

SUSTAINABLE AND AFFORDABLE HOUSING

Spotlighting action from across the
World Green Building Council network



BETTER PLACES
FOR PEOPLE



WORLD
GREEN
BUILDING
COUNCIL



About World Green Building Council

The World Green Building Council (WorldGBC) is the largest and most influential local-regional-global action network, leading the transformation to sustainable and decarbonised built environments for everyone, everywhere.

Together, with 75+ Green Building Councils and industry partners from all around the world, we are driving systemic changes to:

- Address whole life carbon emissions of existing and new buildings
- Enable resilient, healthy, equitable and inclusive places
- Secure regenerative, resource-efficient and waste-free infrastructure

We work with businesses, organisations and governments to deliver on the ambitions of the Paris Agreement and UN Global Goals for Sustainable Development (SDGs).

Green Building Councils

Green Building Councils (GBCs) are independent, non-profit organisations accelerating the uptake of sustainable buildings. As members of WorldGBC, they convene businesses and governments to collectively drive environmental, economic and social impact within the built environment on a national, regional and global scale.

Better Places for People

Better Places for People is a WorldGBC global programme, dedicated to supporting GBCs, partners and the built environment industry to transition towards a healthy, equitable and resilient built environment. Better Places for People is guided by the vision of WorldGBC's Guiding Goal, "a built environment that delivers healthy, equitable and resilient buildings, communities and cities". Our action through the global network is underpinned by the six core principles of [WorldGBC's Health & Wellbeing Framework](#), working to catalyse social and environmental benefits across the built environment value chain.

This work is produced by WorldGBC's Better Places for People Global Programme.

Consulted and co-created by the Better Places for People Housing Taskforce, comprised of:

Green Building Councils:

- Chile Green Building Council
- Colombia Green Building Council
- Emirates Green Building Council
- Green Building Council of Australia
- Green Building Council Brasil
- Green Building Council Costa Rica
- Green Building Council Italia
- Green Building Council of South Africa
- Guatemala Green Building Council
- Indian Green Building Council
- Irish Green Building Council
- Jordan Green Building Council
- Kenya Green Building Society
- New Zealand Green Building Council
- Philippine Green Building Council
- US Green Building Council

Knowledge Partners:

- Build Change
- Institute for Human Rights and Business (IHRB)
- Reall
- World Resources Institute (WRI)

Kindly reviewed by:

- Habitat for Humanity International
- ICLEI
- International Finance Corporation (IFC)
- Office of the United Nations High Commissioner for Human Rights (OCHCR)
- The Predistribution Initiative
- The Shift
- UN-Habitat
- United Nations Environment Programme (UNEP)

Better Places for People Global Programme Partners:



BURO HAPPOLD

Foreword

Our world faces great challenges, many of which are unprecedented in the history of our evolution. The climate emergency we face is one of those, and it goes hand in hand with another – the global housing crisis.

According to the UN-Habitat, the world needs to build 96,000 new homes every day in order to house the estimated three billion people who will need access to adequate housing by 2030. In all geographies around the world, people are facing homelessness, poverty or living in substandard homes. Those people are at the heart of this flagship report from our global Better Places for People programme. Housing should, and can be, affordable, sustainable and fit for purpose for everyone, everywhere.

In this report, we challenge the widespread perception that affordable and sustainable housing is not a widely achievable solution. There is no one size fits all solution for the building and construction industry. As the case studies within this report demonstrate, there are many varied strategies available and being used around the world that could be scaled up to address the housing challenge in all global geographies. I want to thank our partners and the 16 Green Building Councils involved in the Better Places for People global programme Taskforce who have co-developed this report with us. They join us in a unified call to drive the much needed uptake of sustainable and affordable housing. Their successes in policy, finances, design and construction

techniques and other grassroots innovations are clear evidence that rapid progress is already being made to overcome the housing, climate and health crises.

The task at hand is a great one; but there is always optimism if we collaborate on solutions, and spark consideration of best practices being implemented around the world to trigger further research in this area. Our report is another step forward in our collective mission to achieve this.



Cristina Gamboa
CEO of WorldGBC



“It’s been a pleasure to collaborate with the WorldGBC on this report and draw attention to what sustainable and resilient housing looks like in practice. At Build Change, our vision is that every house is made disaster-resilient. Achieving this not only requires an engineering solution, but must include considerations of policy, demand, and finance to address systemic barriers to housing access.

One of the simplest and often overlooked mechanisms for enabling pathways to disaster-resilience is through structural improvements of houses - through incremental upgrades, homeowners have more cost efficient, sustainable, and attainable steps towards resilience. It is with this in mind that we’re happy to share highlights of our work in the Philippines, where homeowners have taken charge of decision-making processes to achieve incremental upgrades with microfinance loans for housing that meets their needs, and those of their families for years to come.”

Monica Schroeder, Director of Global Advocacy, Build Change



Closing the global housing deficit within planetary boundaries demands an urgent reassessment of how we build our present and future cities. It is now widely recognised that business-as-usual is no longer possible. A rapid transition to green and low-carbon urban infrastructure is therefore essential, encompassing global goals and commitments on greenhouse gas mitigation, adaptation and resilience. Yet, building quality and secure housing goes beyond the infrastructure-climate nexus, or decarbonising the built environment. It is also a human rights ambition, it is a public health issue, and it underpins more inclusive and progressive urban futures. This welcome report draws attention to the challenge, but it also provides examples of the kind of innovation and leadership necessary to bring about change. It is notable for its attention and celebration of initiatives and entrepreneurship from the global south itself, and what can be learned from actors and actions which are often unrecognised and overlooked. It has been an honour to contribute to this report, developed in such an inclusive way by the World Green Building Council and its network.

Donovan Storey, Head of Global Policy, Reall

Executive Summary

This report presents a high-level summary of sustainable and affordable housing around the world – profiling challenges facing the housing sector and opportunities available that are driving the uptake of new solutions and approaches, illustrated by local examples documented from within the WorldGBC network.

The case study content from each of WorldGBC's five regions highlights cutting-edge built environment projects making sustainable and affordable housing a reality for all. These projects are demonstrating commitment towards the right to adequate housing and a sustainable future for many populations in different geographies.

This report demonstrates a call to action to strengthen the uptake of sustainable and affordable housing, derived from successful global practice, and showcases leadership in regulatory change, financing, governance models and business innovations.

These solutions and successes can and must be scaled to make rapid progress in overcoming the housing, climate and health crises faced worldwide.

Within the industry, the terms 'affordable housing' and 'sustainable housing' have been increasingly receiving attention for the past decade. However, the misconception that sustainable housing is more expensive, difficult to resource and intensive to pursue is affecting its uptake. The good news is that the knowledge, tools, techniques and technologies to allow for the uptake of sustainable and affordable housing already exist.

Understanding the feasibility and the array of possibilities could help tackle the housing crisis and the various challenges surrounding it, while reprioritising health, equity and resilience.

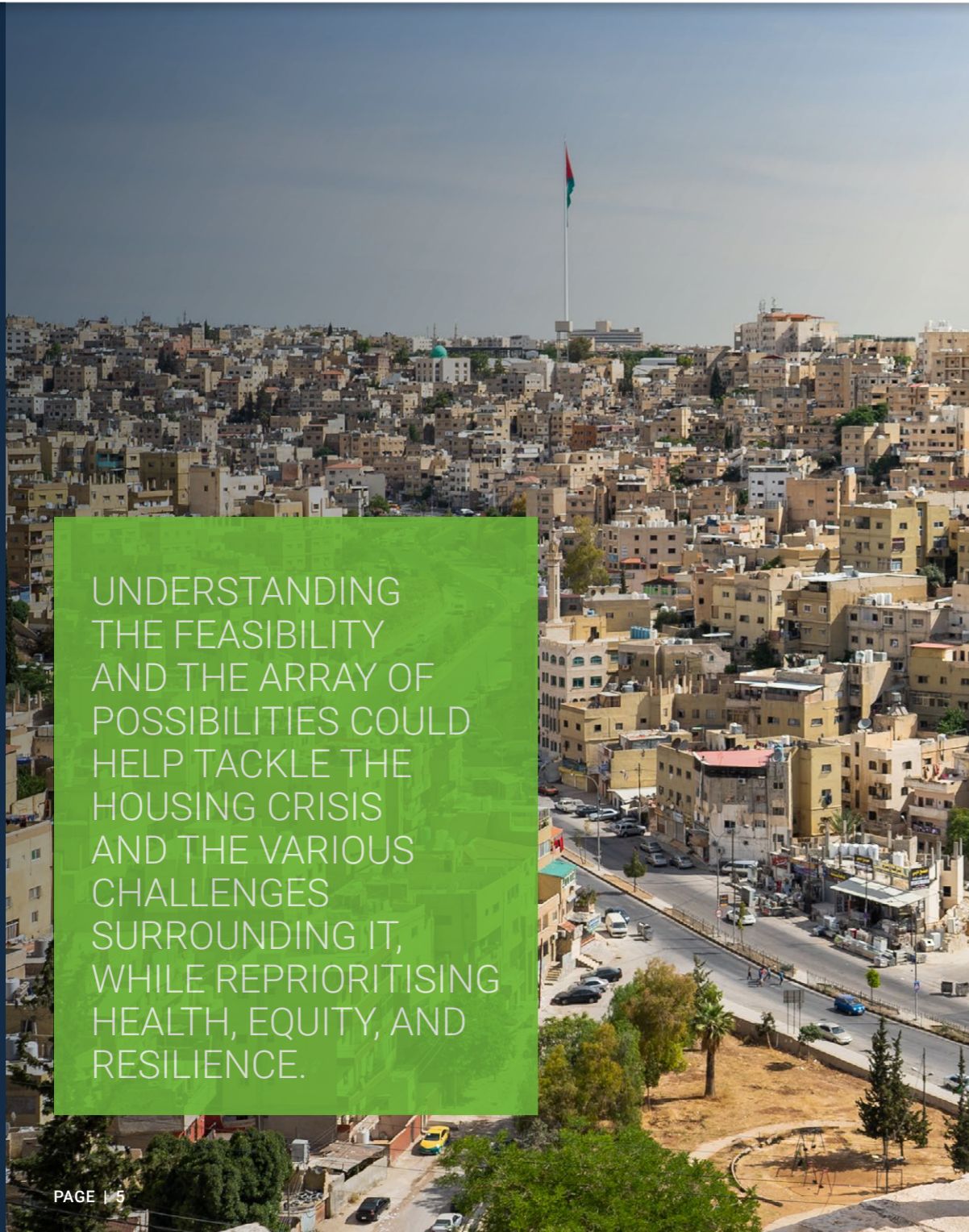
In light of the environmental and social challenges the world is facing, it has never been more critical to demonstrate the attainability of housing that is both sustainable and affordable. Such housing must capture not only the affordability that includes upfront costs of purchase or rental, but also the ongoing affordability of living and operational costs highlighted in the principles section of this report.

In developing this report, a Taskforce of representatives from the WorldGBC network collaborated with other leading industry experts to co-create a series of high-level principles illustrating sustainable and affordable housing in practices. These are:

-  **Habitability and Comfort**
-  **Community and Connectivity**
-  **Resilience and Adaptation to a Changing Climate**
-  **Resource Efficiency and Circularity**
-  **Economic Accessibility.**

HOUSING IS, POTENTIALLY, THE MOST IMPORTANT SUB-SECTOR OF THE BUILT ENVIRONMENT IN TERMS OF IMPACT ON HUMAN HEALTH AND DEVELOPMENT, ECONOMIC RELEVANCE AND ENVIRONMENTAL IMPACT.





← UNDERSTANDING THE FEASIBILITY AND THE ARRAY OF POSSIBILITIES COULD HELP TACKLE THE HOUSING CRISIS AND THE VARIOUS CHALLENGES SURROUNDING IT, WHILE REPRIORITISING HEALTH, EQUITY, AND RESILIENCE.

Within this report, solutions and best practice examples are presented across all five continents and in diverse geographies, cultures and climates.

In showcasing a varied range of examples, a consistent message emerges – the challenges faced are numerous, but there is a growing body of evidence of progress and opportunities. These include from finance solutions, supporting policies and design and in-use strategies that are being seen in practice worldwide and are making sustainable and affordable homes attainable for people in many regions. This should – and could – be a reality for all.

The availability of solutions in this report should inspire optimism, and spark consideration of best practices being implemented around the world to trigger further research. In the context of tracking the global housing stock's significant and growing gaps in terms of quantity and quality, the good practice and analysis provided in this report demonstrates that the solutions for closing this gap are being used across the world already – both through the development of new units and the retrofit of existing homes.

Through our call to action, WorldGBC and partners lay the foundation for greater prioritisation of the housing sector from all built environment actors, including financial and policy stakeholders. However, much more work is needed to take this vision and leadership and translate it to the global financial and development community who invest in, develop and own the properties. There is no doubt that deep commitment and collaboration will be required from actors across the value chain to tackle the growing crisis we face with global housing stocks, but we hope this report contributes to building the awareness, commitment and value proposition needed for positive change towards sustainable and affordable housing for everyone, everywhere.

The report focuses on sustainable and affordable housing for two target populations based on income levels: Low-income housing and Middle-income housing. The characteristics of each are described in the boxes on the right.

Low-income housing

- Social housing and informal settlements, considering minority groups
- Target towards developments led by governments and procurement bodies, or policy-directed or subsidised private development

Middle-income housing

- Mass market and affordable housing
- Private housing
- Target towards wider supply chain including developers, investors, designers, owners, occupiers, and the construction sector

Introduction and Purpose

WorldGBC's global network is committed to working towards a sustainable built environment for everyone, everywhere.

Housing is, potentially, the most important sub-sector of the built environment in terms of impact on human health and development, economic relevance and environmental impact. Through this publication, WorldGBC hopes to champion a unified vision for sustainable and affordable housing and spotlight best practice worldwide to demonstrate opportunities for success that could be scaled for greater impact.

However, in tackling this topic, WorldGBC's network recognises that the fundamental challenges in developing a sustainable and affordable housing stock for all are intensely localised. **Whilst the scope of this report is global, it is not possible to provide comprehensive coverage, nor to provide universal detailed guidelines, but rather demonstrate that the sustainability outcomes that we aspire to can be, and are already being, achieved in varied locations around the world.** The development of principles and analysis of case study data against them illustrates how different a set of principles can seem when embedded in local context. This report will bring this message to fruition by spotlighting insights from real-life challenges, leadership and strategies, to encourage the development of high quality,

sustainable and affordable housing in different regions and provide inspiration to be adapted as appropriate to each local context.

The outcome of this work is to highlight that sustainable housing is, by principle, attainable in all geographies from affordability, access, resource and financial perspectives. This should inspire and support mass market collaboration to build upon the principles and learnings in a multitude of ways, including further development of policy recommendations, guidance for global financial and institutional investment sectors, scaling of solutions through awareness raising, upskilling and industry buy-in, and engagement with occupants on the ground.

WorldGBC calls for global action to be accelerated towards a housing stock that embodies the principles outlined in this report, targeting all stakeholders of the housing sector, including built environment practitioners, decision makers, investors, developers, designers and policy makers to scale up the achievements showcased within this report. The content is also valuable for governments and infrastructure agencies to trigger an increase in ambition for procurement of quality and accessible housing, as well

as to create policy environments such as regulations, standards, incentivisation schemes and procurement practices. Unwavering commitment and collaboration are essential within the housing sector for the mass transition to sustainable and affordable housing for all.

THE OUTCOME OF THIS WORK IS TO HIGHLIGHT THAT SUSTAINABLE HOUSING IS, BY PRINCIPLE, ATTAINABLE IN ALL GEOGRAPHIES FROM AFFORDABILITY, ACCESS, RESOURCE AND FINANCIAL PERSPECTIVES.



Background

HOUSING IS RECOGNISED AS A SECTOR THAT IS CENTRAL TO GLOBAL SUSTAINABILITY TARGETS AND IS A KEY LEVER IN THE TARGETS OF THE SUSTAINABLE DEVELOPMENT GOALS.

Housing is of fundamental importance to human development, in addition to its role in people's identity and social belonging. People's homes are where these impacts are most often felt.

Housing is recognised as a sector that is central to global sustainability targets and is a key lever in the targets of the UN's Sustainable Development Goals. SDG11, target 11.1 states that: "By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums"¹.

Article 25 of the Universal Declaration of Human Rights states that: "Everyone has the right to a standard of living adequate for the health and wellbeing of himself and of his family"².

The UN Special Rapporteur on the Right to Housing states that: "It is time to recognise that sustainability of housing should become an additional core element of the right to adequate housing, in order to ensure that the right to adequate housing is interpreted in full consonance with the right to a clean, healthy and sustainable environment"³.

At least 85% of the world's population has been affected by climate change^{4,5}.

The housing sector is responsible for between 17–21% of global carbon emissions and has a substantial role to play if the world is to meet net zero carbon emissions by 2050⁶. This is a critical target to keep global temperature change within the 1.5°C of warming. However, as average temperatures are already on the rise, acute hazards such as heat waves and floods are growing in frequency and severity and chronic hazards such as drought and rising sea levels are intensifying, affecting 85% of the world's population. Vulnerability is heightening, impacting liveability with severe reduction in people's health, wellbeing and quality of life.

In addition to devastating climate change events, further man-made conflict, violence and human rights violations are also damaging cities and homes, displacing communities and resulting in housing inaccessibility for millions of people worldwide, especially those of indigenous, minority and migratory backgrounds, neglecting vulnerability and lacking inclusivity.

It is estimated that one billion people reside in slums and informal settlements, 1.6 billion people live in inadequate housing, 15 million people are forcibly evicted every year⁷⁻⁹ and 100 million people are displaced by events of conflict and violence⁵.

Such stresses on the housing sector are triggering short-term thinking and reactive decision-making, from rapid home building to informal settlement clearance. It is important to create a demand for sustainable and affordable housing. Transformation that leaves no one behind, with resilient construction, reconstruction and recovery practices and the need to adapt the world's building stock to increasing climate change events^{10,11}.

The world needs to provide two billion homes over the next 75 years¹², with home retrofits and improvements being a vital part of addressing the housing crisis¹³.

By the end of this century, the world's population is set to increase by 50%, to over 11.2 billion — an increase of 45 million people per year¹². In facing global population growth, the demand for urban and residential infrastructure and development is inevitable and the pressure on housing quantity, quality and its affordability will increase¹².

It is estimated that by 2030, three billion people, or 40% of the world's population will need adequate housing units whether new-built or renovated¹⁴, which will double the global material consumption. This is also an essential factor when considering the response to recent socio-economic trends of work and habitation-changing patterns, where it is estimated that people spend about 90% of their time in buildings, with two thirds of that spent at home¹⁶.

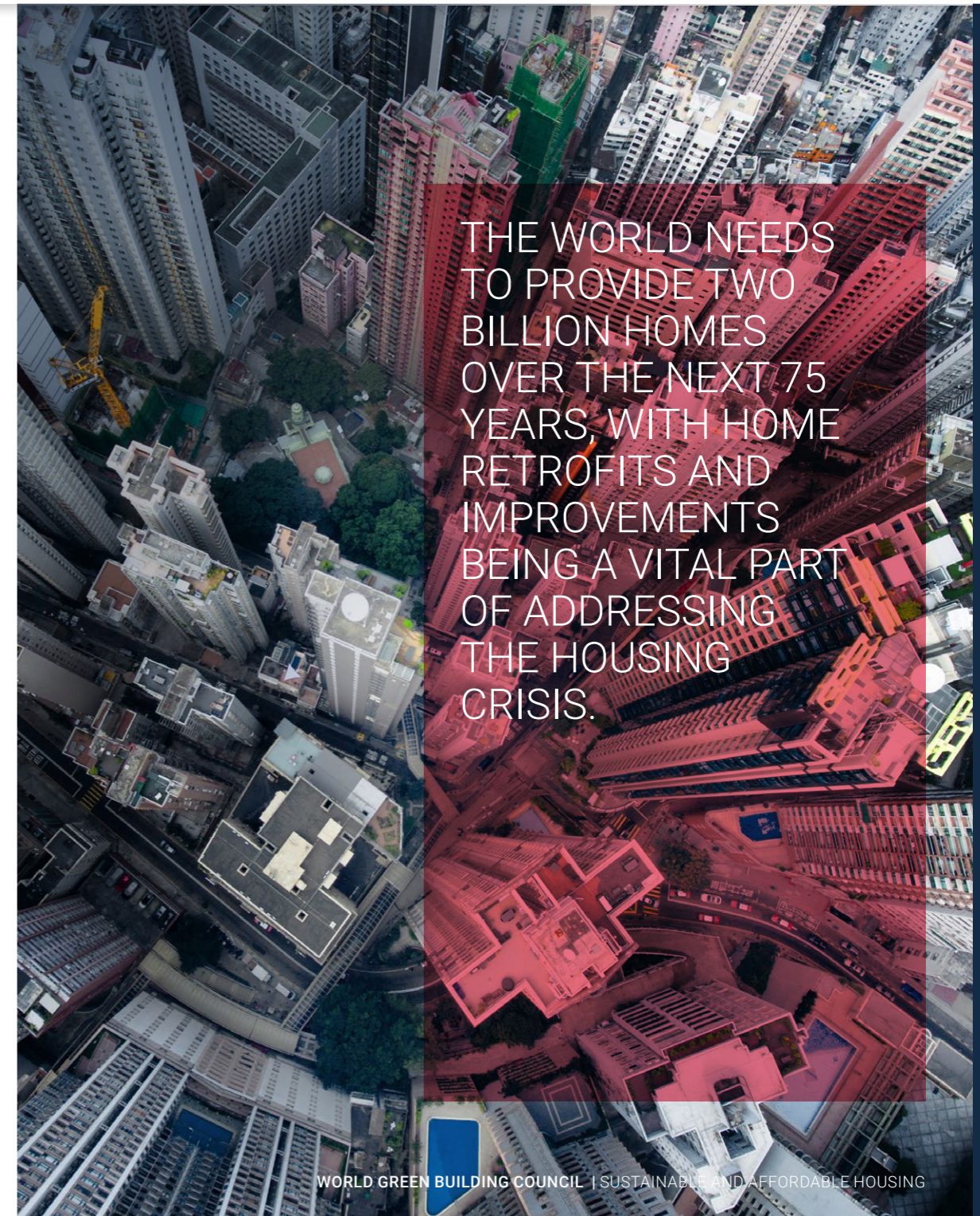
Comprising over 70% of land use in most cities already, with increase in both horizontal and vertical

densification, housing is evidently central to the environmental and social sustainability of future cities. Construction is set to add 230 billion square metres of new buildings in the next 35 years, adding the equivalent of the city of Paris, in terms of new floor space, to the planet every single week¹⁷.

