

# Advancing Net Zero Whole Life Carbon

Offsetting Residual Emissions from the  
Building and Construction Sector

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Disclaimer: This document is intended as a standalone position paper and further guidance for WorldGBC's Net Zero Carbon Buildings (NZCB) Commitment (the Commitment). It has been developed and maintained in conjunction with the Commitment Taskforce and WorldGBC partners. As such, it is a live document and will be updated as required. Please refer to the latest version of the Detailed Guidance document for the most accurate guidance relating to the Commitment requirements.


# Purpose of the document 1.0

This document outlines WorldGBC's recommendations for why, when, and how offsetting may be used to advance net zero carbon emissions in the built environment.

As set out in the document, emission reduction efforts should be prioritised at all opportunities. However, in the immediate term, offsets are a necessary part of the transition towards total decarbonisation, or zero carbon, for the building and construction sector.

The document is advisory, and sets out to contribute to the increasingly important practice of offsetting emissions via compensation and neutralisation towards net zero emissions in the building and construction sector, in order to ensure its contribution towards achieving the Paris Agreement goals. Please refer to national GBC offsets guidance where this has been developed.

Over time, and as offsets markets mature, are standardised and regulated, we anticipate that the guidance in this document will be updated.

For Cities seeking information on offsetting, please refer to the [C40 Carbon Neutral Guidance](#) .

## Advancing offset standards

Where approaches and technologies do not yet exist at a scale which can completely eliminate carbon emissions from construction projects or building operations, offsetting remains an important near-term solution to account and compensate for residual emissions from the sector.

However, the offsets market is under-developed at present.

We want to work with all parties involved to stimulate demand, to encourage clear and transparent reporting, regulation and a consistent approach in the sector, and to promote trusted providers of high-quality offsets who can meet demand in line with global and market specific best practice principles.

## Navigating net zero

WorldGBC recommends transition to permanent carbon removal offsets in the long-term to neutralise any residual emissions and reach net zero. However, as part of the transition towards total sector decarbonisation that also enables tangible environment and social co-benefits in support of the UN's Global Goals for Sustainable Development (SDGs), WorldGBC also recognises the significant contribution of sector-based compensation offsets, and the role they can play in the short- to medium-term in facilitating systemic change.

WorldGBC recognises that definitions of net zero and approaches to achieve a net zero emissions balance vary. WorldGBC does not encourage signatories to make claims about achieving net zero based purely on their participation in the Commitment. However, they will be recognised as leaders in transforming the market and in advancing net zero.

# Glossary 2.0

**Advancing net zero:** Actions taken to reduce emissions from operational and embodied carbon, with residual emissions compensated for via compensation activities in the transition to net zero emissions.

**Avoided emission offset:** Eliminate emissions from a source outside the value chain of the entity, normally by investing offsets credits into projects which establish access to renewable energy sources; for example by replacing fossil fuel sources with solar panels.

**Carbon capture:** Refers to a range of methods which either remove CO<sub>2</sub> from the atmosphere and/or prevent it from being released at source.

**Carbon offset:** An offset is where an avoidance, reduction, or removal of a carbon emission is used to compensate for or neutralise a CO<sub>2</sub> emission that occurs elsewhere.

**Carbon offset credit:** A tradable, non-tangible instrument representing a unit of carbon dioxide-equivalent (CO<sub>2</sub>e) – typically one tonne – that is reduced, avoided or sequestered by a project and is certified/verified to an internationally recognised carbon accounting standard<sup>1</sup>.

**Carbon removal offset:** A type of offset that takes CO<sub>2</sub> out of the air and permanently stores it. For all forms of carbon removal, whether nature-based solutions or technologically-mediated processes, carbon must be stored<sup>2</sup>.

**Embodied carbon:** Carbon emissions associated with materials and construction processes used throughout the whole lifecycle of a building or infrastructure.

**Emissions reduction offset:** Any activity that compensates for the emission of carbon dioxide (CO<sub>2</sub>) or other greenhouse gases (measured in carbon dioxide equivalents [CO<sub>2</sub>e]) by providing an emission reduction elsewhere<sup>3</sup>; e.g. through installation of renewable energy sources in place of fossil fuel-based energy sources for a given asset.

