Ghana Climate Action Roadmap for Buildings and Construction Sector

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Ministry of Works and Housing
P . O . M43, Ministries - Accra
Digital Address: GA-144-0550
Telephone: +233(0)577902988 /+233(0)577902933
Web: https://www.mwh.gov.gh/

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The Climate Action Roadmap for Buildings and Construction was prepared by Emmanuel Tetteh Kodzo Attianah and Prosper Issahaku Korah, with contributions from Alicia Regodon Puyalto (UNOPS), Talia Rangil Escribano (UNOPS), Chloe Decazes (UNOPS), Geoffrey Morgan (UNOPS), Joshua Maviti (UN-Habitat), Marco Voltolina (UN-Habitat), Celia Martinez Juez (UNEP). Other contributors to the report are Chris Pobee, Ministry of Works and Housing (MWH) and Bernard Ayensu (MWH).

The main sections of the roadmap and lead authors are indicated below:

Section	Lead Author/s
Country overview	Prosper Issahaku Korah
Strategic priorities	Prosper Issahaku Korah
Spatial and urban development	Prosper Issahaku Korah
Existing buildings	Emmanuel Tetteh Kodzo Attianah
New buildings	Emmanuel Tetteh Kodzo Attianah
Construction supply chain	Emmanuel Tetteh Kodzo Attianah and Prosper Issahaku Korah with contributions from Frederick Wireko Manu

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Foreword

It is refreshing to know that the Ghana Climate Action Roadmap for Buildings and Construction Sector has been prepared. While the growing demand for new buildings and affordable housing is a huge challenge, it is also an opportunity to expand economic activity and create millions of jobs. This roadmap marks a significant milestone in transforming the building and construction sector to be resilient and inclusive while emitting less carbon.

The Ministry of Works and Housing is mandated to initiate and formulate policies for the Works and Housing sector, as well as coordinate, monitor and evaluate the implementation of plans, programmes, and performance of the sector for national development. The roadmap aligns with our commitments under international frameworks, such as the Paris Agreement, and our national development policies. It underscores our dedication to creating a sustainable future, where the building and construction sector not only meets the needs of today but also preserves the planet for tomorrow.

The strategic actions outlined in this document can be a guideline towards reducing greenhouse gas emissions, promoting energy efficiency, enhancing resilience of the built environment, and promoting sustainable building practices across the country. Going forward, implementation of these actions will require collective effort involving all relevant stakeholders in both the public and private sectors.

I urge all stakeholders to engage actively with this roadmap and to integrate its recommendations into their plans and programmes. Together, we can transform Ghana's built environment and set it on the trajectory of resilience and sustainability.

Hon. Kojo Oppong Nkrumah
Minister for Works and Housing
Republic of Ghana

How to use this report

The document is structured in four main sections:

1) **Introduction:** This section briefly explains why the decarbonization of the buildings and construction sector is critical for Ghana. It includes a brief summary of the current and projected country emissions, context on national climate commitments, policy framework and international obligations that drive the need for decarbonization of the built environment in

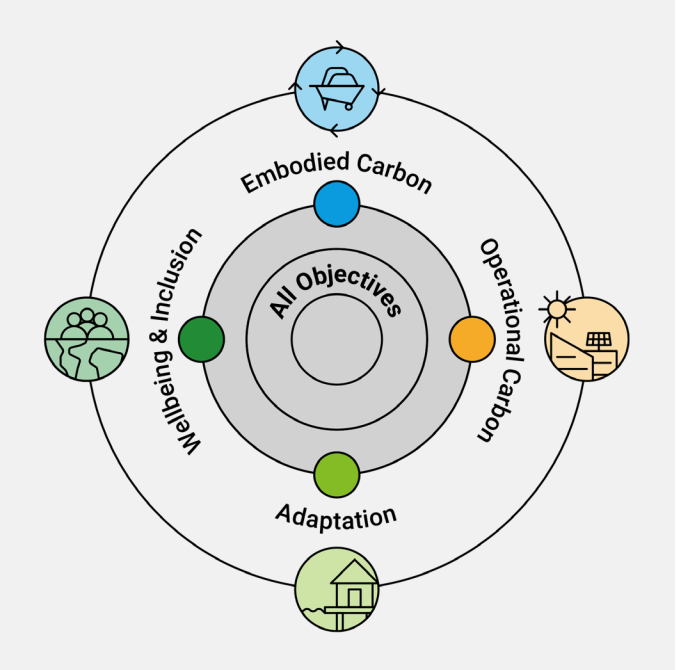
2) **Country overview:** This section provides essential background information about Ghana, including basic figures on geography and climate, population, socioeconomic development, environment, and the building and construction sector. It sets the stage by offering contextual data that impact the country's decarbonization efforts.

3) **Climate action area status:** This section provides information on the current status of each action area, the main challenges and opportunities, the desired goals and targets, and the recommended interventions for the short, medium and long term to achieve them. With the exception of the strategic priorities action area, which refers only to the enabling environment, all the action areas also include valuable information on projections of future emissions if no measures are taken.

4) **Project concepts for implementation**. This section includes eight project concepts for prioritized actions that are considered essential for advancing climate action for the building and construction sector in Ghana.

The four GlobalABC objectives, that is embodied carbon reduction, operational carbon reduction, adaptation, and well-being and inclusion are key themes mentioned throughout the document. To enhance clarity and aid in quickly identifying these objectives, specific icons are used in various tables and graphs. These icons serve as visual markers, helping the reader to easily associate the data, goals, and actions with the corresponding GlobalABC objectives.

Additionally, a fifth icon representing "all objectives'' has been included to represent content that applies simultaneously to the four objectives, for example cross-cutting actions. You can find the icons below:



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Acronyms

AC	Air Conditioning
AMA	Accra Metropolitan Assembly
BAU	Business-As-Usual
BMZ	German Federal Ministry of Economic Cooperation and Development
BRRI	Building and Road Research Institute
CAHF	Centre for Affordable Housing Finance
CBD	Central Business District
CSIR	Council for Science and Industrial Research
CTVET	Commission for Technical and Vocational Education and Training
EPA	Environmental Protection Agency
FDI	Foreign Direct Investment
GAMA	Greater Accra Metropolitan Area
GARID	Greater Accra Resilient and Integrated Development
GDP	Gross Domestic Product
GlobalABC	Global Alliance for Buildings and Construction
GHG	Greenhouse Gases
GIS	Geographic Information System
GREDA	Ghana Real Estate Developers Association
GSA	Ghana Standards Authority
GSS	Ghana Statistical Service
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
LI	Legislative Instrument
LST	Land Surface Temperature
LULUCF	Land Use, Land Use Change and Forestry
LUSPA	Land Use and Spatial Planning Authority
MESTI	Ministry of Environment, Science, Technology and Innovation
MDAs	Ministries, Departments and Agencies
MMDAs	Metropolitan, Municipal, and District Assemblies
MtCO2e	Metric Tons of Carbon dioxide-equivalent
MWH	Ministry of Works and Housing
NAP	National Adaptation Plan
NEIR	National Energy Information Repository
NDCs	National Determined Contributions
NADMO	National Disaster Management Organisation
PPP	Purchasing Power Parity
PWDs	Persons with Disability
RCC	Regional Coordinating Council

TVET	Technical and Vocational Education and Training
UHI	Urban Heat Island
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Programme
UN-Habitat	United Nations Human Settlements Programme
UNOPS	United Nations Office for Project Services
SDG	Sustainable Development Goals

Executive summary

The construction industry in Ghana has experienced strong growth in recent years, accounting for $8 billion, that is 15 per cent of the nation's gross domestic product (GDP) and providing employment to approximately 420,000 people.[1] Data from Ghana's 2021 Population and Housing Census indicate that residential structures increased by 73 per cent in the last decade (from 3,392,745 in 2010 to 5,862,890 in 2021).[2] Increase in Ghana's building stock is expected to be sustained in the coming decades owing to the confluence of rapid urbanisation and rising GDP per capita. Buildings remain the largest consumer of energy in Ghana, accounting for 43 per cent of the total energy used by all sectors of the economy in 2019,[3] and are a major emitter of greenhouse gases (GHG). Ghana's status as a lower-middle income country coincides with increasing household consumption expenditure, paralleling increased comfort and living standards, and significantly impacts how buildings are designed, built and operated. The demand for materials and energy for construction and buildings is growing, as are the sector's GHG emissions. As Ghanaian cities become warmer under changing climate, buildings will need to adapt to being resilient while meeting the needs of a rapidly growing population. The growing demand for new buildings, infrastructure, resilient and affordable housing can be viewed as a huge challenge and an opportunity to expand economic activity and create millions of jobs while transforming the construction industry into a more decarbonized, resilient and inclusive sector.

The Climate Action Roadmap for buildings and construction aims to support the Government of Ghana and its stakeholders to transform the industry towards lower emissions, efficient, and resilient built environment to support the country's commitment, through the Nationally Determined Contributions (NDC), under the Paris Agreement (UNFCCC) to reduce emissions. The roadmap will also help raise the country's climate ambitions under the next updated NDC. This roadmap provides a holistic approach to transform the sector by covering four main cross-cutting objectives: zero operational and embodied emissions, inclusion and well-being, and resiliency across five action areas of the built environment.

The roadmap suggests a number of actions, timelines, and leading actors in four action areas as detailed below, with targets for 2030, 2040 and 2050 underpinned by a comprehensive baseline assessment, mini workshops, and multi-stakeholder consultations conducted between November 2023 and August 2024.

Prioritized actions, timelines and leading actors to achieve low-carbon and climate-resilient built environment in Ghana

Action Area 1: Spatial planning and urban development

Effect on	Country Strategic Goals	Outcome	#	Name of action	Short	Med	Long	Leading actor
Embodied Carbon	Reduce emissions associated with land use and land cover change	Reduced land consumption rate	1	Prepare spatial plans for all regions and districts that includes the establishment of urban growth boundaries, preservation of areas and towns of historical importance and creation of low-carbon districts				Land Use and Spatial Planning Authority
			2	Revise zoning guidelines to include requirements for low-carbon building zones				Land Use and Spatial Planning Authority
			3	Develop a national digital land-use database to track spatial and urban development				Land Use and Spatial Planning Authority
			4	Develop technical capacities of built environment professionals at the MMDAs[4] in low-carbon development to undertake effective planning and management of human settlements				Ministry of Works and Housing
Operational Carbon	Reduce the risk of extreme heat	Reduced per cent of MMDAs at risk of extreme heat	5	Develop guidelines for integrating climate change adaptation and mitigation in zoning and spatial development plans, including measures to reduce urban heat island effect, and provision of green and blue infrastructure				Land Use and Spatial Planning Authority, NDPC
Adaptation	Citywide resilient infrastructure planning	Climate-resilient infrastructure developed in cities	6	Conduct comprehensive assessment and profiling of cities to determine potential threats and vulnerabilities				Ministry of Local Government, Decentralization and Rural Development
		Reduced encroachment on wetlands and flood-prone areas	7	Enforce zoning regulations, Act 925, Act 936, and L.I. 1652, to restrict development in environmental sensitive areas				Metropolitan, municipal, and district assemblies

