Global Alliance for Buildings and Construction

The Buildings Breakthrough operates under:

BREAKTHROUGH AGENDA

Near-Zero Emission and Resilient Buildings

Shared Definitions, Indicators, Frameworks, and Policy Guidance for Implementation

Lead Partner:

WORLD GREEN BUILDING COUNCIL

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Abstract

This document presents the recommendations of the Buildings Breakthrough (BB) initiative's Priority Action on Standards and Certifications, launched under the Breakthrough Agenda at COP28 and co-led by France and Morocco with coordination by the UNEP hosted Global Alliance for Buildings and Construction (GlobalABC) Secretariat, and led by the World Green Building Council (WorldGBC).

The BB target aims to make Near-Zero Emission and Resilient Buildings (NZERBs) the global norm by 2030, by fostering international collaboration to decarbonise the building, construction and real estate sector while enhancing climate resilience.

Building on the 2025 Interim Report, which defined NZERBs and their guiding principles, this final report presents the indicators, metrics, and policy recommendations developed to support the implementation of building policies. It incorporates adjustments and contributions gathered through workshops, as well as through public consultations.

This report:

- Provides a consolidated definition of NZERBs and their core building blocks, including operational and embodied emissions, energy efficiency, low-carbon energy, refrigerants, sufficiency, and resilience.
- Presents a framework of high-level, quantitative and qualitative indicators for greenhouse gas emissions, energy performance, and climate resilience, linked to existing standards and certification systems.
- Offers policy guidance to governments and stakeholders across key areas, including planning and legal frameworks, financing mechanisms, capacity development, and research.

By offering actionable guidance and harmonised metrics, this report is expected to support countries, cities, and industry actors in aligning building policies with global climate goals and advancing a sustainable, resilient, low-emissions built environment.

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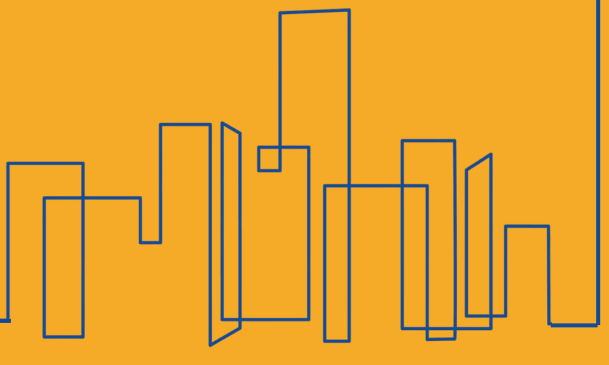
BACKGROUND



Background

Breakthrough Agenda

The Breakthrough Agenda was launched by the UK Government at the UN Climate Summit COP26 to help the world close the "collaboration gap" and accelerate international action on climate change to meet the Paris Agreement's global decarbonisation targets.

The Breakthrough Agenda provides a framework for countries, businesses and civil society to join together and strengthen their actions every year in key emitting sectors. It also provides a service to support coalitions of leading public, private, and public-private global initiatives to deliver those actions.

Since its launch, the Breakthrough Agenda has established an internationally-recognised, annual, COP-centred, collaborative process – backed by 57 countries covering over 80% of global GDP, and by 100+ international initiatives – that enhances global cooperation in seven key sectors: power, road transport, steel, hydrogen, agriculture, buildings, and cement and concrete, covering over 60% of global emissions.

Buildings Breakthrough

The Buildings Breakthrough (BB), launched at COP28, operates under the Breakthrough Agenda and is co-led by France and Morocco, and coordinated by UNEP/Global Alliance for Buildings and Construction (GlobalABC). It aims to make Near-Zero Emission and Resilient Buildings (NZERBs) the global norm by 2030. With endorsement from 29 countries and the European Commission, and support from over 30 initiatives, the BB fosters international collaboration to decarbonise the building sector and promote sustainable, accessible, and affordable solutions.

Following adjustments to the governance arrangements of the GlobalABC, coordination of the BB is being integrated into existing GlobalABC structures. Intergovernmental dialogue is now convened through the Intergovernmental Council for Buildings and Construction (ICBC), which serves as the principal governmental platform within GlobalABC. The BB target –to make Near-Zero Emissions and Resilient Buildings (NZERBs) the global norm by 2030– and its ongoing activities continue to be advanced through GlobalABC working group and partners, with progress across BB priority areas reflected in the NZERB Plan to Accelerate Solutions (PAS).

The Path Towards Near-Zero Emission and Resilient Buildings

To support countries and cities in their transition towards Near-Zero Emission and Resilient Buildings (NZERBs), the BB identifies five priority areas for international collaboration: Standards and Certifications, Demand Creation, Finance and Investment, Research and Deployment, and Capacity and Skills. These priority areas guide coordinated action among policymakers, industry and financial institutions to drive systemic sectoral transformation.

This work aligns with the International Energy Agency's recommendations for unlocking the building sector's potential and scaling NZERBs. The initial phase focuses on essential enablers, bringing stakeholders together around shared goals, establishing common NZERB-aligned terminology and guidelines, mobilising and de-risking finance, and strengthening international knowledge-sharing.

Building on this foundation, the next phase aims to accelerate implementation through supportive policies, demand-creation tools such as public procurement and government-led demonstration projects, and expanded capacity-building efforts. These actions are designed to build market confidence and speed the adoption of NZERB practices.

By 2030, the pathway anticipates a transformed market where sustainable and resilient building practices are standard. This includes widespread use of NZERB-aligned codes, certifications, and standards, as well as the integration of whole-life carbon and climate-resilience considerations across the entire building lifecycle.

This report focuses on the priority area on "Standard and Certifications", which aims to establish shared definitions and guiding principles for NZERBs. Specifically, the task for this Priority Area was to:

"Build consensus among countries on qualitative definitions and principles for Near-Zero Emissions and Resilient Buildings (NZERB) across the entire life cycle, and outline related indicators, as well as guidelines to help ensure transparency, comparability and accountability, and consult on these over 2025"

Methodology

As lead partner for Priority Action 1, WorldGBC identified a need to create a project governance structure that would enable stakeholders to participate in an equitable way. A 'Project Governance Steering Committee' was therefore convened, alongside a wider Plenary Group composed of interested stakeholders and country representatives who contributed to the consultation process. For full details of participants in Priority Action on "Standard and Certifications", can be found in Appendix A.

To guide countries in accelerating the transition to NZERBs, the Steering Committee adopted a structured, step-by-step approach. This ensured that the work progressed logically from high-level ambition to practical implementation. The process unfolded in four key stages:

- **Qualitative definition**
  Establishing the overarching vision of an NZERB — a building that minimises Greenhouse Gas (GHG) emissions across its life cycle and is resilient to climate impacts.

- **Building Blocks**
  Identifying the essential elements required to deliver this vision (such as energy efficiency, operational emissions, embodied carbon, resilience, materials, renewable energy). This stage also defined a set of **principles** describing what "good" looks like in practice.

- **Indicators and metrics**
  Developing indicators to track progress against each principle, along with metrics to quantify performance (e.g., kWh/m²/year, percentage reduction in embodied carbon). These tools convert

the qualitative definition into measurable, comparable criteria that can be applied consistently across countries.

- **Policy recommendations**
  Using the definition, building blocks, indicators, and metrics to identify the enabling conditions governments need to deliver NZERBs at scale. These include regulatory pathways, financial mechanisms, data and reporting requirements, capacity-building, and long-term planning approaches.

This step-by-by-step approach — from definition, to building blocks, to indicators and metrics, to policy recommendations — ensures the NZERB framework is coherent, practical, and ready to support national implementation. It provides governments with a clear line of sight from ambition to action, enabling consistent progress across diverse national contexts.

This report also incorporates and aligns with the adaptation priorities and resilience tracking framework adopted at COP30, ensuring consistency with global efforts to measure and strengthen climate resilience. Addressing mitigation and adaptation together generates strong co-benefits, including improved energy efficiency, thermal comfort, and resilience. At the same time, it requires early assessment and careful management of potential trade-offs to ensure long-term net gains.

Consultation Process

In defining the NZERB, the Steering Committee set out not to replace existing policies, but rather to identify shared principles across global frameworks and establish a unifying and flexible foundation for its adoption. In 2024, over 40 international and regional frameworks were reviewed to identify common elements.[1] These insights informed the development of a draft definition, core building blocks, and a supporting glossary.