**Greenhouse Gases (GHGs):** Gaseous constituents of the atmosphere which properties cause the greenhouse effect. Water vapour (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>) and ozone (O<sub>3</sub>) are the primary GHGs in the Earth's atmosphere.

**Net zero operational carbon:** When the amount of carbon dioxide emissions associated with building operations on an annual basis is reduced (highly energy efficient and

fully powered from on-site and/or off-site renewable energy sources) to a level that is consistent with reaching net zero at the global or sector level in 1.5°C pathways. Any residual emissions that remain unfeasible to eliminate should be neutralised through carbon removals<sup>4</sup>.

**Net zero whole life carbon:** When, in addition to net zero operational carbon, upfront carbon and other embodied carbon across the building lifecycle is reduced to a level that is consistent with reaching net zero at the global or sector level in 1.5°C pathways. Any residual emissions that remain unfeasible to eliminate should be neutralised through carbon removals<sup>4</sup>.

**Non credit based actions:** Projects to compensate for emissions that are credible, unique, additional and permanent, but not currently verified by credit schemes.

**Operational carbon:** Carbon emissions associated with energy used to light, heat, cool, and power a building.

**Residual emissions:** Emissions which remain once all feasible methods for reducing emissions during construction and operation have been exhausted.

**Restorative carbon removal:** Actions which actively sequester carbon from the atmosphere, reversing the effects of anthropocentric emissions.

**Sector-based compensation offsets:** Verified offsets which contribute to avoiding or reducing emissions from buildings or construction projects external to the asset.

**Scope 1 emissions:** Emissions from operations that are owned or controlled by the reporting company.

**Scope 2 emissions:** Indirect emissions from the generation of purchased or acquired electricity, steam, heat, or cooling consumed by the reporting company.

**Scope 3 emissions:** All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions, with no direct ownership or control over.

**Upfront carbon:** Total carbon emissions produced in the production and construction process stages of a building lifecycle, including emissions from raw material supply, manufacturing, transportation, and construction or installation of a building.

**Zero carbon:** Refers to highly efficient assets which are built and operated using 100% renewable energy sources and are fossil fuel free.

1 ICROA, 'Code of Best Practice for Carbon Management Services' (2020)  
2 University of Oxford, 'The Oxford Principles for Net Zero Aligned Carbon Offsetting' (2020)  
3 Definition from the Encyclopedia Britannica (2021)  
4 Science Based Targets, 'Foundations for Science-based Net Zero Target Setting in the Corporate Sector' (2020)

# Introduction 3.0

## 3.1 The scale of the challenge

**The processes involved in the building and construction industry (materials production, transport, construction processes, building operations) are intrinsically carbon intensive.**

With a shift in recent years towards more efficient means of design, construction and operation, innovative technologies and design approaches are driving efficiencies across each phase of a building's lifecycle. However, transitioning to a fully decarbonised sector presents significant and unprecedented challenges to overcome. As we continue to build new buildings (the global building stock is expected to double by 2060<sup>5</sup>) and operate existing buildings that have inefficient or fossil fuel-based operations "locked in", the pace of change required to shift action from industry-leading frontrunners to every stakeholder in the value chain is enormous, and will not be sufficient without significant effort.

While an urban area the size of Paris is being built every week<sup>6</sup>, regulatory frameworks are not yet driving best practice development. The sector is therefore continuing to use up its remaining global 'carbon budget', making it increasingly unlikely that we will align with the 1.5°C Paris climate goal.

**A bold and radical approach is required to reduce and compensate for emissions from the building and construction sector.**

As awareness of the impacts of carbon emissions has increased, so has the use of carbon offsets which either compensate for or neutralise those impacts. However, offsetting, if not done well, can result in greenwashing and create negative unintended impacts for people and the environment.

Current best practice helps to reduce some of the risks associated with existing offsets (e.g. improper carbon accounting, re-release of stored carbon, negative unintended impacts on humans or ecosystems, etc.), but, in isolation is unlikely to deliver the types of offsetting needed to progress us towards net zero emissions.

