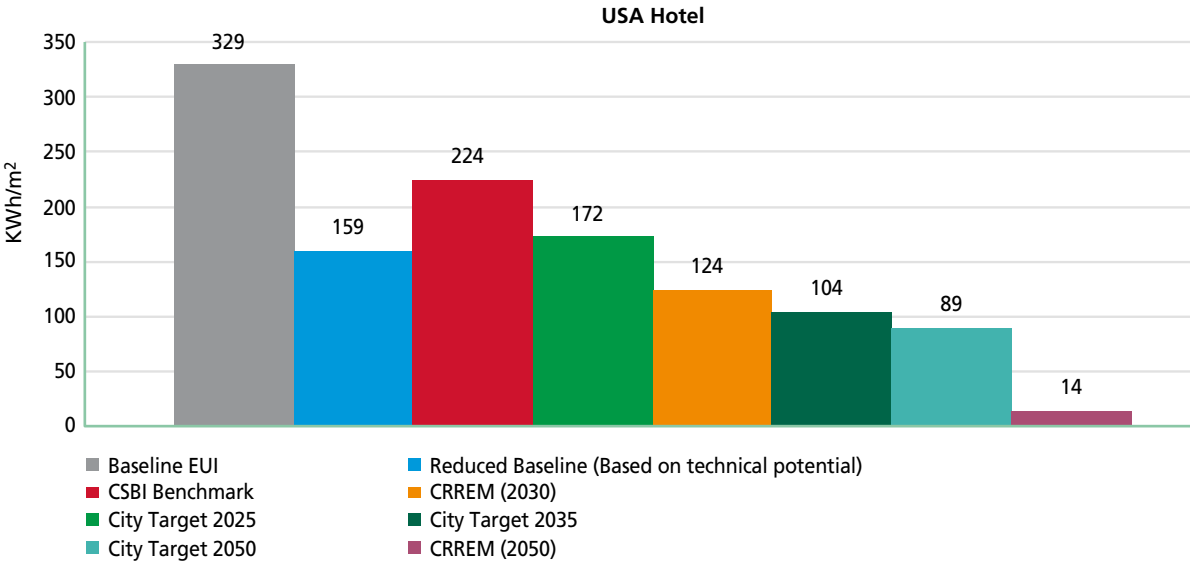
Energy intensity and reduction targets are, by nature, more bespoke and therefore less available, for the eighteen archetypes included in the study. This is due to the unique split of end uses for each asset type (which can also be dependent on location). Other than the targets provided for Dutch offices (Figure C4), the two archetypes with the greatest number of energy targets for comparison are the UK multi-family residential and the USA hotel archetypes (Figure C10).

The breadth of stringency of energy targets included within this figure furthers the conclusion that a consistent approach to NZC definitions is required for market actors to understand how best to position themselves for net zero, based on both asset types and geographies. These figures also highlight the additional level of obscurity that is provided by national and city based targets and regulations, presenting further challenges to investors managing diverse portfolios.

APPENDIX C: CASE STUDIES

Figure C10: Comparison of Energy Intensity for UK Multi-Family Residential Buildings and US Hotels