However, there are 42 million unoccupied homes worldwide, an estimate of roughly one in 10 homes are vacant¹³. Retrofitting and renovating existing homes and converting unused buildings into residential space helps address the chronic housing crisis in terms of both quantity and quality, as well as homelessness and housing inadequacy in many countries^{18,19}.

Housing infrastructure can continue to exacerbate problems or can be part of the solution. The global building and construction industry needs a monumental shift²⁰.

Effective housing policies that successfully increase affordability at the level of each home, from purchase to maintenance and repair, are crucial for enhancing resilience. In addition, decarbonising the economy, restoring nature and ecosystem services and tackling the production and consumption of raw material and products are essential to mitigate further climate change impacts²¹. The challenge faced is creating the context, such as political will, set of legislations, policies, regulations, business processes and cultural and behavioural change — for rapid acceleration and uptake of solutions.



THE WORLD NEEDS TO PROVIDE TWO BILLION HOMES OVER THE NEXT 75 YEARS, WITH HOME RETROFITS AND IMPROVEMENTS BEING A VITAL PART OF ADDRESSING THE HOUSING CRISIS.

Definition of Sustainable and Affordable Housing

Affordability is a global issue which directly affects the wellbeing of people. It is estimated that around 80% of cities worldwide do not have affordable housing options for the majority of their population²².

The housing affordability crisis exacerbates urban inequalities. The lack of affordable solutions often pushes people, and particular social groups, such as low-income households, migrants, as well as young people and the elderly, into sharing overcrowded and unsafe dwellings. It can also cause them to move into areas which have little access to employment and education opportunities, healthcare, or green spaces.

UN-Habitat states that: "A house cannot be considered adequate and accessible if its cost threatens or compromises the occupant's enjoyment of other human rights and satisfaction of needs such as food, healthcare, education and transport²³". Affordability is a central component of the right to adequate housing. The definition of 'affordable housing' has undergone extensive review from the global community in recent years, reflecting that affordable housing must encompass a broad range of criteria, instead of only its monetary value being below market rate.

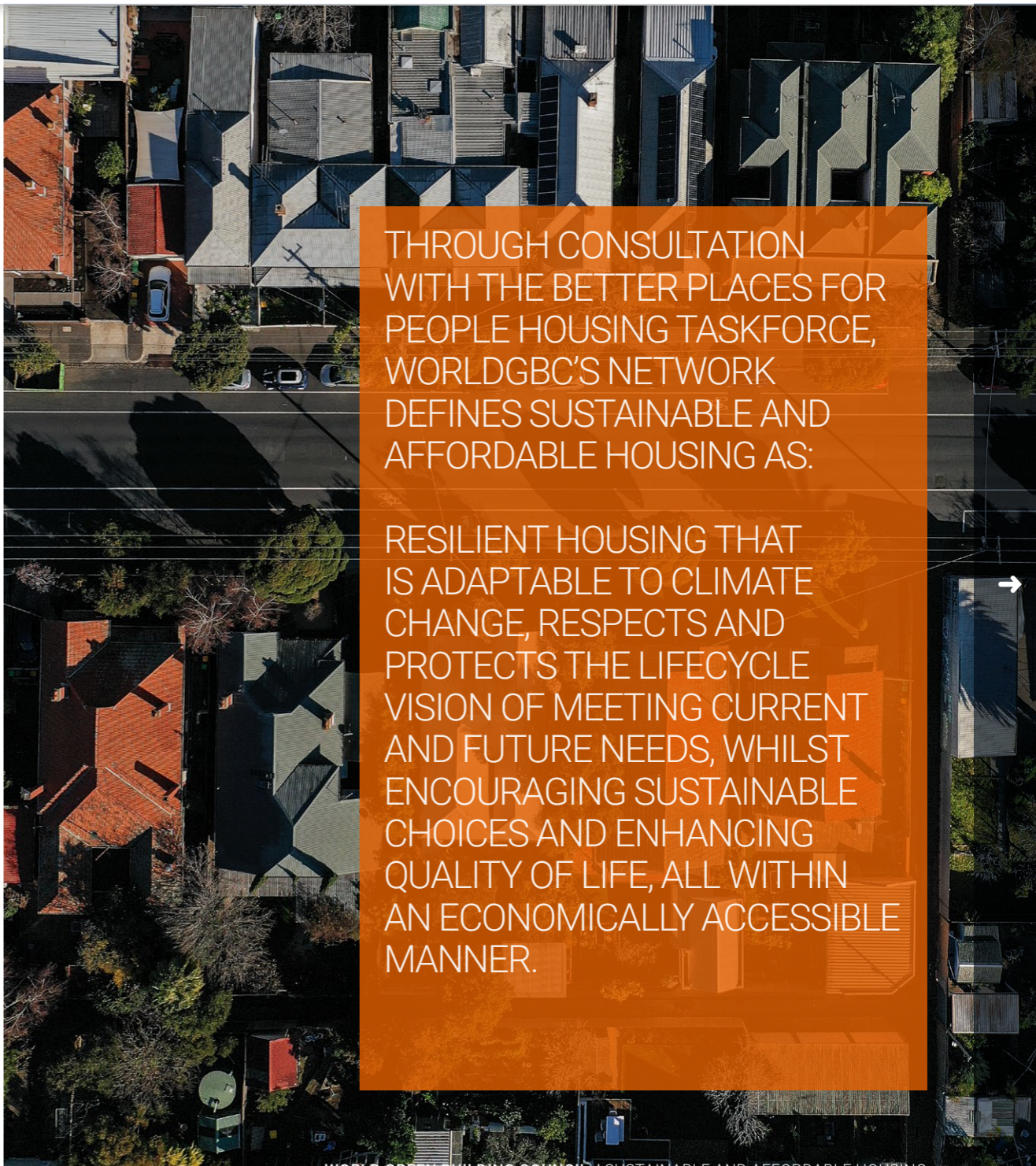
'Affordable housing' is now increasingly being defined as: "Housing that is priced at or below market rate, whilst considering the average household income of the area (Area Median Income), so that the net monthly expenditure on housing cost does not exceed 30% of the total monthly income of the household^{23,24}".

This definition relates to the average absolute value of housing itself in relation to the average resident's purchasing power, capturing not only the affordability that includes upfront costs of purchase or rental, but also the ongoing affordability of living and operational costs²⁵. Together with security of tenure, affordability is central for preventing the risk of evictions as it reflects the capacity of people to sustain rent and mortgage payments, whilst maintaining a wider criteria of household maintenance, utilities, or location, in relation to transport, employment and services²³.

THROUGH CONSULTATION WITH THE BETTER PLACES FOR PEOPLE HOUSING TASKFORCE, WORLDGBC'S NETWORK DEFINES SUSTAINABLE AND AFFORDABLE HOUSING AS:

RESILIENT HOUSING THAT IS ADAPTABLE TO CLIMATE CHANGE, RESPECTS AND PROTECTS THE LIFECYCLE VISION OF MEETING CURRENT AND FUTURE NEEDS, WHILST ENCOURAGING SUSTAINABLE CHOICES AND ENHANCING QUALITY OF LIFE, ALL WITHIN AN ECONOMICALLY ACCESSIBLE MANNER.

Further Resources:
[OHCHR's report of the Special Rapporteur on the right to adequate housing](#)



Principles of Sustainable and Affordable Housing

The development and upgrading of communities to create sustainable and affordable housing occurs differently around the world. However, through consultation with the Better Places for People Housing Taskforce, WorldGBC's global network has concluded that sustainable and affordable housing in any and all geographies must reflect implementation of the following principles, with consideration of the cross-cutting nature of many of the topics.



Habitability and Comfort



Community and Connectivity



Resilience and Adaptation to a Changing Climate



Resource Efficiency and Circularity



Economic Accessibility





Habitability and Comfort

- **Health and comfort:** Enhance indoor environmental quality to boost occupants' mental and physical wellbeing and reduce factors that can lead to viral transmission and ill health, by considering all relevant health and comfort determinants, including air, light, water, sanitation, acoustic, thermal and visual comfort*.
- **Outdoor environment:** Enhance outdoor environmental quality, including access to nature and promote walkability*.
- **Dignity:** Enhance dignity, privacy and security, providing enough space to prevent overcrowding.
- **Rights:** Protect against evictions, destruction and demolition, with appropriate entitlements of land and property.
- **Lifestyle:** Encourage healthy occupant behaviour and lifestyle choices*.



Community and Connectivity

- **Inclusive design:** Prioritise inclusion of citizens in the planning and design stages of community or project development to avoid issues of social unrest or displacement.
- **Access to transport and services:** Incorporate accessible transport systems into community or masterplan, to allow accessibility to employment, services and amenities such as shops, schools, healthcare facilities and public areas.
- **Culture and community:** Foster inclusion and social equity, by enhancing equality, inclusivity, diversity and non-discriminatory, culturally relevant environments that foster a sense of belonging.



Resilience and Adaptation to a Changing Climate

- **Adaptability:** Ensure housing is adaptable, durable and easy to maintain through its lifecycle, to facilitate ease of retrofit and reuse **.
- **Nature-based solutions:** Enhance natural capital, maintaining and preserving ecological processes to support whole life impact on ecological health, prioritise the regeneration of ecosystem services and enhance bio-climatic resilience.
- **Safety:** Ensure structural safety is met and designed to withstand climate change scenarios to offer long-standing usability.
- **Hazard and disaster resilience:** Consider extreme temperature change and weather conditions such as floods, wildfires, droughts, hurricanes, storms and high winds**.



Resource Efficiency and Circularity

- **Net zero whole life emissions:** Target whole life carbon emission reduction, working towards net zero operational and embodied carbon at building and community scales.
- **Energy transition and efficiency:** Support the energy transition away from fossil fuels and towards electrification through the generation and use of clean and renewables-powered electricity, demonstrating energy reduction through efficiency measures to reduce emissions and operational energy use and costs.
- **Water:** Reduce water footprint of materials and processes and ensure water efficiency in operation.
- **Waste and materials:** Support reuse, recycling and up-cycling of materials through circular design principles.



Economic Accessibility

- **Purchase and leasing price:** Support affordable purchase, upfront rental costs, with options to secure housing beyond direct payment.
- **In-use costs:** Ensure accessible and affordable operation, maintenance and ongoing improvement costs.
- **Economic security:** Ensure financial security and a suitable housing option for any income level, whilst supporting the progression of a growing household to a successively higher quality of living, habitat and infrastructure.
- **Living costs:** Ensure access to affordable utilities and services to increase occupants' discretionary income.
- **Development costs:** Source locally and utilise local industries to reduce building costs and support economic development.

Further Resources:

- * WorldGBC's Health & Wellbeing Framework: For more information on health, equity and resilience strategies in the built environment
- ** WorldGBC's Resilience in the Built Environment Guide: For more information about climate resilience and adaptation in the built environment
- IHRB's Dignity by Design Framework: For more information on each stage of the built environment lifecycle, aiming to minimise risks to people and maximise social outcomes.
- ICLEI's Circular City Actions Framework: For more information on a range of strategies and actions available to work towards circular development at the local level.

Lifecycle of Sustainable and Affordable Housing

The principles of sustainable and affordable housing are to be considered at all relevant stages of the building and construction lifecycle.



The Business Case for Making Housing Sustainable and Affordable

It is fundamental to establish a value proposition for investing in sustainable and affordable housing to mobilise action across the built environment. The risks of inaction and cost of remediation at later stages outweigh the opportunities and investments required to change practices today.

Some prominent arguments to drive the business case combining present and future action and inaction are outlined in the following tables.

Opportunities for action

Governments including: local, district, national, international government and multi-level governance

By setting regulatory pathways for sustainable buildings by means of building codes, subsidy schemes, minimum standards, as well as enforcement, building inspections, and control – governments could recognise:

- **Increased energy security:** Sustainable and affordable homes require less energy to heat, cool and power, and generate renewable-sourced power on site – therefore decreasing energy consumption and reducing strain on national energy demands. This may result in reduction of imported energy, risk of shortages, and energy poverty.
- **Reduced carbon emissions and waste:** 550 million metric tonnes of CO₂ equivalent emissions could be saved by 2050 from residential efficiency globally⁹. Energy-efficient residential construction practices could also result in a 40% reduction in global energy savings. Sustainable construction and operation of homes would also greatly reduce waste production, increase circularity and limit landfill contributions.
- **Greater resilience and quality of life of population:** Quality housing best services the needs of the population, with expected improvements in health and wellbeing.
- **Protection of human rights:** Community and supply chain workers' rights can be protected and enhanced through public policy welfare programmes, and social justice considerations.

Industry stakeholders including: developers, investors, contractors, engineering, architectural firms, investors and banks

By investing, developing, designing, constructing, managing, or owning sustainable affordable housing, built environment industry stakeholders could experience:

- **Investment opportunities:** Research suggests there is a \$17 trillion USD opportunity for investing in sustainable housing⁹, with long-term investment benefits and reliable returns through impact investment²⁷.
- **Access to green finance:** Increased access to green bonds and loans, lowered default rates and superior collateral value for green mortgages and insurance rates.
- **Low carbon portfolios:** Achieving sustainability goals offers investment benefits alongside resilience to policy change and investor pressures.
- **Reputational benefit:** Enhanced sustainability credentials may improve brand recognition and faster market differentiation.
- **Housing value:** Increased desirability of properties, with higher resident retention, particularly through creation of community and resident engagement.

Occupants and communities

By owning, renting and retrofitting homes and communities towards sustainable and affordable outcomes, occupants could experience:

- **Economic security:** Sustainable and affordable homes offer financial savings and better spending predictability on utility and service bills. Renewable energy generation and efficiency practices can also provide return on investment benefits for the owner.
- **Resilience:** Strengthened community relationships allow for greater resilience to environmental and systemic stressors, such as climate change impacts. Sustainable housing presents better durability during extreme weather events, with enhanced opportunity for retrofit and maintenance.
- **Quality of life and social value:** Sustainable and affordable properties lead to greater comfort, health and wellbeing standards for occupants and improved standards of living and productivity. Improved accessibility and services may lead to generation of new jobs and access to better quality education and healthcare.

Continued on next page >

The Business Case for Making Housing Sustainable and Affordable (Continued)

Further Resources:
[IFC's article on building the business case for green affordable housing](#)

Risk of inaction

Governments including: local, district, national, international government and multi-level governance

Without concentrated and dramatic action towards the transformation of the national housing stock towards sustainable and affordable homes, governments could experience:

- **Spiralling energy demand:** Unsustainable housing in areas of growing population – and increasing electrification of transport – risks unmanaged demand for domestic energy use.
- **Mitigation and adaptation measures:** Each additional year of delay in implementing sustainability measures, costs an additional \$0.3–0.9 trillion USD in total costs²⁶. Sustainable and affordable housing are an essential part of climate change mitigation and adaptation to impacts.
- **Urban sprawl and planning:** Unmanaged urban sprawl could present socio-economic and environmental risks for the population, such as lack of access to adequate services, jobs, green spaces and other facilities. Sustainably planned communities would limit the risk of these negative impacts.
- **Risk of stranded assets:** Social housing and communities, including public services and infrastructure, that are unsustainable present greater risk from damage or abandonment in future climate scenarios.
- **Economic distress:** Unsustainable and unaffordable housing for the population increases levels of financial and energy poverty, thereby increasing financial burden of support on the state and possibly social unrest. Possible risk of spiralling healthcare costs due to public burden of ill-health from substandard homes.
- **Environmental degradation:** Continued emissions and waste creation, including increase in toxic landfills, deforestation, pollution, and loss of biodiversity.
- **Growth of informal settlements:** Lack of preparation for population change, increase in climate refugees, continued evictions or displacement of low-income renters by gentrification presents a greater risk of informal settlements, gentrification, and substandard housing, which may lead to displacement and migration.

Industry stakeholders including: developers, investors, contractors, engineering, architectural firms, investors and banks

If the transition to sustainable and affordable homes for all is not realised, industry stakeholders could experience:

- **Stranded Assets:** Increased risk of stranded assets due to lack of attention to ESG, human rights considerations, regulatory shifts or damage from extreme weather events
- **Finances:** Reduced attractiveness to sustainable financial products, risking loss of investors and income.
- **Community conflict and opposition:** Unsustainable developments increase risk of conflict and opposition to projects, as well as increasing pressure on local communities.

Occupants and communities

Owners or occupiers of unsustainable homes may experience:

- **Financial stress:** Unsustainable dwellings create higher operational housing costs, and risk increasing levels of energy poverty. Further impacts include reduced housing value and increased insurance premiums of non-resilient homes.
- **Lack of resilience:** The greater risk of significant damage and loss to non-resilient and non-durable structures from climate change events increases vulnerability of housing and infrastructure.
- **Socio-spatial segregation:** Unplanned, sprawling settlements leads to reduced access to jobs, education, and creates a lower quality of life for all.
- **Health risks:** Increased diseases and illnesses associated with substandard housing and environmental degradation, such as pollution and extreme temperatures.

Sustainable and Affordable Housing Worldwide

This section will present a high-level summary of sustainable and affordable housing in every continent, with illustrated local examples documented from within WorldGBC's network. Each regional snapshot will include the following:

- **Challenges facing the housing sector:** Considering population growth and movement, political and environmental challenges that are causing difficulty in the uptake of sustainable and affordable housing.
- **Driving the uptake of sustainable and affordable housing:** Opportunities, leadership, financial innovations and supportive planning and policy that are driving the uptake of sustainable and affordable housing.
- **Case studies for sustainable and affordable housing:** Cutting-edge built environment projects, making sustainable and affordable housing a reality for all, demonstrating a commitment towards the right to adequate housing and a sustainable future.

WorldGBC recognises that the fundamental challenges in developing a sustainable and affordable housing stock for all are intensely localised. The scope of this report is not to cover the entire world, nor to provide instructions, but rather, demonstrate that these outcomes can and are already being achieved, with spotlight and insights on real-life challenges, leadership and strategies that require global attention, to encourage the development of high quality, sustainable and affordable housing in different regions and provide inspiration to be adapted as appropriate to each local context.



All the case studies in this report are within 30% of area median income as defined on **page 16**, and are mapped against the sustainable and affordable housing principles as seen on **page 18**.

Africa Regional Snapshot

CHALLENGES FACING THE HOUSING SECTOR

Africa is the most rural region in the world, yet has incredible diversity across the continent, with centres of wealth and urbanisation. The continent is also at the frontline of climate change impacts, such as droughts and expansion of desertification.