## 3.2 Why is offsetting necessary?

The recent IPCC report<sup>7</sup> estimates the remaining global carbon budget between 2020 and 2050, if we are to reach the global net zero goal, is around 300 GtCO<sub>2</sub>. This would give us 83% likelihood of meeting the 1.5°C scenario.

For the built environment, this means we must use all of the tools at our disposal – in the right ways – to transition towards a net zero carbon, healthy, equitable and resilient built environment as soon as possible.

As we continue to build, we worsen the situation. Even with carbon emissions reduced through good design and specification, utilising the best available approaches, technologies and materials, there remains a significant residual carbon impact that can only currently be addressed through offsetting. A transition to a fully decarbonised building and construction sector requires a complete and unprecedented migration away from fossil fuels in building operations (both new and existing), supply chains and construction processes, as well as maximising opportunities for circularity in materials and buildings.

Therefore, in addition to aggressive emissions reduction strategies via effective, high performance building design (as set out in the [Advancing Net Zero](#) framework<sup>8</sup>) and until necessary design, technological and supply chain interventions can be adopted as business-as-usual, residual emissions may remain – particularly when pursuing net zero whole life carbon.

**Compensating for the emissions we cannot prevent today will support acceleration of the decarbonisation agenda – critical to achieving the 1.5°C Paris climate goal.**

Although WorldGBC recognises that in the long-term, achieving net zero means neutralising residual emissions with carbon removals, sector-based compensation offsets and non credit based actions can be part of a holistic approach to sustainability that supports the SDGs.

In the short- and medium-term, sector-based compensation offsets can enable tangible environmental and social co-benefits such as improved air quality, access to renewable energy and quality of life.

5 GlobalABC, '2020 Global Status Report for Buildings and Construction' (2020), p.59.

6 UN Environment and International Energy Agency, 'Global Status Report 2017: Towards a zero-emission, efficient, and resilient buildings and construction sector' (2017), p.2.

7 Intergovernmental Panel on Climate Change (IPCC)'s Sixth Assessment Report (AR6) on the physical science basis of climate change (2021).

8 WorldGBC, 'Advancing Net Zero Whole Life Carbon vision' (2020).

### 3.3 Offsetting principles

WorldGBC advocates for halving emissions of the building and construction sector by 2030 and the total decarbonisation of the sector by 2050. As we transition, we also recognise the value of offsets as a means to compensate for and neutralise the impacts of the sector, and to facilitate positive social and environmental impact in pursuit of overall net zero emissions.

This will be achieved through prioritising a best practice approach, as set out within the following principles:

#### 1. Prioritise emissions reduction

Minimise the need for offsets in the first place via best practice sustainable construction and operation. This means reducing energy demand, shifting away from fossil fuels, and using 100% renewable energy as soon as possible.

#### 2. Compensate for residual emissions

For any residual emissions – those which cannot be abated – invest in carbon reduction or storage projects that are credible, unique, additional and permanent, as determined via independent third party verification.

#### 3. Advance tangible benefits

Direct investment into offsets that store carbon and provide additional tangible environmental and/or social improvements, particularly those that have additional nature-based co-benefits or co-benefits in line with the Sustainable Development Goals.


Please refer to local Green Building Council (GBC) guidance for market-specific guidance and offsetting principles. National guidance has been produced by multiple GBCs, including UKGBC<sup>9</sup>, DGNB<sup>10</sup> and GBC Australia<sup>11</sup>.



9 UKGBC, 'Renewable Energy Procurement & Carbon Offsetting Guidance for Net Zero Carbon Buildings' (2021)  
10 DGNB, 'Framework for Carbon Neutral Buildings and Sites' (2020)  
11 GBC Australia, 'A carbon positive roadmap for the built environment' (2020)

# Advancing Net Zero Whole Life Carbon 4.0

It is estimated that between 2020 and 2050, new buildings will produce around half of their emissions from embodied sources, and half from operational sources over their whole lifecycle<sup>12</sup>. However, this ratio is skewed in the medium-term towards **embodied emissions**, which account for **72% of building emissions over a 10-year time horizon**<sup>13</sup> – roughly the amount of time we have before we exceed the 1.5°C global temperature change threshold.