APPENDIX D: STAKEHOLDER INTERVIEW QUESTIONS

1. Please confirm your role and how it relates to the real estate investment market.
2. How do you perceive the importance of achieving NZC in the IREI market (OR in buildings for occupiers), relative to other challenges the industry faces?
3. Please could you tell me a little about your personal experience and understanding of NZC schemes. Which NZC schemes are you most familiar with and which do you believe have the greatest influence and industry take-up in real estate investment today?
4. Carbon emissions arise in a number of ways from the real estate investment process, both directly and indirectly. Which areas of carbon impact do you believe that the IREI market currently considers to be within the scope of NZC schemes?
5. Are there particular sources of energy use in buildings that should be excluded from NZC definitions?
6. Which asset characteristics should be used to differentiate what NZC performance means?
7. Does your organization have a house view on the role of offsetting in NZC schemes and definitions? Are there particular scopes or sources of carbon that are more or less acceptable to be mitigated by offsets?
8. Do you believe that the NZC status of a building currently impacts its commercial performance (value, voids, attractiveness to occupiers)? How do you anticipate this changing in the short- and long-term?
9. What challenges, if any, do you foresee in transitioning the international real estate investment market to net zero?
10. Do you think there are particular sectors or building types that pose the greatest challenge?
11. Do you think there are particular geographies that pose the greatest challenge?
12. Do you think there are particular stages in the asset lifecycle that pose the greatest challenge?
13. Which stakeholder groups or market actors will play the greatest role in delivering NZC in the international real estate investment market?
14. Do you think that existing NZC schemes leave any potential of leading to unintended consequences?
15. How would you like to see NZC schemes and definitions change in the short- and long-term?
16. What would be a useful outcome from this IPF research project for you?

APPENDIX E: STAKEHOLDER SURVEY QUESTIONS

Table E1: Key challenges and actions

Section	No.	Question	Question type	Options 1
NZC in Real Estate Investment	1	How would you rank the following challenges facing the international real estate investment market according to their importance?	Rank/sort	Economic recovery post-Covid, Changing demands for space posing risk to income streams, Outdated infrastructure, Inclusion, diversity and social support/affordable housing, Climate change mitigation (NZC), Climate change adaptation, Changing regulatory requirements or increased taxation, Elevated pricing due to low global interest rates, The level of gearing in global property markets, Other
	2	Which of the following NZC frameworks, targets or definitions have you used?	Checklist	CRREM, PAS2060, SBTi, WGBC 'Advancing Net Zero' via national GBC initiatives (e.g. UKGBC NZC Buildings Framework Definition), LETI, BBP Climate Change Commitment, Net Zero Asset Owners Alliance, ILFI Zero Carbon Certification, ULI Greenprint Net Zero Goal, None of the above
	3	Are there any other NZC initiatives not listed that you believe have significant influence/industry take-up in the real estate industry today?	Open text	
	4	How well (on a scale of 1-5) do you believe that the NZC frameworks in the market today satisfactorily address the following sources of carbon emissions from real estate?	Scale	Operational energy, Embodied carbon from developments/refurbishments, Other Scope 3 emissions (e.g. purchased goods and services, employee commuting, business travel)
	5	The definitions for NZC for buildings in the market today often draw distinctions between different types of building, with requirements dependent on a number of factors. Please rank the characteristics you believe should be used to differentiate what NZC performance means.	Rank	Geography (i.e. country and climate), Asset type, Presence of mixed uses, New vs. existing buildings, Intensity of user activities (for example, occupant density in offices, turnover and refrigerated food storage in retail premises, room occupancy in accommodation), Occupancy hours, Main heating fuel
	6	Are there any other characteristics you believe should be used to differentiate what NZC performance means?	Open text	

APPENDIX E: STAKEHOLDER SURVEY QUESTIONS

Table E1: Key Challenges and Actions (cont'd.)

NZC in Real Estate Investment	7	What metric do you believe should be used to define NZC performance in real estate assets?	Checklist	Energy use intensity targets (kWh/m^2), carbon intensity targets (i.e. kgCO_2e/m^2), a combination of both, a consumer-friendly scale (e.g. bronze to platinum, 1 to 6 stars etc.), Other (please specify)
	8	Should offsetting be acceptable as part of a 'NZC' definition for real estate, and if so, for which emissions sources should they be permitted?	Checkbox Array	Columns: Offsets not necessary, Offsets should be used, Offsets should be permitted subject to energy efficiency threshold (kWh/m^2), Offsets should be permitted subject to embodied carbon threshold (kgCO_2e/m^2) Rows: Scope 1 emissions (e.g. natural gas use for services managed by the landlord), Scope 2 emissions (e.g. electricity use for services managed by the landlord), Scope 3 emissions arising from energy use by occupiers, Scope 3 emissions arising from embodied carbon in developments, refurbishments and maintenance, Scope 3 emissions arising from the property investment process (e.g. purchased services, business travel, employee commuting), Other (please specify)
	9	Which specific challenges do you see in achieving NZC in real estate, and at which particular stages in the asset investment process do you see these arising? Please tick up to three challenges that apply to each stage	Checkbox Array	Columns: Supply chain skills, Extra costs for asset owner, Lower return on investment for investors, Reporting: delineation measurement, rating and disclosure, Other challenges (please specify below). Rows: Design, Manufacture and Construction, Acquisition, Operation, Refurbishment and Redevelopment, Handover and Disposal
NZC Challenges	10	Please provide any further comments relating to the previous question, specific to the different stages in the asset investment process	Open text	
	11	Please provide any comments relating to question 15 which relate to particular sectors or building types. Do you see challenges specific to particular sectors or building types?	Open text	
	12	Please provide any comments relating to question 15 which relate to particular regions or countries. Do you see challenges specific to particular regions or countries?	Open text	