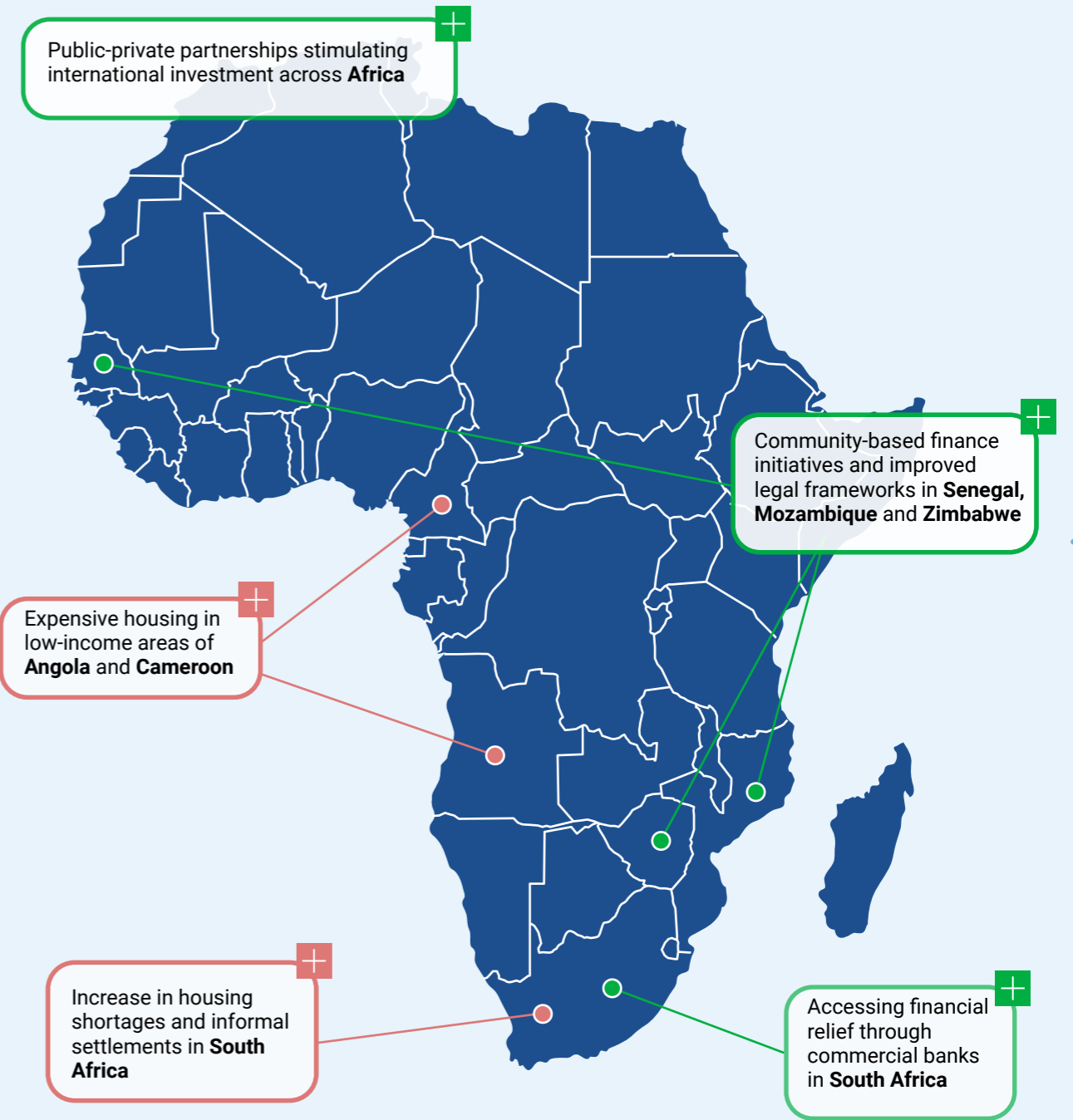
The African continent is experiencing the fastest urban growth in the world, with population projected to grow 63% by 2040 and double by 2050²⁸. Two-thirds of this growth will be absorbed by urban areas, with cities becoming the new home to over 40,000 people every day and adding 950 million people in the next 30 years²⁹. Almost 53 million people live in slum conditions, with a growth of under-serviced, substandard and insecure housing that is disconnected from livelihood options³⁰.

In some areas of Africa, particularly central and sub-Saharan Africa, there is little formalisation in urban planning, with some countries experiencing overlapping markets for land, ownership, buildings, finance and services such as water, electricity and sewerage. These challenges could be compounded with major issues on inadequate infrastructure and supply capacity, with a lack in technical and financial strength to construct large-scale projects³¹.

DRIVING THE UPTAKE OF SUSTAINABLE AND AFFORDABLE HOUSING

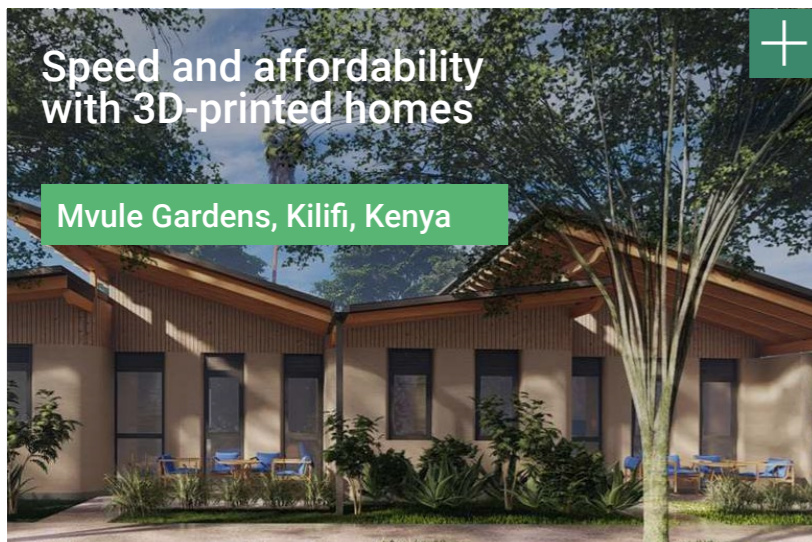
In the last decade, there is a growing body of evidence of sustainable projects, policies and plans being implemented across the built environment in Africa.

Signals of change are evident across the continent, with opportunities that can be scaled across the region. Many international agencies and independent companies have been investing in Africa for the construction of affordable homes, while creating jobs in the community and focusing on upskilling local developers³⁴.



Africa Regional Snapshot

Case Studies



The largest 3D-printed affordable housing projects in the world, emphasizing replicability and speed. The project is part of the 'Green Heart of Kenya' regenerative ecosystem, a model for inclusive and climate-resilient cities. The goal of the project is to build an affordable homes movement which will transform the lives of 100 million people in urban Africa and Asia by 2030, while creating qualified jobs, placing people on a development trajectory.



Beira's first zero-carbon home in partnership with easy housing, all cyclone-proofed and constructed from sustainable hardwood. In 2019, Cyclone Idai destroyed at least 70% of housing in the area, but all 10 of Casa Real's pilot homes remained standing, with only minimal and easily repaired damage. Prior to Casa Real, housing was unaffordable to 99% of the population and 80% of homes were self-built with low quality materials, being extremely vulnerable to natural disaster. Casa Real is now providing for 160 households in Beira, with new sites in nearby cities being negotiated with municipalities.



Jewel City is an urban redevelopment project that revitalized a former hub of the diamond and precious metals trade industry, an area that has historically suffered high vacancy and crime rates. The project achieved this revitalization by integrating affordable housing, along with retail, business, sport, and creative spaces. These elements are all centered around a meticulously planned public realm, which caters to the diverse needs of inner-city residents.

Africa Regional Snapshot

NEARLY 950 MILLION PEOPLE ARE SET TO MOVE TO MORE URBAN AREAS IN AFRICA IN THE NEXT 30 YEARS

In Africa, housing provision is often characterised by low density, under-serviced, substandard and insecure housing disconnected from existing transport networks and economic opportunities. This is causing great risk to the nearly 950 million people set to move to more urban areas in the next 30 years²⁹.

The rate of implementation of quality and sustainable housing close to economic opportunity is dwarfed by demand. However, progress is noted across the region with governments, international organisations, independent companies and investors leading initiatives that are taking steps towards transforming the housing market and demonstrating how well-located and well-designed housing is vital in tackling the region's socio-economic challenges.

Identified case studies demonstrate the successful use of modern technologies for faster construction, as well as retrofitting and redevelopment techniques to meet the housing demand of a growing population, while mobilising finance into communities. This is exhibiting positive direction and progression in which social, environmental and financial aspects are considered for long-term sustainability and stability, providing inspiration for further action.

With thanks to:
Green Building Council of South Africa,
Kenya Green Building Society and Reall

Americas Regional Snapshot

CHALLENGES FACING THE HOUSING SECTOR

The Americas region is the second most disaster-prone region in the world, with 152 million people affected by over 1,200 natural disasters from the years 2000-2019; including floods, storms, droughts, wildfire and extreme temperatures⁴¹.

In Central and South America, around 500 million people live in cities under an accelerated, defective and exclusive urbanisation process, with almost 94% of urban homes being insufficient in quality⁴². The right to adequate housing has been particularly poorly provided amongst women, ethnic minorities, migrants and other disadvantaged groups, despite it being supported by the legislation in many countries. This has often resulted in low-quality shelter with minimal facilities or without any permanent accommodation for vulnerable populations across the continent⁴³. Informal settlements are a persistent challenge in Latin America, with approximately one-quarter of the urban population living in informality⁴⁴.

North America is the third-largest continent in the world, home to approximately 515 million people. The region is not only suffering impacts from climate change, but is a disproportionate contributor to climate change, producing a greater share of greenhouse gas emissions over time than any other continent⁴⁵. The US alone has the highest national GDP per capita in the world⁴⁶, yet suffers from a housing shortage of between 5.5 million units to seven million units and severe inner-city poverty, with about 1 in 10 homes impacted by natural disasters⁴⁷. Inner cities represent 10% of the population in the US, 16% of unemployment, 22% of poverty and 32% of minority poverty⁴⁸.

DRIVING THE UPTAKE OF SUSTAINABLE AND AFFORDABLE HOUSING

A range of innovation and financing, policy and development models are being utilised across the continent to drive affordable, sustainable housing across the Americas.

In Latin America, there are various degrees of dependency on private Foreign Direct Investment (FDI) and international aid for housing provision, as well as on regional development banks. There is a great opportunity to strengthen the role of the state as city-wide or state-wide provider of basic housing; and to develop financial mechanisms, such as public housing and utility companies to strengthen public finance. In addition, community-based financing models are increasing, as well as public FDI between governments⁵⁶.



Americas Regional Snapshot

Case Studies



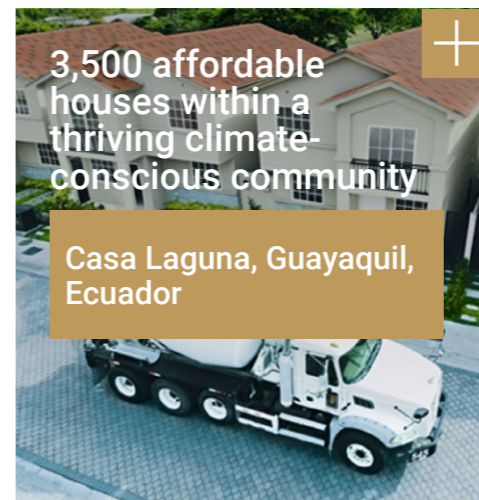
El Paraíso is a social housing project that achieved high environmental standards, with excellent community flourishing and habitability characteristics.



The project was developed to bring those living in informal settlements to a more urban environment within the city, closer to sources of employment, urban facilities and public transportation.



This project was evaluated under the EcoCasa program, which aims to reduce CO2e emissions in affordable houses and contribute to the achievement of SDG 11: Sustainable Cities and Communities. This project used tools to measure aspects related to energy efficiency, water savings, housing environment and carbon footprint of materials. The compliance with these criteria allows the developer to access a preferential rate on its loan.



Ecuador's largest climate-conscious construction project on the outskirts of Guayaquil ensures affordable housing for 3,500 families.



El Camino Apartments' integrated design made it possible for residents to achieve financial sustainability by offering rental costs in keeping with agricultural workers' seasonal income. Resilience and efficiency strategies lowered operating costs while supporting wellbeing.

Americas Regional Snapshot

LARGE-SCALE CLIMATE CHANGE IMPACTS ARE LIKELY TO AFFECT THE HOMES AND SETTLEMENTS OF APPROXIMATELY ONE BILLION PEOPLE.

The Americas is experiencing large-scale climate change impact on residential homes and widespread informal settlements that represent approximately one billion people. **Despite huge diversity in wealth and development levels, almost 94% of urban homes are insufficient in quality, with particular urgency for housing rehabilitation in inner-city regions across Central, North and South America.**

The overall speed of transition to sustainable and affordable housing is alarmingly slow, with the need for increasing innovation in creating the context for change, as well as having appropriate solutions for the specific challenges in the vast geographies of the region.

Points of optimism are seen, notably in policies, subsidies and regulations that are stimulating the increased development of sustainable and affordable housing. Finance schemes, housing models and the use of innovative technologies featured in the case studies demonstrate great leadership by developers, investors and communities with opportunities for collaboration and replicability across the region.

With thanks to:

Colombia Green Building Council, Chile Green Building Council, Green Building Council Brasil, Green Building Council Costa Rica, Guatemala Green Building Council, US Green Building Council, World Resources Institute (WRI) and Institute of Human Rights and Business (IHRB)

Asia Pacific Regional Snapshot

CHALLENGES FACING THE HOUSING SECTOR

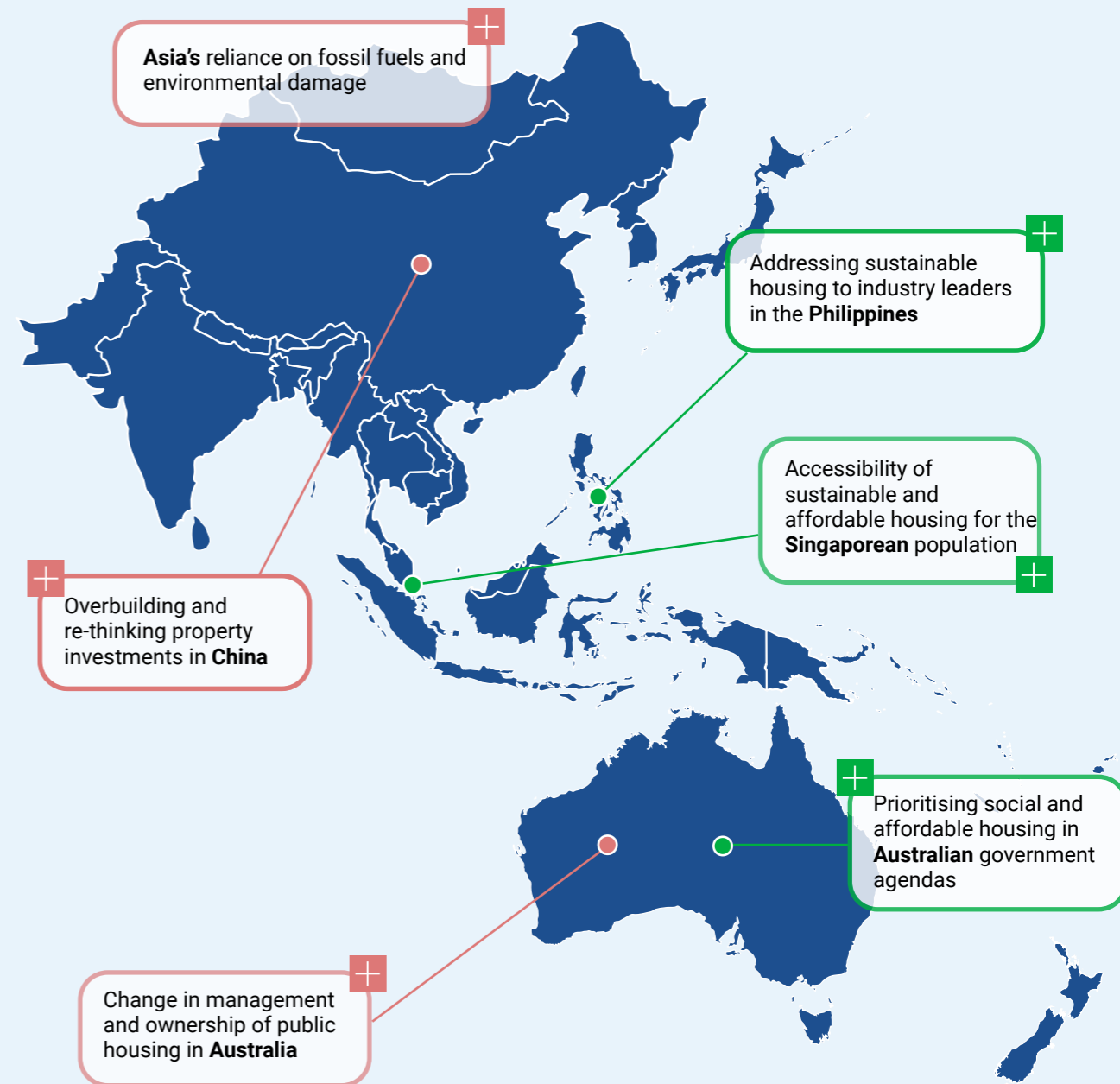
The continent of Asia is experiencing massive demographic changes, with the growing and urbanising populations of Asia's developing nations presenting an urgent demand for sustainable and affordable housing. Across the entire continent, the physical impacts and risk of climate change have already been realised⁶².

Asia is the most populous continent in the world, with a population expected to reach 5.3 billion by 2050⁶³. By 2030, India will need an additional 25 million homes and China will have a further 70 million people moving into its cities. The demand is also seen in Vietnam, Indonesia, Philippines and many parts of Asia with a largely growing population⁶⁴.

Asia's rapid economic growth in recent decades has lifted hundreds of millions out of extreme poverty, but the gap between Asia's rich and poor has widened alarmingly. Asia accounts for two-thirds of the world's poor, with more than 800 million people still living on less than \$1.25 USD a day and 1.7 billion people surviving on less than \$2 USD a day⁶⁵.

DRIVING THE UPTAKE OF SUSTAINABLE AND AFFORDABLE HOUSING

Increasing the supply of sustainable and affordable housing has been a national priority for many governments in the Asia Pacific region, with a consistent message that countries need to build more and an increase in private investors supporting local development.



Asia Pacific Regional Snapshot

Case Studies



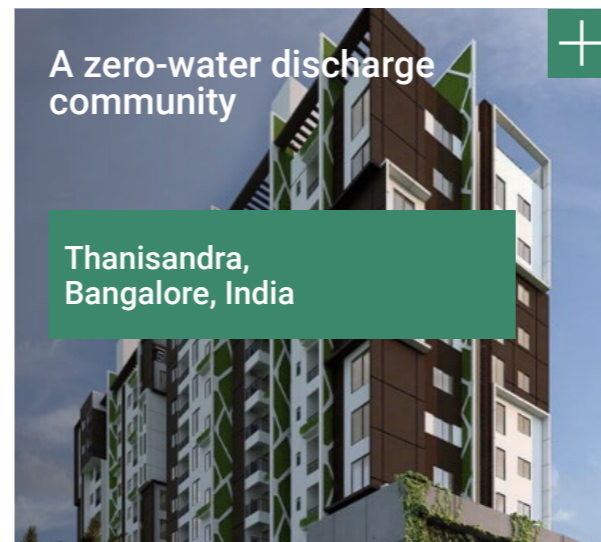
Resettlement of impoverished communities and creating a positive dialogue of collaboration

Salyani housing project, Bharatpur, Chitwan District, Nepal



Disaster resilience retrofits, improving quality of life and keeping costs to a minimum

Tiwi, Albay, Philippines



A zero-water discharge community

Thanisandra, Bangalore, India



Promoting affordable housing for indigenous populations, while standing the test of time

Gibbons Street, Redfern, Australia

The project was dedicated to the alleviation of poverty through the improvement of shelter conditions and upgrading of slums for vulnerable communities of informal settlements, while strengthening communities and increasing household savings and credits.

The project retrofitted houses with measures to ensure the overall strength and resilience of the house during a disaster, specifically targeted towards prevention of damage caused by earthquakes, typhoons and heavy rains. This provided safe space for families, increasing quality of life, while keeping the overall cost to a minimum.

The project uses water efficiency and recycling techniques, creating a 30% reduction in freshwater demand and recycling 100% water in a hot and humid climate, all year round.

The development is a modern and secure 18-storey building, comprising 162 residential units of which 40 are social housing and 122 are affordable housing units. In addition, 40% of the units are allocated to First Nations households, recognising the cultural significance of the indigenous Australian people.

Asia Pacific Regional Snapshot

SUSTAINABLE AND AFFORDABLE HOUSING IS ACCESSIBLE THROUGHOUT DEVELOPING NATIONS AND AMONGST LOW AND MIDDLE-INCOME HOUSEHOLDS.

Asia Pacific is a densely populated region with a wide range of geographies, experiencing different challenges varying from climate change impacts, to policies, finances and management. The rates of sea-level rise in the oceans surrounding Asia are faster than the global mean, putting pressure on land, destructing biodiversity, creating water pollution and water scarcity, while causing significant physical damage to properties and infrastructure. Challenges also include building and overbuilding and the difficulty addressing sustainable housing to leaders of the industry.

Nevertheless, Asia's developing nations offer some of the biggest opportunities for sustainable and affordable housing, with consistent messages across countries for its clear demand. Countries such as Singapore are demonstrating the ability to provide sustainable and affordable housing for the entire population that could be used as a model across the continent.

The case studies demonstrate that sustainable and affordable housing are accessible throughout the developing nations and amongst low-middle-income households, as well as for vulnerable groups of people regardless of the challenges.