Action Area 2: Existing buildings

Effect on	Country Strategic Goals	Outcome	#	Name of action	Short	Med	Long	Leading actor
Embodied Carbon 	Develop a circular building supply chain that integrates low-carbon materials into the life-cycle assessments, mapping and developing maintenance policies and inspection guidelines for existing buildings for enforcement before approval for renovation and retrofitting designs and construction.	Reduced dependency on cement and metal sheets as main retrofitting and renovation materials	1	Train and engage media networks, built environment professional bodies' stakeholders, e.g. designers and quantity surveyors and National Commission on Civic Education in information dissemination on alternative low-carbon materials and their economic social benefits				National Commission on Civic Education, and Ministry of Information
			2	Initiate partnerships between MMDAs and the private sector to engender the uptake of decarbonization actions to harmonize expertise on specifying vernacular materials in building designs and enforce their implementation				National Commission on Civic Education, and Ministry of Information
			3	Engage the Commission for Technical and Vocational Education and Training (TVET) to develop and include content on local low-carbon materials science (e.g. bricks, thatch, laterite etc.) in their curriculum and leverage on their schools across the country to train local artisans and technical supervisors				Commission for Technical and Vocational Education and Training (TVET)
Operational Carbon 	Promotion of energy efficiency in homes, industry and commerce (NDC)	Increased usage of solar and other sustainable energy options in existing buildings	4	Review existing green-building certification regime to match local built environment requirements and make certification a requirement for retrofitting works				Ministry of Environment, Science, Technology and Innovation; and Energy Commission
			5	Develop guidelines and encourage specific training of Ministry of Energy staff to coordinate with Customs Excise and Preventive Service and Ghana Revenue Authority to enforce the Appliance Standards and Labelling Regime under which importers and retailers of room air conditioners and compact fluorescent lamps (CLF) operate				Ministry of Energy and Energy Commission
			6	Develop campaigns using local languages (e.g. Ga, Adangme, Ewe, Twi, Dagbani) through NCCE, the media and local authorities to create awareness on the carbon emission footprints to regulate and enforce Legislative Instrument (L.I.) 1932, which bans the importation of used refrigerators and air conditioners and enforces appliance regimes				Ministry of Local Government, Rural Development and Decentralization, Ghana Standards Authority, and Energy Commission

Effect on	Country Strategic Goals	Outcome	#	Name of action	Short	Med	Long	Leading actor
Adaptation 	Citywide resilient infrastructure planning (NDC)	Increased resilience of existing buildings	7	Develop resilient Green Building Guidelines and resource-built environment ecosystem stakeholders e.g. (GREDA, MMDAs, LUSPA, building and civil engineering contractors) to apply guidelines in retrofitting, renovation, maintenance designs				(GREDA, MMDAs, LUSPA, building and civil engineering contractors
				Build capacity of built environment sector players, designers, contractors and MMDA staff on application of green guidelines, sustainability and accessibility in retrofitting and renovation construction				Ministry of Local Government, Rural Development and Decentralization
Well-being and Inclusion 	Upgrade existing slums and prevent the occurrence of new ones	Increased supply of affordable housing	8	Develop a social policy for affordable and energy-efficient housing retrofitting programmes using solar, photovoltaic and windmills subsidized for urban poor				Ministry of Works and Housing, Ministry of Energy, and Energy Commission

Action Area 3: New buildings

Effect on	Country Strategic Goals	Outcome	#	Name of action	Short	Med	Long	Leading actor
Embodied Carbon 	Promote the adoption and use of robust and sustainable local materials in building and construction.	Increased use of low-carbon cement and concrete e.g. low-clinker cement like calcined clay cement	1	Develop guidelines that mandate building sector players (e.g. designers, architects, engineers, quantity surveyors) to specify the use of local eco-friendly low-carbon materials for construction of public sector led projects. Develop low-carbon cement standards and low-carbon concrete codes to be used in the new buildings				Ministry of Works and Housing, and Department of Rural Housing Ministry of Trade and Industry, Ghana Standards Authority
			2	Develop green building guidelines that promote the use of local low-carbon building materials such as pozzolana cement, compressed earth, laterite, bamboo, and empower MMDAs to enforce them				Ministry of Environment, Science, Technology, and Innovation Architectural Council, and Energy Commission
			3	Engage the Commission for Technical and Vocational Education and Training (TVET) to develop and include content on local low-carbon materials science (e.g bricks, thatch, laterite) in their curriculum and leverage on their nationwide to train local artisans and technical supervisors				Ghana TVET Service and Commission for Technical and Vocational Education and Training (TVET)
		Alternative low-carbon materials, e.g. thatch and bricks adopted	4	Implement demonstration projects to showcase successful use of local low-carbon materials				Ministry of Works and Housing
			5	Train and engage country communication networks and built environment professionals' stakeholders (e.g. designers, quantity surveyors and designers) and National Commission on Civic Education in information dissemination on alternative low-carbon materials and their economic and social benefits				National Commission on Civic Education, and Ministry of Information
Operational Carbon 	Integrate the concept of green design in the building code to support emission reduction,	Integrate climate change response measures into construction designs for retrofitting existing buildings and constructing new buildings (use of local low-carbon eco-friendly materials)	6	Subsidize the importation and installation of solar panels, wind farms, heat inversion pumps and inverter air conditioners, and set up a taskforce to monitor and evaluate the work of the beneficiary organizations				Ministry of Energy, and Energy Commission
			7	Revise existing green buildings certification regimes to adapt and match local built environment requirements (e.g. using inverter air conditioners that reduce cooling loads)				Ministry of Energy, and Energy Commission

Effect on	Country Strategic Goals	Outcome	#	Name of action	Short	Med	Long	Leading actor
Adaptation 	Review building regulations and implement climate change, disaster resilient construction and infrastructure standards, including for public and private sector buildings, to include public health, education, WASH, private housing etc.	Building designs are climate resilient	8	Review by-laws and empower local authorities' staff to prevent siltation of drains and indiscriminate dumping of solid waste				MMDAs
			9	Enforce building regulations and streamline building permitting guidelines to empower MMDAs to enforce new building developments that are climate resilient				Ministry of Works and Housing, and MMDAs
Well-being and Inclusion 	Upgrade existing slums and prevent occurrence of new ones	Increased supply of affordable housing	10	Design guidelines that enforce housing designs to address all-inclusiveness and accessibility of vulnerable groups, adequately				Ministry of Works and Housing
			11	Coordinate with and revise curriculums of TVET and technical universities' academic programmes to include training of artisans and professionals in the science and practical implementation of low-carbon eco-friendly materials				Commission for Technical and Vocational Education and Training (TVET)
			12	Establish MMDA funds to be used to develop temporary accommodations for most vulnerable groups in society, manage collection of daily or weekly rents for repayment for the use of the houses				MMDAs and Ministry of Finance
			13	Promote participatory slum upgrading and community-led initiatives, for example by developing models similar to UN-Habitat's "Participatory Slum Upgrading Programme", funded by the European Union with Slum Dwellers International through the Ghana Federation of the Poor, to fund housing programmes for the poor and use their contributions to repay and develop new housing schemes				Ministry of Works and Housing, donor agencies

Action Area 4: Construction supply chain

Effect on	Country Strategic Goals	Outcome	#	Name of action	Short	Med	Long	Leading actor
Embodied carbon reduction 	Sustainable production in the construction industry to identify, develop and promote the use of sustainable local materials in building and construction.	Reduced demand for high carbon content materials (e.g. cement, metal sheets)	1	Provide funding support for research into low-carbon materials, recycling and reuse value chain				Ministry of Environment, Science, Technology and Innovation, and Ministry of Works and Housing
			2	Develop policies and incentives for adoption of local low-carbon and vernacular construction				Ministry of Works and Housing
			3	Implement demonstration projects to showcase successful use of local low-carbon materials				Ministry of Works and Housing, and the Building and Road Research Institute (BRRI)
			4	Launch public awareness campaigns using the media, e.g. radio and television and National Commission on Civic Education (NCCE), to promote the benefits of using low-carbon building materials				National Commission on Civic Education, and Ministry of Information (Information Services Department - ISD)
			5	Develop and implement building materials Environmental Product Declaration (EPD) standards and eco-labelling regime				Ministry of Environment, Science, Technology and Innovation, Ghana Standards Authority (GSA)
			6	Develop a database of materials and associated embodied carbon content properties to guide building designs				Council for Scientific and Industrial Research (CSIR), GSA
			7	Mandate the use of low-carbon building materials for all public buildings				Ministry of Works and Housing
			8	Engage the Commission for Technical and Vocational Education and Training (TVET) to develop content on local low-carbon materials, e.g. bricks, thatch, laterite and leverage on their schools nationwide to train local artisans and technical supervisors				Commission for Technical and Vocational Education and Training (TVET)
Operational Carbon 	To promote energy efficiency in homes, industry and commerce leading to emission reduction	Reduced importation of cooling appliances	9	Revise existing standards and labelling regulations on cooling appliances to cover unregulated air conditioners and the importation of high energy used appliances				Energy Commission, and Ghana Standards Authority

Adaptation 	To safeguard the viability of base resources used in the production of new homes	Reduced environmental damage	10	Enforce by-laws that involve local communities in the management of natural resources, e.g. sand and stones				MMDAs
Well-being and Inclusion 	Promote the use of sustainable local materials in pro-poor housing delivery	Developed market for local building materials	11	Expand access to local eco-friendly building materials by providing incentives for mass production of these materials, e.g. tax breaks				Ministry of Works and Housing, and Ministry of Finance

Introduction

The buildings and construction sector contributes significantly to global climate change, accounting for about 21 per cent of global greenhouse gas emissions[5]. Already, 30 per cent of steel and 50 per cent of cement go into buildings globally, and cement alone is expected to contribute to 12 per cent of global greenhouse gas emissions by 2060.

The adoption of cement or concrete masonry building materials in Ghana for outer walls of dwelling units has risen sharply, from 39 per cent in 2000 to 58 per cent in 2010 and 64 per cent in 2021. Use of cement and concrete as the main materials for outer walls of buildings is more prevalent in urban areas (83 per cent) than rural areas (38 per cent). In contrast, the use of mud and earth bricks declined over the same period (50.0 per cent in 2000; 34.2 per cent in 2010 and 29.6 per cent in 2021).[6] According to Ghana's Energy Commission,[7] the energy used by the residential sector in 2019 was 3,423 Ktoe, representing 43 per cent of the total energy used by all sectors of the economy in that year.

With an estimated housing deficit of 1.8 million homes, a growing slum population, and 70 per cent of the population living in urban areas by 2050, it is projected that the building of new homes will continue apace through the next decade, resulting in a rise of carbon emissions from building activities. As Ghanaian cities become warmer under changing climate, buildings will need to become resilient, while meeting the needs of a rapidly growing population. The growing demand for new buildings, infrastructure and resilient and affordable housing can be viewed as a huge challenge and an opportunity to expand economic activity and create millions of jobs while transforming the construction industry into a more decarbonized, resilient and inclusive sector.[8]

Ghana's updated Nationally Determined Contribution (NDC) under the Paris Agreement (2020 to 2030) covers 19 policy areas, translating into 47 adaptation and mitigation programmes of action. These climate actions are, among others, expected to generate an absolute greenhouse gas emission reduction of 64 MtCO2e[9]. Specifically, the following policy actions of the NDC demonstrate the Government's commitment to undertake climate mitigation and adaptation measures in the built environment sector. These actions are:

- To achieve citywide resilient infrastructure planning for climate change adaptation
- To increase low-carbon electricity generation and promote clean rural households lighting leading to a combined emission reduction
- To promote energy efficiency in homes, industry and commerce leading to emission reduction

Sustainable production in Industry

The Climate Action Roadmap for Buildings and Construction aims to support Ghana, through the Ministry of Works and Housing, in reducing building emissions across the construction value chain and increase climate goals within the industry. This aligns with the NDC policy actions mentioned above and is aimed at reviewing the upcoming NDC. This roadmap aims to provide a holistic approach to transform the sector by covering four objectives across five action areas. The four objectives are **embodied carbon, operational carbon, adaption, and inclusion and well-being**. The five action areas are **strategic priorities, spatial and urban development, new buildings, existing buildings, and construction supply chain.**

Overview of the roadmap

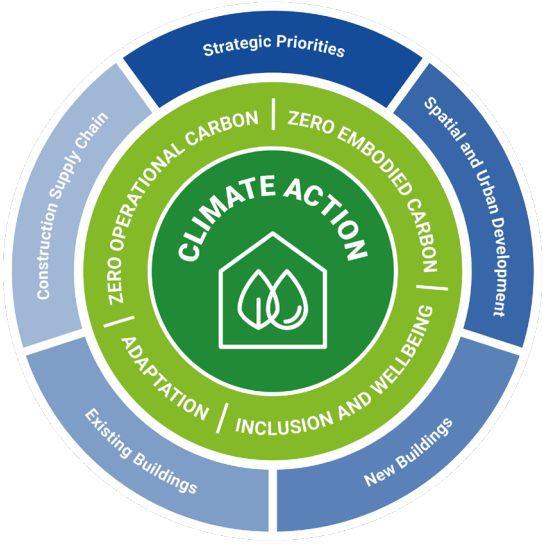
The GlobalABC framework

The Global Alliance for Buildings and Construction (GlobalABC), whose secretariat is hosted by UNEP, is leading efforts to support governments and their partners to develop regional, national and local climate action roadmaps for the buildings and construction sector. Ghana's roadmap follows the GlobalABC roadmap template, which is part of a collective effort of GlobalABC members and was developed within the framework of the UNEP project titled "Transforming the Built Environment through Sustainable Materials". The effort is funded by the German Ministry for Economic Development and Cooperation (BMZ), and implemented in partnership with UNOPS and UN-Habitat from July 2023 to December 2025.