APPENDIX E: STAKEHOLDER SURVEY QUESTIONS

Table E1: Key Challenges and Actions (cont'd.)

The Future of NZC in Real Estate Investment	13	In the main markets in which you operate, to what extent do you believe that NZC performance of real estate assets is impacting on asset valuation today, or will impact on it in the future?	Scale	Today short term future (2-3 years from now), Long term future (5-10) years from now). Please provide any comments relating to you answer
	14	What are the key market changes that you believe would accelerate the transition to NZC in real estate? Please select from the following options or provide your own suggestions.	Checklist	Mandatory disclosure of asset level operational performance, High carbon prices, TCFD/SFDR reporting of asset level carbon impacts, A NZC verification scheme, Other (please specify)
	15	Finally, have the entities which you can influence and/or your organisation set a target year for achieving the following positions?	Dropdown Boxes	Carbon Neutral, Net zero (i.e. including offsets), Absolute zero (i.e. excluding offsets), Please provide any comments relating to your answer including other commitments if comparable
Additional Comments	16	Is there any further information you would like to provide in response to the questions above, or on this topic in general? Please provide a reference to the question number if applicable.	Open text	

APPENDIX F: TERMINOLOGY

Table F1 lists key defined terms used throughout the report and their meaning in the context of achieving Net Zero Carbon emissions in the international real estate sector. This is followed by Table F2, detailing acronyms used throughout the report.

Table F1: Glossary

Word/Phrase	Definition
Landlord	An individual or organisation responsible for the ownership of a building.
Asset/Investment Manager	Third party service, procured by the asset owner, to manage the operational stage of a building lifecycle.
Investor/Asset Owner	An individual or organisation allocating capital for the acquisition, development or operation of a building – potentially as part of a pension fund, endowment or foundation, or for high-net-worth and retail investors who own underlying real assets but charge the management of those assets to asset/investment managers.
Occupier/Tenant	An organisation residing in/operating from a building.
Climate Mitigation	Actions or investments made at a building or organisational level to reduce the release of GHG emissions.
Climate Compensation	Actions or investments made at a building or organisational level to mitigate GHG emissions through third party action (supplementary to any climate mitigation actions already pursued).
Offsetting	Actions or investments made at an organisational level to facilitate another party to reduce or avoid emissions, or absorb atmospheric carbon – synonymous to climate compensation.
Insetting	Actions or investments made at an organisational level to facilitate a carbon offsetting project within the organisation's own value chain.
Carbon Neutral	A status whereby an entity measures and balances GHG emissions with an equivalent of GHG reductions or removals, often in the form of offsets.
NZC Efficient	A building-level status whereby the building has undergone steps to improve the energy performance and reduce inefficiencies. Remaining emissions are offset.
NZC Ready	Similar to NZC Efficient but as well as eliminating inefficiencies, this building-level status requires the replacement of any fossil-fuel derived energy use. Remaining emissions are offset.
NZC	Similar to NZC Ready but this building-level status is achieved on completion of national grid decarbonisation. Remaining emissions are offset.
Zero Carbon	A status whereby an entity has eliminated all Scope 1, 2 and 3 emissions and does not rely on any offsetting schemes.
Net Positive/Climate Positive	A status whereby an entity has achieved zero carbon and further delivers net carbon removals.
1.5° Aligned/1.5° Pathway	A target, commitment or reduction pathway, which, if applied globally, will ensure global warming is limited to 1.5°C above pre-industrial temperatures by the year 2100.