With thanks to:

Green Building Council of Australia, Indian Green Building Council, New Zealand Green Building Council, Philippine Green Building Council and Build Change

Europe Regional Snapshot

CHALLENGES FACING THE HOUSING SECTOR

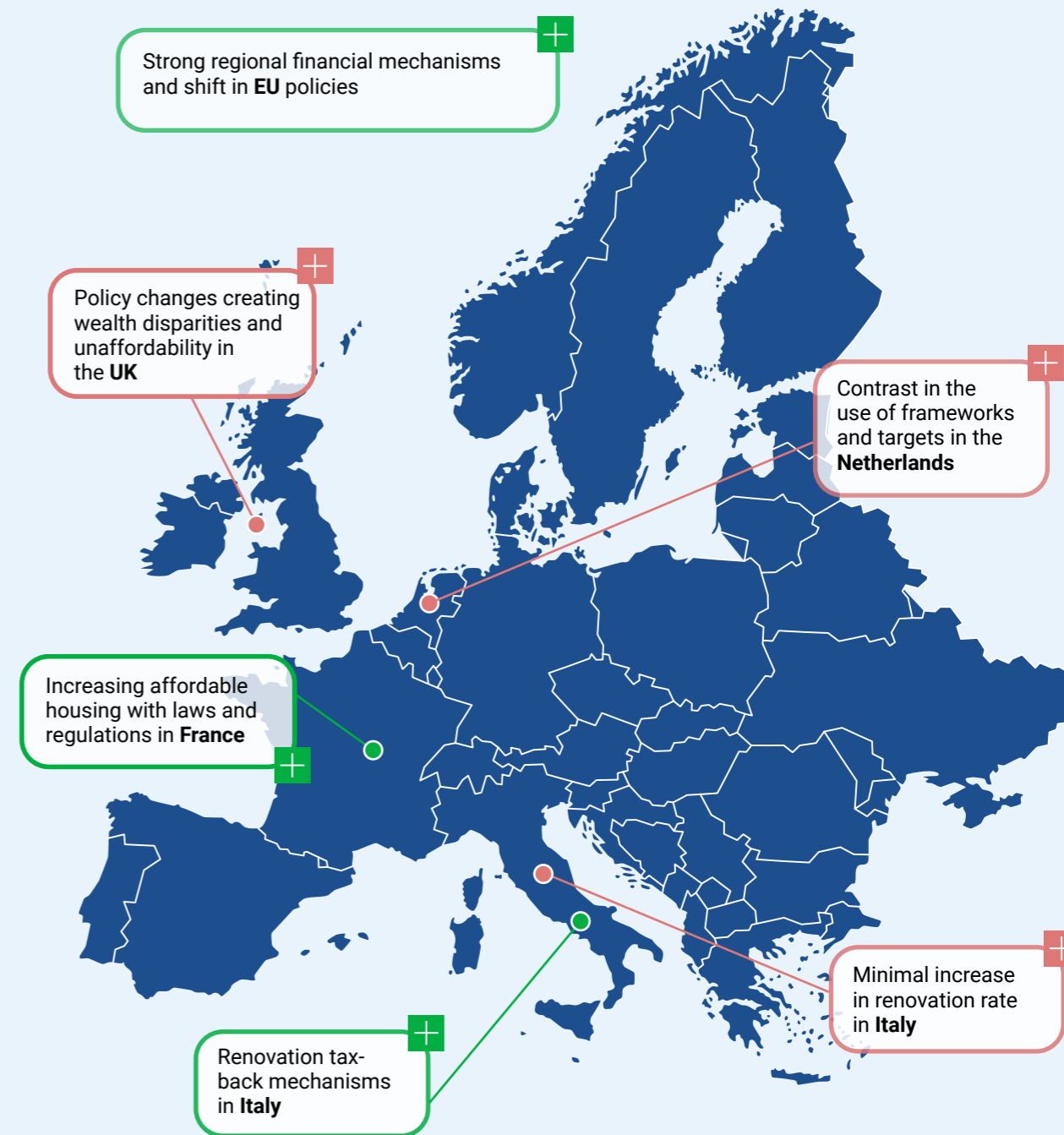
The European region has the highest GDP per capita of any continent⁸⁰ and yet only represents less than 10% of the world's total population. However, most European countries are projected to experience a 20% decline in population by 2050⁸¹.

Europe has witnessed the average house prices in the private sector increasing by over 30% and rents increasing by around 15% between 2015 and 2021^{82,83}.

This is due to several factors including population growth, increased rents, unregulated tourism, the privatisation of social housing stock. Together with growing prevalence of insecure work contracts, these factors increase concern for low and middle-income households, as well as vulnerable groups, with countries seeing an upward trend in social exclusion, urban poverty, and unemployment⁸⁴. Europe is also being affected by climate change as extreme weather events such as droughts, floods and heat waves are becoming more frequent⁸⁵.

DRIVING THE UPTAKE OF SUSTAINABLE AND AFFORDABLE HOUSING

There are many sophisticated examples of affordable and sustainable housing in Europe being driven through a range of channels, from policy to private funding. Concern about physical climate risk is recognised as a key driver for greater investment in the residential sector, alongside EU-level policy driving retrofits as part of the 'Green Deal'; the regional action plan for moving to a clean, circular economy while restoring biodiversity, cutting pollution and reaching climate neutrality by 2050⁹¹.



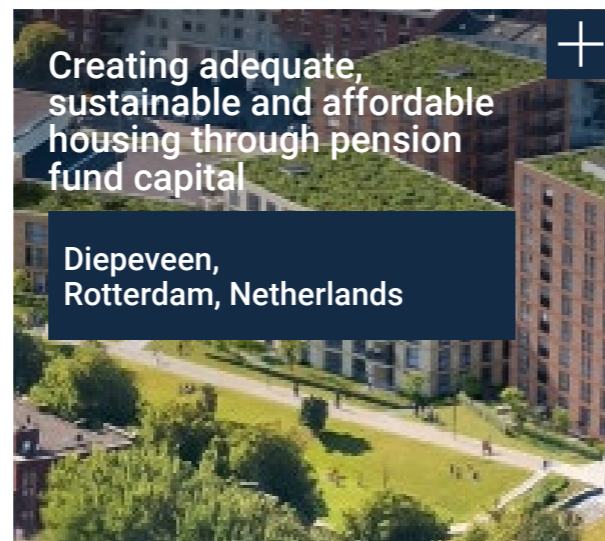
Europe Regional Snapshot

Case Studies



The project follows a cooperative housing scheme, in which it is financed, developed, maintained and owned by the residents of the co-housing, creating an increased sense of ownership.

About 7% of the Danish population live in a form of cooperative owned housing, accounting for one-third of the housing stock in Copenhagen.



The project is a primary example of how adequate, sustainable and affordable housing could be created with pension fund capital.

The project is also alleviating the severe housing shortage, especially for the middle-income segment. The Netherlands is set to build approximately one million homes by 2035.



A 40-unit multi-award-winning social housing scheme.

This project was the first multi-unit development in Ireland to be awarded a gold certification under the Home Performance Index (HPI), a certification system developed by the Irish Green Building Council (IGBC) to assess quality and sustainability in new residential developments.



The EnergieSprong approach has a strong focus on satisfaction and comfort of the inhabitants.

The objective of the project's approach is to drastically reduce costs through mass production and industrialisation of processes, developing a more mature market and multiplying the operations to achieve economies of scale. The replicability of this project contributes to improving the affordability of high-performance renovation projects.

Europe Regional Snapshot

← THE FACILITATION OF KNOWLEDGE SHARING AND THE ADOPTION OF VARIOUS HOUSING MODELS COULD BECOME WIDE-SPREAD AND BENEFICIAL ACROSS EUROPE, CREATING A 'HEALTHY COMPETITION' AMONG COUNTRIES. →

Europe is a region with countries of various economic wealth, population sizes and quality and quantity of housing. It is also at risk from extreme weather and climate-related hazards such as heat waves, floods and droughts, which have already been felt in recent years. Such environmental impacts are set to intensify and worsen, leading to adverse impacts on ecosystems, economic sectors and human health and wellbeing.

Europe has seen fluctuations in the housing sector with increased rental and purchase prices, inflation, as well as increasing insecurity in employment and homelessness.

Housing stock deficits in the European region are minimal compared to other regions, but the crucial renovation rate remains low, with its impacts flowing into the overall energy crisis and urban poverty faced by the region.

Sustainable and affordable housing has become an essential element embedded into European policies, regulations and frameworks. The facilitation of knowledge sharing and the adoption of various housing models could become wide-spread and beneficial across Europe, creating a 'healthy competition' among countries. In addition, the awareness, knowledge, skills, resources and technologies are clearly at hand for the European region, placing them at a great advantage for a swift uptake of sustainable and affordable housing.

With thanks to:
Green Building Council Italia and
Irish Green Building Council

Middle East And North Africa Regional Snapshot

CHALLENGES FACING THE HOUSING SECTOR

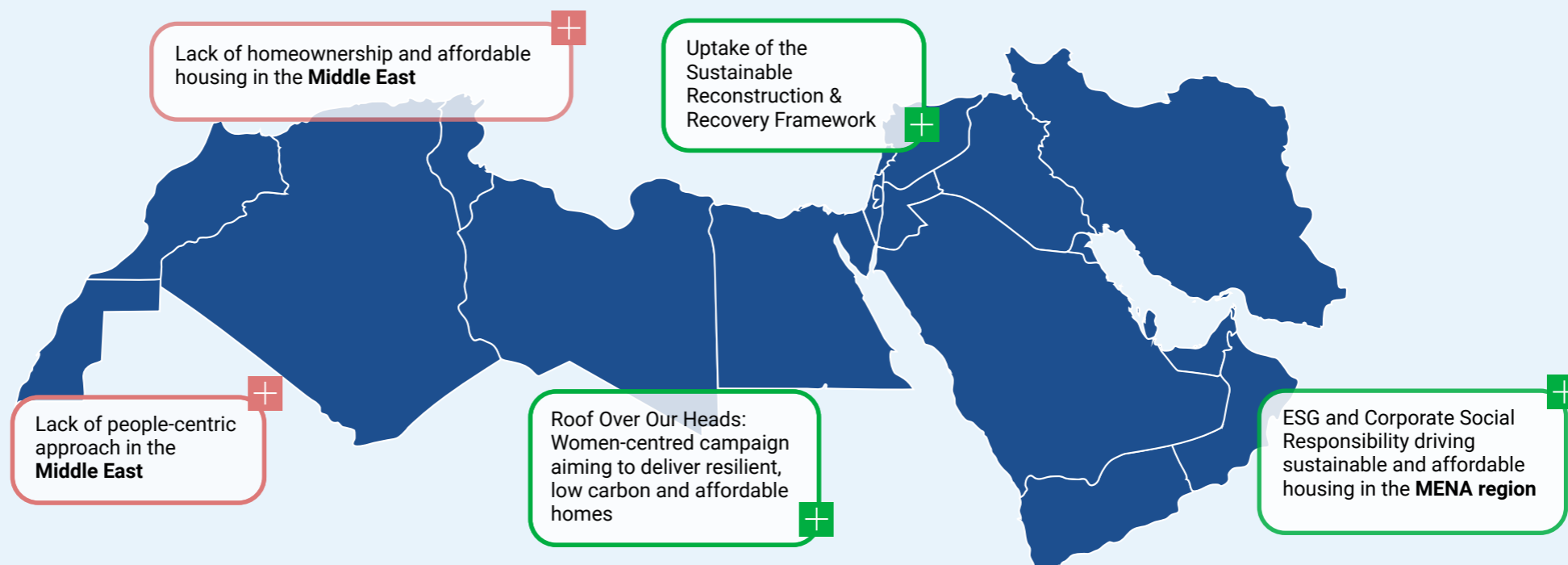
The Middle East is one of the most urbanised regions in the world, with over 56% of inhabitants living in cities. As average inhabitants grow younger and refugee populations increase, this is set to rise to 68% of total inhabitants, approximately 646 million people, living in cities by 2050. The housing demand will result in 70% of land use in most cities comprising housing⁹⁸.

Climate change is already exacerbating fragility in the MENA region that is undergoing post-conflict transitions. Climate change effects will have a devastating toll on the region’s water supplies and food production systems, with average temperatures soaring at a rate that is 2-7 times faster than any other region⁹⁹.

DRIVING THE UPTAKE OF SUSTAINABLE AND AFFORDABLE HOUSING

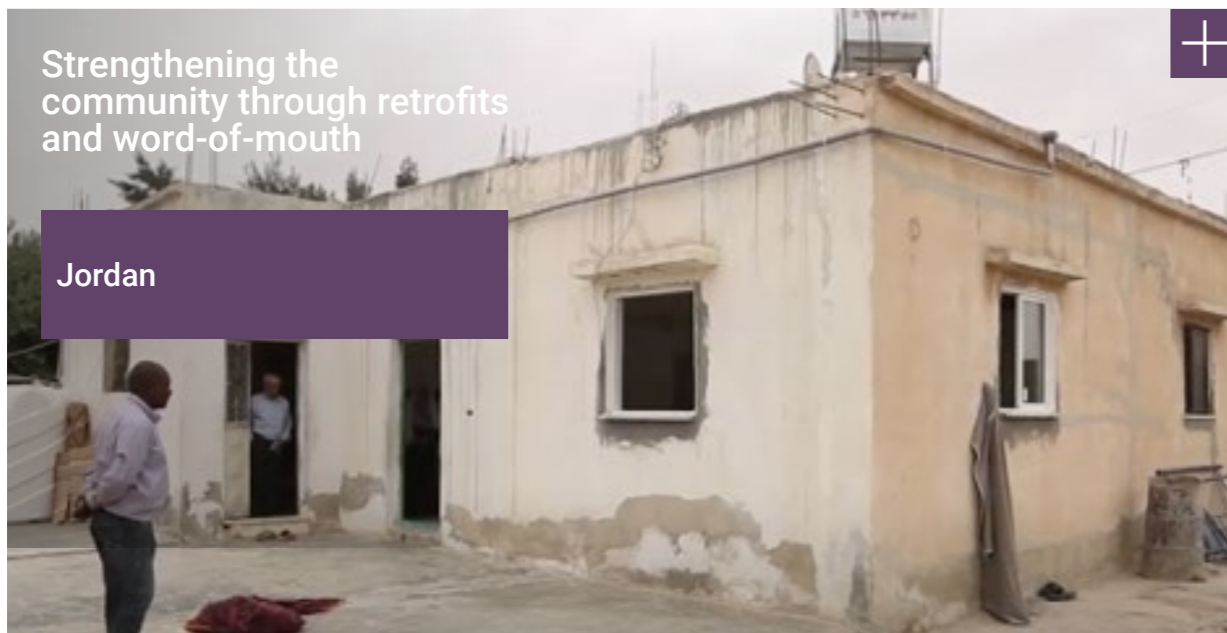
Varied approaches to sustainable, affordable housing can be observed, with greater or lesser degrees of government intervention in this area. The MENA region has strived to become more environmentally friendly, with record-breaking developments and a shift towards more sustainable practices in design and construction.

Broadly, these trends correspond to the strength of government institutions at points in recent history and their emphasis on social benefits and welfare. The market for developing sustainable and affordable housing is operational, and subsidised land and rebates for affordable developments have been helping fuel the movement in countries such as Morocco, Tunisia and Egypt³⁵. Several programmes have been developed in collaboration with international organisations for the sheltering of low-income, migrant and refugee populations. Many of the future MENA region housing policies are also having to confront the damage and destruction of housing stock from years of conflict¹⁰¹.



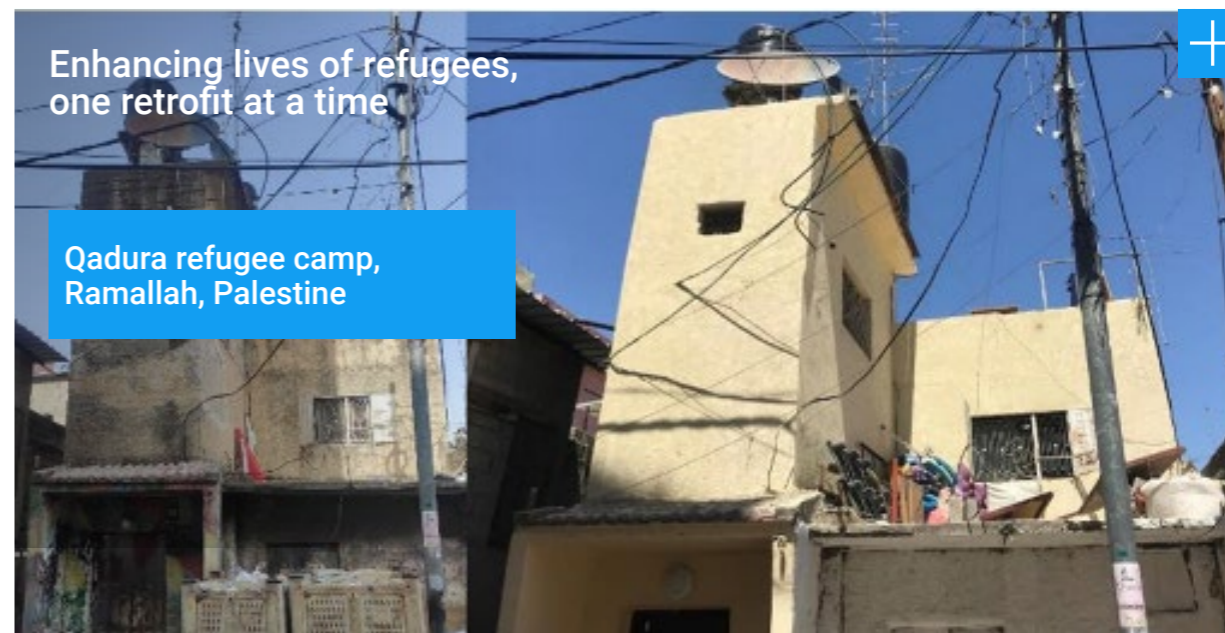
Middle East And North Africa Regional Snapshot

Case Studies



The Affordable Housing Project retrofitted 48 homes and built three new homes across five different districts in Jordan, demonstrating that sustainable housing is affordable, with fast pay back periods.

The project created an opportunity for cohesion between locals and refugees through their engagement and involvement, with notable change in “a greener way of thinking within the society”.



The project contributed to sustainable housing and the wellbeing of refugees and underprivileged communities, by offering 'home retrofitting' measures to support the implementation of economically and environmentally friendly practices.

This was done through a bottom-up approach, taking into consideration the occupants' needs and designed in a participatory manner, while involving all key partners.

Middle East and North Africa Regional Snapshot

← THE REGION HOLDS TREMENDOUS OPPORTUNITY THROUGH ITS HIGH EDUCATION LEVELS, AS SOCIAL AND ENVIRONMENTAL ISSUES ARE COMING TO THE FORE WITH GOVERNMENTS SEEKING TO TRANSITION TO A SUSTAINABLE FUTURE. →

The MENA region has experienced extreme temperatures, set to worsen in the next decades, compounded by precipitation patterns, water insecurity and projected sea level rise, affecting livelihoods and infrastructure. Average inhabitants are growing younger and refugee populations increasing, with particular urgency for awareness, as well as a people-centric approach and the need for clear communication and collaboration amongst stakeholders and project implementers.

The region holds opportunity through its high education levels, as social and environmental issues are coming to the fore with governments seeking to transition to a sustainable future. The case studies have also demonstrated a movement and focus on vulnerable populations with the much-needed people-centric approach.

The region has experienced massive developments and a shift towards more sustainable practices in design and construction, with varied approaches to sustainable and affordable housing. This includes the region's rapid transformation of economic growth, diversifying economies, creating jobs, giving back to communities and improving overall quality of life.

With thanks to:
Emirates Green Building Council and
Jordan Green Building Council

Call to Action to Strengthen the Uptake of Sustainable and Affordable Housing

In showcasing a varied range of examples, a consistent message occurs — the challenges faced are numerous, but there is a growing body of evidence of progress and opportunities. These range from finance solutions, supporting policies and design and in-use strategies that are being seen in practice worldwide and are making sustainable and affordable homes attainable for people in many regions. These practices can and must be scaled to make rapid progress in overcoming the housing, climate and health crisis faced worldwide, while applying key principles of sustainable and affordable housing, adapted to the specific needs of a place and population.

The key successes and themes that are being used to create and strengthen the uptake of sustainable and affordable housing demonstrated in this report, are outlined in the following summary.

For more information on each of the call to action areas, see worldgbc.org

Call to Action for Policy Change

Strategies for all built environment decision makers to support policy change include:

Regulations and standards

- Integrate the principles of sustainable and affordable housing into national building codes and regulations.
- Ensure that Nationally Determined Contributions reflect the principles of sustainable and affordable housing.
- Analyse existing housing policies to determine gaps that could be addressed.
- Call for greater regulatory ambition around sustainability and affordability complemented by support to local governments for its enforcement, tailored incentivisation schemes to drive demand, skills development and knowledge sharing to enhance the capacities to supply-side sectors.
- Reflect global sustainability frameworks and targets such as the SDGs into national development agendas.

Support and incentives

- Greater support for local governments to increase technical and financial resources to: enforce ambitious codes, develop integrated sustainable urban development plans, develop public procurement practices and monitoring frameworks, implement programmes to help vulnerable groups and strengthen skills of local construction and renovation value chain actors, among others.
- Awareness raising campaigns to enable a better understanding of the co-benefits of improved housing by decision makers.
- Incentivise development on brownfield land through fast-tracked planning processes and tax breaks, and raise awareness of environmental justice boundaries.
- Support national infrastructure developments to maximise durable homes and support the resilience of the city and its population.
- Develop well-structured subsidies on the demand and supply side to avoid distortions that work against the under-served.

Monitoring

- Implement policy data and monitoring to keep up to date with progression of the country's sustainability goals and meet global goals where possible.



Call to Action to Increase Access to Finance

Strategies for all built environment stakeholders to increase access to finance include:

Public-facing initiatives

- Promote mortgage financing in local currencies, to avoid currency mismatches.
- Promote financial instruments with a sustainability or social component such as green and social bonds and loans and seek out blended finance opportunities with international or local public frameworks, to attract the participation of the private sector.
- Increase accessibility of mortgages through partnership with banks and developers.
- Establish processes to cap rent-to-income ratios and ensure affordability.
- Support infrastructure development through public sector funds for in-filling the land, such as public water pumps and the mobilisation of resources for better accessibility of the population to basic services.
- Fund lighthouse projects, where the supply side is strengthened through the involvement in such projects (e.g. skills development) and the demand side is made more aware of sustainability issues.