As set out in [Bringing Embodied Carbon Upfront](#) , it is vitally important that we move swiftly towards net zero emissions from both embodied and operational sources in buildings<sup>14</sup>. This is a shift which we must undertake now. As the global building stock continues to grow, we must deliver new buildings optimised to operate at net zero, as the opportunity to see these reductions through retrofit or the renovation of existing buildings is challenging in terms of feasibility and cost. Additionally, because emissions are cumulative and because we have a limited amount of time to reduce them, carbon reductions now have more value than carbon reductions in the future<sup>15</sup>.

In many markets, climates and building typologies, achieving net zero operational carbon is possible without the use of offsets. In these instances, buildings are designed and built to be highly energy efficient and exclusively powered by renewable energy, with no residual emissions. Therefore operationally, they are completely decarbonised and reach absolute zero carbon. However due to external limitations in some markets, including existing fossil fuel-based electricity grids, other barriers to renewable energy supply or climate conditions, offsets represent an important facilitator in advancing net zero.

This is more significant when advancing net zero embodied emissions (and therefore net zero whole life carbon). After all measures have been implemented to reduce upfront and whole life emissions, residual embodied carbon emissions will almost inevitably remain.

Advancing net zero whole life carbon today will:

- (1) Require reasonable use of verified offsets to mitigate remaining emissions, after all reduction strategies have been exhausted, and
- (2) Create a strong demand signal for necessary investments and interventions required by the supply chain to bring greater and more equitable access to low carbon materials and technologies.

## 4.1 Varieties of offsets

WorldGBC considers an offset to be a measure which avoids, reduces, or removes GHG emissions, compensating for or neutralising the impacts of GHG emissions that occur elsewhere.

Offsets can be traded in the form of credits that typically represent one metric tonne of carbon dioxide equivalent emission reductions. An offset is not a reduction in emissions generated within a company's own operations and value chain, but rather an action intended to compensate for residual emissions by mitigating emissions outside of a company's own value chain.

Offsets come in many varieties and can be categorised into three main groups; offsets which:

- 1. Avoid emissions** – where the action aims to avoid emissions in a source outside the value chain of the entity (e.g. by fuel switching to renewable energy in buildings beyond the entity's control). By investing offset credits into projects which replace fossil fuel sources with renewable energy, these offsets reduce emissions outside of the project scope and spur wider market transformation, advancing us towards a zero carbon built environment.
- 2. Reduce emissions** – where the action aims to reduce emission in a source outside the value chain of the entity (e.g. through energy efficiency improvements, weatherising buildings, retaining stored carbon in land, or carbon capture at source). By investing in energy efficiency retrofits and renovations, these offsets help to reduce emissions compared to a business-as-usual scenario. Importantly, emissions reduction funds must not be invested into any projects which entrench fossil fuel usage, (e.g. replacing coal energy sources with natural gas energy sources) as this would be counterproductive to the intent of this approach.
- 3. Remove carbon** – where the action aims to extract and store carbon which has already been emitted into the atmosphere. This can be done by investing in short-lived (e.g. new forestry projects) and long-term storage solutions (e.g. bioenergy with carbon capture and storage), discussed in more detail in section 4.3.

12 Architecture 2030, 'New Buildings: Embodied Carbon' (2020)

13 Mazria, E., 'Getting to Zero: The Urgency of Zero Emissions' (2020)

14 WorldGBC, 'Bringing Embodied Carbon Upfront: Coordinated action for the building and construction sector to tackle embodied carbon' (2019)

15 Carbon Leadership Forum, 'The Time Value of Carbon' (2020)

The diversity of the offsets market has caused confusion over which types deliver the best outcomes, and particularly over whether compensation offsets (which avoid or reduce emissions) are a valid route to net zero.

From WorldGBC's perspective, all of the offsets considered here are valuable either as a transition mechanism which compensates for current emissions, or as a tool for neutralising residual emissions which cannot be abated. They are not, however, an alternative to improving energy efficiency and transitioning to clean energy use within an entity's own portfolio.