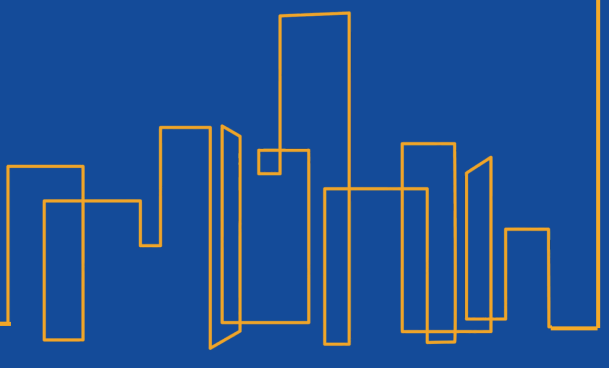
Through workshops and consultations with the Plenary Group in late 2024 and throughout 2025, proposals were iterated and refined to further develop the qualitative definition and guiding principles of "Near Zero Emission" and "Resilience." Insights from these engagements shaped consolidated options for the NZERB definition and building blocks.

In May 2025, a qualitative definition and core *building blocks* were introduced and subsequently refined through public consultation. This foundational work was published in October 2025 under the Buildings Breakthrough *Interim Report: Definition and Principles for Near-Zero Emission and Resilient Buildings (NZERBs)*, providing national governments with a baseline framework to align policy implementation with internationally recognised principles.

Building on this foundation, indicators, metrics, and policy recommendations to accelerate the global transition to NZERBs were collected throughout 2025, supported by a series of workshops and consultations with participating organisations. A final public consultation on the complete report was conducted in February 2026, ensuring that the full set of recommendations reflects broad stakeholder input and consensus.

[1] The list of these frameworks can be found in the 2025 Interim Report.

1. DEFINITION

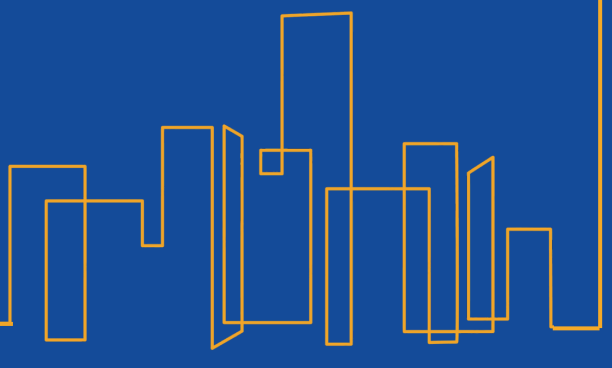


1. Definition

The following definition for a Near-Zero Emission and Resilient Building (NZERB) has been agreed:

A Near-Zero Emission and Resilient Building (NZERB) is highly energy efficient with minimised greenhouse gas (GHG) emissions across its life cycle. It is a structure that fulfils functional and technical requirements, protects its users, and preserves social, economic, and environmental value, from reasonably anticipated current and future local hazards.

2. BUILDING BLOCKS AND GLOSSARY



2. Building Blocks and Glossary

The table below outlines the core components - or terms - that make up a NZERB, such as energy efficiency, operational emissions, and resilience. The Building Blocks are arranged in a sequence that begins with measures to reduce emissions from the existing building stock, with a focus on improving operational performance and overall building efficiency. This is followed by strategies that address emissions from both existing and new buildings, and concludes with the additional requirements needed to strengthen or achieve building resilience. For each element, the table also identifies the guiding principle necessary to deliver that component effectively in practice.

NZERB Building Blocks

Term	Principle
Operational Emissions - Operational emissions are the greenhouse gas (GHG) emissions associated with the use phase of the building.	Minimise, to the greatest extent possible, these emissions, including non-energy related emissions such as refrigerants.
Energy Efficiency - Energy efficiency in buildings refers to the practice of using less energy to fulfil the building's functional and technical requirements.	Optimise energy efficiency by prioritising the implementation of passive design strategies, climate-appropriate building envelope improvements, and high energy performance equipment, with considering building type and climate zone.
Low-Carbon Energy and Prioritisation of Fossil Fuel Free Energy- Low-carbon energy refers to energy sources and technologies that produce significantly fewer GHG emissions compared to conventional fossil fuels. Burning fossil fuels is the leading cause of GHG emissions and their use pollutes the air with harmful chemicals, degrades ecosystems, and contaminates water and soil through spills and waste, threatening both environmental and human health.	Integrate demand flexibility, grid-interactive technologies[2] and/or locally available renewable resources to avoid, to the greatest extent possible, the on-site use of fossil fuels.
Low Global Warming Potential (GWP) Refrigerants - Low GWP refrigerants are cooling agents used in	Use low GWP refrigerants[3] and avoid hydrofluorocarbons (HFCs).

[2] Grid-interactive technologies refer to systems and devices that enable buildings to actively interact with the grid, allowing them to respond dynamically to grid signals, optimise energy use, and provide services back to the grid.

[3] European Commission: Climate-friendly alternatives to HFCs.

Term	Principle
air-conditioning, refrigeration, and heat pump systems that have a reduced impact on climate change.	
Embodied Emissions - Embodied emissions[4] refer to the total GHG emissions associated with the entire life cycle of construction products, including manufacturing, construction processes, renovation, demolition and end-of-life processing.	Minimise, to the greatest extent possible, embodied GHG emissions, before removals[5], caused by the generation and production of construction products, construction processes, water use, waste transport and disposal, and building-related transportation activities, throughout the whole life cycle of an asset (including **Upfront Emissions** - **Renovation** and **End of Life Measures**).
Embodied Emissions - Upfront Emissions - Upfront emissions are the GHG emissions released into the atmosphere before a building is used, primarily during the construction product manufacturing and construction.	Minimise, to the greatest extent possible, upfront emissions by prioritising low-carbon and circular options in the selection of construction products and building design (including resource efficiency and durability), and lean construction practices. Material decarbonisation roadmaps should be considered to support product selection.
Embodied Emissions - Renovation - Renovation refers to the process of repairing, updating, or improving an existing building to enhance its functionality, appearance, safety, or energy performance. It can range from minor appearance upgrades to major structural changes. Embodied emissions associated with renovation arise from the extraction, manufacturing, transportation, installation, maintenance, and disposal of building	Prioritise upgrades and renovations that extend the lifespan of the building or its components, significantly reducing its GHG emissions compared with constructing new buildings[7].

[4] Sometimes also referred to embodied carbon.
[5] Removals refer to processes or strategies that actively remove GHG gases from the atmosphere and store them in a stable form, offsetting the associated emissions.
[7] Renovation, retrofit, and refurbishment are related but distinct terms that describe to what extent the building or its components can be improved or updated.

Term	Principle
materials, components and products[6]. These emissions are "embodied" by the materials themselves and are released before, during, and after the renovation process.	
Embodied Emissions - End of Life Measures - End-of-life (EOL) measures refer to strategies, processes, and actions implemented when a building reaches the end of its useful life. These measures aim to safely decommission, dismantle, or repurpose the structure while minimizing environmental, social, and economic impacts.	Implement appropriate measures for maintenance, repairs, and renovations, accounting for flexibility and future adaptation. This includes aspects such as designing for disassembly and deconstruction to facilitate future reuse, and selecting construction components and products that can be reused, recycled, or easily separated for processing.
Sufficiency - Sufficiency in buildings refers to the design and use of buildings in ways that meet human needs without excess, reducing demand for resources, and space.	Continuously optimise the use of resources, including efficient use of space.
Climate-Resilient Building - A climate-resilient building is a structure that is planned, designed, built, operated, and continuously adapted to withstand shocks and stresses resulting from, or driven by, climatic and natural hazards - particularly those intensified, or expected to intensify, due to climate change.	Design, construct or retrofit buildings based on hazard and vulnerability assessments to withstand natural and climate hazards, including those linked to climate change.
Resilience Assessment - A resilience assessment is the continual process of identifying potential current and future shocks and stresses and implementing measures that allow the system to prepare for, resist, absorb, withstand and recover from the identified hazards. Implementation balances the criticality of the system function in the face of identified hazards versus the level of investment required to maintain system function and integrity.	Design buildings based on resilient assessments and implement measures that allow the system to prepare for, resist, absorb, withstand and recover from the identified hazards, over their expected lifetime.

[6] Material refers to the raw substance from which something is made, such as wood, or steel. Component denotes a distinct part or sub-assembly that is manufactured from one or more materials. Product is the final, fully assembled item, composed of multiple components and ready for use or sale.