The GlobalABC roadmaps offer a comprehensive and inclusive approach for reducing emissions and improving resilience of the built environment throughout its entire life cycle. They set aspirational short-, medium- and longer-term targets in accordance with the Marrakech Partnership for Global Climate Action Human Settlements Pathways. The roadmaps focus on four main cross-cutting objectives: zero embodied carbon; zero operational carbon; resilience; and inclusion and well-being.

With the aspiration to reduce material use and carbon emissions and improve climate adaptation, the roadmaps include five key action areas: strategic priorities, spatial and urban development, new buildings, existing buildings and construction supply chain (see figure 1).

Figure 1: The GlobalABC framework

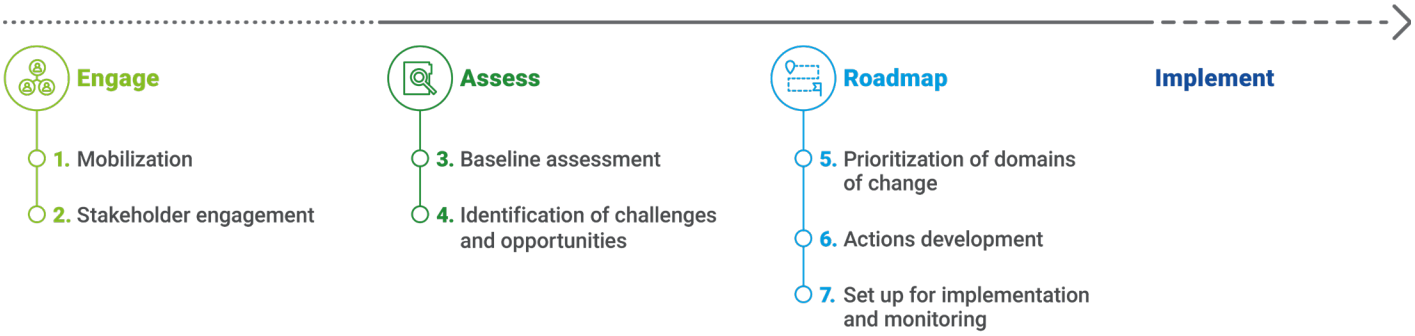


Following this approach, the **climate action roadmap for buildings and construction** examines the current status of the building and construction sector in Ghana general targets for operational and embodied carbon reductions between 2030 and 2040. This goal is to achieve a decarbonized, resilient and healthy built environment by 2050. The roadmap then identifies priority actions with project concepts for implementation.

The roadmap development process

The roadmap development in Ghana followed a seven-step methodological process as shown in figure 2.

Figure 2: Ghana roadmap development



Step 1 - Mobilization: This step of the process involved engagement with relevant authorities with a mandate covering sustainable, resilient and inclusive buildings and construction in the country. It includes the definition of the roadmap's objectives and scope. A delivery team was constituted comprising an urban planning and resilience expert, and housing, basic services, and construction expert.

Step 2 - Stakeholder Engagement: This step entailed the identification of country stakeholders from the public and private sectors, academia and research institutions, as well as relevant donors and financing entities to support the roadmap's elaboration and future implementation. The stakeholders and initiative mapping checklist was used to identify stakeholders, their sector, primary and secondary action areas, priorities, and the stakeholder's impact within the sector, as well as their ability to affect results within this policy area. The level of interest and influence of the long list of stakeholders was used to arrive at a working stakeholder list as shown in Annex 1. A strategic brief—summarizing Ghana's strategic priorities and policies in relation to decarbonization of the building and construction sector, current challenges and opportunities—was developed and used as the basis for a kick-off meeting with stakeholders. One multi-stakeholder and three thematic working groups were constituted and engagement work plans developed. These plans outlined the role and responsibilities of stakeholders towards the roadmap development and clarified consultation modalities at every stage of the process to ensure inclusiveness. The methodology leverages a participatory approach for the co-development of the baseline assessment and the roadmap, to ensure actions and priorities align with stakeholders' visions and that they engage in the roadmap implementation.

Step 3 - Baseline Assessment: This step focused on understanding the current status of the buildings and construction sector in Ghana, encompassing the physical and the enabling environments (see Annex 2). It included collecting quantitative and qualitative data to identify a baseline, make projections, and identify gaps to achieve the country's decarbonization goals. The following tools were used to support the process:

The physical environment data collection checklist: A comprehensive list of physical components of the buildings and construction sector to be analysed was defined within the four GlobalABC action areas. This was accompanied by a data collection checklist that helped identify key documents and information necessary for the analysis. The physical environment assessment was underpinned by data and analysis that drew on sources such as the European Space Agency Sentinel 2-10m Land Use/Cover time series data, Global Human Settlement Layer, World Bank Development Indicators, and a review of academic and national policy documents like the Ghana National Spatial Development Framework, Updated Nationally Determined Contribution (NDC), and the Long-Term National Development Plan (2018–2057).

GlobalABC Projection Dashboard (link): This tool was designed to provide current estimates and projections for 2030 and 2050 for a set of indicators (e.g., urban population density, annual building stock operational

carbon emissions, and carbon emissions of imported construction materials,) under each action area.[10] The end goal of these dashboards was to help assess and analyse the current data and projections of the country (blue line), in relation to the country's domestic decarbonisation goals, and also compared to the regional average (green line) and the global average (grey line). See figure 3 sample. This was particularly useful in the case of Ghana where little or no data exists, or where no modelling exists to provide a baseline or projected emissions.

The Enabling Environment Assessment Tool: This qualitative question-based tool was used to analyse the current status of the building and construction sector's enabling environment, that is how buildings are planned, delivered and managed throughout their lifespan and value chain. It helps identify what impairs or supports the physical environment to adapt and mitigate climate change. The tool looks at seven enabling domains: (1) institutional arrangements; (2) processes; (3) policies, laws and regulations; (4) stakeholder engagement; (5) financial management and funding; (6) knowledge and technical capacities; and (7) data management and reporting through the 5 GlobalABC action areas.

For each action area, the tool identifies the enabling environment capacity to achieve the 4 GlobalABC objectives and generates diagrams to support the analysis (see figure 4 sample).

Step 4 - Identification of challenges and opportunities: This step included the identification of information gaps, challenges and opportunities per action area. Several mini-workshops were organized to validate the results and collect further input from stakeholders to complete the baseline assessment. Problem trees were also drafted during this step to visualize the relationship between the challenges and opportunities and the country objectives to be achieved.

Step 5 - Prioritization of domains of change: This step consisted of the definition of priority areas of intervention (i.e. domains of change) and the final goals and targets of the roadmap. A prioritization workshop was organized to review the problem and solution trees interactively and develop prioritized areas of intervention for the four action areas; namely, spatial and urban development, new buildings, existing buildings and construction supply chain.

Figure 3: Sample from the GlobalABC Projections Dashboard

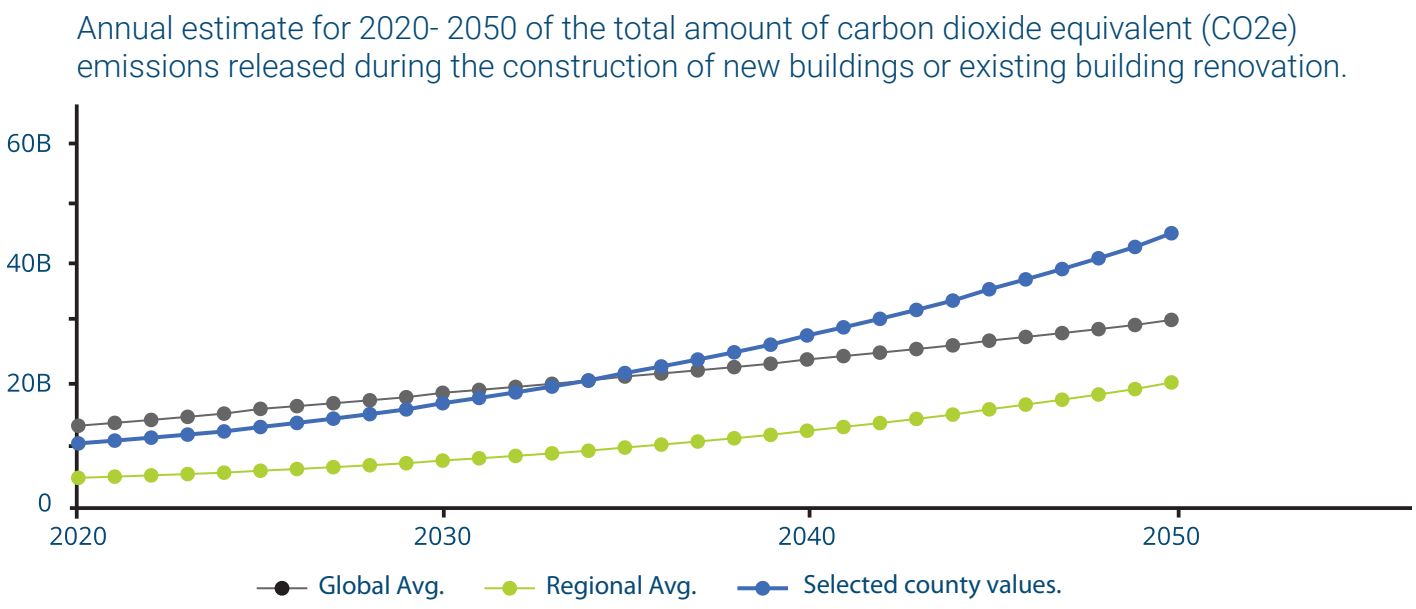
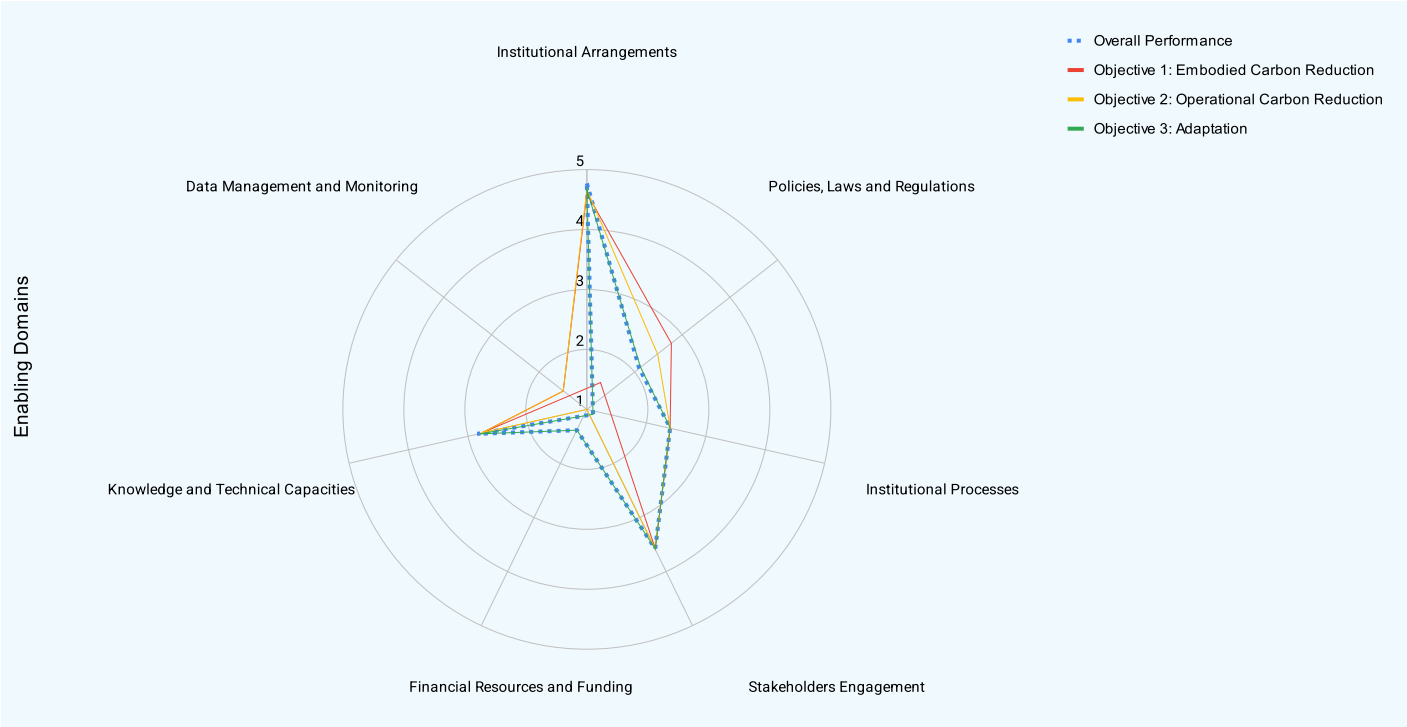