Collaboration and partnerships

- Encourage private investment and collaboration to increase public-private partnerships, for greater finance accessibility for developers and homeowners/occupiers, such as with pension and private equity funds.
- Encourage collaboration with credit cooperatives and local banks to arrange affordable finance for clients.
- Encourage partnerships with microfinance institutions for an increased access to funds.

Impact returns

- Overlay the financial return offered to investors with strong social and environmental impact returns.
- Offer competitive returns to investors through good design and efficient construction and property management.
- Encourage responsible investment for increased acknowledgement and understanding by the investor, on the relevance of environmental, social and governance factors, as well as of the long-term health and sustainability of the housing sector, while also encouraging social housing programmes and sustainable procurement practices.

Incentives and subsidies

- Create incentives for sustainable and affordable housing projects, creating greater interest for various developers and projects.
- Encourage banks to generate financial incentive programmes for developers seeking a certification for their projects.
- Offer grants, preferential interest rates, free technical assistance and expedited building permits to developers who achieve certain local certifications, compensating for the additional costs of implementing sustainable technologies, with the aim that the end user has access to sustainable and affordable housing at the same price as a conventional one.
- Create financing schemes that promote the local and regional production of sustainable building materials, components and technologies to reduce cost and strengthen local production and capacity.
- Develop insurance policies against climate risks and stresses for sustainable buildings, to reduce governmental reconstruction expenses and to incentivise sustainable buildings.
- Access funds and financial incentives by using climate-smart and construction simulation tools and sustainable technologies adapted to local conditions, to measure and demonstrate a sustainable whole-house approach.
- Promote the participation of commercial banks in new subsidies to make finance for housing accessible to all, such as default guarantees or housing credit insurance.
- Reduce licence fees for housing projects under a green building certification process to encourage the increase of sustainable building development.
- Make loans and grants available to vulnerable and minority groups.

Further Resources:

Ahead of the wave: Financing the transition to a decarbonised built environment

Call to Action for Community Participation

Strategies that demonstrated successful use of bottom-up community focused approaches include:

Community capacity building

- Conduct regular community engagement on financial capabilities, saving strategies and mortgage credit to strengthen the capacity of the communities.
- Give technical and legal support where possible to low-income households to apply for housing subsidies from the national and subnational governments and family compensation funds.
- Implement social strategies for leadership where possible, such that technical and community self-management skills are developed.
- Formalise companies supplying materials and services to the development, to generate formal jobs, with inclusive and equal employment opportunities.

Engagement and involvement

- Prioritise the involvement of local communities and focus on diversity, inclusion and social equity to enhance the sense of ownership and belonging.
- Bridge the country's infrastructure gap and create skilled local jobs, such as training locals on-site throughout the building lifecycle to enhance community resilience.
- Create an opportunity for inclusive communities through their engagement to strengthen collaboration and a sense of belonging and security.
- Involve all key partners and design in a participatory manner, while considering the occupants' needs to cater for long-term development and sustainability.

Awareness raising

- Raise awareness on the impact of every intervention on comfort and energy efficiency, creating a long-term impact on occupants and their future decision making regarding rehabilitation and energy management behaviours.
- Support the implementation of economically and environmentally friendly practices.
- Empower occupants by encouraging home retrofits, to enhance efficiency for better comfort.

Communication

- Maintain open communication with the community to understand their needs and enhance resilience.
- Develop a continuous dialogue with the municipality to collaborate for the benefit of vulnerable communities and strive for a positive change in perception of the local governing body and public perception towards the marginalised groups.

Liveability

- Facilitate improved quality of life and disease prevention through natural lighting, indoor air quality, safe ventilation systems and thermal comfort, while promoting safe areas for the entire population.
- Use locally sourced materials and with considerations of cultural norms around construction and housing to ensure appropriateness and longevity in the usage of the building.
- Avoid relocation and allow the community to continue development and growth within the existing social fabric, with easy access to public transport, education and employment.



Call to Action for Sustainable Built Environments

Strategies for the built environment sector to accelerate sustainability in all housing projects include:

Decarbonisation

- Prioritise energy efficiency in all new and existing homes, through highly efficient design of new dwellings and retrofit of existing residential properties, prioritising passive design strategies in the first instance – such as the use of natural ventilation, shades or insulation for thermal comfort.
- Target net zero whole life carbon emissions, working to eliminate emissions across the whole lifecycle of all housing and generate energy on-site through renewable sources.
- Contribute to the clean energy transition by supporting the phase-out of fossil fuels and the transition to a highly efficient, renewable energy-powered and all electric homes.

Resilience and adaptation

- Support occupant resilience to climate change by future-proofing homes and developments to comfortably withstand predicted climate change impacts, based on assessment of vulnerabilities of the building area to ensure the adoption of risk mitigation strategies.
- Consider community adaptation, designing to enhance places' ability to respond to environmental, social and economic changes – with a focus on current and future climate change impacts.
- Support a just transition, prioritising an equitable phase towards green jobs, societies and economies.

Health, wellbeing and equity

- Design and construct to protect occupant health and wellbeing, by maximising indoor environmental quality, limiting exposure to pollution, and tackling energy poverty through passive design measures to reduce energy requirement for comfort.
- Maximise equity and positive social impact throughout the housing supply chain and recognise community values – including cultural heritage and indigenous knowledge.
- Support the development of sustainable infrastructure to promote community and city scale transformation.

Circularity and regeneration

- Minimise product and material use and waste production through circular economy strategies, with a focus on housing adaptation and retrofit, material reuse and recycling and modular construction.
- Prioritise the regeneration of nature and ecosystem services through housing design, construction, retrofit and end of life, with a focus on water management – using strategies such as rainwater harvesting, stormwater retention and blue/green infrastructure.
- Avoid degradation of nature through prioritising development on brownfield sites (previously developed areas) or repurposing existing buildings, with minimal requirement for new land.



Conclusion

WORLDGBC'S GLOBAL NETWORK IS COMMITTED TO WORKING TOWARDS A SUSTAINABLE BUILT ENVIRONMENT FOR EVERYONE, EVERYWHERE.

Further Resources:

- WorldGBC Global Policy Principles
- Health & Wellbeing Framework
- Net Zero Carbon Building Commitment

The global housing crisis, interlinked with the dual crises of unprecedented climate change and biodiversity loss, is undoubtedly one of the greatest social challenges we are facing today. According to UN-Habitat, the world needs 96,000 new affordable homes to be built every day in order to house the estimated three billion people who will need access to adequate housing by 2030.

Through this report, WorldGBC challenges the widespread perception that affordable and sustainable housing is not a mass market solution. By presenting a unifying definition and high-level summary of sustainable and affordable housing in each of WorldGBC's five regional networks whilst profiling challenges facing the housing sector, the report spotlights working strategies and key opportunities that are driving the uptake of sustainable and affordable housing across the world today.

Five key principles, co-developed by an international Taskforce of Green Building Councils and affordable housing experts, guide the analysis of best practice solutions across the globe. These are:

-  **Habitability and Comfort**
-  **Community and Connectivity**
-  **Resilience and Adaptation to a Changing Climate**
-  **Resource Efficiency and Circularity**
-  **Economic Accessibility**

WorldGBC invites the residential real estate market to engage with and evolve these high-level principles for their geographies and markets, noting the core themes of occupant health, social equity, decarbonisation, resilience and resource efficiency that must be fundamental to all housing across the world.

Through this publication, WorldGBC has also initiated necessary discussion on the business case for making housing sustainable and affordable. There are many opportunities, alongside risks of inaction, that should be central to the industry narrative for driving change from governments, private sector and community stakeholders – from regulations and resilience to investment loss and stranded assets. WorldGBC invites further work and collaboration from the sustainable finance community to help propagate an engaging financial and non-financial discourse to drive action throughout key markets.

Bringing to life the wider societal co-benefits and the value proposition of sustainable and affordable housing, are over 18 local example case studies documented from within WorldGBC's network. By presenting content from each global region, this report has highlighted cutting-edge built environment projects whilst also demonstrating that sustainable and affordable housing can and must be a reality for all, in every geography and community.

Through an analysis of case study data, this report derives key calls to action for government and policy makers, finance community, local authorities and communities, the design and construction industry. Many of the solutions

to the global housing crisis already exist and strengthening the uptake of sustainable and affordable homes can be scaled from existing solutions and derived from successful practices from within the case studies. In order to catalyse change at the necessary speed for impact, solutions and successes must be scaled at unprecedented pace.

WorldGBC's global network is committed to working towards a sustainable built environment for everyone, everywhere. Housing is potentially the most important sub-sector of the built environment in terms of impact on human health and development, economic relevance and environmental impact. Through this publication, WorldGBC champions a unified vision for sustainable, affordable housing and spotlights best practice worldwide to demonstrate opportunities for success that could be scaled for greater impact.

WorldGBC hopes to plant the seed for the further work needed to take this vision and leadership and translate it to the global financial and development community who invest in, develop and own the properties. There is no doubt that deep commitment and collaboration will be required from actors across the value chain to tackle the growing crisis we face with global housing stocks. We hope this report contributes to build the awareness, commitment and value proposition needed for positive change towards sustainable, affordable housing for everyone, everywhere.

References

- ¹ UN, 'Goal 11: Make cities inclusive, safe, resilient and sustainable' (2022)
- ² UN, 'Universal Declaration of Human Rights' (2022)
- ³ OHCHR, 'Towards a just transformation: climate crisis and the right to housing – Report of the Special Rapporteur on the right to adequate housing, Balakrishnan Rajagopal' (2022)
- ⁴ Washington post, 'At least 85 percent of the world's population has been affected by human-induced climate change, new study shows' (2021)
- ⁵ UNHCR, 'Ukraine, other conflicts push forcibly displaced total over 100 million for first time' (2022)
- ⁶ BBC, '2045: MEMORIES OF THE FUTURE | HOUSING' (2021)
- ⁷ UN, 'Make cities and human settlements inclusive, safe, resilient and sustainable' (2018)
- ⁸ UN, 'First-ever United Nations Resolution on Homelessness' (2020)
- ⁹ Reall, 'Affordable Housing: A route to climate mitigation & resilience' (2021)
- ¹⁰ McKinsey Sustainability, 'Climate change hazards intensifying' (2020)
- ¹¹ IPCC, 'Climate Change 2022: Impacts, Adaptation and Vulnerability' (2022)
- ¹² WEF, 'The world needs to build 2 billion new homes over the next 80 years' (2018)
- ¹³ Better Dwelling, 'The World Has Millions of Vacant Homes, and 1.3 Million Are In Canada: OECD' (2021)
- ¹⁴ IFC, 'Affordable Housing in Africa' (2022)
- ¹⁵ WEF, 'This material impact of global urbanization' (2022)
- ¹⁶ What Works Wellbeing, 'How home design can impact our mental health' (2020)
- ¹⁷ UNEP, 'As buildings and construction sector grows, time running out to cut energy use and meet Paris climate goals' (2017)
- ¹⁸ The London Economic, 'Millions of homes lying unoccupied around the world as homelessness soars' (2021)
- ¹⁹ Property Week, 'Why retrofitting buildings is so vital' (2021)
- ²⁰ The Shift, 'The Shift Directives' (2022)
- ²¹ UN, 'Goal 13: Take urgent action to combat climate change and its impacts' (2022)
- ²² European Parliament, 'Access to decent and affordable housing for all' (2020)
- ²³ UN Habitat, 'Addressing the Housing Affordability Challenge: A Shared Responsibility' (2020)
- ²⁴ City of Toronto, 'Updating the Definitions of Affordable Housing' (2021)
- ²⁵ WEF, 'Making Affordable Housing a Reality in Cities' (2019)
- ²⁶ Scientific Reports, 'Assessing the costs of historical inaction on climate change' (2020)
- ²⁷ SBRC, '5 Benefits of Making Your Home Eco-Friendly' (2023)
- ²⁸ Science Direct, 'Africa energy future: Alternative scenarios and their implications for sustainable development strategies' (2017)
- ²⁹ UN Habitat, 'Affordable Land and Housing in Africa' (2011)
- ³⁰ The Guardian, 'Housing in sub-Saharan Africa improves but millions of people live in slums' (2020)
- ³¹ African Development Bank, 'Africa's Infrastructure: Great potential but little impact on inclusive growth' (2018)
- ³² Green Building Council South Africa, 'Does location matter?' (2021)
- ³³ CAHF, 'Housing Finance in South Africa' (2022)
- ³⁴ IFC, 'Rapid urbanization is pushing up demand for housing in Sub-Saharan Africa' (2023)
- ³⁵ CAHF, 'Housing Finance in Africa Yearbook' (2022).
- ³⁶ CAHF, 'Revolving fund for urban renewal in Senegal' (2021)
- ³⁷ Reall, 'Casa Real Launch Landmark Affordable Housing Mortgage in Mozambique' (2021)
- ³⁸ CAHF, 'Gungano Urban Poor Fund' (2022)
- ³⁹ OHCHR, 'Realizing Women's Rights to Land and Other Productive Resources' (2013)
- ⁴⁰ CAHF, 'Africa Housing Finance Yearbook' (2021)
- ⁴¹ OCHA, 'Natural Disasters in Latin America and the Caribbean, 2000-2019' (2020)
- ⁴² IADB, 'Sustainable Cities' (2019)
- ⁴³ OHCHR, 'The Right to Adequate Housing' (2009)
- ⁴⁴ Urbanet, 'Learning from Latin America's Informal Settlements and Urban Policies' (2021)
- ⁴⁵ Our World in Data, 'Who has contributed most to global CO₂ emissions?' (2019)
- ⁴⁶ Statistics Times, 'List of continents by GDP per capita' (2021)
- ⁴⁷ CNBC, 'Natural disasters hit roughly 1 in 10 American homes in 2021' (2022)
- ⁴⁸ ICIC, 'Bipartisan Legislation Looks to Boost Private Investment in Distressed Communities' (2017)
- ⁴⁹ JCHS, 'The State of the Nation's Housing' (2022)
- ⁵⁰ Brookings, 'Homeownership, racial segregation, and policy solutions to racial wealth equity' (2021)
- ⁵¹ Financial Times, 'Blackstone steps up tenant evictions in US with eye on boosting returns' (2023)
- ⁵² JSTOR, 'Costa Rica's Arias at Midterm' (1987)
- ⁵³ OECD, 'Public Governance in Costa Rica' (2021)
- ⁵⁴ Cross Catholic Outreach, 'Housing Poverty in Guatemala' (2022)
- ⁵⁵ TIME, 'They Left Guatemala for Opportunities in the United States. Now They Want to Help Others Stay' (2022)
- ⁵⁶ UNCTAD, 'Foreign direct investment to Latin America rebounded by 56% in 2021' (2022)
- ⁵⁷ Oxford Business Group, 'Colombia increases focus on subsidised and free housing programmes' (2019)
- ⁵⁸ BBC, 'Improving housing in urban areas' (2023)
- ⁵⁹ Cities Today, 'Access to affordable housing in Latin America: Lessons from Argentina, Brazil and Mexico' (2014)
- ⁶⁰ USGBC, 'Green for All: Healthy and Efficient Affordable Housing' (2019)
- ⁶¹ USGBC, 'Green and Affordable: Qualified Allocations Plans' (2022)

⁶² UN Habitat, 'pro-poor urban climate resilience in Asia and the Pacific' (2014)

⁶³ Our World in Data, 'More than 8 out of 10 people in the world will live in Asia or Africa by 2100' (2019)

⁶⁴ Pere, 'Asia's Affordable Housing Conundrum' (2020)

⁶⁵ Compassion, 'Poverty in Asia' (2020)

⁶⁶ OECD, 'Asia's Challenges' (2013)

⁶⁷ CNBC, 'China's real estate crisis isn't over yet, IMF says' (2023)

⁶⁸ Financial Times, 'Evergrande: the end of China's property boom' (2022)

⁶⁹ AIH, 'Housing assistance in Australia' (2022)

⁷⁰ Climate Council, 'Markets are moving: The cost of Australia's Climate Inaction' (2021)

⁷¹ Bloomberg, 'Why Singapore Has One of the Highest Home Ownership Rates' (2020)

⁷² Statista, 'Share of population living in public housing by the Housing and Development Board (HDB) in Singapore from 2012 to 2021' (2022)

⁷³ Community Housing, 'Australia's Community Housing Industry in Profile' (2020)

⁷⁴ NHFIC, 'Affordable Housing Bond Aggregator (AHBA) loans' (2022)

⁷⁵ Green Building Council of Australia, 'Exploring Green Star' (2022)

⁷⁶ Climate Bonds Initiative, 'Climate Bonds Initiative recognises Green Star as a pathway to net zero buildings: Two new proxies available for Certification under the Low Carbon Buildings Criteria' (2021)

⁷⁷ Newsroom, 'CommBank announces Green Home Offer' (2022)

⁷⁸ NAB, 'Home buyers to benefit from NAB's energy efficient incentive' (2022)

⁷⁹ Bank Australia, 'More reward for going greener' (2023)

⁸⁰ Statistics Times, 'List of European countries by GDP' (2021)

⁸¹ Eurostat, 'Population projected to decline in two-thirds of EU regions' (2021)

⁸² Housing Europe, 'The state of Housing in Europe' (2021)

⁸³ Investigate Europe, 'Europe strains under rising prices as renters bear brunt of housing crisis' (2022)

⁸⁴ Euro Cities, 'Housing affordability: A European crisis' (2020)

⁸⁵ European Environment Agency, 'What are the climate change impacts in Europe?' (2016)

⁸⁶ Positive Money, 'Banking on Property' (2022)

⁸⁷ Science Direct, 'A home for all within planetary boundaries: Pathways for meeting England's housing needs without transgressing national climate and biodiversity goals' (2022)

⁸⁸ CUSP, 'A home for all within planetary boundaries: pathways for meeting England's housing needs without transgressing national climate and biodiversity goals' (2022)

⁸⁹ CIDOB, 'Affordable Housing in Europe: Innovative Public Policies that can Effectively Address the Housing Crisis' (2017)

⁹⁰ European Commission, 'Renovation wave' (2020)

⁹¹ WorldGBC, 'Building Life' (2022)

⁹² ERDF, 'European Regional Development and Cohesion Funds' (2021)

⁹³ JSTOR, 'From Social Housing to Subsidized Housing? Accommodating Low-Income Households in Europe' (2015)

⁹⁴ IHRB, 'Human Rights and the Decarbonisation of Buildings in Europe' (2021)

⁹⁵ European Commission, 'Affordable housing initiative' (2021)

⁹⁶ Apur, 'Social housing in Paris as defined by the SRU Law' (2021)

⁹⁷ Italy House Hunting, 'Home Improvement Incentives' (2022)

⁹⁸ ESCWA, 'Social Housing in the Arab Region: An Overview of Policies for Low-Income Households' Access to Adequate Housing' (2017)

⁹⁹ Brookings, 'Climate change may devastate the Middle East. Here's how governments should tackle it' (2022)

¹⁰⁰ Statista, 'Shortage of affordable housing in the Middle East and Africa region in 2018' (2023)

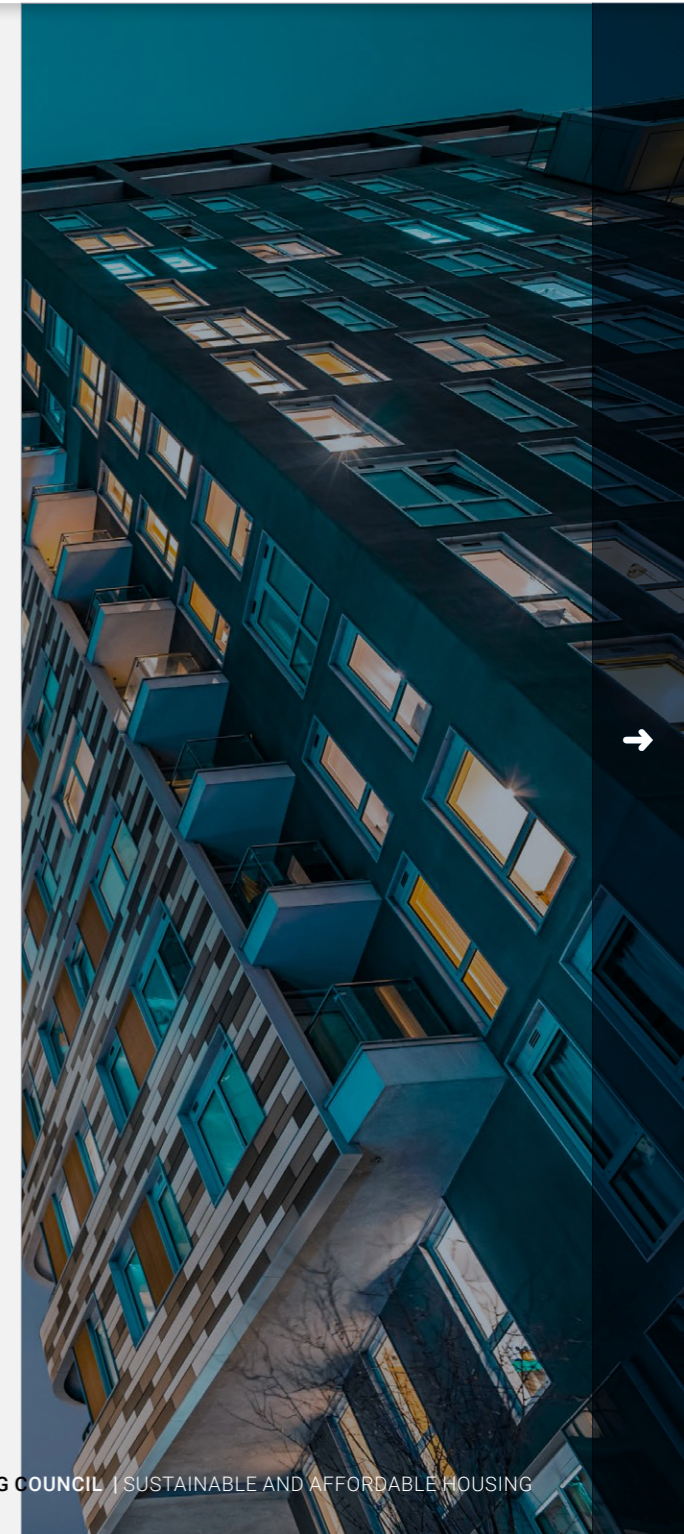
¹⁰¹ WorldGBC, 'Sustainable Reconstruction & Recovery Framework' (2021)