WorldGBC recommends that all offsets be implemented through a verified offset credit scheme (e.g. Gold Standard, VCS or CDM), or as verified non credit based actions in accordance with the principles in section 3.3. The potential for double counting must be accounted for, noting that companies should not count a reduction or removal both within their inventory and as an offset, or sell an offset where they are counting the benefit towards their own target.

All of the offsets discussed here are consistent with the Oxford Principles for Net Zero Aligned Carbon Offsetting<sup>16</sup> [↗](#). Please also refer to local Green Building Council for specific country-guidance, where this is available.

**WorldGBC considers it necessary that over time we transition from offsetting measures which reduce or avoid emissions in favour of measures which actively and permanently sequester carbon from the atmosphere as an important and necessary countermeasure to the climate crisis.**

It should also be noted that different types of offsets may be better suited in certain conditions or in different market contexts. As such, WorldGBC defers to local Green Building Councils where local offsetting guidance exists. National guidance has been produced by multiple GBCs, including UKGBC<sup>17</sup>, DGNB<sup>18</sup> and GBC Australia<sup>19</sup>.

Figure 1 (on page 9) illustrates WorldGBC's recommendations for how offsets should be used, and how we expect the market to develop over time.

## 4.2 Removing carbon from the atmosphere

Carbon removal offsets actively sequester carbon dioxide from the atmosphere and can be used to decrease atmospheric CO<sub>2</sub> levels in proportion to the residual emissions produced by a given building. In this way carbon removal offsets serve as a mechanism for neutralising the emissions produced from buildings and construction.

Sequestering carbon from the atmosphere is currently only affordable and accessible using nature-based methods (see 'Immediate offsets', below). However, there is also increasing investment and interest in an emerging set of technical carbon capture methodologies, which work by mechanically or chemically extracting CO<sub>2</sub> from the atmosphere and storing it permanently, normally either in redundant fossil fuel wells or embodied as aggregate.

## 4.3 Types of carbon removal offsets

Carbon removal offsets come in two varieties which are explained and considered below. WorldGBC recommends that immediate (short-lived) offsets be the primary method used for neutralising residual emissions over the medium-term. However, it is anticipated that permanent (long-term storage) offsets - which are in mid-to-late stage development at present - will mature and come to market in the near future.

Over time, in accordance with the Oxford Principles for Net Zero Aligned Carbon Offsetting [↗](#), WorldGBC anticipate that a transition at scale to permanent carbon capture will become an important and necessary countermeasure to the climate crisis.