Figure 4: Performance of the seven enabling domains in the spatial and urban development action area



Step 6 -Actions development: This step encompassed the identification and prioritization of actions. It also involved the definition of their timeline and the responsible bodies for their implementation. Among the prioritized actions, 10 were selected to be further developed as project concepts to be presented to donors or partners to explore funding opportunities for its implementation. A long list of actions was developed and reviewed with the Ministry of Works and Housing, based on a set of criteria to arrive at 41 actions across the four action areas. The shortlist of actions were further validated and ranked by stakeholders at a workshop to arrive at the 10 prioritized actions. Following this, the roadmap targets for 2030, 2040, and 2050 were validated.

Step 7 - Set up for implementation and monitoring: This step involved defining the steps towards the implementation of the roadmap and the monitoring mechanism.

The process of developing the roadmap lasted from July 2023 to September 2024 (see table 1).

Table 1: Timeline summarizing the process of developing the roadmap

2023		2024			
July	November	April	May	August	September
Mobilization of delivery team	Kick-off workshop	Baseline Assessment (Mini Workshops)	Prioritization workshop	Roadmap workshop	Implementation and Monitoring Set-up

Country overview

Geography and climate

Ghana is located in West Africa and at latitude of 7.9465° N and longitude of 1.0232° W. Ghana is bordered to the north by Burkina Faso, to the east by Togo, to the west by Cote d'Ivoire, and to the south by the Gulf of Guinea. Ghana has a total land area of approximately 238,533 sq. km, comprising 227,533 sq. km (95.4 per cent) of land and 11,000 sq. km (4.6 per cent) of water. Ghana has five geographical areas of five varied types of climate. These are the northern zone, eastern coast, west coast, southern zone, and the central zone. Generally, the country has a tropical, warm and humid climate. It receives a mean annual rainfall of about 1,200 millimetres and an annual temperature range of between 25°C and 29°C along the coast to about 28.6°C in the driest northern regions. Temperatures vary with season and zone. The dry season comes from October or November to March or April, while the rainy season covers the remaining period. Seasonal variations in temperature in Ghana are greatest in the north, with highest temperatures in the dry and hot seasons averaging above 35 degrees Celsius. In recent times, weather and climate extremes have increased in frequency and magnitude, triggering floods and heat waves across the country.[11] Major cities like Accra and Kumasi have become hotspots for perennial flood events.

Ghana is a constitutional republic with two spheres of government: national and local. Local government is enshrined in the constitution, as is decentralization, and the main relevant legislation is the Local Governance Act 2016 (Act 936).[12] There are 16 administrative regions, made up of 261 metropolitan, municipal, and district assemblies (MMDAs) (see figure 5). Each region and district is headed by a regional minister and district chief executive, respectively, appointed by the president. While strategic policies emanate from the central Government, political and administrative authority rests with each MMDA.

Figure 5: Administrative map of Ghana

Source: Ghana Statistical Service

Population

Ghana's population is rapidly increasing (see figure 6). The population grew from 6.7 million in 1960 to 31 million in 2021, representing a 360 per cent increase within the period. According to the Ghana Statistical Service, the population will double in 33 years and by 2050, it will be over 50 million.

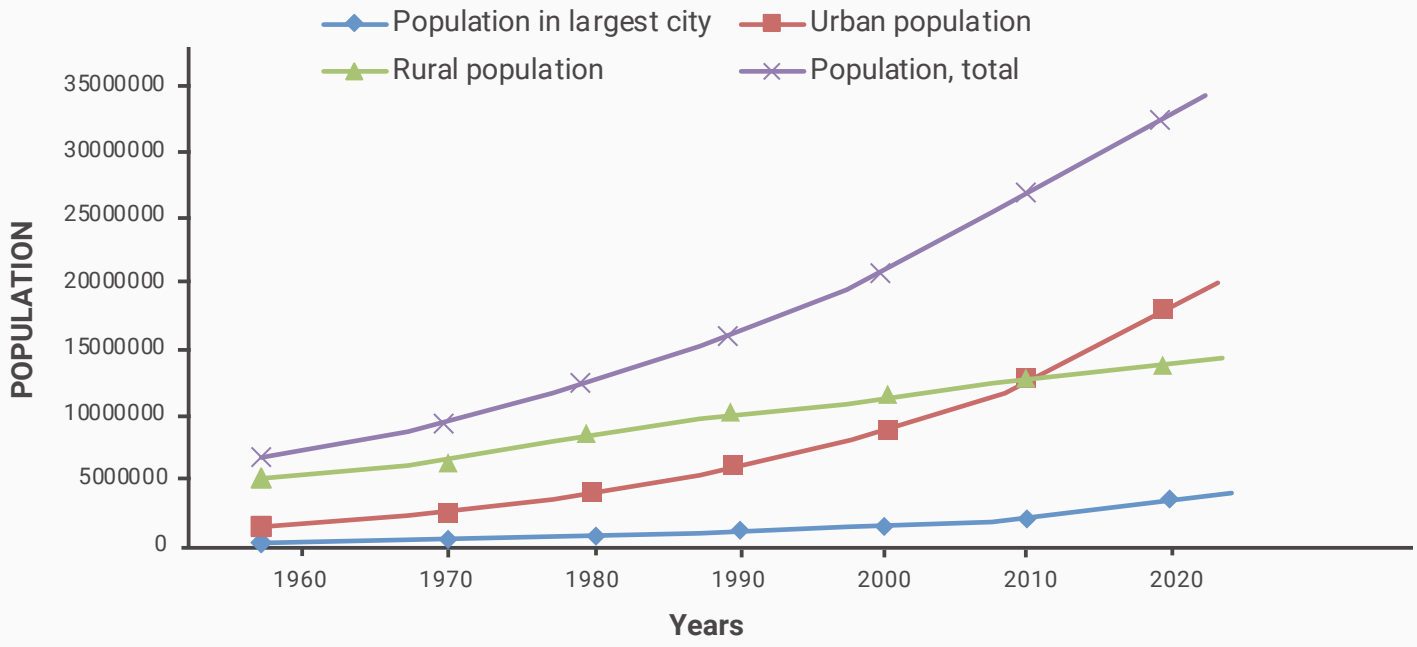
Ghana's population age structure is transitioning from one dominated by children (0 –14 years) to one dominated by young people (15–35 years). The proportion of children declined from 41 per cent in 2000 to 35 per cent in 2021, while that of young people increased from 34.6 per cent to 38.2 per cent in 2021.[13] This transition from children to young people is true for all regions and urban areas in Ghana, with Greater Accra witnessing the most pronounced change. A growing youthful population will increase demand for housing and associated infrastructure like electricity, water and roads.

Ghana's population is predominantly urban, the share of people living in urban areas is 60 per cent and is projected to reach 70 per cent by 2050. Currently, about half of the urban population, more than one quarter of the total national population, is concentrated in the cities of Accra (4.5 million inhabitants) and Kumasi (2.8 million inhabitants). The rate of urbanisation and concentration of people in the large cities is widening the housing deficit in urban and rural areas, as it is not matched by the rate of housing delivery, especially affordable housing and associated infrastructure. Ghana's current housing deficit is estimated at 1.8 million homes,[14] and about 40 per cent of the urban population reside in informal settlements that lack basic services and amenities. Rapid population increase with rapid urbanisation imply that the building of new homes to augment the housing stock will likely be sustained in the coming decades, and this will increase carbon emissions from the building sector.

Socioeconomic development

Ghana is classified as a lower-middle income country with a GDP of $216 billion, ranking 70th on the list of countries by GDP (purchasing power parity) and translating into per capita income of about $6,400 (based on PPP) as at 2022. Ghana has seen a sustained

Figure 6: Population growth dynamics in Ghana (1960–2020)



Source: Author development, UN-Habitat 2023. Based on World Bank Development Indicators.

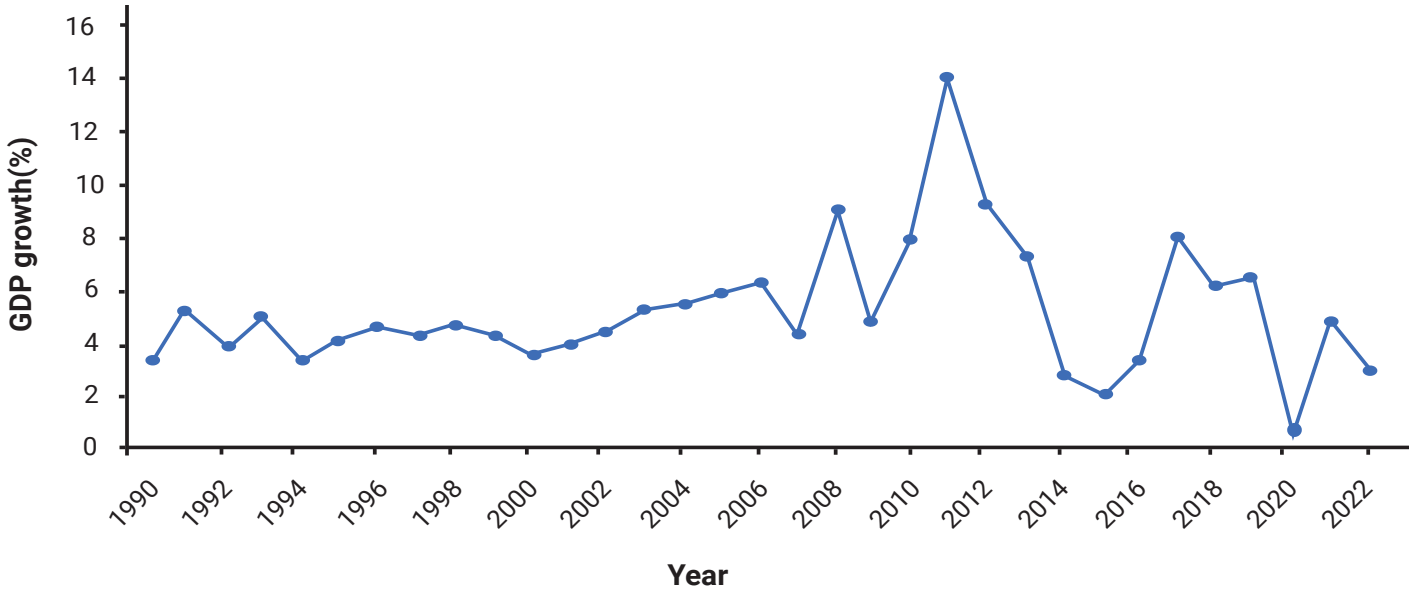
GDP growth since the year 2000, averaging a 5 per cent increase per annum (see figure 7). This sustained GDP growth is underlined by tourism, agriculture, natural resources (e.g. timber and rubber) and minerals (e.g. gold) exports and more recently oil, which was discovered in commercial quantities in 2007. In 2020, the GDP growth rate dropped to below 1 per cent as was the case for most countries during the Covid-19 pandemic. The post-pandemic GDP growth is expected to slow until after 2024, while poverty incidence is projected to worsen, reaching 34 per cent by 2025.[15]

More recently the real estate and construction sectors have emerged as some of the leading contributors to Ghana's GDP. The construction sector is worth $8 billion and accounts for about 15 per cent of the country's GDP,[16] while cement production is one of the largest industries. The construction industry employs approximately 420,000 people. Rising GDP growth in Ghana coincides with increasing household consumption expenditure as incomes improve.[17] This consumption expenditure includes household appliances like refrigerators, air conditioners and ceiling fans. Climate change and extreme temperatures will lead to increased usage of these home appliances and cooling systems and thus serve as a barrier to attaining sustainability objectives.