Term	Principle
Risk Assessment - A risk assessment is the process of identifying current and future localised risks to hazards, and evaluating exposure and potential impacts on the project site, building and building function. Risks may include loss of life, injury or destruction or damage to assets occurring within a specified time period from an identified set of hazards. Risk assessments can be conducted at national level, but should be informed by and address local conditions. Risk assessments, along with vulnerability assessments, should inform the development of strategies to implement resilience measures. They should include both risks that are evident in the near future and longer-term risks due to climate change (droughts, heavy precipitation, floods, cyclones, fires, coastal erosion), combined with social and demographic changes and other evolving factors throughout the expected lifetime of the building.	Design, construct or retrofit buildings based on prospective risk assessments reflecting local conditions and implement strategies to mitigate the identified risks.
Vulnerability Assessment - Vulnerability refers to the susceptibility of a building and its users to the impacts of hazards, including physical, social, economic and environmental impacts. A vulnerability assessment identifies how exposed a building and its occupants are to identified risks and the potential impact, should such risks actually be realised. Vulnerability assessments should include expected social, environmental and economic impacts on the building, its users and the broader community.	Design, construct or retrofit buildings based on vulnerability assessments to guide decisions on resilience measures and practices across its life cycle.
Resilience Measures - Resilience measures are the combination of strategies that assure buildings are prepared for and can resist and recover from their associated risks and vulnerabilities. These strategies may include a combination of technical solutions applied at building and/or community scales (e.g., avoiding risk-prone areas, building elevation to protect from floods or sea walls to resist sea level rise).	Implement resilience measures and practices across the building life cycle.

Term	Principle
Such strategies can be supported by policy measures at the community or even national scale (for example, building code adoption and enforcement and prohibiting construction in hazardous areas).	

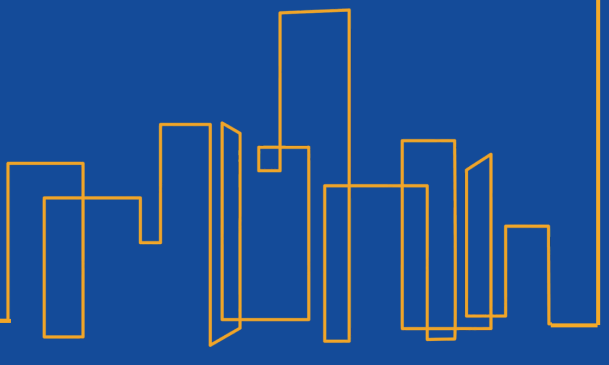
Glossary

Term	Clarification
Near-Zero Emission	Near-zero emissions refer to the process of minimising the GHG emissions of buildings to get as close as possible to emissions neutrality[8].
Greenhouse Gas (GHG) Emission	Greenhouse gas emission refers to the release of gases that trap heat in the Earth's atmosphere and contribute to global warming and climate change based on the greenhouse effect. Main greenhouse gases are Carbon Dioxide (CO2), Methane (CH4), Nitrous oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF6), and Nitrogen trifluoride (NF3).
Functional Requirements	Functional requirements refer to specific criteria that a building must satisfy to ensure that it is fit for purpose. The functionality of a building is determined by the users' demands, considering the relation between the users' needs and the ability of the building to fulfil them.
Technical Requirements	Technical requirements refer to engineering and technological aspects necessary to successfully complete a building, including installation, products, procedures, and quality standards.
Social, economic and environmental value	The social, economic, and environmental value of a building refers to the multifaceted benefits and impacts that a building contributes to its users, community, and the broader ecosystem. **Social** value relates to how a building enhances the well-being, equity, and quality of life for individuals and communities **Economic** value refers to the financial and productivity-related benefits a building generates over its lifecycle. **Environmental** value focuses on the building's impact on natural systems and its contribution to sustainability.
Hazards	Hazards refer to reasonably anticipated events, precipitated by natural or human activities, that impact the ability of a building, piece of infrastructure, community or the people that rely on that building or infrastructure to continue to maintain functionality at or above the level in place prior to the event. Hazards can be characterised as shocks or stresses. **Shocks** Shocks are events that develop over a short time period and have an immediate, measurable impact on the affected people, buildings, systems, or communities. Also can be described as an acute event.

[8] Achieving neutrality entails offsetting all emissions within a specified timeframe (e.g., annually), for instance by exporting excess renewable energy generated.

Term	Clarification
	Stresses Stresses are events that develop over an extended period of time with impacts that may not be immediately noticeable, but over time impact people, buildings, systems, or communities. Also can be described as a chronic event.
Local Impacts	Local impacts occur at or around the building site, and can be influenced by regional, national or international environmental, regulatory or socio-economic factors.
Life Cycle	The life cycle of a building starts from raw material extraction through production, construction, use, operation and maintenance, including replacement of building components, to end-of-life treatment, recycling and final reuse or disposal (i.e. cradle-to-grave or cradle-to-cradle approach).

3. INDICATORS AND METRICS



3. Indicators and Metrics

The Building Blocks described above represent key components of policies and actions that support the delivery of NZERBs. Building on these elements, the working group identified a set of indicators and metrics to support countries and actors across the building value chain to demonstrate achievement of the outcomes captured in the building blocks.

Indicators provide a means of assessing progress toward the building blocks and, ultimately, toward the achievement of NZERBs. Metrics refer to the specific units or outputs used to quantify performance against these indicators.

The proposed indicators should be assessed using a life-cycle approach and applied through context-adaptive tiers that reflect local data availability, climate risk, and development conditions, ensuring global relevance and equity. The framework establishes harmonised indicator categories and reporting structures to support international comparability while allowing flexibility for national implementation. The framework does not prescribe universal numeric thresholds. Instead, quantitative targets should be defined at national or subnational level, aligned with 1.5°C-compatible climate pathways, grid decarbonisation trajectories, and local climatic conditions.

Operational performance indicators should progressively transition from design-stage modelling to measured, post-occupancy performance data. Where feasible, governments are encouraged to require disclosure of verified energy use and emissions to ensure alignment between intended and actual performance.

Core indicators

Energy consumption and Greenhouse Gas (GHG) emissions

Energy consumption in buildings is a fundamental metric for assessing both operational efficiency and environmental impact. Measuring the energy required to maintain functionality, safety, and comfort within a structure enables the establishment of benchmarks and targets, helps identify opportunities for efficiency improvements and cost savings, and supports compliance with sustainability standards. Common energy-performance metrics for buildings include:

- Total Energy Consumption measured in **kWh or MJ**
- Energy Use Intensity (EUI) - energy per unit area measured in **kWh/m²/year**
- Peak Energy Demand measured in **kW**

Global warming is driven by energy- and process- related emissions of carbon dioxide and other greenhouse gases (collectively referred to as greenhouse gases). Human-made (anthropogenic) GHG emissions are quantified through established accounting frameworks, with life-cycle assessment (LCA) commonly used to assess emissions at the product, building, and system levels. These emissions are typically attributed to the “climate change” impact category within an LCA.

- GHG emissions are expressed in carbon dioxide equivalent (**CO_2e**), a metric that standardizes the climate impact of different greenhouse gases by converting them into the equivalent amount of carbon dioxide.
- To assess and compare life-cycle GHG emissions from buildings, results are typically normalized by gross floor area (i.e., **kg CO_2e/m^2**).
- Further normalization is required to account for the relevant life-cycle stage and reference study period. For instance, operational GHG emissions are calculated or measured on an annual basis (**kg CO_2e/m^2/year**), while embodied GHG emissions are most often reported as a one-time value over a life-cycle stage (**kg CO_2e/m^2**). **Embodied emissions should ideally be expressed as kg CO_2e/m^2 over a defined reference study period, as the selected number of years significantly influences comparability and interpretation**.

Impacts that can influence benchmarks and vary between buildings include differences in weather, hours of use, occupancy rates, and the system boundary (e.g., whether results include only base building services or also tenant or occupant equipment).

Life-cycle GHG emissions include both operational emissions (direct and indirect) and embodied emissions associated with the extraction, transport of materials and products, manufacturing, construction, maintenance, and end-of-life treatment of buildings, materials, and components. Direct measurement and assessment of resource consumption - such as the energy required for heating and cooling, or indicators such as Thermal Energy Demand Intensity (TEDI) and Cooling Energy Demand Intensity (CEDI), as well as delivered energy - are essential for comparability, as they are not influenced by variations in grid energy sources.

Embodied GHG emissions can be affected by several factors, including:

- Building and component optimisation during the design phase to reduce energy needs, total primary energy, and non-renewable primary energy
- Choice of main structural materials and overall building form
- Energy sources and energy efficiency of manufacturing processes for construction products
- Efficient use of resources such as water and materials
- Use of renewable and low-carbon construction products
- Recycling and reuse of construction products
- Extension of the service life of buildings and building components
- Systematic maintenance

For all these aspects, the introduction and use of specific indicators is possible and useful. These complement the high-level indicators presented above.
An additional important indicator relates to the use or depletion of primary raw materials (e.g., minerals, ores, fossil energy carriers, biomass), given the significant environmental, economic, and social implications associated with resource extraction and use.