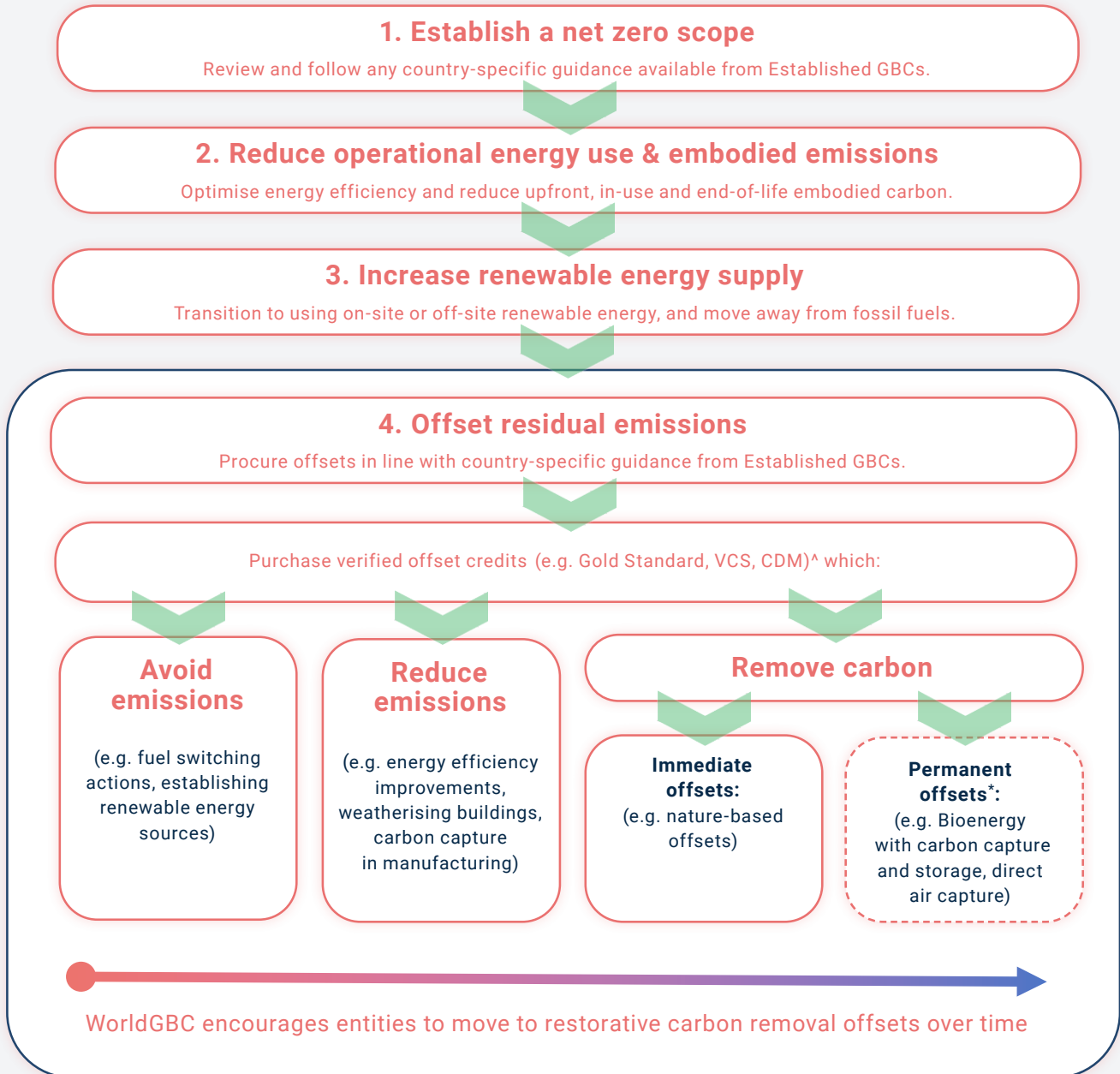
### Immediate offsets

These are referred to in the Oxford Principles as short-lived storage<sup>20</sup>. Immediate offsets are a ready and available means for sequestering carbon in comparatively short-lived storage, as described in the Oxford Principles<sup>21</sup>. These offsets tend to rely on nature-based carbon sequestration methods, such as afforestation, reforestation, sustainable forest management, forest restoration, rewilding, and the expanded protection of areas of biodiversity. Forests currently absorb around 12% of annual carbon emissions globally, and this amount is increasing<sup>22</sup>.

(continued page 10)

<sup>16</sup> University of Oxford, 'The Oxford Principles for Net Zero Aligned Carbon Offsetting' (2020)  
<sup>17</sup> UKGBC, 'Renewable Energy Procurement & Carbon Offsetting Guidance for Net Zero Carbon Buildings' (2021)  
<sup>18</sup> DGNB, 'Framework for Carbon Neutral Buildings and Sites' (2020)  
<sup>19</sup> GBC Australia, 'A carbon positive roadmap for the built environment' (2020)  
<sup>20</sup> University of Oxford, 'The Oxford Principles for Net Zero Aligned Carbon Offsetting' (2020)  
<sup>21</sup> University of Oxford, 'The Oxford Principles for Net Zero Aligned Carbon Offsetting' (2020)  
<sup>22</sup> Sapkota & White, 'Carbon offset market methodologies applicable for coastal wetland restoration and conservation in the United States: A review'. Science of the Total Environment, 701, (2020)





**Figure 1: WorldGBC’s recommendations for emissions reduction and offsetting pathways towards net zero buildings**

<sup>^</sup> There are other approaches to carbon offsetting which an entity may wish to consider. For example, entities may wish to place a carbon price on their residual carbon emissions that is higher than the market price of carbon credits, and is more commensurate with the societal cost of unabated emissions. This would allow entities to finance a broader portfolio of activities that can more rapidly advance the sector’s decarbonisation. Note that entities would still be required to compensate for their residual emissions through verified carbon offsets only.