Environment

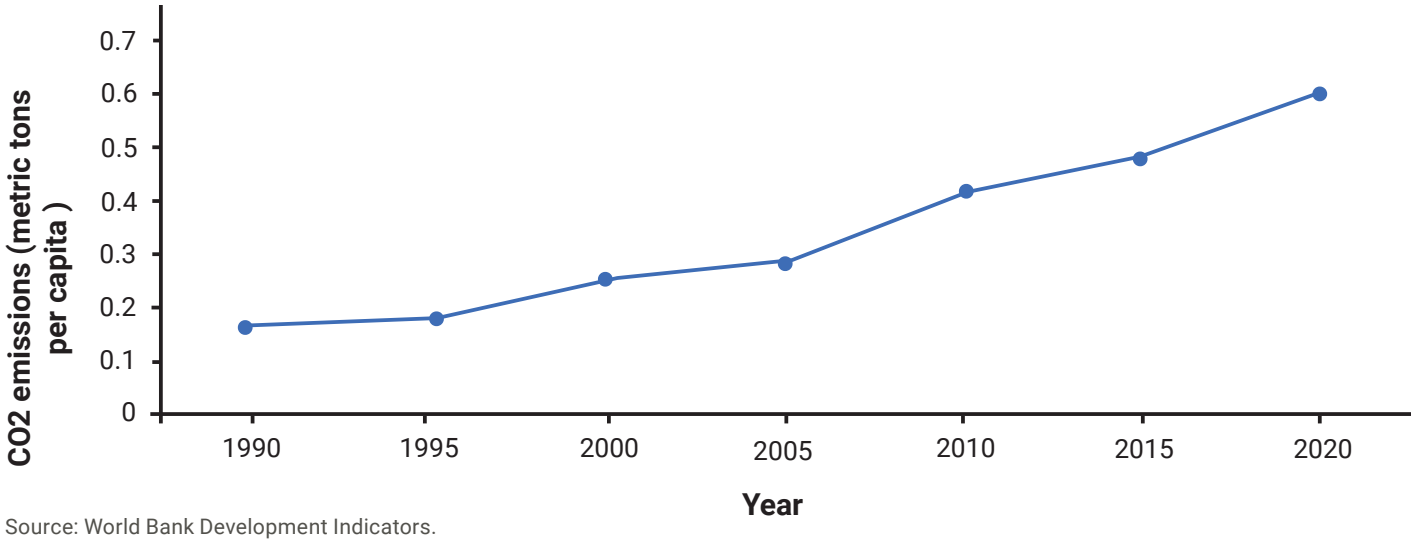
Ghana is exposed to climate hazards such as drought, wildfires, floods, coastal erosion, and heatwaves.[18'19] These hazards predominantly affect major cities in the country. The capital, Accra, is beset with perennial disruptive floods, destroying properties worth several millions of dollars and loss of human life. Between 2000 and 2012, floods in Accra killed 83 people and displaced 178,750; and the estimated cost of material damage was put at $43 million.[20] In June 2015 alone, unusually severe floods in the Greater Accra Metropolitan Area displaced 53,000 people and caused an estimated $100 million in damages.[21] Current development dynamics such as rapid urbanisation, unplanned physical development, growing coastal neighbourhoods, and declining green spaces will contribute to the density increase of people and habitation. Unless there is better spatial planning, there will be an increased number of people living in

Figure 7: GDP growth rates from 1990–2022



Source: Author development, UN-Habitat 2023. Based on World Bank Development Indicators.

Figure 8: Carbon dioxide emissions per capita



Source: World Bank Development Indicators.

areas at risk of climate-related hazards. The challenge of adapting cities to be resilient and safe for all residents is increasing with the expected rise in extreme weather events like flooding[22] in the coming decades.

In 2019, Ghana's total GHG emissions, including land use, land use change and forestry (LULUCF) were estimated to be 59.8 million tonnes (Mt) CO2-equivalent (CO2e). The 2019 emissions were 16.3 per cent higher than the 2016 levels and 139.2 per cent above 1990 levels.[23] CO2 emissions per capita rose from 0.16 tons in 1990 to 0.60 tons in 2020, representing an almost four-fold increase (see figure 8). The rising emissions trend correlates with expansion of the national economy, population growth, and deforestation.

When the total GHG emission results are disaggregated, land use, land use change and forestry (LULUCF) and agriculture became the two largest sources in 2019. LULUCF accounts for 24.3 per cent of the 2019 total estimated national greenhouse gas emissions of 59.8 MtCO2e (see table 2).[24]

Table 2: Ghana's total greenhouse gas emission for 1990–2019 categorized by sources

Sectors/ Categories	Total Emissions (MtCO2e)					Percentage change (%	
	1990	2000	2012	2016	2019	2016- 2019	1990 2019
National Emissions with LULUCF	**25.0**	**26.2**	**42.6**	**51.4**	**59.8**	**16.3**	**139.2**
National Emissions without LULUCF	**10.7**	**12.8**	**29.1**	**38.0**	**45.3**	**19.1**	**323.4**
Energy	2.9	4.1	14.9	22.4	27.3	22.1	841.4
Industrial Processes and Product Use	2.0	0.9	2.0	1.7	1.70.	0.0	-15.0
Agriculture, Forestry, and Other Land Use	19.0	19.5	22.6	23.7	26.6	12.2	40.0
Waste	1.1	1.6	3.1	3.6	4.1	13.9	272.7

Source: Environmental Protection Agency (2021).

Buildings and construction sector

Data from the Ghana Statistical Service (GSS) showed that the construction sector expanded by 14.25 per cent and 12.4 per cent (yearly) in the first and second quarters of 2021, culminating in an annual growth of 5.9 per cent in the same year. According to Ghana Investment Promotion Centre, the real estate sector recorded a 30 per cent compounded annual growth rate (CAGR) between 2016 and 2021, making it one of the fastest growing economic sectors in the country.

More recently the real estate and construction sector has emerged as one of the leading contributors to Ghana's GDP. The $8 billion construction sector, which employs some 420,000 people, accounts for about 15 per cent of the country's GDP,[25] while cement production is one of the largest industries. The Ministry of Works and Housing together with professional bodies such as Architects Registration Council, Ghana Standards Authority, The Association of Building and Civil Engineering Contractors of Ghana, Ghana Real Estate Developers Association (GREDA) and Ghana Institution of Engineering set standards for the construction of homes. Though there is a proposal to establish a regulatory body for the sector, it is yet to be passed into a law. Thus, the building and construction sector is dominated by small-scale, unregistered contractors and artisans.

Strategic priorities

The strategic priorities action area refers to the definition of vision, orientations, goals and targets and how they are formalised into strategic documents (e.g. National Development Plan), prioritized and implemented by Government entities and the private sector. Setting strategic priorities for decarbonizing the building and construction sector unlocks actions and gives a clear mandate and direction to stakeholders along the value chain, including line ministries and local governments, implement climate initiatives within the sector.

The *Ghana Updated Nationally Determined Contribution (NDC) under the Paris Agreement (2020 –2030)* covers 19 policy areas translating into 47 adaptation and mitigation programmes of action. These 47 climate actions are, among others, expected to generate an absolute greenhouse gas emission reduction of 64 MtCO2e. The NDC has the following actions directly related to buildings and construction:

- To achieve citywide resilient infrastructure planning for climate change adaptation
- To ensure a resilient-built environment
- To increase low-carbon electricity generation and promote clean rural households lighting, leading to a combined emission reduction
- To promote energy efficiency in homes, industry and commerce, leading to emission reduction

Vision and objectives

Below are the country objectives, based on NDCs and the *Long-term National Development Plan (2018–2057)* that are related to decarbonization of the building and construction sector.

Embodied and operational carbon

- Increase low-carbon electricity generation and promote clean rural households lighting leading to a combined emission reduction
- Promote energy efficiency in homes, industry and commerce leading to emission reduction

Adaptation

- Achieve citywide resilient infrastructure planning for climate change adaptation
- Build well-planned and safe communities, while protecting the natural environment

Well-being and inclusion

- Identify, develop and promote the use of sustainable local materials in building and construction
- Create an equitable, healthy and prosperous society

Current status and progress

Plan, policy, law, regulation	Strategy/ provision related to buildings and construction	Related GlobalABC objective				
						
Nationally Determined Contribution (NDC) (2021, https://ndpc.gov.gh/resource_and_publications/plans)	Promotion of energy efficiency in homes, industry and commerce, low-carbon electricity production; promotion of clean rural households lighting, access to clean cooling and scaling up renewable energy by 10% by 2030					
Long-term National Development Plan of Ghana (2018–2057), https://ndpc.gov.gh/resource_and_publications/plans	Goal one seeks to create an equitable, healthy and prosperous society while goal three aims to build well planned and safe communities, while protecting the natural environment					
Ghana National Spatial Development Framework (2015, https://www.luspa.gov.gh/media/plan/NSDF_Final_Report_-_Vol_I_Final_Edition_TAC.pdf)	Pillar 5: Ensure sustainable development and protect ecological assets					
National Housing Policy (2015, https://www.mwh.gov.gh/wp-content/uploads/2018/05/national_housing_policy_2015-1.pdf	Identify, develop and promote the use of sustainable local materials in building and construction Upgrade existing slums and prevent the occurrence of new ones					
Land Use and Spatial Planning Act (2016, https://luspa.gov.gh/wp-content/uploads/2023/11/ACT-925-LUSP.pdf	Section 46 mandates the preparation of spatial plans at all levels, i.e. national, regional and local					
National Adaptation Plan (NAP) https://faolex.fao.org/docs/pdf/gha189992.pdf	The objective is to clarify the country's approach to its NAP process, align the process with existing policies, strategies, programmes and adaptation research and serve as a basis for stakeholder engagement					
Renewable Energy Act (2011, https://www.energycom.gov.gh/files/RENEWABLE%20ENERGY%20ACT%202011%20(ACT%20832).pdf	It provides for the development, management, utilisation, sustainability, adequate supply of renewable energy for generation of heat and power					

Challenges and opportunities

Several laws, policies, plans and policy frameworks can be utilised to reduce emissions in the building and construction sector in Ghana, but there are still some ongoing challenges. They are the following:

Access to funding to implement climate actions remains one of the biggest obstacles to achieving the NDC.[26] Currently, much of the Government's climate adaptation and mitigation measures are supported by donor and bilateral funds. The Government is also seeking partnership with the private sector to invest in climate resilient infrastructure projects.[27] The difficulty with external support and private sector funding for climate adaptation and mitigation is that this is unsustainable overtime and that partners dictate conditions related to specific sectors and scale. Therefore, there is limited action and funding support for decarbonizing the building and construction sector.

The NDC could also benefit from clearly defined and measurable building and construction sector targets.