Resilience

Resilience in buildings is a multi-dimensional and dynamic concept describing a structure's ability to absorb, adapt to, and recover from shocks and stresses. Rather than a fixed measure of strength, resilience spans interconnected domains such as physical/technical, economic, and environmental.

Because of this complexity, no single high-level indicator can fully capture or communicate a building's climate resilience. Instead, resilience is typically evaluated through a suite of indicators or indices tailored to local climate risks and expected impacts. Assessing building resilience therefore requires a Resilience Assessment, informed by both risk assessments and vulnerability assessments. These analyses identify relevant local hazards and translate findings into appropriate building-level resilience strategies.

At the international level, COP30 proposed a global framework for tracking climate resilience through a set of indicators under the Global Goal on Adaptation (GGA). This framework marks a shift toward measuring adaptation progress in terms of reduced vulnerability, strengthened systems, and improved protection of lives and infrastructure. Adaptation is now a political priority, with countries agreeing to triple adaptation finance to $120 billion annually by 2035.[9] Despite this, major gaps remain in funding and capacity, especially for health and infrastructure resilience. The adopted indicators will guide nations in monitoring progress across sectors, and will inform the next Global Stocktake in 2028.

To align with the GGA framework, buildings should integrate climate adaptation into design, construction, and operation. Key actions include:

- Strengthening structural resilience to withstand climate-related hazards under different warming scenarios.
- Ensuring continuity of essential services during and after extreme events, such as maintaining full capacity of critical facilities.
- Adopting and implementing monitoring systems to track resilience indicators, such as the share of facilities climate-proofed or operational during disruptions.
- Leveraging adaptation finance for retrofits and upgrades that reduce vulnerability and improve energy, water, and health resilience.

The indicators, metrics, and policy recommendations outlined in this report are aligned with this emerging global framework, addressing actions within the scope of building projects, from planning and design to construction, operation, and end-of-life management.

[9] https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(25)00298-0/fulltext

Quantitative Indicators for GHG Emissions

The table below outlines key indicators and metrics that governments and policymakers can use to measure progress and support the implementation of the building blocks principles. These indicators provide practical pathways for improving environmental performance and aligning actions with sustainability goals. The indicator categories presented do not provide universal numeric thresholds. Instead, quantitative targets should be defined at national or subnational level in alignment with climate pathways and the local context.

Across different jurisdictions, a range of standards and building certification schemes exist to support measurement and verification against these indicators and metrics. The examples referenced - including the countries noted - are non-exhaustive and are intended to serve as signposts to the types of frameworks that governments and stakeholders may leverage.

Standards establish formalised guidelines and technical specifications that define best practices for building design, construction, and operation. They ensure consistency, safety, and quality across projects while facilitating regulatory compliance and interoperability between systems. By setting minimum performance requirements, standards provide a foundation for sustainable development and help reduce environmental impacts. They also provide clarity for stakeholders, enabling predictable outcomes and supporting the integration of emerging technologies within structured regulatory frameworks.

Building certification systems, typically managed by independent organisations, provide third-party verification that a project meets defined sustainability and performance criteria. These schemes often go beyond basic regulatory compliance by encouraging higher levels of performance in areas such as energy efficiency, water management, indoor environmental quality, and occupant well-being. Certifications also serve as a market differentiator, signalling commitment to environmental responsibility and social value. They also foster innovation by rewarding projects that exceed conventional practices, creating benchmarks for continuous improvement and transparency in the built environment.

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
Energy Efficiency as: (**a**) indicator for buildings in use (real performance) or (**b**) partial value for estimated energy demand	• Primary and final energy consumption. • Energy Use Intensity. • Thermal Energy Demand Intensity (TEDI) and Cooling Energy Demand Intensity (CEDI).	• kWh/m^2/year • kWh/m2/year (per area type, e.g. heated area) • % of primary or final energy demand met by renewable energy (onsite and offsite)	**Industry Standards & Frameworks (case b):** EN 15978 EN-ISO 52000 ISO 52016-1 ASHRAE 90.1 ASHRAE 100 International Energy Conservation Code International Green Construction Code/ASHRAE 189.1 Energy Performance of Buildings Directive (EPBD Level(s) **Building Certifications based on actual performance** (**case a**): BEAM Plus Existing Buildings BREEAM In-Use DGNB New Construction and DGNB Renovation Bewertungssystem Nachhaltiges Bauen (BNB) ENERGY STAR Green Mark Existing Buildings Green Star - Performance Tool HKGBC Zero Carbon Ready Building Certification and Net Zero Energy Building Certification HQE IGBC Green Existing Buildings O&M LEED for Existing Buildings: Operations and Maintenance (LEED O+M) LOTUS Buildings in Operation (BIO) NABERS Low Carbon Building Initiative (LCBI) Passive Haus Standard

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
			The Living Building Challenge (LBC): T Zero Carbon Building Standard – Performance (CAGBC) Zero Energy Certification (Living Future Institute) **Building Certifications on design (case b)**: **Australia and New Zealand** Green Star Buildings **Africa** Green Star Buildings (Kenya, South Africa) **Americas** CASA (Brazil, Colombia) Canada - Zero Carbon Building Standard - Design LEED Green Globes **Asia** GBEL (China Three-Star) LOTUS (Vietnam) Greenship (Indonesia) Green Mark (Singapore) BERDE (Philippines) BEAM Plus (Hong Kong) IGBC Green Buildings (India) GreenSL (Sri Lanka) GBI (Malaysia) MyCREST (Malaysia) GreenRE (Malaysia)

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
			G-SEED (Korea) **Europe** BREEAM NL BREEAM NO BREEAM SE HQE Effinergy DGNB HPI (IE) BREEAM UK net Zero Carbon Buildings Standard Verde (Spain) **Middle East** Trakhees GBR (UAE) Estidama Pearl (UAE) Dubai GB (UAE) Barjeel GBR (UAE) Mostadam (Saudi Arabia)
Operational GHG Emissions as: (**a**) independent indicator for buildings in use (real performance)	• GHG emissions, both including or excluding refrigerant gases (partial value), based on as designed or real energy consumption -– in EN 15987 called B6 module sometimes also called “operational carbon” (Note: In EN 15978 F-gases are included in module B1.2).	• $kgCO_2e/m^2/year$ • GWP100 (as GWP100 total or GWP100 fossil)	**Industry Standards & Frameworks (case b):** EN 15978 ISO 52016-1 ASHRAE/ICC 240 RICS Whole life carbon assessment (WLCA) for the built environment (2^{nd} edition) **Building Certifications based on actual performance** (**case a**):

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
or (**b**) partial value for GHG emissions in the life cycle (based on calculated energy demand)	Emissions of CO_2 and other GHGs can be summarised as Global Warming Potential GWP 100 [10], total or subdivided in GWP 100 fossil, GWP 100 biogenic and GWP 100 LULUC (Land Use and Land-Use Change). Operational GHG Emissions are in most of the cases energy related GHG emissions, caused by the operation of the building. In addition, there are energy related GHG emissions, caused by use / users of the building, which are part of the B8 module. • Measured Operational Energy Use Intensity (EUI)	• kWh/m²/year (post-occupancy)	BEAM Plus Existing Buildings BREEAM In-Use DGNB New Construction and DGNB Renovation (based on calculated energy demand) Bewertungssystem Nachhaltiges Bauen (BNB) ENERGY STAR Green Mark Existing Buildings Green Star Performance v2 HKGBC Zero Carbon Ready Building Certification and Net Zero Energy Building Certification HQE IGBC Green Existing Buildings O&M LEED for Existing Buildings: Operations and Maintenance (LEED O+M) LOTUS Buildings in Operation (BIO) NABERS Low Carbon Building Initiative (LCBI) Zero Carbon Building Standard – Performance (CAGBC) Zero Energy Certification (Living Future Institute): verifies projects that achieve net zero energy performance based on actual, measured data.
Low carbon energy and Prioritisation of Fossil Fuel Free	• CO2-emissions at site. • Percentage of renewable or low carbon energy in the total energy consumption of the building.	•kgCO2e/m2 • % of primary/final energy demand met by renewable energy produced	**Building Certifications**: **Australia and New Zealand** Green Star Buildings **Africa** Green Star Buildings (Kenya, South Africa)