<sup>\*</sup> The dotted line indicates that permanent offsets are not mature and/or widely commercially available at present, but that WorldGBC anticipates their arrival in the offsets market in the future.

These offsets, as they rely on natural cycles, tend to sequester carbon over an organism's lifecycle. For instance, trees will sequester carbon from the atmosphere incrementally for as long as they live. Once the organism dies and decomposes the sequestered carbon tends to be released back into the atmosphere. This can constitute a comparatively short-lived cycle for carbon storage if proper measures are not taken to protect these offsets.

Nature-based offsets, therefore, need to be protected, maintained and preserved for as long as possible in order to maximise their impact on atmospheric carbon levels and yield additional co-benefits for humans and nature.


Managed correctly, they will remain a viable carbon sink, improve air quality and can help to counteract biodiversity loss - essential to achieving our climate goals. Critically, nature-based offsets are a ripe and ready solution now, and can be purchased through verified offset credit providers.

#### Permanent offsets

These are referred to in the Oxford Principles as long-term storage<sup>23</sup>. Permanent offsets are an emerging set of technical solutions which can be used to sequester carbon permanently or near-permanently in so called long-lived storage<sup>24</sup>. This encompasses a range of technologies at various stages of technological maturity – not all of which are currently commercially available. Emerging technologies in this area include Direct Air Capture, and Bioenergy with Carbon Capture and Storage (BECCS).

These offsets are considered to be 'long-lived' or 'permanent' because in most cases they actively remove carbon from the atmosphere which will not, under normal circumstances, revert back into CO<sub>2</sub> and be re-emitted. The carbon is locked away in aggregate, disused oil wells or geological reservoirs.

At present, long-lived methods of carbon sequestration are more expensive, less widely available and smaller in scale than nature-based solutions. We anticipate that long-cycle offset technologies will increasingly develop to complement nature-based options over the medium term.

**Consistent with the Oxford Principles for Net Zero Aligned Carbon Offsetting (2020) , WorldGBC advocates that companies shift their offsets (1) towards carbon removal over time, and (2) that offsets are deployed with a maximum possible lifespan, under-pinning offset permanence wherever possible<sup>25</sup>.**

#### 4.4 Recommendations

WorldGBC recommends that the building and construction sector pursues a strategy to compensate for the total impacts of its activities that prioritises a reduction first approach (as set out in Figure 1), and embraces the potential of the offsets market (guided by the principles set out in section 3.3) to facilitate positive social and environmental impact in pursuit of overall net zero emissions.

To facilitate this, companies may choose to apply an internal financial commitment, high enough to reflect the true social and environmental cost of their emissions, as per WWF's [Blueprint for Corporate Action on Climate and Nature](#)<sup>26</sup> .

As companies shift their offsets towards carbon removals over time to neutralise residual emissions, there is a significant opportunity **today** to invest in sector-based projects that avoid or reduce wider sector emissions (outside the emissions boundary of the entity), in order to enable others to advance towards net zero, and provide additional tangible environmental and/or social improvements.

Whilst this concept is currently underdeveloped and requires attention to address double counting, it presents a real and tangible opportunity to direct investment into accelerating the decarbonisation agenda, and achieve sustainable buildings for everyone, everywhere.

**WorldGBC calls on the building and construction sector to recognise how offsetting residual emissions is critical to achieving sector decarbonisation goals.**

23 University of Oxford, 'Oxford Principles for Net Zero Aligned Carbon Offsetting' (2020)

24 University of Oxford, 'Oxford Principles for Net Zero Aligned Carbon Offsetting' (2020)

25 University of Oxford, 'Oxford Principles for Net Zero Aligned Carbon Offsetting' (2020)

26 WWF, 'Beyond Science-Based Targets: A Blueprint for Corporate Action on Climate and Nature' (2020)

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