¹⁰² PWC, 'Reimagining our region through ESG' (2022)

¹⁰³ Deloitte, 'The Impact of Social Good on Real Estate' (2021)

¹⁰⁴ Climate Champions, 'Roof Over Our Heads: Delivering resilient, affordable, low carbon homes for 2bn people by 2050' (2022)

¹⁰⁵ ROOH, 'A Campaign to help the poor access Resilient & Affordable Homes' (2022)



Acknowledgements

Lead Author:

Sara Kawamura

Programme Coordinator, Better Places for People, WorldGBC

Co-Authored by:

Catriona Brady

Director of Strategy and Development, WorldGBC

Kindly reviewed by:

- **Habitat for Humanity International** - Amanda Entriakin and Jennifer Oomen
- **ICLEI** - Andreas Jäger and Magashen Naidoo
- **International Finance Corporation (IFC)** - Rusmir Musić and Michelle M. Farrell
- **Office of the United Nations High Commissioner for Human Rights (OCHCR)** - Mariya Stoyanova
- **The Predistribution Initiative** - Delilah Rothenberg
- **The Shift** - Julieta Perucca
- **UN-Habitat** - Jesus Salcedo Villanueva and Christophe Lalande
- **United Nations Environment Programme (UNEP)** - Jonathan Duwyn and Pauline Guerecheau

Consulted and co-created by Better Places for People Housing Taskforce, between April 2022 - May 2023. Comprised of:

Green Building Councils:

- **Chile Green Building Council** - Gabriela Sabadini
- **Colombia Green Building Council** - Lorena Pupo
- **Emirates Green Building Council** - Lana AbuQulbain and Jinan El Hajjar
- **Green Building Council of Australia** - Elham Monavari
- **Green Building Council of Brazil** - Enzo Tessitore
- **Green Building Council Costa Rica** - Esteban Cervantes Jiménez
- **Green Building Council Italia** - Marco Caffi and Valentina Marino
- **Green Building Council of South Africa** - Jo Anderson and Georgina Smit
- **Guatemala Green Building Council** - Pamela Castellan
- **Indian Green Building Council** - Gaurav Pershad and Pallavi Bhallamaudi
- **Irish Green Building Council** - Johanna Varghese
- **Jordan Green Building Council** - Hind Hadidi, Yasmine Shraim and Dana Al-Sharayha
- **Kenya Green Building Society** - Rachael Mutheu
- **Philippine Green Building Council** - Mario Suelto
- **US Green Building Council** - Elizabeth Beardsley, Elizabeth Thompson and Rebecca Price

Knowledge Partners:

- **World Resources Institute (WRI)** - Kayla Rakes and Fairuz Louf
- **Institute for Human Rights and Business (IHRB)** - Annabel Short, Andreia Fidalgo and Alejandra Rivera
- **Reall** - Donovan Storey and Elizabeth Tarney
- **Build Change** - Monica Schroeder

Regional Support:

- Amira Ayoub (MENA Regional Head)
- Laura Chapa (Americas Regional Head)
- Joy Esther Gai (Asia Pacific Regional Head)

Individual Support:

- David Thompson
- Hamoda Youssef

Global Programme Partners:

- **Buro Happold** - Duncan Price and Smith Mordak
- **Saint Gobain** - Timoteo Marquez Arreaza and Pascal Eveillard

Kindly supported by Better Places for People Global Programme Partners:

BURO HAPPOLD



This work was produced by WorldGBC's Better Places for People Global Programme.



Case Studies

Speed and affordability with 3D-printed homes

Mvule Gardens, Kilifi, Kenya



The largest 3D-printed affordable housing projects in the world, emphasising replicability and speed. The project is part of the 'Green Heart of Kenya' regenerative ecosystem, a model for inclusive and climate-resilient cities. The goal of the project is to build an affordable homes movement which will transform the lives of 100 million people in urban Africa and Asia by 2030, while creating qualified jobs, placing people on a development trajectory.

Habitability and Comfort

- Home ownership is a key principle for the project, providing homes designed in collaboration with future homeowners and the ability to grow with the new occupants.
- Large roof overhangs were designed in the front and the back of the house to provide shade and comfortable indoor temperatures, even on very hot days.

Community and Connectivity

- The neighbourhood offers gardens, common outdoor spaces and pedestrian pathways, promoting a safe and inclusive environment for children, women and elders in a landscape that enhances biodiversity.
- The project is bridging the country's infrastructure gap while creating skilled local jobs, such as training locals to use 3D printers and recruiting locals on-site for the set-up of machines, site preparation and operation.

Resilience and Adaptation to Climate Change

- Local construction habits were studied to come up with a design that was innovative, yet in harmony with local designs in coastal Kenya.
- The project is looking to prove the viability of climate-smart and innovative construction technology for the low-income housing bracket in a way that can be scaled and replicated.

Resource Efficiency and Circularity

- The walls of the house can be built at a record speed of 12 to 18 hours, allowing the fast execution of construction projects.

- Reduction in carbon emissions by up to 70%, and reduction of environmental footprint of each house by more than 50% compared to conventional methods, while minimising construction material use and waste production.
- Focused on accelerating three technologies: construction printing, durabrick soil-stabilised bricks, and concrete formworks, offering a complete range of sustainable and affordable solutions.
- The project's advanced sustainability profile won an IFC-EDGE Advanced sustainable design certification, which recognise resource-efficient and zero-carbon buildings.

Economic Accessibility

- 20% reduction in construction costs, allowing for affordability for people living on low incomes.
- Collaboration with credit cooperatives and local banks to arrange affordable finance for clients.
- Houses are below \$30,000 USD, targeted for first time buyers and homeowners of income below \$1,360 USD, the bottom 20-40% of the income pyramid.

Partners:

14Trees, Holcim and British International Investment (BII)

Certification:

EDGE Advanced Design Certification

More information:

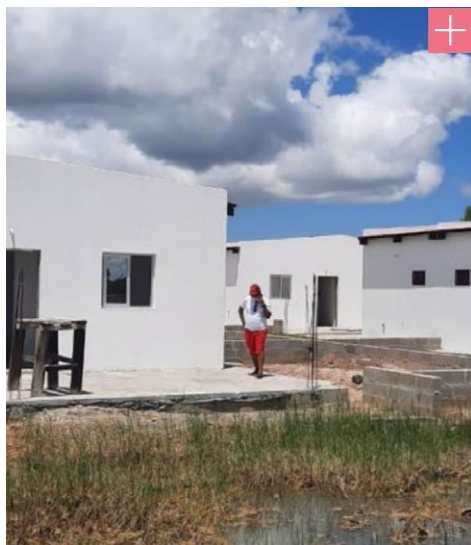
<https://mvulegardens.com>

<https://www.14trees.com>

<https://www.holcim.com/who-we-are/our-stories/largest-3D-printed-affordable-housing>

Unlocking low-income housing finance with proven climate-resilient homes

Casa Real, Beira, Mozambique



Beira's first zero-carbon home in partnership with Easy Housing, all cyclone-proofed and constructed from sustainable hardwood. In 2019, Cyclone Idai destroyed at least 70% of housing in the area, but all 10 of Casa Real's pilot homes remained standing, with only minimal and easily repaired damage. Prior to Casa Real, housing was unaffordable to 99% of the population, and 80% of homes were self-built with low quality materials, being extremely vulnerable to natural disaster. Casa Real is now providing for 160 households in Beira, with new sites in nearby cities being negotiated with municipalities.

Habitability and Comfort

- All houses come equipped with indoor water, electricity, and sanitation, improving health outcomes and security.
- The foundations laid on the project empower residents to add extra rooms and floors, adding value to their homes, and building for the future.

Community and Connectivity

- The project's safe and quality homes have been life-changing for families, situated within walking distance to schools, healthcare centres, local markets, employment hubs, and easy access to national and international transport links.

Resilience and Adaptation to Climate Change

- Innovative construction techniques and high-quality materials ensure built-in resilience to climate shocks, providing vital protection to vulnerable communities.
- The project considers environmental factors, design and building materials, to improve climate resilience of all homes.
- Introduced innovative cyclone-proof technologies into Mozambique and resilient houses that stood up to Cyclone Idai.

Resource Efficiency and Circularity

- The project's latest range incorporates solar power, wastewater recycling, insulated roofs and FSC certified timber.

Economic Accessibility

- Casa Real was the first organisation to work with a bank in Mozambique to access mortgages for earners on low incomes. In a country of 30 million people, only 600 mortgages were available, and housing finance was only for the wealthy elite.
- Casa Real has pioneered an innovative approach to house financing in Mozambique, generating revenue by selling and leasing homes. Having worked closely with the Beira Municipal Council to agree to much smaller plot sizes for affordable homes, Casa Real has been working to establish a rent-to-buy partnership with a local bank.
- Homes on site are accessible to the bottom 40% of income earners, with prices starting at just \$10,000 USD per unit. All of Casa Real's incremental homes are available for purchases or on a tenant purchase scheme with a rental price of \$70 USD per month for five years, giving new homeowners time to acquire a credit rating to access housing finance.
- For each year of rental, tenants gain a reduction in the eventual sales price. The tenant purchase scheme is renewable up to a maximum of 15 years, by which time the capital has been paid off.

Partners:

Casa Real and Reall

Awards:

- Second cheapest house in Africa in 2021 as recognised by the Centre of Affordable Housing in Africa (CAHF).
- Finalist at API's 'Best Affordable Housing Award' Africa in 2021.

More information:

<https://casareal.co.mz>



Jewel City is an urban redevelopment project that revitalized a former hub of the diamond and precious metals trade industry, an area that has historically suffered high vacancy and crime rates. The project achieved this revitalization by integrating affordable housing, along with retail, business, sport, and creative spaces. These elements are all centered around a meticulously planned public realm, which caters to the diverse needs of inner-city residents.

Habitability and Comfort

- Designed with liveability in mind, prioritising natural lighting and natural ventilation.
- Buildings are access controlled to avoid overcrowding, with house rules that prevent noise and disturbances to ensure a comfortable environment for the occupants.
- The new residential units include a wide range of apartment types, from micro-studios to family-size two-bedroom flats, encouraging both economic and social diversity.

Community and Connectivity

- Set in a well located, pedestrianised area, with inclusion of schools, healthcare clinics, sporting facilities and clubs, shops, restaurants, large public square, and an urban park that is flanked with trees, animated by fountains and public art.
- The development made use of a number of existing buildings where heritage aspects were maintained. A layer of heritage was also introduced through artworks, signage, and interpretive panels, with an economic injection into the local art economy, prioritising the involvement of local artists and artisans.
- The development consists of residential

rental units complemented by commercial spaces, offices, a school, and a medical facility. This diverse mix contributes positively to the urban environment.

Resilience and Adaptation to Climate Change

- Built for durability and serviceability of the building in the long term.
- Jewel City Precinct has received an EDGE Preliminary Design Certificate from the Green Building Council of South Africa (GBCSA). It is nearing post-construction EDGE status, indicating compliance with the EDGE Standard for a minimum 20% improvement in energy, water, and embodied energy in materials compared to standard building regulations.

Resource Efficiency and Circularity

- Includes solar, LED lights, efficient water fixtures, and energy efficient central heat pumps, while contributing to carbon emission reductions from it being centrally located.
- Architectural brief involved repurposing the existing industrial buildings into six blocks of residential and mixed-use buildings, with a 13-storey residential building standing as the Flagship building of the Jewel City precinct.
- Existing building facades were refurbished and adorned with local artwork throughout the precinct.

Economic Accessibility

- Average rental cost of an apartment is \$230 USD, with no sales. Average household income of the area is \$860 USD per month.
- Efficient and sustainable facilities aims to reduce monthly utility costs for families and residents.

- Acquired an estimate of \$43 million USD investment through private sector investors such as pension funds and private equity funds. This was achieved by overlaying the financial return offered to investors with strong social and environmental impact returns.
- Market-beating returns offered to investors targeted equity returns of 15% to 18% in line with market expectations, through good design, and efficient construction and property management.

Developer:
Diversity Urban Property Group

- Awards:**
- South African Property Owners Association (SAPOA) 2022 Property Development Awards: winner of 'Innovative Excellence: Best Residential Development' and 'Overall Transformation (impact) Award' categories.
 - Shortlisted for the UN-PRI 'Emerging Markets Initiative of the Year' award: 'Real-world impact of the year' and 'the emerging markets initiative of the year' categories.
 - Construction World's Best Projects 2021 Awards: winner of 'Architects' Category.

More information:
www.divercity.co.za
<https://www.worldbuildingsdirectory.com/entries/jewel-city/>
https://gbcsoa.org.za/wp-content/uploads/2021/09/30.09-Diversity_Carbon-Study_Final.pdf
<https://app.edgebuildings.com/project-studies/jc-the-onyx>

Creating financial sustainability and climate resilience through social housing

Urbanización El Paraíso,
Valparaíso, Antioquia, Colombia



El Paraíso is a social housing project that achieved high environmental standards, with excellent community flourishing and habitability characteristics. This project, located in a small city in Colombia, is an example of residential development designed to enhance local community life quality. El Paraíso resolved a large part of the quantitative housing deficit in the municipality, a notable result in Colombia, where the housing deficit for people of lower socio-economic status is approximately 35%. This project allowed its residents to become homeowners, achieving financial sustainability with adequate access to subsidies and mortgage loans.

Habitability and Comfort

- El Paraíso obtained the highest score in the 'Wellbeing' category of the CASA Colombia Certification. The housing units and buildings have natural ventilation systems, guaranteeing thermal comfort in a region that reaches temperatures around 27°C all year. These ventilation characteristics prevent diseases caused by factors such as indoor air pollution and mold. The housing unit's design improves the residents' quality of life through natural lighting and ventilation systems.
- Most of the residents are homeowners (67%) of their housing unit. The project allows and encourages the residents to improve the interior design of their house, a condition that differs from most social housing projects where changes are not allowed.

Community and Connectivity

- El Paraíso is located on the main municipal transport route and is within walking distance of various service facilities and the central park. The project is proposed as a new municipal centre due to its generous open spaces for social interaction, recreation, and commercial areas. Also having an ecological trail for the enjoyment of the entire community.
- Within El Paraíso, there is an area for an urban agriculture project, benefitting the project and the community by contributing to financial sustainability. This is also planned as an initiative for food and nutritional security in the future.
- The project contributes to developing technical and

financial capacities, and increase of local population participation in the project's construction. Through the National Learning Service (SENA) and the CESDE Academic Institution, the project had 26 people from the local community training and participating in the project.

- Through a social strategy called SYMA CULTURE, leadership skills and community organisation processes are developed. These skills contribute to developing security conditions, a sense of belonging, care, and protection of the acquired common heritage.

Resilience and Adaptation to Climate Change

- Recovery of the surrounding forest and the Yalí creek. Planting native species adapted to local conditions, adding ecological corridors that promote natural diversity to the internal landscaping. The care of the Yalí creek, the respect for its hydric ground and the reforestation processes will generate the conditions to adapt better to possible flood events in the rainy season.
- Differentiated networks for domestic wastewater and rainwater, prioritising green areas and built rainwater infiltration and storage strategies to reduce peak flows and preserve the water balance.
- The project rated 100% in the flood risk mitigation criteria from extreme weather events. It meets earthquake resistance criteria, exceeding those required by Colombian law for this type of project.

Resource Efficiency and Circularity

- With appropriate practices in block-cut modulation, classification, and proper maintenance. More than 688 tonnes of CDW have been reused and have contributed to the project's landscape enrichment.
- 99% of waste diverted during construction, and more than 18,000 tonnes of solid waste material recycled during the construction phase and the first operational year, with 100% organic waste composted. The waste collection system, with classification at the source, has allowed the use of more than 7.1 tonnes of organic material during the Project's construction and first year of operation.



- Passive and active energy efficiency measures lead to housing unit energy efficiency of 18.95% [ASHRAE 90.1-2010 standard], with 25% reduction in water consumption through efficiency measures.

Economic Accessibility

- The Project has created local jobs and contributed to the sector's formalisation. El Paraíso generated 120 formal jobs, with high diversity and equal employment opportunities, directly linked by the company. Within the new jobs created, 20% were people over 55, 25% were under 25, 10% were indigenous, 5% were women, and 3% were disabled people.
- For 91% of homeowners at El Paraíso, this was their first home. 15% of the collaborators of the project became owners of the houses they were building.
- SYMA conducted workshops for the local community on financial capabilities, saving strategies, and mortgage credit. Families with incomes of less than \$15 USD a day can access the benefits of the social housing policy; therefore, SYMA guided and supported the families in their application for housing subsidies from the national and departmental governments, and family compensation funds.
- Mortgage instalments were obtained on a very low average of USD 68.3, while the rental value ranges from \$91 USD, which means savings of surplus for the owner families.
- Colombia has a maximum value of social housing of \$30,733 USD. However, the total value of the housing in the urbanisation project was just over \$25,000 USD, ensuring the construction costs were accessible to the local market.

Developer:

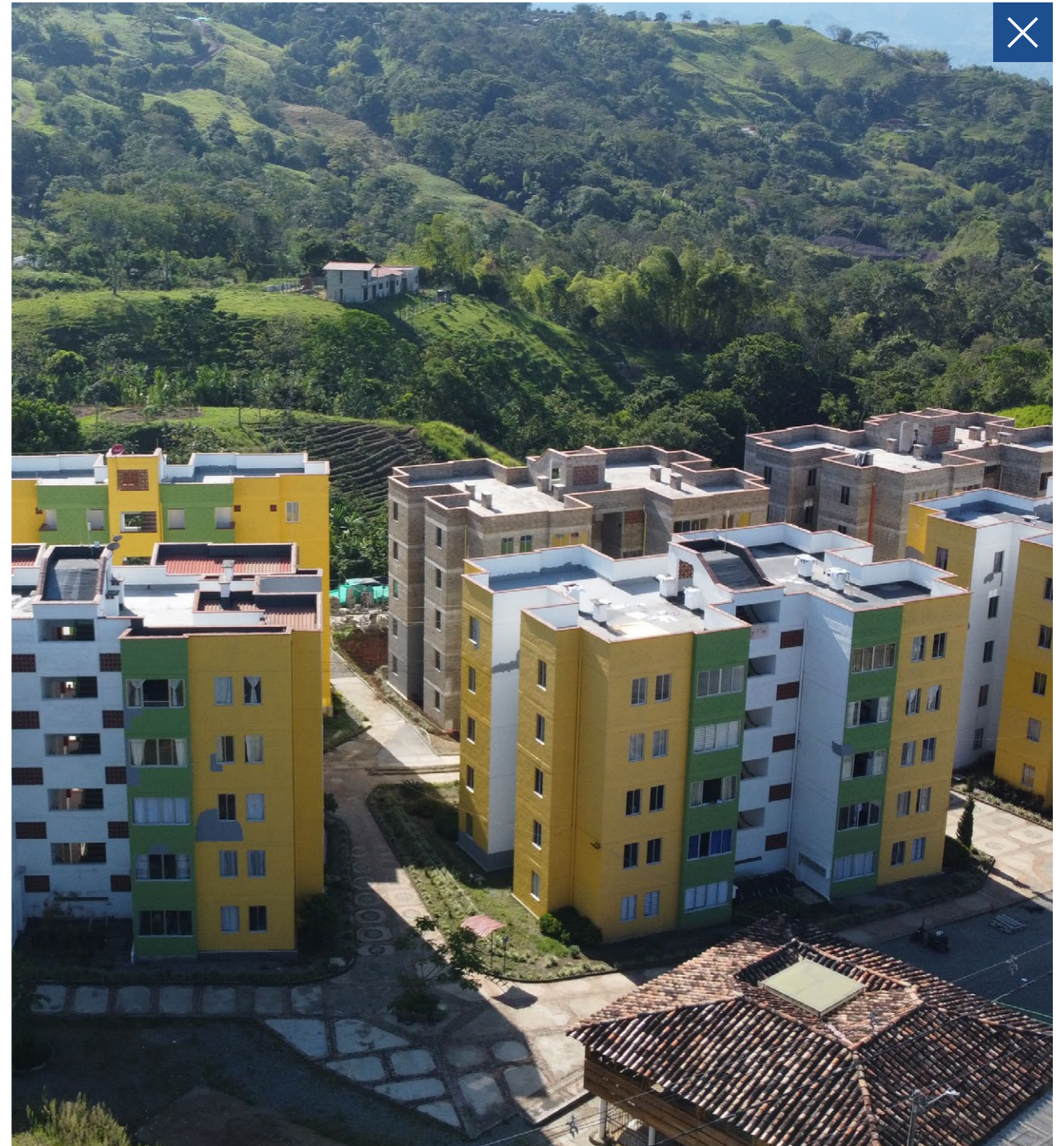
SYMA Consultores y Constructores S.A.S. Beneficio de Interés Colectivo "BIC".