APPENDIX F: TERMINOLOGY

Table F1: Glossary (cont'd.)

Paris-Aligned	A target, commitment or reduction pathway that is aligned with the requirements of the Paris Agreement (2015) – synonymous with 1.5° aligned.
Paris-Proof Principle	A concept pioneered by the Dutch GBC basing energy reduction requirements on the future zero carbon energy generation capacity.
Energy/Mitigation Hierarchy	A principle that prioritises the improvement of energy performance above all other carbon mitigation/compensation methods and allows offsetting to be used only as a last resort in any NZC definition.
Operational Carbon	GHG emissions associated with the operational stage of a building's lifecycle, mostly attributed to emissions from energy use.
Embodied Carbon	GHG emissions associated with building construction, including those arising from extracting, transporting, manufacturing, and installing building materials, in addition to the operational and end-of-life emissions of the materials.
Whole Life Carbon	GHG emissions associated with the full lifecycle of a building – combining embodied carbon, operational carbon and any other sources of emissions.
Fugitive Emissions	Emissions that are not produced intentionally – within the built environment, this is usually attributed to leakage of refrigerants from cooling systems and heat pumps.
Green Tariff	A market mechanism whereby electricity purchasers pay providers for energy that is sourced from renewable sources.
Base Building	Areas of a building managed by the landlord, rather than the occupier.

APPENDIX F: TERMINOLOGY

Table F2: Acronyms

Abbreviation	Name
AIGCC	Asia Investor Group on Climate Change
BBP	Better Buildings Partnership
CER	Certified Emission Reduction
CO_2e	Carbon Dioxide Equivalent
CRREM	Carbon Risk Real Estate Monitor
E+C-	Energy Positive Climate Negative (French Green Building Council)
EPC	Energy Performance Certificate
EPD	Environmental Product Declaration
ESG	Environmental, Social and Governance
EUI	Energy Usage Intensity
EUT	European Union Taxonomy
GBC	Green Building Council
GHG	Greenhouse Gas
GIA	Gross Internal Area
IGCC	Investor Group on Climate Change
IIGCC	Institutional Investor Group on Climate Change
ILFI	International Living Futures Initiative
IREI	International Real Estate Investment
LCA	Lifecycle Assessment
LETI	London Energy Transformation Initiative
NBIM	Norges Bank Investment Management
NZAMI	Net Zero Asset Managers Initiative
NZAOA	Net Zero Asset Owners Alliance
NZC	Net Zero Carbon

APPENDIX F: TERMINOLOGY

Table F2: Acronyms (cont'd.)

NZIF	Net Zero Investment Framework
nZEB	Nearly Zero Energy Building
PAII	Paris Aligned Initiative
PED	Primary Energy Demand
PPA	Power Purchase Agreement
PPC	Paris Proof Commitment (DGBC)
PPOT	Paris Proof Office Targets (UKGBC)
RMU	Removal Units
SBTi	Science Based Target Initiative
SFDR	Sustainable Finance Disclosure Regulation
TCFD	Taskforce for Climate related Financial Disclosure
UNEPFI	United Nations Environmental Programme Finance Initiative
UNGC	United Nations Global Compact
UNPRI	United Nations Principles for Responsible Investment
VCU	Verified Carbon Units
VER	Voluntary/Verified Emission Reduction
WGBC ANZ	World Green Building Council Advancing Net Zero
WGBC NZCBC	World Green Building Council Net Zero Carbon Buildings Commitment
WLC	Whole Life Carbon
WRI	World Resources Institure
WWF	World Wind Fund for Nature
ZCC	Zero Carbon Certification

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