Lack of coordination among State agencies and limited capacities remain an impediment to ensuring sustainability in the building and construction sector. There is lack of vertical (e.g. between different levels of governance) and horizontal (e.g. across sectors) coordination and policy coherence that would ensure incorporation of all dimensions of sustainability in development plans, policies and programmes.[28] Second, the local governments, which have jurisdictions over land use, housing development and construction, do not have adequate logistics, personnel and know-how to carry out their physical control development functions, particularly ensuring the inclusion of low-carbon materials in building and construction and development of affordable housing. There is opportunity to revise the curricula of built environment programmes such as architecture and building technology to include low-carbon building materials.

A disconnection between research and policies. Currently, a lot of quantitative and qualitative information is generated by academia, yet there is no coordinated effort to ensure synergies between this information and policies.

Absence of disaggregated data to identify patterns and trends at the local level. GHG emissions from the construction sector are reported in Ghana's Fifth National Greenhouse Gas Inventory,[29] although not well disaggregated to inform voluntary local reviews of local governments.

The performance and gaps of Ghana's strategic priorities relative to the GlobalABC objectives and the seven enabling domains is shown in figure 9.

The way forward

Actions to tackle the challenges identified under the strategic priorities have been embedded in the spatial planning and urban development, new and existing buildings, and construction supply chain action areas. This was done to avoid repetition and streamline the activities across all action areas.

Figure 9: Strategic Priorities - Performance of the 7 enabling domains

Source: Authors, UN-Habitat-Ghana.

Spatial and urban development

Current status, projections and progress

Embodied carbon

Urban development in most Ghanaian cities is characterized by sprawl, low-density building, and isolated structures with varying densities from the Central Business District. Densities are highest in these districts, while sprawl predominates the outskirts of cities. Most rural settlements in Ghana evolve organically with no central planning and are sprawl linearly along main roads.

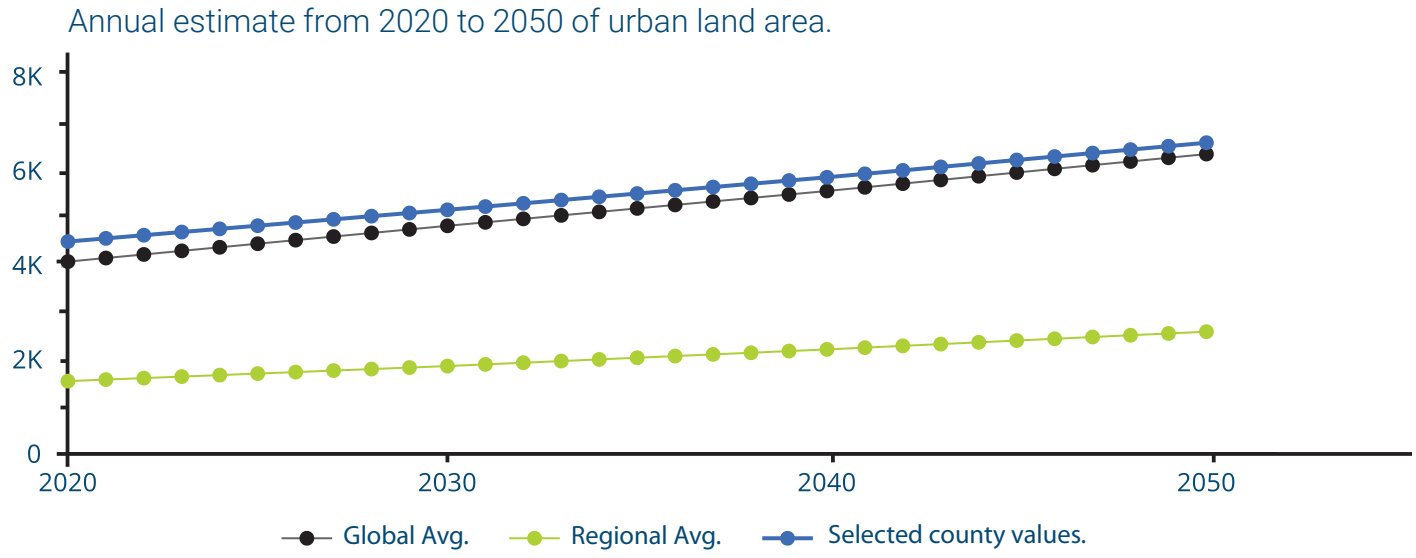
Analysis of data from the Global Human Settlement Layer shows that the average annual growth in built-up area between 1990 and 2020 was 2.75 per cent. This is just above the typical yearly growth rate of population of 2.5 per cent during that time frame. Population growth and urbanisation are the main factors behind the significant increase in development in Ghana. Ghana's urban population grew from 15 per cent in 1950 to 31 per cent in 1980, and shot from 44 per cent in 2000 to 60 per cent in 2024. Projections of urban land area and urban population density up to 2050 are shown in figures 10 and 11.

Presently, the most common housing in the country is the detached (standalone house), making up 63.3 per cent.[30] This type of housing is most common in rural areas (77 per cent) compared with urban areas (54 per cent). Inadequate staffing, budgetary constraints, limited planner capacity at the MMDAs, and the land tenure system have hampered effective spatial planning and enforcement.

Operational carbon

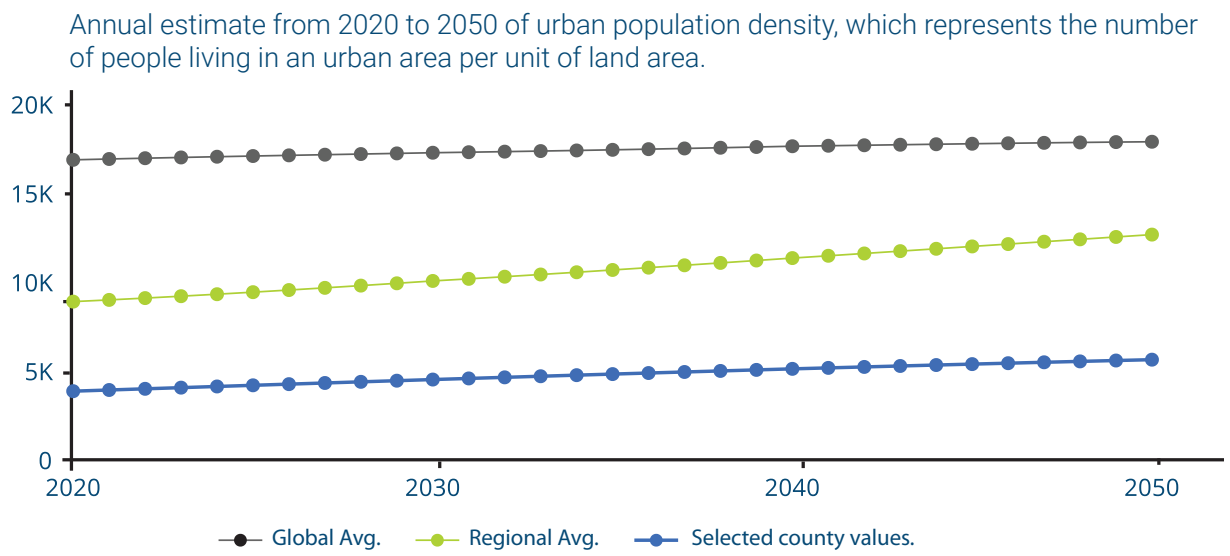
Overall access to electricity in Ghana in 2021 stood at 87.[31] While this figure is significantly higher than the average of 50.6 per cent in Africa south of the Sahara, spatial disparities persist in terms of access to electricity across Ghana. The World Bank Development Indicators show that in 2021, the percentage of the population with access to electricity in rural areas

Figure 10 Urban land areas in Ghana and projected trend to 2050



Source: GlobalABC Gap Analysis & Projections.

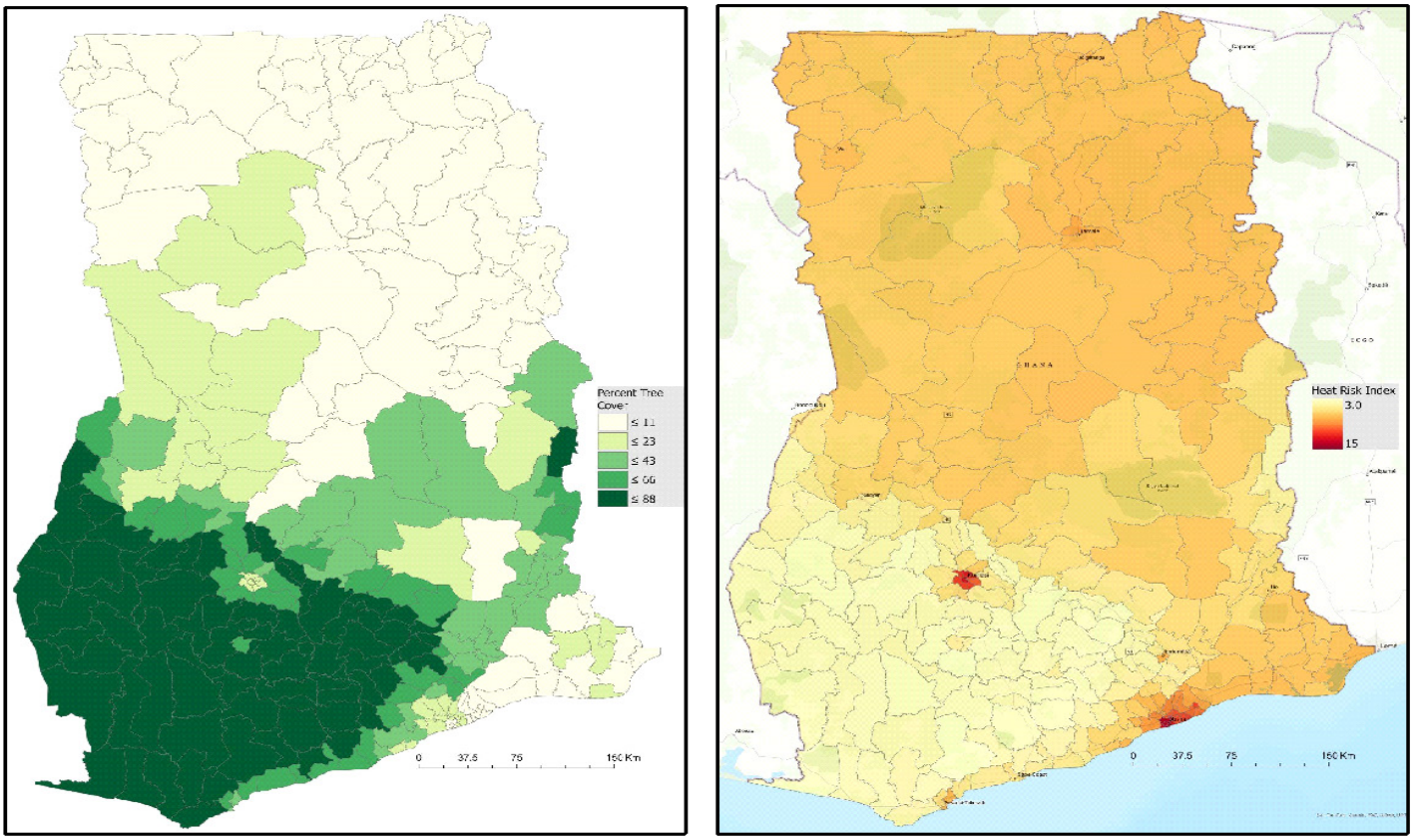
Figure 11: Urban population density in Ghana and projected trend to 2050



Source: GlobalABC Gap Analysis & Projections.

was less (74 per cent) than urban areas (95 per cent). Examination of tropical tree cover data from Global Forest Watch indicates that 77—a third of the 261 MMDAs, mostly in northern Ghana and some parts of Greater Accra Region—have tree coverage of less than 10 per cent of their total land area. This is significantly lower than the recommended planning standard of at least10 per cent. In addition, more than half (52 per cent) of the MMDAs have less than 30 per cent of their total areas covered by tree cover (see figure 12a). Built up surface, including increasing use of concrete pavements as against grass, and the absence of tree cover, tends to increase land surface temperatures. By combining per cent tree cover, population density and per cent of built surface, figure 12b shows the districts at risk of extreme heat. It shows that much of the districts in northern and eastern Ghana, together with the nation's two largest cities (Accra and Kumasi) are at greatest risk of extreme heat. While the zoning guidelines mandate developers to reserve 10 per cent of the development area as green space, this requirement is not considered during vetting of building permits applications. Similarly, few green or open spaces are reserved in local plans. In cases where provisions are made for green spaces, they are later rezoned for commercial and residential use, sometimes with limited appreciation of implications for climate change.