[10] GWP100, or Global Warming Potential over 100 years, is a measure of a greenhouse gas's heat-trapping ability compared to carbon dioxide CO_2 over a 100-year period

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
		onsite • % used on-site • % used off-site	**Americas** CASA (Brazil, Colombia) Canada - Zero Carbon Building Standard - Design LEED Green Globes **Asia** GBEL (China Three-Star) LOTUS (Vietnam) Greenship (Indonesia) Green Mark (Singapore) BERDE (Philippines) BEAM Plus (Hong Kong) IGBC Green Buildings (India) GreenSL (Sri Lanka) GBI (Malaysia) MyCREST (Malaysia) GreenRE (Malaysia) G-SEED (Korea) **Europe** BREEAM NL BREEAM NO BREEAM SE HQE Effinergy DGNB HPI (IE) BREEAM UK net Zero Carbon Buildings Standard

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
			Verde (Spain) **Middle East** Trakhees GBR (UAE) Estidama Pearl (UAE) Dubai GB (UAE) Barjeel GBR (UAE) Mostadam (Saudi Arabia) **Industry Standards & Frameworks** ISO 17800: Facility Smart Grid Information Model EPBD ASHRAE Design and Operation Resource Guide IEC/IEEE Standards: Various International Electrotechnical Commission (IEC) and Institute of Electrical and Electronics Engineers (IEEE) standards address the interoperability of smart appliances, IoT, and DER (Distributed Energy Resources) for grid responsiveness
Demand Flexibility & Grid Interaction	• Peak demand reduction (% compared to baseline) • Load shifting capability (kW or % shiftable load) • On-site renewable self-consumption ratio (%) • Storage integration (yes/no + capacity)		
Low Global Warming Potential (GWP) refrigerants	• GHG-emissions caused by F-gas coming from refrigerants.	• GWP100 (as GWP100 total or GWP100 fossil)	**Industry Standards & Frameworks:** ASHRAE/ICC 240: quantification of GHG emissions across the building life-cycle including refrigerant (fugitive) emissions. International Mechanical Code: model code supporting the safe use of low GWP refrigerants **Building Certifications**: **Australia and New Zealand** Green Star Buildings **Africa** Green Star Buildings (Kenya, South Africa)

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
			Americas CASA (Brazil, Colombia) Canada - Zero Carbon Building Standard - Design LEED Green Globes **Asia** GBEL (China Three-Star) LOTUS (Vietnam) Greenship (Indonesia) Green Mark (Singapore) BERDE (Philippines) BEAM Plus (Hong Kong) IGBC Green Buildings (India) GreenSL (Sri Lanka) GBI (Malaysia) MyCREST (Malaysia) GreenRE (Malaysia) G-SEED (Korea) **Europe** BREEAM NL BREEAM NO BREEAM SE HQE Effinergy DGNB HPI (IE) BREEAM UK net Zero Carbon Buildings Standard

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
			Verde (Spain) **Middle East** Trakhees GBR (UAE) Estidama Pearl (UAE) Dubai GB (UAE) Barjeel GBR (UAE) Mostadam (Saudi Arabia)
Embodied GHG Emissions	• Life-cycle embodied GHG emissions including energy and process related GHG emissions caused by production, construction, maintenance, replacement of components, deconstruction, processing and disposal, sometimes also called “embodied carbon”.	• GWP100 (as GWP100 total or GWP100 fossil) • kg CO_2e/m^2	**Industry Standards & Frameworks:** ASHRAE/ICC 240 RICS Whole life carbon assessment (WLCA) for the built environment (2nd edition) ISO 14025: Overall framework for Environmental Product Declarations ISO 21930: Requirements for EPDs of construction products **Building Certifications**: **Australia and New Zealand** Green Star Buildings **Africa** Green Star Buildings (Kenya, South Africa) **Americas** CASA (Brazil, Colombia) Canada - Zero Carbon Building Standard - Design LEED Green Globes **Asia** LOTUS (Vietnam)

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
			Green Mark (Singapore) BEAM Plus (Hong Kong) IGBC Green Buildings (India) **Europe** DGNB Low Carbon Building Initiative (LCBI) BREEAM UK net Zero Carbon Buildings Standard
Upfront GHG Emissions	• Energy and process related GHG emissions in relation to production of construction products and construction of the building – in EN 15978 called module A1-A5, sometimes limited to A1-A3.	• $kgCO_2e/m^2$	**Industry Standards & Frameworks:** ASHRAE/ICC 240 RICS Whole life carbon assessment (WLCA) **Building Certifications**: **Australia and New Zealand** Green Star Buildings **Africa** Green Star Buildings (Kenya, South Africa) **Americas** Canada - Zero Carbon Building Standard - Design LEED **Asia** LOTUS (Vietnam) Green Mark (Singapore) BEAM Plus (Hong Kong) IGBC Green Buildings (India) **Europe**

Building Block	Indicators	Metrics / measurement units	Standards & Certifications
			DGNB BREEAM UK net Zero Carbon Buildings Standard
Sufficiency	• space-use intensity/total floor area per capita • Adaptive reuse rate • Vacancy rate	• m2/occupant • % existing structure retained • % of unoccupied spaces	

Indicators on Resilience

While achieving resilience to physical hazards is a universal objective, the specific hazards faced by buildings are highly location-dependent. Therefore, the indicators and metrics provided here focus on the high-level processes required to achieve resilience. While many of the high-level metrics are identified as binary indicators (yes or no), actual implementation may occur along a spectrum depending on local conditions and levels of capacity. A non-exhaustive list of potential hazards and example metrics is provided to assist actors translate localised hazards to metrics.

Indicators	Metrics	Standards & Certifications
The government (at the national or subnational level) has identified present and future local hazards.	Hazard identification: - Availability of hazards maps (at minimum current risk, but ideally incorporating future risk scenarios) - Availability of regional risk assessments Monitoring, Forecasting & Early Warning Systems: - Operational hazard monitoring systems at national and subnational levels	**Industry Standards & Frameworks:** - ASTM E3350-22 Standard Guide for Community Resilience Planning for Buildings and Infrastructure

	- Early warning systems for key hazards, integrated with local authorities and communities - Integration of monitoring data into planning and emergency response	
The government (at the national or subnational level) has established expectations for performance in the face of identified local hazards.	- Implemented and enforces a mandatory building code for all buildings establishing minimum requirements to withstand identified hazards - Implemented and enforces land use policies restricting construction in highly exposed areas - Implementation of localised disaster readiness and response plans for identified hazards	**Industry Standards & Frameworks:** International Building Code International Residential Code - technical guidance for building resilience
The project team identifies reasonably anticipated hazards and vulnerabilities across the building's life-cycle.	- For new buildings, owners or operators undertake resilience assessments to determine risks (exposure to hazards and vulnerabilities) - For existing buildings, owners or operators undertake resilience assessments to determine risks (exposure to hazards and vulnerabilities) at regular intervals	**Industry Standards & Frameworks:** ASTM E3429-24 Standard Guide for Property Resilience Assessments Green Star's Climate Change Pre-screening checklist European Union: How to develop a risk and vulnerability assessment AIA Resilience Design Toolkit
The building is designed, constructed and operated to be resilient against reasonably anticipated risks.	- The project team has identified and implemented resilience measures to counter the risks	**Industry Standards & Frameworks:** International Building Code International Residential Code **Building Certifications:** Green Star Building Resilience Index (IFC Trademark) LEED v5 LOTUS v4

Buildings meet government established resilience requirements.	- New buildings are designed and constructed in accordance with current building code and land use requirements - Existing buildings are operated in accordance with resilience requirements and, when undergoing renovations, meet upgrades required by building codes and other policies	**Industry Standards & Frameworks:** International Building Code International Residential Code International Existing Building Code
Examples of Specific Hazards		
Flooding	Vulnerability metrics: - Design Flood Level (DFL) - Elevation of critical systems above flood risk - Availability of adequately sized shelter within a safely accessible distance - Period of immersion (h) Exposure metrics: - Permeability of the local area - Proportion (%) of green and blue infrastructure - Freeboard above flood levels - Flooding recurrence intervals (e.g.,100-year flood)	**Industry Standards & Frameworks:** ASCE 24 Risk Management Strategies for Coastal Communities (US Army Corps of Engineers)
Drought	Vulnerability metrics: - Water Recycling/Reuse - Water availability	**Industry Standards & Frameworks:** International Plumbing Code CSA B805/ICC 805: Standard for Rainwater Harvesting Systems
Extreme Heat/Cold	Vulnerability metrics: - Operative Temperature Range - Heating and Cooling Degree Days[11] above a threshold	**Industry Standards & Frameworks:** ASHRAE 55, EN 16798 - Elevated air

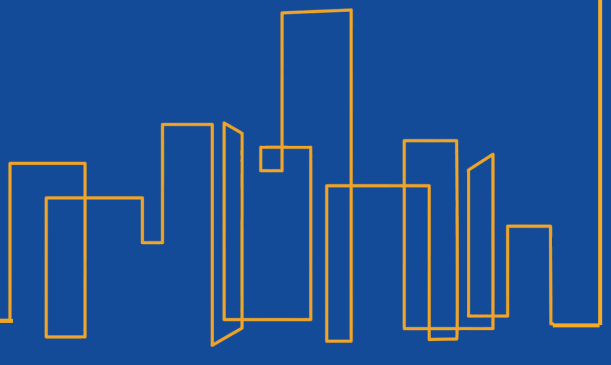
[11] Heating and Cooling Degree Days (HDD/CDD) measure how much heating or cooling is needed on a given day by calculating the difference between the daily average temperature and a base temperature.