Awards:

- Recognised by Construimos a La Par awards for the Women in Construction category.
- National Camacol Corporate Social Responsibility Award - Best Environmental Management programme 2022 - Integral Habitats in the Province.
- CASA Colombia Certification Exceptional Level of Sustainability - 5 Stars.
- Winners of the Corantioquia Sustainability Seal in Category A.

More information and awards:

<https://www.syma.com.co/>





Defying the market and increasing available incentives and finances

Trasciende La Parroquia,
15 Avenida, 7-47, Zona 6,
Guatemala City



The project was developed to bring those living in informal settlements to a more urban environment within the city, closer to sources of employment, urban facilities, and public transportation. The success of this project created interest and increased efforts to promote sustainable and affordable housing in the urban context.

This project was the first of its kind to integrate 'sustainability' within its housing model, and the first pilot project approved under the new priority housing regulations in Guatemala City. The project was also one of the first to register in the pilot version for the local certification programme, 'CASA Guatemala', and the first project to achieve the certification. Guatemala GBC created the CASA Guatemala programme as a way to encourage and measure sustainable housing development. CASA Guatemala is applicable only to housing developments and is currently being very well received for priority housing projects.

Habitability and Comfort

- Ensures optimal natural air flow conditions in all interior spaces.
- Gardens offering exercise machines and swings for children.

Community and Connectivity

- Located in close proximity to collective transport stations and various urban facilities within walking distance such as banks, gyms, supermarkets, restaurants, a hospital, and more than four schools and education institutions.
- Socialisation process during the construction process, including maintaining open communication with the community for waste management and dust mitigation.

Resilience and Adaptation to Climate Change

- A stormwater runoff retention tank for better resilience for residents as well as the surrounding neighbourhood and infrastructure.
- The implementation of responsible stormwater management has minimised flooding and overloading of public infrastructure. Guatemala city, located in a warm tropical climate zone, has faced alterations in the natural rain cycles where it rains more volume in short periods of time, making it considerably vulnerable to heavy rains.

Resource Efficiency and Circularity

- Built in a previously developed area with minimal requirement of new land space, reducing environmental impact.
- 20% water reduction per day per household, with a landscape design that achieved a 34% water reduction for irrigation.
- Reduced waste production, such as the use of cast-in-place reinforced concrete walls.

Economic Accessibility

- Total investment of \$1,937,742 USD from a private developer.
- Each housing unit costs an estimated \$25,836 USD – \$32,295 USD, less than half the median home value in Guatemala City.
- One of the largest companies in Central America for cement and concrete is supporting and promoting developers and municipalities to create incentives for the easier uptake of sustainable housing projects, creating great interest for various developers and projects.
- Currently, there are eight projects for urban affordable housing, with access to incentives, and working with three banks that offer special mortgages for projects certifying CASA Guatemala, such incentives are supporting urban projects to take more sustainable approaches.
- The Municipality of Guatemala now offers a 25% reduction in licence fees for social housing projects under a green building certification process. Additionally, banks began to generate financial incentive programmes for developers seeking a certification for their projects. Three of the projects that are currently pre-certified in the CASA certification programme arise from these incentives.

Partners:

Intepro (developer), Cementos Progreso, Municipality of Guatemala and Guatemala GBC

Certification:

CASA Guatemala

More information:

<https://casagt.org/trasciende-la-parroquia/>

<https://casagt.org>

http://www.fopavi.gob.gt/Documentos_en_Index/junio2020_Politica_Vivienda_vf.pdf

Sustainable and affordable housing with low carbon footprint

SEXTUPLE, Tlajomulco de Zuñiga, Mexico



This project was evaluated under the EcoCasa program, which aims to reduce CO₂e emissions in affordable houses and contribute to the achievement of SDG 11: Sustainable Cities and Communities. This project used tools to measure aspects related to energy efficiency, water savings, housing environment and carbon footprint of materials. The compliance with these criteria allows the developer to access a preferential rate on its loan.

Habitability and Comfort

- Obtained an 88% comfort range. This is estimated at 25°C for the upper limit during summer, and 20°C for lower limit during winter. Projects supported by EcoCasa programme, increase the level of comfort in housing from 40% to 80%, compared to a conventional home.

Community and Connectivity

- Close proximity and accessibility to: health centre, sports facilities, public administration facilities, recreational facilities, employment opportunities, and access to public transportation, facilitating the mobility and accessibility of its inhabitants.

Resilience and Adaptation to Climate Change

- Integrates strategies that can be allied in future scenarios, including insulating the house and the use of very low water consumption furniture and sanitary fixtures.
- Construction of housing with quality materials at an affordable cost, taking care of the location to avoid building in flood zones and alignment with municipal urban development plans.

Resource Efficiency and Circularity

- Achieved a mitigation of 32% CO₂e compared to a baseline dwelling, contributing directly to the reduction of 37,981.56 tonCO₂e emissions during the life cycle of its homes.
- Achieved greater energy and water efficiency, shorter commute times for transport CO₂ reduction, and lower carbon footprint of building materials.

Economic Accessibility

- Inclusive access to financial mechanisms for construction of affordable sustainable housing with a government standard supported by international resources and whose methodology was certified by Climate Bonds Initiative (CBI) as a "Low Carbon Residential Building", becoming the first residential housing programme in Mexico to be certified by the CBI and the first to focus particularly on social housing in the world.
- The average rental cost for each housing unit is \$126 USD, and the average purchase cost for each housing unit is \$19,660.95 USD, almost 70% lower than average housing costs.
- A Mexican development bank grants preferential interest rates and free technical assistance to developers who achieve the EcoCasa standard, compensating for the additional costs of implementing ecotechnologies, with the aim that the end user has access to adequate sustainable housing at the same price as a conventional one.
- Financial incentives provided to developers were based on results of four simulation tools used to measure a sustainable whole-house approach: DEEVi-Energy Efficient Housing Design, SAAVi-Water Saving Simulator in Housing, HEEVi-Assessment Tool of the House Environment and materials carbon footprint tool.

Partners:

Edificaciones Integrales Futura (developer and Sociedad Hipotecaria Federal (SHF) (organisation)

Certification:

EcoCasa I

More information:

<https://www.gob.mx/shf/acciones-y-programas/programa-ecocasa-shf>

3,500 affordable houses within a thriving climate- conscious community

Casa Laguna, Guayaquil,
Ecuador



Ecuador's largest climate-conscious construction project on the outskirts of Guayaquil ensures affordable housing for 3,500 families. Ensuring that this housing development was as sustainable and climate friendly as possible were key priorities for the developer.

Habitability and Comfort

- Directly benefits 3,500 families, from a social, environmental, and economic approach.
- The community benefits approach of the project allows the enjoyment of a better quality of life for all with affordable and low costs.
- Housing models ranging from of 111m² to 160 m² per unit.

Community and Connectivity

- Located near shopping centres, schools, colleges, and banks, as the project is mindful of Ecuador's deficit for housing and the needs of good location, accessibility, and ease of acquiring food, medicine, and access to schools.
- Includes a community events hall, community swimming pool, parks, and recreational areas.
- The project is creating sustainable livelihoods for the communities it works with through the management of bamboo plantations alongside local communities. There is also the development of industrial-scale bamboo plantations creating further value for the communities.

Resilience and Adaptation to Climate Change

- Development built on a safer northern area of the river basin to avoid climate change impacts such as sea level rise and flooding, as Guayaquil is the fourth most vulnerable coastal city to climate change in Ecuador.
- Studies carried out to quantify economic losses caused by floods and ensure a safer ground for the development to prevent damage.

Resource Efficiency and Circularity

- Used ECOPact green concrete for all housing units, resulting in a reduction of 98kg of CO₂ equivalent to each cubic metre sold. This amounts to 60% less CO₂ emissions, or a total of 1,100 tonnes of CO₂ saved.
- The use of ECOPact also achieved a 30% reduction in carbon footprint.
- Where regulatory conditions allow, ECOPact+ concrete integrates upcycled construction and demolition materials, further closing the resource loop to reduce the environmental footprint.

Economic Accessibility

- Ease of direct and fast financing with the builder, state financing and private banking. Highly developed area, properties with a high possibility of increasing capital gains over time.
- Holcim Ecuador supplied all of the ready-mix concrete needed to complete the project, totalling a volume of 13,000 m³ of ECOPact to meet the sustainability requirements.
- Average rental cost for each housing unit - \$600 USD per month.
- Average purchase cost for each housing unit - \$120,000 USD per house which is the average cost of an apartment in the area.

Developer:
Ritofa

More information:
<https://www.holcim.com/who-we-are/our-stories/ecuador-affordable-housing-ecopact>



Affordable LEED platinum apartments

Hatch, New Mexico, United States



El Camino Apartments' integrated design made it possible for residents to achieve financial sustainability by offering rental costs in keeping with agricultural workers' seasonal income. Resilience and efficiency strategies lowered operating costs while supporting wellbeing.

Agricultural workers in the city of Hatch, New Mexico were uniquely vulnerable to seasonal economic fluctuations. While the soil and water conditions are beneficial for growing the chilies that are unique to this region, there are few opportunities for work. This affordable residential community, El Camino, became a healthy and resilient solution for the people of Hatch. An integrative design and construction process resulted in a 70% improvement in energy efficiency over the baseline and reduced long-term costs for residents. Recognising how El Camino changed the community's quality of life for the better, USGBC celebrated the project with a Finalist award in the LEED for Homes Project of the Year competition.

Habitability and Comfort

- For a vulnerable population, choices that support health and comfort are especially valuable. The design team selected materials for durability and wellness. The community chose a no-smoking policy to foster healthy air quality.
- Mobility-accessible units are available.

Community and Connectivity

- Less than a mile from downtown churches, banks, and bus services.
- Unique outdoor environments of different scales offer opportunities for connection and solitude, including walking paths, rest areas, playgrounds, a gazebo, and low-water, xeric landscapes,

Resilience and Adaptation to Climate Change

- Designed to be 70% more energy-efficient than average construction, and zero-energy-ready, El Camino reduces energy costs and increases resilience.
- Rooftop solar photovoltaics take advantage of the optional solar exposure in the southwest of the United States, generating clean energy and offsetting the remaining energy usage.
- With climate change, the risk of damaging seasonal storms has increased. On-site stormwater management reduces the risk of flooding. Going beyond the site, a retention pond slows runoff from the surrounding hills.
- This high desert climate receives less than 12 inches of rain a year. The project design minimizes water use by selecting low and no water use fixtures and planning for water reuse.

Resource Efficiency and Circularity

- Energy modeling was used throughout the design process to maximize efficiency. This approach allowed the project team to evaluate the energy demands of each component, including heating, cooling and ventilation systems, water heating, and appliances.
- The building envelope's design was also integrated into the energy modeling and cost evaluation processes.
- Exterior shading elements and interior blinds reduce heat gain and reliance on air conditioning.

Economic Accessibility

- The project was designed to be affordable for the agricultural workers of Hatch by offering income-based rent that fluctuates between the busy growing season and the off-season, supporting the workers whose labor helps the Hatch Chile to continue to be a celebrated part of the cuisine of the southwest.

- Through resilience and efficiency measures, the residents have low – or even no – utility bills. This supports residents' financial wellbeing.
- Low maintenance interior and exterior materials prolong the lifecycle of materials and reduce long-term costs.
- The design team prioritized creating healthy indoor air quality, which promotes better health and leads to fewer doctor visits. Most occupants do not have health insurance, so the community is designed to promote day-to-day health.
- All 40 units meet the Federal Tax Credit for Zero Energy Ready Homes with a 50% energy reduction requirement, which brings an additional \$80,000 in tax credits.
- The New Mexico Sustainable Building Tax credit of \$360,412 USD also offsets expenses.

Partners:

Thomas Development (Developer), Crestline Builders (Contractor), Environmental Dynamics (EDI) and Green Insight (Consultants)

Awards:

- LEED for Homes Finalist for Project of the Year.
- LEED Platinum | Certified August

More information:

<https://www.usgbc.org/projects/el-camino-real-phase-1>

Resettlement of impoverished communities and creating a positive dialogue of collaboration

Salyani housing project, Bharatpur, Chitwan District, Nepal

BEFORE



AFTER



The project was dedicated to the alleviation of poverty through the improvement of shelter conditions and upgrading of slums for vulnerable communities of informal settlements, while strengthening communities and increasing household savings and credits.

The community also developed a continuous dialogue with the municipality to collaborate for the benefit of vulnerable communities, resulting in a positive change in perception of the local governing body towards the impoverished communities. This was also the beginning of community architecture initiatives in Nepal.

Habitability and Comfort

- Fear of eviction, loss of shelter investment, and doubts on governmental decisions and the community itself reduced, and the confidence level of the community grew.
- Upgrading of 31 on-site households.
- The city has become a positive supporter of a community-driven development, showing progress towards the community achieving secure housing.

Community and Connectivity

- The community was responsible for the management of the funds, procurement of the material, and building the houses.
- Households located along a stretch of road near a community forest and national park. Therefore, every household is a member of the forest with easy access to timber for firewood and construction.
- Maximum participation of women including management of funds and decision-making during planning, development, and implementation phases.
- Community involvement in construction, where members of the community helped build each other's homes, strengthening the sense of community and ownership.

Resilience and Adaptation to Climate Change

- Community members developed viable solutions for their housing problems and work together to ensure secure tenure in the city by being organised, strengthening savings and communities, and developing management skills.
- Community established an effective model to resolve issues of squatters in urban areas, which can be replicated in other communities and cities.
- The use of open spaces opposite to the settlement for urban agriculture, creating a self-reliant and resilient community.

Resource Efficiency and Circularity

- There has been a variation in the type of construction materials for the houses depending on the financial status of the households.
- Houses built entirely by the residents, showing a variety of incremental building strategies and budgets, using a variety of materials and construction systems, mostly purchased collectively in bulk by the community committee at subsidised rates.

Economic Accessibility

- The house construction was funded by loans from the Asian Coalition for Community Action programme (ACCA), budgeting \$40,000 USD.
- Infrastructure was granted from the municipality – approximately \$3,000 USD from the local government for landfilling, road, drainage and electricity. Community members contributed to its implementation.
- The cost of upgrading or rebuilding the houses came to \$2,000 - 3,000 USD per family.
- Each family was given loans up to \$1,000 USD, with a minimum interest rate of 5%, payable over 5 years.
- The owners of the houses contributed to 50% of the total construction cost from savings.
- Savings of the community grew to a very strong capacity in recent years, with repayment of loans being very organised and regular.
- Received funds from the municipality for in-filling the land, as well as public water pumps, and the mobilisation of resources to further support infrastructure development, such as drainage in the community.

Partners:

Lumanti Support Group for Shelter, ACCA programme, The National Federation of Informal Communities 'Nepal Basobas Basti Samrachyan Samaj', The National Women's Federation 'Nepal Mahila Ekta Samaj', The Amar Deep Women's Savings Cooperative, Community Forest Department, Bharatpur Municipality and Bharatpur Citizens Forum.

More information:

<http://www.lumanti.org.np>

https://www.youtube.com/watch?v=_eDmrAue3w0

Disaster resilience retrofits, improving quality of life and keeping costs to a minimum

Tiwi, Albay, Philippines



BEFORE



The project retrofitted houses with measures to ensure the overall strength and resilience of the house during a disaster, specifically targeted towards prevention of damage caused by earthquakes, typhoons, and heavy rains. This provided safe space for families, increasing quality of life, while keeping the overall cost to a minimum.

Habitability and Comfort

- Prioritised both structural improvements as well as habitability measures to improve overall quality of life.
- Addition of rooms for family members, providing better comfort and privacy.

Community and Connectivity

- Houses were improved using homeowner-driven reconstruction, prioritising the needs and interests expressed by the homeowners during the overall improvement process.
- Avoided relocation and allowed the community to continue development and growth within the existing social fabric, with easy access to public transport, school, and employment.

Resilience and Adaptation to Climate Change

- Use of resilient building materials, and best practices in design and engineering to safeguard the houses' ability to withstand the local hazards.
- Undertaken with locally available materials and with considerations of cultural norms around construction and housing to ensure appropriateness and longevity in the usage of the building.

Resource Efficiency and Circularity

- Each house was improved via structural improvement interventions, resulting in overall increased reuse of materials where appropriate and safe as compared to new construction.
- Structural retrofits saved up to 69% of embodied carbon, and up to 26% when they included a vertical expansion component.

Economic Accessibility

- Homeowners gained access to a non-mortgage loan to undertake structural improvements, thereby building credit and undertaking incremental improvements in accordance with their resource availability and ability to repay.
- Structural improvements on average cost 23% of the cost of new housing relative to new construction.
- The project was in partnership with microfinance institutions.

Partners:

Build Change, ASA Philippines Foundation, ASKI, Kagana Ka Development Center, Inc. (KDCI) and Kasagana Cooperative (K-Coop)

Awards:

Averted Disaster Award – Intervention of Distinction.

More information:

<https://buildchange.org/locations/the-philippines/>

A zero-water discharge community

Thanisandra, Bangalore, India



The project uses water efficiency and recycling techniques, creating a 30% reduction in freshwater demand and recycling 100% water in a hot and humid climate, all year round.

Habitability and Comfort

- Occupants are motivated to be mindful of their habits through water efficiency and waste segregation practices, becoming a sustainable and major lifestyle change for occupants.

Community and Connectivity

- Diverse and socially active community with residents from over 20 different states of India, bringing varied cultures and traditions displayed in full glory during festivities.
- Greenery connects residents to nature, with amenities such as gymnasium, rooftop pool, meditation rooms, children's playgrounds and recreational areas.
- Well-connected and in close proximity to parks, play grounds, schools, restaurants, transport and supermarkets, as well as the city's largest technological park.

Resilience and Adaptation to Climate Change

- Heat reflective paint on the roof and external walls as well as high-performance glass for windows, reflecting 80% of the heat.
- Drought-tolerant native species to reduce water consumption and water storage tanks in which the sizes were optimised for lower freshwater handling at design stage, reducing concrete, cost and carbon emissions.

Resource Efficiency and Circularity

- Zero-electricity waste converters on site, converting wet waste to organic manure used for landscaping, while dry waste is further segregated and sold to scrap dealers.
- Sewage treatment plants are used that do not contain pumps or motors and work by biomimicking the cow's digestive system.

- Grey and black water separation on-site and recycled through flushing and irrigation.
- Electricity is generated through wind turbines and solar panels, with excess sold to the grid and electric vehicle charging points provided.
- Annual reduction of operational carbon by 242 tonnes and embodied carbon by 1,738 tonnes.
- Efficient plumbing fixtures are used, reducing freshwater demand by 30%.
- 100% recycling of water, resulting in net savings of 65% amounting to 25.2 million litres of water saved annually.

Economic Accessibility

- Energy conserving features such as reflective paint and glass, LED lights and sensors, saves more than 300,000 units of electricity annually for the community occupants.
- The zero-electricity STP and the zero-energy organic waste converter save significant operational costs, having no pumps or motors and requiring minimal manpower.
- Monthly rental costs range from \$250 USD for one-bedroom units to \$625 USD for three-bedroom units.
- Purchase costs range from \$56,250 USD for one-bedroom units to \$150,000 USD for three-bedroom units.
- Average annual earnings for the community are approximately \$37,500 USD per household.

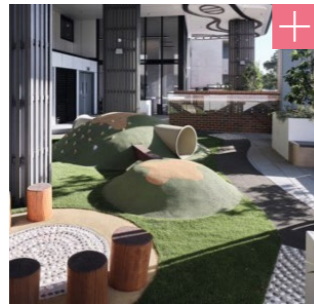
Developer:
CoEvolve Estates

More information:
<https://coevolvegroupp.com/northern-star-apartments-in-thanisandra/>
<https://www.youtube.com/watch?v=oJvVfZhcYas>



Promoting affordable housing for indigenous populations, while standing the test of time

Gibbons Street, Redfern, Australia



The development is a modern and secure 18-storey building, comprising 162 residential units of which 40 are social housing and 122 are affordable housing units. In addition, 40% of the units are allocated to First Nations households, recognising the cultural significance of the indigenous Australian people. The developer employed an Aboriginal Affordable Housing Engagement Coordinator (AAHEC) to promote affordable housing for Indigenous Australians.

Habitability and Comfort

- Designed to a Liveable Housing Silver Standard, championing safer, more comfortable and easier to access homes for changing needs and abilities of people over lifetime.
- Fresh air ventilation system and addresses outside city noise.
- Partnership with Civic Disability on My Home to coordinate and provide drop-in support to help disabled occupants meet their housing and wellbeing goals - supporting five National Disability Insurance Scheme participants.