Figure 12: Per cent tree cover by districts (left – 12a), and heat risk (right – 12b)



Source: Author development, UN-Habitat 2024. Based on tropical tree cover data from Global Forest Watch.

Adaptation

Ghana is highly vulnerable to climate variability and change, which continues to pose a threat to urban areas, particularly. Rising sea levels, higher temperatures and erratic rainfall negatively impact infrastructure and disrupt livelihoods. Climate change has resulted in perennial disruptive flooding in major cities, destroying several million dollars' worth of property and leading to loss of human lives (see figure 13).

Approximately one fourth of the population lives along the coast in rapidly expanding urban areas like Accra, and is especially vulnerable to flooding and waterborne diseases.[32] Average annual temperatures in Ghana are predicted to increase between 1.4°C and 5.8°C by 2080, with the greatest increases in the north.[33, 34] Climate change is expected to increase the risks and impacts associated with flooding and extreme heat. These impacts will be significant in slums, which are densely populated, situated in high-risk areas, and lack access to basic amenities such as water, electricity and green spaces. The frequency of extreme weather events such as flooding in the coming decades amidst rapid urbanisation presents a challenge for adapting cities to become resilient, while at the same time being safer for all residents.

Figure 13: Share of Ghana's population affected by natural disasters between 2020 and 2022

2.6 Population affected by natural disaster in the last three years (% of the national population)

0.12%

-3.37% from Global avg

Source: GlobalABC Gap Analysis & Projections.

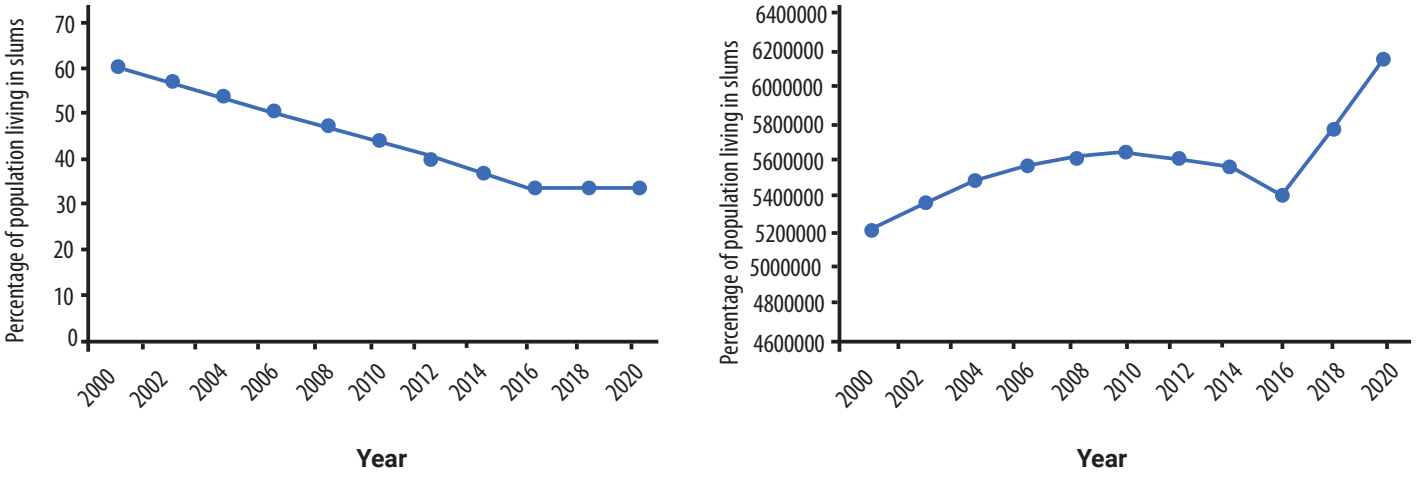
Well-being and inclusion

At the turn of the 21st century, the proportion of urban population living in slums has been declining, from 60 per cent in 2000 to 34 per cent in 2020 (see figure 14). In absolute terms, however, the number of people living in slums in urban areas increased from 5.2 million in 2000 to 6.2 million in 2020. There are currently 23 slums across the country 11 of which are in the Greater Accra Region.[35] With the share of people living in urban areas projected to reach 70 per cent by 2050, the number of people living in slums is expected to increase. The rapid expansion of slums is linked to destruction of open spaces, the natural environment, and deteriorating environmental quality. Rapid unregulated building construction is leading to encroachment on wetlands, eroding biodiversity and the multiple ecosystem benefits they provide.[36]

Challenges and opportunities

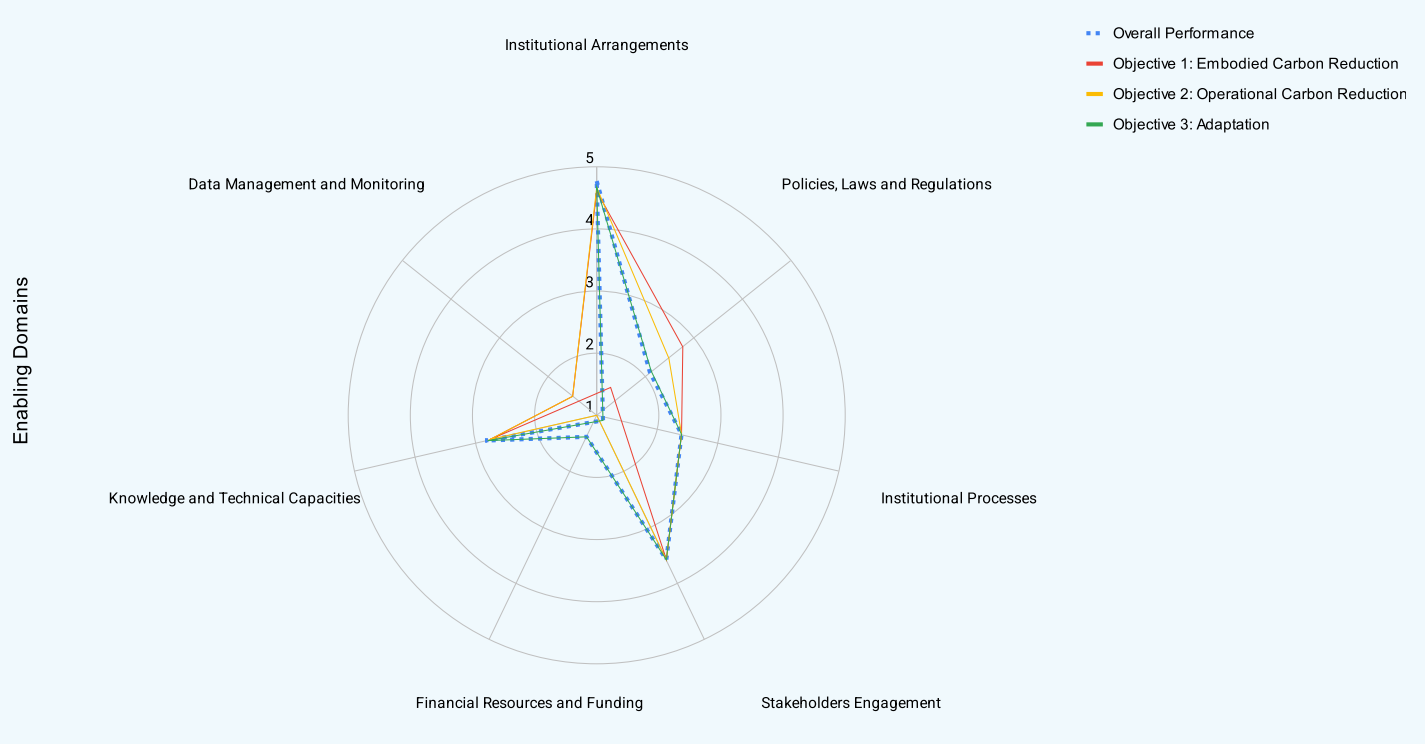
Urban development is characterized by sprawl, low-density, and isolated buildings, leading to destruction of the natural environment and compromising its carbon sequestration potential. While the baseline assessment also revealed the manifestations of climate change across urban areas in Ghana, slums and vulnerable communities are highly susceptible to climate change impacts like flooding and extreme heat. Rapid urbanisation and unguided urban growth, non-existence of Spatial Development Frameworks for most MMDAs, non-compliance with spatial planning guidelines and zoning regulations, and poor landownership and administrative structures are some of the complexities faced in adapting cities to climate change. Other challenges include the absence of a comprehensive nationwide land-use data for monitoring urban development and limited focus on climate change issues in urban planning,[37] partly because of the inadequate abilities of professional planners to identify, quantify and plan for climate change risks.

Figure 14: Percentage of population living in slums (% of urban population) (left), and urban population living in slums (right)



Source: Author development, UN-Habitat 2024. Based on World Bank Development Indicators.

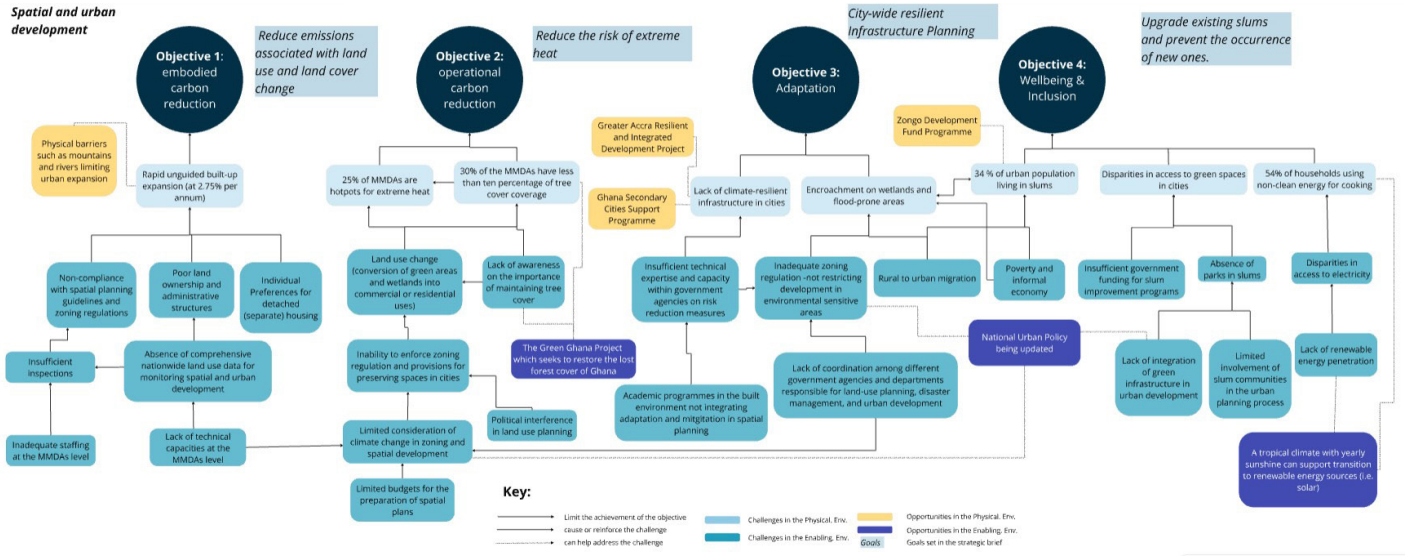
Figure 15: Spatial and urban development - Performance of the 7 enabling domains



Some opportunities include the Updated National Urban Policy, which contains some actions for climate change mitigation and adaptation, the Land Use and Spatial Planning Act, 925 (2016), which mandates all MMDAs to prepare Spatial Development Frameworks (SDFs) to guide urban development, and the Green Ghana Project, which seeks to restore Ghana's lost forest cover and to contribute to the global effort to mitigate climate change. With a tropical climate with yearly sunshine, particularly in northern Ghana, a transition to renewable energy sources (that is solar) would enhance access to electricity while reducing carbon emissions as contained in Ghana's NDC.