	- Standard Effective Temperature (SET)[12] - Thermal Comfort Exceedance Hours Exposure metrics: - Time Above or Below Operative Temperature Range Threshold (°C or % time) - Cumulative value of SET degrees falling outside SET thresholds (SET degree hours)	speed comfort zone method and Adaptive Thermal Comfort model Enhancing Resilience in Buildings through Energy Efficiency, U.S. Department of Energy
Cyclones/Hurricanes	Vulnerability metrics: - Design to anticipated wind loads (mph or km/h) - Availability of adequately sized shelter within a safely accessible distance	**Industry Standards & Frameworks:** ASCE 7 CC Standard 600: Standard for Residential Construction in High Wind Regions EN 1991-1-4: Eurocode 1 - Actions on Structures: Wind Actions France : Guide de conception et construction paracycloniques de maisons individuelles (C2PMI)
Tornadoes	Vulnerability metrics: - Design to anticipated wind loads (mph or km/h) - Availability of adequately sized shelter within a safely accessible distance - Storm shelter within vulnerable or public structures (y/n)	**Industry Standards & Frameworks:** ASCE 7 ICC/NSSA Standard 500: Standard for the Design and Construction of Storm Shelters EN 1991-1-4: Eurocode 1 - Actions on Structures: Wind Actions

[12] Standard Effective Temperature (SET) is a metric used to measure thermal comfort by creating a hypothetical, "standard" environment that represents the combined effects of air temperature, humidity, radiant temperature, air velocity, clothing, and metabolic rate.

Wildfire/Bushfire	Vulnerability metrics: - Use of non-combustible materials - Defensible space from combustibles / Fuel availability around the building (garden furniture, bushes, etc.) - Evacuation routes are identified, maintained, and evacuation plan is implemented Exposure metrics: - Proximity of wildfire-prone areas - Number of days with meteorological conditions favouring ignition (hot, dry, windy, rainless conditions)	**Industry Standards & Frameworks:** International Wildland Urban Interface Code Development and structure of the Canadian Forest Fire Weather Index System Report of the interministerial mission "Climate change and the expansion of areas sensitive to forest fires" [Fr]
Snow	Vulnerability metrics: - Maximum layer of snow expected - Maximum load of snow expected Exposure metrics: - Proximity to avalanche-prone areas	**Industry Standards & Frameworks:** International Building Code International Residential Code EN 1991-1-3: Eurocode 1 — Actions on Structures — Part 1-3: General actions — Snow loads.
Storms	Vulnerability metrics: - Freeboard height Exposure metrics: - Exposure to rainfall (max mm/hour) versus the capacity of the site to cope (runoff rate L/s)	
Coastal erosion	Exposure metrics: - Rate of local coastline withdrawal - Proximity to the coastline	**Industry Standards & Frameworks:** Risk Management Strategies for Coastal Communities (US Army Corps of Engineers)

4. POLICY RECOMMENDATIONS



4. Policy Recommendations

General Recommendations

The policy recommendations in this report are organised across three overarching policy categories:

1. Enabling Environment
2. Carbon and Energy
3. Adaptation and Resilience

Each category contains a set of subcategories that group related policy actions. The recommendations are intended as non-binding guidance that countries can adapt to their own contexts, capacities, and priorities. They can also serve as a checklist of potential actions and enabling conditions that support the delivery of NZERBs.

To ensure international integration, governments are encouraged to engage in relevant international frameworks and platforms such as the *Declaration de Chaillot* and Intergovernmental Council for Buildings and Climate (ICBC), and align national definitions and reporting frameworks with recognised international methodologies where appropriate. Sharing progress and lessons learned through these platforms can support transparency, strengthen peer learning and accelerate collective progress towards NZERBs.

Enabling Environment

This category includes eight subcategories that together establish the institutional, regulatory, financial, and knowledge foundations required to deliver NZERBs at scale. These elements are essential to ensure that policy frameworks are coherent, well-resourced, and capable of driving long-term transformation in the sector.

Governance and Institutional Capacity

- Establish clear implementation pathways for delivering the NZERB, outlining defined roles, responsibilities, and timelines across national and local governments, as well as regulatory and implementing agencies. Coordination mechanisms for strategic planning, funding allocation, and approvals processes should be also considered.
- Develop collaboration mechanisms between national and subnational governments, and lead by example through municipal building projects.
- Strengthen vertical and horizontal coordination across ministries, local authorities, the private sector, and civil society to reduce silos and align resources.
- Establish consistent governance structures, including clearly defined roles and responsibilities, to support long-term planning and implementation.

Building Strategy, Policy and Planning

- Define general objectives and targets aligned with NZERB definitions and indicators.
- Develop NZERB roadmaps that integrate these targets into planning policies, approval processes, building codes, action plans, and Nationally Determined Contributions (NDCs).
- Incorporate relevant standards and building certifications into these roadmaps where appropriate. Such frameworks provide a structured foundation with established indicators and metrics, as well as comprehensive guidance for implementing holistic sustainability approaches.
- Develop national hazard mitigation plans and support local adaptation strategies that address specific climate risks and vulnerabilities.

Building Laws, Regulations and Codes

- Establish legally binding frameworks governing the construction sector that supports climate, safety, and sustainability goals.
- Commit to national adaptation and resilience targets supported by enforceable strategies, sectoral goals, performance indicators, and, where relevant, standards and certifications.
- Ensure that the building sector has a clearly defined and legally anchored role in national emissions-reduction targets.
- Introduce or strengthen building codes and standards aligned with 2030 and 2050 climate objectives, including appropriate compliance procedures and inspection protocols.
- Require public institutions to lead by example in implementing NZERB-aligned roadmaps.
- Gradually mandate emissions reporting and resilience planning across the building life cycle, starting for example with large commercial buildings and progressively extending to residential properties. Governments should collaborate with developers and other key stakeholders to determine the most appropriate implementation pathways.

Fiscal Policy and Market Instruments

- Align public finance with NZERB principles, including through public procurement policies.
- Promote fiscal instruments, such as taxes, subsidies, and incentives, to drive sustainable development in the built environment (e.g., carbon pricing, green loans, blended finance, and grants).[13]
- Align sustainable finance taxonomies with NZERB principles to guide investments towards such buildings.
- Promote standards and certifications that exceed minimum regulatory requirements.
- Develop financial incentives and disincentives, including the removal of fossil-fuel subsidies, to accelerate the transition
- Enable resilience investments through robust risk-assessment mechanisms by:
    - Publishing publicly accessible climate-risk maps.
    - Mandating climate-risk assessment disclosures where appropriate.
    - Updating risk frameworks used by insurers and financial institutions.

[13] Guidance on financial mechanisms will be published in Q2 2026 as part of the Priority Action 3: Finance work

Social Innovation and Data

- Support public and private initiatives that raise awareness and encourage behavioural change in building design, construction, and use.
- Provide access to future climate and hazard data (e.g., IPCC climate scenarios) to guide building design, retrofits, and long-term planning.
- Develop locally adapted methods for assessing life-cycle greenhouse gas emissions and integrate them into national standards and methodologies.
- Expand national building statistics to include building-stock characteristics, mitigation and adaptation plans, demographics, materials, and hazard impacts.
- Establish or strengthen databases on construction products, materials, processes, energy systems, and service life to support life-cycle analysis.
- Promote tools such as Building and Material Passports, Environmental Product Declarations (EPDs) and Health Product Declarations (HPDs).
- Gradually mandate life-cycle reporting and target-setting for upfront, embodied, and operational carbon.
- Establish national public engagement and awareness campaigns to promote NZERB principles, improve understanding of energy and resilience performance, and support behavioural change among households, building owners, and developers.