Community and Connectivity

- Access to quality services and facilities including post offices, supermarkets, retail centres, employment, education hubs and medical centres.
- Community Hub available to external community organisations, promoting inclusion and delivering benefits for the wider community.
- Safe recreational grounds, including children's playground, barbecue areas, rooftop terrace, tree canopy and a community room with a kitchen.
- Culture incorporated into illuminated artwork titled "The Way Home", symbolising 'connection and country' for the community and reflecting history and traditions.

Resilience and Adaptation to Climate Change

- Double glazing and low-e glass, LED lights, ceiling fans, high performance floor and wall insulation and trickle vents to allow airflow control.

- Rainwater collection tanks and rooftop garden spaces with drought-tolerant planting.
- Building's exterior is unpainted or Nawkaw coloured concrete adhesive.
- 40-year forward Whole of Life (WOL) assessment, influencing material selections to ensure longevity and maintenance considerations, aligning with expense management with anticipated life expectancy, operational costs, maintenance costs and replacements.

Resource Efficiency and Circularity

- Recycling and correct disposal on-site.
- High energy efficiency standard, including LED lighting, rooftop solar panels and battery storage.
- 48% saving on heating and cooling energy demand when compared with other buildings in the area with an average 8-star rating under the Australian Nationwide House Energy Rating Scheme (NatHERS).

Economic Accessibility

- Originally financed through the Clean Energy Finance Corporation and refinanced to National Housing Finance and Investment Corporation (NHFIC).
- SGCH also secured a grant of \$104,000 USD from the City of Sydney to fund a AAHEC role to achieve a minimum allocation target of 25% for indigenous Australians for new developments within the city.
- Negotiated a discount to market land sale with the City of Sydney, with an additional fee dependent upon the final yield. The site was purchased for \$10 million USD – a slightly smaller neighbouring site sold privately for \$36 million USD in the same year.
- Residents for the 40 social housing tenancies were drawn from the NSW Department Communities and Justice Housing Register, with rents based on percentage of household income.
- The remaining 122 affordable housing units were marketed to low-to-moderate income working individuals and families who are eligible for affordable housing under NSW Affordable Housing Guidelines.

- Average rental rates for the affordable housing units are: \$260 USD for one bedroom, \$310 USD for two-bedroom, \$370 USD for three-bedroom.
- Occupants are offered tailored financial and individual support to identify and achieve housing and wellbeing goals.
- Savings on electricity costs of \$340 USD a year for a two-bedroom unit and \$240 USD a year for a one-bedroom unit as a result of the thermal efficiency.

Partners:

St George Community Housing (SGCH) (Developer), DKO Architecture (Architect), Keylan (Planner), WT Partnership (Quantity Supervisor), Lendlease (Builder), Northrop (Consultant), ABC Consultants (Consultant), In View (Consultant), Steve Watson Partners (Consultant), National Housing Finance and Investment Corporation (Current Financier) and Clean Energy Finance Corporation (CEFC) (Original Financier)

Awards:

- Urban Taskforce 2021 – Development Excellence Awards, Affordable Development.
- Best Accommodation Provider 2021 in the Australian Disability Service Awards.
- UDIA NSW Crown Group Awards for Excellence – Winner of Affordable Development 2022.
- Master Builders Awards – Winner Affordable Housing 2022.

More information and awards:

<https://www.sgch.com.au/projects/gibbons-street-redfern/>
<https://new.gbca.org.au/green-star/rating-system/homes/>
https://www.cefc.com.au/media/2vqg5rly/cefc_investmentinsights_communityhousing.pdf

Reducing costs through cooperative housing

Stavnsholthave 1-51,
Farum, Denmark



The project follows a cooperative housing scheme, in which it is financed, developed, maintained and owned by the residents of the co-housing, creating an increased sense of ownership. About 7% of the Danish population live in a form of cooperative owned housing, accounting for one-third of the housing stock in Copenhagen.

Habitability and Comfort

- Area is optimised for a functional and pleasant low-density structure with its large, green common areas.
- Creates a net positive whole life impact on ecological health, indoor and outdoor environmental quality.

Community and Connectivity

- Developed in close collaboration with its residents in initial programming, district planning, mediation with authorities and the detailed design.
- Easy access to a private entrance yard on one side and a terrace towards the common meadow, where social mingling and liveliness is encouraged.
- A common house for activities with communal kitchen, dining rooms, laundry rooms and extra rooms for the resident's guests, saving space in the individual houses.
- Close proximity to public transport and bike paths, with EV charging stations provided.

Resilience and Adaptation to Climate Change

- Green rainwater system, preventing flooding throughout the area and creating a natural habitat for flora and fauna.

Resource Efficiency and Circularity

- Low CO₂-footprint of 8,7kg CO₂-equivalent/m²/year where the limit in Denmark in 2023 is 12.
- Garden equipment and other sharable tools are provided and shared, reducing household clutter, need for storage spaces and excess waste.

- Use of prefabricated local timber and heat-treated wood construction for improved durability to climate change impacts.
- The limit decreases every second year, enabling the project to pass the Danish limits of 9kg CO₂-equivalent/m²/year in 2027.

Economic Accessibility

- A homeowner purchases a share of their own unit, common house and common areas of the co-owned estate for an average cost of \$234,000 USD (for 135m²). The rest of the estate is shared and rented, with a monthly rental cost of \$1,092 USD.
- Maintenance, social events and administration is done on a voluntary basis by residents to keep expenses down.
- Prices of cooperative housing have not increased much since founded in 1975, meaning deposits and subsequent mortgage instalments are affordable even for those earning below the median income.

Partners:

Urban Power (architecture and landscape), Rasmus Friis A/S (contractor), Wissenberg (consulting engineer), A/B Stavnsholt (client) and Plan 1 (client advisor)

Certification:

DGNB building

More information:

<https://urbanpower.dk/project/stavnsholt/>
<https://www.abf-rep.dk/om-os/about-abf/>

Creating adequate, sustainable, and affordable housing through pension fund capital

Diepeveen, Rotterdam, Netherlands



The project is a primary example of how adequate, sustainable and affordable housing could be created with pension fund capital. The project is also alleviating the severe housing shortage, especially for the middle-income segment. The Netherlands is set to build approximately one million homes by 2035.

Habitability and Comfort

- Focuses on inclusion and social equity.
- The blend of mid-range and upmarket rental apartments, alongside owner-occupied properties, is helping create a diverse residential quarter, while allowing for ongoing improvements with increased household savings.

Community and Connectivity

- A distinctive neighbourhood at the tail end of a rooftop park and nestled in the middle of a new emerging district.
- Located with great accessibility to transport, services and public amenities such as parkings, parks and libraries.

Resilience and Adaptation to Climate Change

- Use of tailor-made geographic information system (GIS), determining that the long-term climate risks are limited for the development.
- Various factors considered such as location and nature of operations and vulnerability from environmental disturbances.
- Raising the terrain to mitigate flood risks.

Resource Efficiency and Circularity

- The roof is fully equipped with solar panels, with homes connected to Rotterdam's district heating system.

Economic Accessibility

- This project adds 187 owner-occupied and rental properties to the shortage of Rotterdam housing market, spread over 5 buildings.
- More than 80% of the 90 rental units fall under the mid-range rental segment, with average rental cost at \$1,054 USD and average purchase cost at \$335,535 USD.
- Dutch institutional investors, including pension funds, are helping alleviate the housing shortages.
- The project generates a stable return for the Dutch pension funds who are shareholders of the project.

Partners:

Bouwinvest Real Estate Investors in partnership with Dudok Real Estate B.V. and developer Dura Vermeer Bouw Zuid West B.V. on behalf of its Dutch Residential Fund

More information:

<https://www.bouwinvest.com/news/latest-news/2021/bouwinvest-buys-mid-range-rental-complex-in-rotterdam>



Measuring everything to achieve sustainable and affordable social housing

Kilbride Lane, Bray, County Wicklow, Ireland



A 40-unit multi-award-winning social housing scheme. The first multi-unit development in Ireland to be awarded a gold certification under the Home Performance Index (HPI), a certification system developed by the Irish Green Building Council (IGBC) to assess quality and sustainability in new residential developments.

This is based on five categories of verifiable indicators and a point scoring system for: environment, economy, health and wellbeing, quality assurance and sustainable location and 35 point-based indicators. This project scored in 9 further innovative indicators, achieving a total of 74%, well above the minimum 70% to obtain gold certification. Convictions of one practice on a single project can help to transform the industry.

Habitability and Comfort

- Terrace houses, duplexes, apartments, with density of over 54 units per hectare.
- Uses a 10-step measure to enhance biodiversity which are achievable in most cases with minimal cost uplift and little or no maintenance uplift.
- Indoor environmental quality being monitored for CO₂, relative humidity and internal temperature.

Community and Connectivity

- The development is assessed on the sustainability of the location of housing, based on accessibility measurements relating to public transport, schools and amenities.
- Achieved 87% in sustainable location and 76% in universal design.

Resilience and Adaptation to Climate Change

- COADY Architects worked with a list of manufacturers, encouraging them to get independently valid audits of the overall environmental impacts of their products. This enabled 62 products being used, having Environmental Product Declarations (EPDs) to EN15804 and ISO14025, which included EPDs for precast concrete planks, concrete thermal blocks and PIR insulation, all with higher order embodied carbon emissions.
- Used a national water calculator to achieve a consumption of 79 Litres/person/day with a low flush toilet at 4/2.5 litres flush volumes and 5 litres/minute shower restrictors.
- Enhanced biodiversity for plants and animals using a 10-step plan. This involved assessing and calculating the ecology of the area before and after the development, using IGBC's ecology calculator, scoring -11.2.

Resource Efficiency and Circularity

- Measurable indicators applied to a range of areas, including not only operational carbon, embodied carbon, biodiversity, density and water use, but also land use, design team skills, contractor team skills, services commissioning and others.
- The 40 units achieved an average energy performance coefficient of between 0.19 and 0.21, representing between 79-81% reductions in calculated energy demand compared to Ireland's 2005 regulations.
- Post Occupancy Evaluation is being carried out on 11 units to determine actual energy consumption, with occupiers to be informed on further energy saving measures once the analysis is complete in June 2023.
- Used 81% FSC/PEFC - certified timber by volume.

- The 62 products with Environmental Product Declarations (EPDs) and/or Product Environmental Passports (PEPs) provided a more accurate Life Cycle Assessment, which calculated Whole Life Carbon of 1728 kgCO₂e/m² and Embodied Carbon of 718kgCO₂e/m².
- Logged construction waste to input into the Life Cycle Assessment (LCA).
- Built using block-cavity wall on strip foundations, meeting the minimum building regulations brief from the local authority this demonstrated meeting the RIAI Climate Challenge 2025 using business as usual construction.

Economic Accessibility

- Monthly energy bills estimated at a minimum of \$48 USD for one-bedroom unit, to a maximum of \$100 USD for a 4-bedroom unit.

Architects:

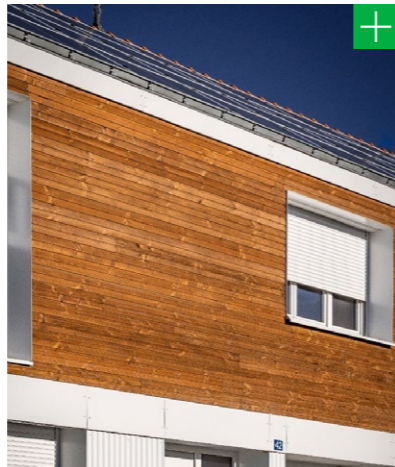
COADY Architects with Wicklow County Council

Awards and Certifications:

- Gold certification under the Home Performance Index (HPI).
- Winner of 'Green Construction and Infrastructure Project Award' 2023.
- Winner of Irish Building And Design (OBDA) Awards 2022 - Public Sector Housing Project Of The Year.
- Winner of Irish Construction Industry Awards (ICIA) 2022 - Green Project Of the Year.
- Net Zero Construction Awards 2022 Housing Category.

More information:

<https://passivehouseplus.ie/magazine/feature/measure-everything>



The EnergieSprong approach has a strong focus on satisfaction and comfort of the inhabitants. The objective of the project's approach is to drastically reduce costs through mass production and industrialisation of processes, developing a more mature market and multiplying the operations to achieve economies of scale. The replicability of this project contributes to improving the affordability of high-performance renovation projects.

Habitability and Comfort

- Integration of recurring comfort challenges is allowed by a diagnosis and by consulting the occupants at the beginning of the project.
- Thermal comfort all year round with a temperature of 21°C, not exceeding 25°C for more than 10% of the year.
- Guaranteed indoor air quality and ventilation for occupants, with measurements of three indicators: air renewal rate, maximum residual air velocity in living rooms, maximum ventilation noise in living rooms.
- Occupants are supported in managing the energy performance of their homes and in understanding the associated benefits to their comfort and health.

Community and Connectivity

- Occupants were involved throughout the renovation project and integrated into the upstream decision-making processes.
- Prior to the renovation, the Alisée association carried out a socio-technical diagnosis of the houses. Post renovation, a collective energy efficiency workshop was held, as well as physical and remote interviews for the first year

and first three years, respectively, to provide specific support for long-term and new occupiers.

- The project provided occupants with an increased sense of belonging and equality within the community by: allowing residents to be responsible for their energy consumption, training occupant ambassadors to act as referents for their neighbours and promoting the benefits of the renovations to all, with particular attention to the quality of the relationship between the landlord and the tenants.

Resilience and Adaptation to Climate Change

- Off-site prefabrication of the façade components allows for adaptability, enabling the renovated buildings to be integrated into their neighbourhood.
- Resilience and adaptability are at the heart of the renovation project respecting the constraints of the EnergieSprong approach.
- The E=0 level, balance between production and consumption of the building, has been achieved as a result of the renovations and is guaranteed for 30 years, with the assurance of comfort to cope with climatic variations, limiting the impact of heat waves in particular.

Resource Efficiency and Circularity

- Due to the off-site prefabrication and the industrialisation of processes, the waste generated during the renovation project has been greatly reduced.
- The choice of a biobased insulation material reduces the overall impact of the façades on the environment.

Economic Accessibility

- Allow for long-term savings and a shield against energy price increases, with 32% reduction in occupants' annual expenses.
- Most of the cost of the renovation was financed by the homeowners and landlords.
- Public aid and subsidies were made available. Fundings were provided through the Energy Savings Certificates (ESC) and valuation through an Energy Performance Contract (EPC), for an amount of approximately \$10,600 USD per dwelling, as well as various additional regional and national grants.

Partners:

EnergieSprong France(facilitator), Podeliha (housing association), Alterea, Pouget Consultants, Bouygues and Johanne San

Certification:
ISO 50001

More information:

<https://www.energiesprong.fr/projet/renovation-32-logements-individuels-angers/>
<https://www.podeliha.fr/actualites/energiesprong-une-demarche-vertueuse-qui-vise-le-niveau-energie-zero-pour-les-logements-en-renovation/>



Strengthening the community through retrofits and word-of-mouth

Jordan



The Affordable Housing Project retrofitted 48 homes and built three new homes across five different districts in Jordan, demonstrating that sustainable housing is affordable, with fast pay back periods. The project created an opportunity for cohesion between locals and refugees through their engagement and involvement, with notable change in “a greener way of thinking within the society”.

Habitability and Comfort

- 10-25% increase in mental performance and memory.
- 5-14% higher grades in schools and students learning 20-26% faster.
- 6-12% faster responding to communication.
- 18% higher activity in workers.
- 15-40% sales increase.
- 8.5% shorter stays in hospitals.

Community and Connectivity

- 288 people of low-income households from 5 local communities participated in the project, including men, women, children and disabled individuals.
- 20 local refugee builders were trained on green practices, concepts and standards.
- 44 local women were trained and supported to develop eco-friendly and economically beneficial upcycling products.
- Awareness was raised amongst more than 9,000 people, which created significant word-of-mouth and interest on the financial and health benefits of ‘green homes’. This created further job opportunities for the locally trained builders and increased the uptake of sustainable housing in the communities.

Resilience and Adaptation to Climate Change

- A focus on installing thermal insulation, double-glazed windows, rainwater harvesting systems and eco-friendly, nontoxic and zero-VOC paint.

Resource Efficiency and Circularity

- Shading devices have been produced from locally-sourced recycled materials.
- Solar water heaters installed.

Economic Accessibility

- 60% reduction in monthly electricity costs, 50% less energy used for heating and cooling.
- 30% reduction in water usage, 49% savings in drinking-water consumption.
- 5 months total average payback period of all fixtures (e.g. kitchen and shower faucets).
- An analytical study conducted on the development and operation of 9 sustainable homes in Jordan, indicated that the extra cost needed to build sustainable homes compared to non-sustainable homes was only 0-4% higher, with a payback period of 3-5 years and a 15-20% investment return considering the default age of the housing being 20 years.

Partners:

JordanGBC in cooperation with Habitat for Humanity Jordan and funded by the UK’s Department for International Development through the Moving Energy Initiative (MEI).

Awards:

Finalists of 2020 Ashden Awards

More information:

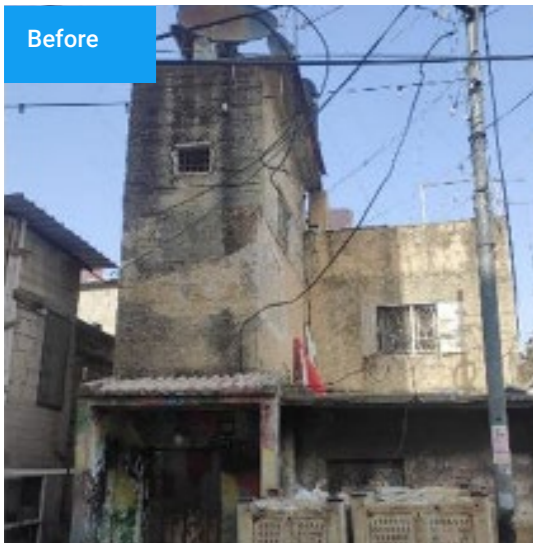
[Guidelines for Green Affordable Homes’ booklet available via JordanGBC](#)
<https://www.youtube.com/watch?v=l7J7idG6CXg>
https://www.facebook.com/Jordan.Green.Building.Council/photos/a.213994035321742/2307673005953824?_rdc=1&_rd
<https://jordantimes.com/news/local/right-green-home-project-builds-energy-water-efficient-houses>

Enhancing lives of refugees, one retrofit at a time

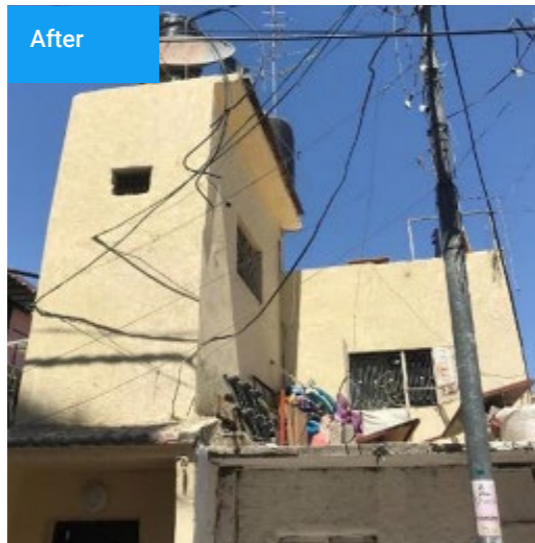
Qadura refugee camp,
Ramallah, Palestine



Before



After



The project contributed to sustainable housing and the wellbeing of refugees and underprivileged communities, by offering 'home retrofitting' measures to support the implementation of economically and environmentally friendly practices. This was done through a bottom-up approach, taking into consideration the occupants' need and designed in a participatory manner, while involving all key partners.

Habitability and Comfort

- Increased thermal comfort and preventing cold and hot airflow, as well as dampness.

Community and Connectivity

- The project trained and built the capacity of local contractors with key retrofitting concepts and trained local engineers and workers on-site on the quality of implementation.
- Raised awareness to the community on the impact of every intervention on comfort and energy efficiency, creating a long-term impact on occupants and their future decision-making regarding rehabilitation and energy management behaviour.

Resilience and Adaptation to Climate Change

- Increased the resilience of occupants by enhancing their living conditions and reducing their energy bills, which raised their ability to cope, adapt and transform against chronic and acute shocks they encounter.
- The project was designed to be replicated in any low-income household.

Resource Efficiency and Circularity

- Replacement of single-glazed to double-glazed windows and insulating the roof and envelope.
- Replacing appliances and lighting to energy efficient equipment.
- Installing solar water heaters instead of electric boilers.

Economic Accessibility

- \$7,000-\$11,000 USD retrofit investment per house, contributing to 30% reduction and savings in electricity bills.
- Institutional resilience and fiscal sustainability were enhanced through collaboration of multi-level institutions that share the benefit of reducing public debts from communities, who are now committed to paying bills.
- An incentive package was designed where the occupants' living conditions would be improved via building renovation for agreeing to install prepaid electricity metres. This also helped reduce the national electricity debt.
- The funds are part of the Transition to Solar Energy programme, supporting transitions to solar energy in Education and improving energy efficiency in Refugee Camps. The funds covered all the retrofitting expenses except for replacing some appliances such as refrigerators, these appliances were conditioned by 50% cost-sharing by households.

Partners:

Palestine Green Building Council (designer, developer and supervisor), UNDP (implementer), Government of Japan (funder) and Palestinian Energy and Natural Resource Authority (PENRA) (home audits and data, and savings validator)

More information:

<https://www.youtube.com/watch?v=tDayMbl2LmE>