Human capacity and industry skills

- Facilitate dialogue among the insurance, finance, emergency management, and building/real-estate sectors to align priorities and scale adaptation finance. Promote professional training and continuing education aligned with NZERB principles.
- Develop and refine national building-stock models to assess emissions, resilience, and investment needs.
- Support research and innovation on mitigation–adaptation interlinkages, data infrastructure, low-carbon materials, and circular practices.
- Establish and implement mechanisms to regularly update plans, building codes, and assessments
- Strengthen compliance monitoring and enforcement mechanisms across levels of governance.
- Expand building-sector capacity to support NZERB deployment at scale,

including workforce development, certification of installers, expansion of low-carbon material production, and alignment of contractors, manufacturers, and suppliers, designers, and engineers with NZERB standards.

- Ensure NZERB policies incorporate equity and just-transition considerations, including affordability safeguards, targeted incentives, and support for low-income and informal housing sectors.

Phased Implementation Approach

Governments should adopt a progressive implementation pathway:

- Voluntary benchmarking and disclosure
- Mandatory reporting of energy and carbon performance
- Minimum performance standards aligned with NZERB criteria
- Progressive tightening toward whole-life carbon caps

Carbon and Energy

Building Block: Energy Efficiency

- Mandate Minimum Energy Performance Standards (MEPS) within building codes and related policies, with clear procedures for incremental updates. MEPS should apply to both new and existing buildings and cover major building technologies (heat pumps, HVAC systems, lighting, appliances, building envelope).

- Promote and incentivise passive design strategies, including passive heating, cooling, shading, and natural ventilation, to reduce energy demand and improve thermal comfort in both new construction and retrofits.

- Develop a comprehensive national retrofit and upgrade strategy to improve the energy performance of the existing building stock while maintaining high indoor environmental quality, prioritising the most energy-intensive buildings, including large public buildings.

- Establish or strengthen baselines and Energy Performance Certificates (EPCs) to support transparency, benchmarking, and improved energy performance across the sector.

- Integrate GHG emissions data into EPCs to provide a more complete picture of building performance and support informed decision-making.

- Enable integrated planning between energy providers and the building sector to coordinate investments, optimise energy-system efficiency, and support GHG-reduction measures.

Building Block: Operational Emissions

- Mandate reporting of operational emissions across the building life cycle, using clear methodologies aligned with national climate targets.
- Set operational-carbon reduction targets for both new and existing buildings, aligned with 2030 and 2050 climate goals.
- Promote low-carbon building operations through efficient systems, optimised controls, commissioning, and continuous performance monitoring.
- Support the adoption of low-carbon technologies (e.g., heat pumps, district energy, renewable-ready infrastructure).
- Ensure that indoor environmental quality (IEQ) is maintained or improved while reducing operational emissions, avoiding trade-offs between efficiency and occupant health.
- Encourage performance-based approaches, including operational ratings, real-time monitoring, and continuous commissioning, to ensure buildings perform as intended in practice.

Building Block: Low carbon energy and prioritisation of fossil fuel free

- Establish and progressively enforce policies that promote the use of locally available renewable resources (including on-site generation), while enabling grid-responsive demand management, and eliminating or minimising reliance on on-site fossil fuels to the greatest extent possible.
- Encourage and incentivise the adoption of alternative renewable heating and cooling such as solar thermal, geothermal systems, district energy, and other low-carbon technologies, to reduce emissions and enhance efficiency.
- Mandate the phased electrification of heating, cooling, and appliances, replacing fossil-fuel-based systems wherever feasible and ensuring compatibility with a fully decarbonised energy system.
- Prioritise funding and regulatory support for large-scale renewable energy infrastructure and battery storage, to strengthen energy security, stabilise energy prices, and accelerate the decarbonisation of the building sector.
- Coordinate electrification strategies with grid decarbonisation plans and demand-response frameworks to avoid emissions shifting and optimise energy-system performance.

Building Block: Low Global Warming Potential (GWP) Refrigerants

- Mandate the use of low-GWP refrigerants in HVAC systems and cooling technologies, supported by a phased plan to transition away from high-GWP hydrofluorocarbons (HFCs) in line with international commitments and national climate targets.

- Establish robust requirements for refrigerant recovery, reuse, and leak management, ensuring proper handling of existing refrigerants, to minimise emissions and environmental impact.

Building Block: Embodied Emissions

- Mandate reporting and target-setting across the entire building life cycle, including upfront, embodied, and operational carbon, with clear reduction pathways relative to national datasets.

- Incentivise and reward reuse and maintenance of existing buildings over demolition or new construction, recognising the carbon savings and resource efficiency benefits associated with extending building lifespans.

- Progressively require more comprehensive functional and environmental product information at both building and product levels. This should include dismantling guidance, reusability and recyclability potential, recycled content, in-use performance requirements, and toxicity profiles.

- Promote the use of secondary materials through measures such as mandatory recycled-content requirements, material-recovery policies, and investment in advanced waste-sorting and recovery infrastructure.

- Facilitate market entry for secondary building materials recovered through demolition and deconstruction activities by improving quality assurance, certification pathways, and procurement incentives.

- Establish frameworks that optimise resource and material use, including:
    - Renovation of existing assets
    - Design for deconstruction and disassembly
    - Recovery of materials
    - Design for modularity and adaptive reuse
    - Waste separation at source and recycling
    - Land and space efficiency

- Implement circular-economy infrastructure policies that promote closed-loop material flows, enforce demolition-waste regulations, and support resource-sharing systems to minimise construction and demolition waste.

Building Block: Sufficiency

- Prioritise the use of existing buildings before new construction by promoting "reuse-first" assessments that demonstrate why constructing a new building is necessary.
- Enable and incentivise space-efficient living by reforming planning regulations to support co-living, multigenerational housing, shared amenities, and more flexible occupancy arrangements.
- Activate vacant and underused building stock by establishing national or municipal vacancy registries to systematically identify, monitor and bring empty properties back into use.
- Encourage brownfield and greyfield development over greenfield expansion for new construction, where appropriate, in order to limit land-use change, reduce infrastructure demand, and promote more compact and efficient urban development.
- Promote resource-efficient design and construction by optimising the use of resources (water, materials) and structural elements. This includes encouraging design approaches that minimise material intensity, maximise structure efficiency, and reduce resource consumption across the building life cycle.

Adaptation and Resilience

Building Block: Climate-Resilient Building

- Integrate hazard mapping and climate-risk zoning into national and local planning policies to prevent construction in high-risk areas such as floodplains, seismic zones, wildfire-prone regions, and landslide-prone areas.
- Strengthen and enforce planning policies that protect and expand blue and green infrastructure, enhancing ecosystem services and climate resilience in urban areas.
- Incentivise higher-density development in lower-risk areas through land-use and economic policies, fostering both physical and social resilience.
- Promote Nature-based Solutions (NbS) as cost-effective measures that support both climate adaptation and mitigation.
- Review and promote mandatory installation of backup and redundancy systems for critical building functions (e.g., energy supply, water systems, cooling) in priority buildings such as hospitals, schools, and emergency facilities.

Building Block: Resilience Assessment

- Develop climate-risk assessments and long-term resilience strategies for buildings and building portfolios to inform property valuation, insurance frameworks, and financing decisions, ensuring that climate risks are reflected in asset pricing and investment planning.

Building Block: Risk Assessment

- Progressively mandate climate-risk assessments within building regulations for new and existing structures, incorporating forward-looking climate data and hazard projections.
- Develop contingency plans for extreme climate events, including heatwaves, storms, and water shortages, supported by investments in early-warning systems and emergency response infrastructure.

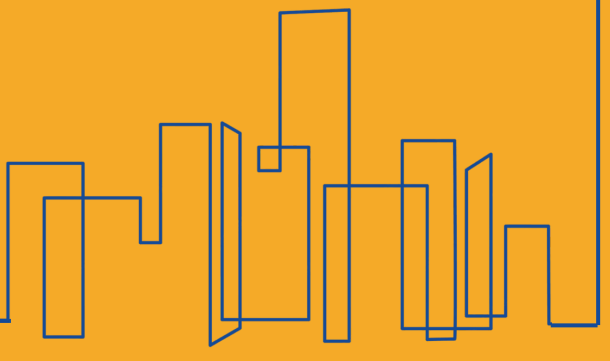
Building Block: Vulnerability Assessment

- Integrate vulnerability assessments of buildings and communities into planning, design, and retrofitting policies to identify populations, building types, and locations most exposed to climate hazards and prioritise targeted adaptation measures.

Building Block: Resilience Measures

- Strengthen and enforce planning policies that protect, restore and expand blue and green infrastructure to enhance climate resilience and ecosystem services.
- Develop contingency plans for extreme climate events, supported by early-warning systems and resilient emergency response infrastructure.
- Incentivise higher-density development in lower-risk areas through planning and land-use policies that steer growth away from highly vulnerable zones.
- Promote the integration of Nature-based Solutions (NbS) to manage climate risks while delivering co-benefits for biodiversity, water management, and urban cooling.

APPENDIX A: WHO WE ARE



Appendix A: Who We Are

The Priority Action on "Standard and Certifications" members consist of the Buildings Breakthrough Secretariat (GlobalABC), the lead partner (WorldGBC), countries that have signed-up to this priority area, supporting GlobalABC Hubs/Action Groups, and supporting partners and their initiatives. Together these organisations formed the 'Working Group'.

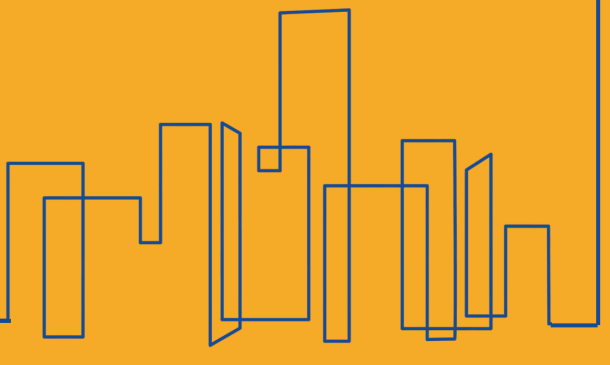
Due to the large ecosystem of stakeholders involved in the Buildings Breakthrough, a "Project Governance Steering Committee' was established in 2024. In addition, a wider plenary group was convened. This group includes stakeholders not eligible to join the working group but who were interested to follow the work and contribute to discussions.

The composition of the Steering Committee is shown in the table below:

Organisations	
UNEP hosted GlobalABC Secretariat	Government of France- Ministry of Ecological Transition and Territorial Cohesion
World Green Building Council (WorldGBC)	German Federal Ministry for Housing, Urban Development and Building
GlobalABC Materials Hub	Government of Senegal, Ministry of Environment and Sustainable Development
International Code Council (ICC)	Government of Türkiye, Ministry of Environment, Urbanization and Climate Change
Royal Institution of Chartered Surveyors (RICS)	UK Government - Department of Energy Security and Net Zero
World Business Council for Sustainable Development (WBCSD)	U.S. Green Building Council
Carbon Risk Real Estate Monitor (CRREM)	Vietnam Green Building Council
International Initiative for Sustainable Built Environment (iiSBE)	

This Steering Committee was tasked for setting the strategic direction and defining the scope of work whilst the 'Working Group' and 'Plenary Group' supported the work of the Steering Committee to facilitate dialogue, exchange views and serve as a platform to consult on deliverables and recommendations of the Project Governance Steering Committee.

APPENDIX B: EXAMPLES AND RESOURCES



Appendix B: Examples and Resources

- **Energy Performance of Buildings Directive (EPBD) - Energy Performance Certificates (EPCs):** The EPBD focuses on reducing greenhouse gas (GHG) emissions from buildings by requiring Energy Performance Certificates (EPCs) to include operational GHG emissions and by mandating progressively higher energy performance standards.
  Under the directive:
  - New public buildings must meet zero operational emissions by 2028
  - All other new buildings must achieve zero operational emissions by 2030
  - EU Member States must define maximum allowable operational CO_2 emissions for different building types and climate zones. These thresholds will be used in Energy Performance Certificates (EPCs) and for classifying buildings.
- **WorldGBC NDC Scorecard:** The 'NDC Scorecard for Sustainable Buildings' supports countries to evaluate and strengthen their national-level plans and policies. The NDC Scorecard is a free digital tool that helps governments and key stakeholders to:
  - Identify best practice policy measures that should be contained within a country's NDC and their national policy framework.
  - Analyse how their country's NDC, national policies and regulations align against these policy measures.
  - Facilitate collaboration between industry stakeholders and governments.
  - Prepare for a wider process to develop national decarbonisation roadmaps.
- **Nordic Countries Regulations:** Nordic countries are implementing varying regulations on building emissions, with a focus on harmonising assessment methods while allowing national differences. Examples of mandatory limit values for national policies across the region can be found here.
- **The Carbon Leadership Forum (CLR):** The CLR provides an Embodied Carbon Policy Toolkit as a collection of resources designed to provide policymakers with tools to understand the current landscape of embodied carbon policy and to support the crafting of policies to radically reduce embodied carbon in buildings and infrastructure. More information can be found here: Policy Factsheets and map.
- **New York City - Local Law 97:** New York City's Local Law 97 requires large buildings to meet greenhouse gas (GHG) emissions limits and will fine those that exceed their limits starting in 2025.
- **C40 Cities´ Clean Construction Programme:** support cities to reduce embodied emissions by at least 50% for all new buildings, major retrofits, and infrastructure projects by 2030.
- **Global Building Data Initiative:** Leverages data to inform industry and policy action for reducing resource use and upfront embodied carbon.
- The Climate Value-at-Risk (CVaR) methodology: is a framework used to quantify the potential financial losses and opportunities for companies, assets, or investment portfolios resulting from climate change, across specific future climate scenarios.
- **France new EPC Directive:** since January 2025, it is prohibited to rent accommodation labeled G on the energy performance diagnostic. More information can be found here.

- **Policy examples on sufficiency:**
  - France is tackling underused housing through a national vacant-building database that has identified over a million empty units and helps municipalities bring them back into use. A rising vacancy tax further encourages owners to return unused homes to the market.
  - Germany promotes better use of existing housing by supporting homeowners to subdivide large single-family homes and by giving municipalities strong powers to restrict misuse, including tourist rentals. These measures maintain residential availability and reduce pressure for new construction.
  - Poland's national mapping programme identified 1.5 million vacant homes and assessed which could be renovated, helping municipalities prioritise bringing adaptable units back into use. This supports more efficient use of the existing housing stock
- **Methodological Recommendations from iiSBE, IEA EBC Annex 89 and the work on EN 15978 within the framework of CEN TC 350:** in addition to existing frameworks for determining greenhouse gas emissions over the life cycle of buildings, countries may benefit from developing and introducing national standards. The following aspects and steps are recommended, considering where appropriate the distinction between building modelling and existing buildings:
  - Definition of terms and definitions: Clarify WLC vs. life-cycle GWP based on calculation of GHG emissions.
  - Definition of indicators: Define GWP (total), GWP (fossil), and biogenic carbon content.
  - Definition of building model: Specify required building elements and cutting criteria.
  - Definition of life cycle model: Define life-cycle phases and information modules to include.
  - Determination of accounting period: Establish a reference period (e.g., 50 years).
  - Treatment of time-dependent variables: Choose between static, forward-looking, or dynamic/prospective approaches.
  - Assumptions and scenarios: Address climate change, decarbonization, and future processes (e.g., dismantling and disposal).
  - Data types/sources – Construction products: Determine use of standard vs. specific data.
  - Data types/sources – Replacement cycles: Specify standard vs. specific data requirements.
  - Data types/sources – Emission factors: Define which standard or specific data to apply.
  - Data types/sources – Transport & construction processes: Choose between standard or specific datasets.
  - Data types/sources – Processing & disposal: Use standard vs. specific data as appropriate.
  - Rules for renewable energy production and use: Include provisions for technologies such as BIPV.
  - Rules for accounting for operational GHG emissions: Use national standards for calculating final energy demand where applicable.
  - Rules for accounting for embodied GHG emissions: Base methods on standards used for determining construction costs if needed.
  - Reference areas: Define reference area types, e.g., "used area."
  - Requirements for processors: Establish qualifications or competency expectations.
  - Software requirements: Include requirements such as external quality inspections.
  - Report formats: Integrate GWP results into formats such as energy performance certificates.
  - Requirements and rules for limit and target values: Use top-down or bottom-up approaches (e.g., science-based targets).

Global Alliance for Buildings and Construction

The Buildings Breakthrough operates under:

BREAKTHROUGH AGENDA

Near-Zero Emission and Resilient Buildings

Shared Definitions, Indicators, Frameworks, and Policy Guidance for Implementation

Lead Partner:

WORLD GREEN BUILDING COUNCIL