The performance and gaps of Ghana's spatial and urban development relative to the GlobalABC objectives and the seven enabling domains is shown in figure 15, and a diagram with the main problems in this area and their root causes is displayed in figure 16.

Figure 16: Problem tree



Source: Authors, 2024.

The way forward

Goals and targets

The goals and targets pertaining to spatial planning and urban development are tailored to reducing carbon emission while promoting adaptation. The main areas of intervention are land consumption, exposure to extreme heat and climate-resilient infrastructure. Specific interventions and targets were developed to help achieve the defined objectives.

Effect on	Country Strategic Goals	Outcomes	Baseline	2030 Target	2040 Target	2050 Target
Embodied carbon 	Reduce emissions associated with land use and land cover change	Reduced land consumption rate	Annual built area expansion at the rate of 2.75 per annum	Annual built expansion rate reduced to 2% per annum	Annual built expansion rate reduced to 1% per annum	Annual built expansion rate reduced to under 0.5% per annum
Operational carbon 	Reduce the risk of extreme heat	Reduced per cent of MMDAs at risk of extreme heat	25% of MMDAs are hotspots for extreme heat	Per cent of MMDAs at risk of extreme heat reduced to 20%	Per cent of MMDAs at risk of extreme heat reduced to 15%	Per cent of MMDAs at risk of extreme heat reduced to under 10%
		Increased percentage of tree cover in MMDAs	30% of MMDAs have less than 10% of their area covered by tree cover	25% of MMDAs have less than 10% of their total area covered by tree cover	20% of MMDAs have less than 10% of their total area covered by tree cover	10% of MMDAs have less than 10% of their total area covered by tree cover
Adaptation 	Citywide resilient infrastructure planning	Climate-resilient infrastructure developed in cities	Not available	Develop resilience standards for critical infrastructure systems (water, energy, transport) to withstand projected climate change impacts	Integrate resilience standards into national and local building codes	70% of new infrastructure in all major cities are designed and implemented be climate-resilient
		Reduced encroachment on wetlands and flood prone areas	No digital land-use data available at the subnational level	Map all wetlands and flood-prone areas starting with the metropolitan areas	All MMDAs have digital database of all wetlands and flood-prone areas to guide issuance of development permits	Zero net loss of wetlands and flood-prone areas through the integration of comprehensive digital land-use databases, enforcement of development controls, and the promotion of restoration initiatives across all MMDAs

Prioritized actions

To achieve the objectives stated in the way forward, the following actions were identified along with their timelines and responsible actors.

Effect on	Country Strategic Goals	Outcome	#	Name of action	Short	Med	Long	Leading actor	Other actor
Embodied carbon 	Reduce emissions associated with land use and land cover change	Reduced land consumption rate	1	Prepare spatial plans for all regions and districts that includes the establishment of growth urban growth boundaries, preservation of areas and towns of historical importance and creation of low-carbon districts				Land Use and Spatial Planning Authority	Regional coordinating councils; metropolitan, municipal, and district assemblies (MMDAs); National Development Planning Commission (NDPC), Lands Commission
			2	Revise zoning guidelines to include requirements for low-carbon building zones				Land Use and Spatial Planning Authority	MMDAs, Parliament of Ghana
			3	Develop a national digital land-use database to track spatial and urban development				Land Use and Spatial Planning Authority	
			4	Develop technical capacities of built environment professionals at the MMDAs in low-carbon development to undertake effective planning and management of human settlements				Ministry of Works and Housing	Ministry of Local Government, Decentralization and Rural Development
Operational carbon 	Reduce the risk of extreme heat	Reduced per cent of MMDAs at risk of extreme heat	5	Develop guidelines for integrating climate change adaptation and mitigation in zoning and spatial development plans, including measures to reduce urban heat island effect, and provision of green and blue infrastructure				Land Use and Spatial Planning Authority, NDPC	MESTI, EPA, MMDAs
Adaptation 	Citywide resilient infrastructure planning	Climate-resilient infrastructure developed in cities	6	Conduct comprehensive assessment and profiling of cities to determine potential threats and vulnerabilities				Ministry of Local Government, Decentralization and Rural Development	Ministry of Works and Housing, Ghana Hydrological Authority, NADMO
		Reduced encroachment on wetlands and flood-prone areas	7	Enforce zoning regulations, Act 925, Act 936, and L.I. 1652, to restrict development in environmental sensitive areas				MMDAs	EPA, Water Resources Commission

Existing buildings

The existing buildings action area is a snapshot of Ghana's current building stock. This action area focuses on existing building management, maintenance, renovation, decommissioning and recycling and actions to reduce carbon emissions, increase climate adaptation, while fostering well-being and inclusion.

The emphasis on overcoming developmental challenges, and ensuring governance continuity has shifted attention from investing adequate resources for successful housing provision, especially for low- and middle-income groups in dire need.[38] This, in effect, has led to Ghana experiencing numerous setbacks in providing affordable public housing.[39] Despite this, the number of housing units has increased nearly three-fold (2.6 times) since Ghana's first population and housing census.

A large proportion of the existing buildings in Ghana lack sustainable design features and technologies, resulting in high-energy consumption, which contributes to increased carbon emissions and negatively impacts climate mitigation efforts. According to the 2022 national energy statistics published by the Energy Commission of Ghana, the reliance of buildings on the conventional grid for power resulted in an increased peak load of 3246 MW in 2021, a 178 per cent jump from the 2000 peak load of 1161 MW.[40]

Current status, projections and progress

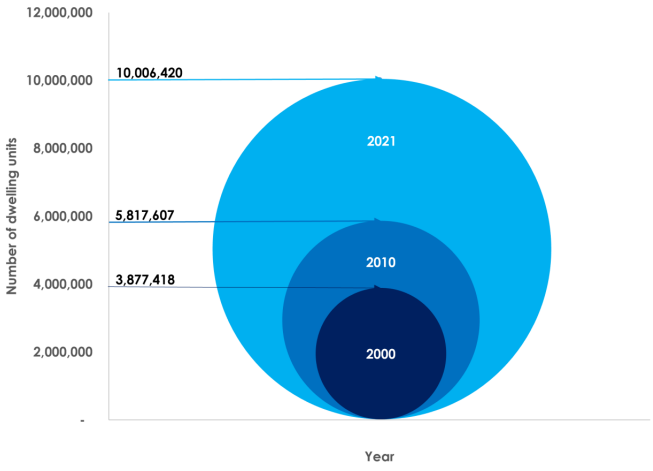
Embodied carbon

The rate of urbanisation and the concentration of population in large cities are increasing, outpacing the rate of housing delivery, particularly in terms of affordable housing and infrastructure for the urban poor.[41]

Evidence of this disparity can be seen in the substantial shortage of housing, exacerbated by the presence of informal settlements where 40 per cent of city dwellers live without basic services or amenities.[42]

According to the Ghana Statistical Service (GSS),[43] the number of dwelling units stood at 10,006,420 in 2021 from 2,000,000 in year 2000 as indicated in figure 17. Ghana's housing stock is dominated by detached housing typology (63%)[44] even though detached housing is associated with the highest carbon footprint among all other typologies.[45]

Figure 17: Number of dwelling units, 2000–2021



Source: Ghana Statistical Service (GSS), 2021.

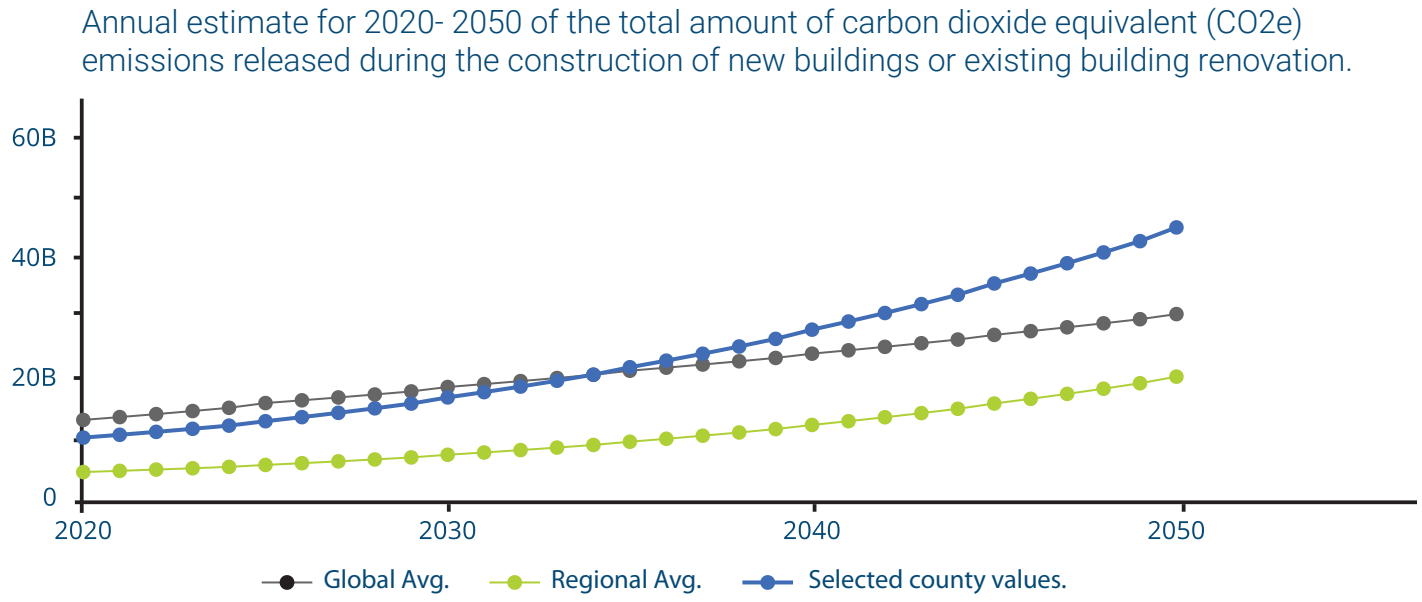
Data on the level of energy consumed and environmental monitoring emissions are fragmented and uncoordinated. This lack of coherent and consistent data regarding energy usage makes it difficult to assess the entire energy footprint of buildings in Ghana. This poses difficulties for mitigation, adapting to, and inclusive management of all aspects of buildings throughout their lifespan. The National Building Regulations 1996, (LI 1630),[46] the Ghana Building Code (GhBC) GS 1207:2018[47] and the Local Government Law - (Act 462)[48] have several parts that guide the development processes of the lifespan of buildings, yet the enforcement of building codes and regulations remains formidable. Compliance with construction standards is not systematically tracked, and penalties for non-compliance are inconsistently applied. This leads to substandard retrofitting designs, construction with potential safety risks. The complexity of permit procedures, requiring approvals from multiple agencies, also deters formal compliance and encourages informal construction. Retrofitting existing buildings for energy efficiency faces additional hindrances as current policies do not adequately support energy-efficient renovations or require lifespan assessments.

Figure 18 shows the annual estimate from 2020 to 2050 of the total amount of carbon dioxide equivalent (CO2e) emissions released during the construction of new buildings or the renovation or retrofitting of existing buildings. The data demonstrates that, if construction methods in Ghana remain unchanged, the country, which is currently higher than the regional average, could exceed the global average by 2034, in under a decade.

Operational carbon

Ghana's residential sector alone accounts for 38.9 per cent of the total final energy consumption (Energy Commission, 2021),[49] see figure 19. With the energy production in Ghana heavily reliant on non-renewable sources, such as natural gas, crude oil and diesel, which contribute highly to the country's carbon emissions, there is an increased reliance on thermal generation. This reliance is evidenced by a declining proportion of renewable energy in the total supply, which has implications for the country's efforts to mitigate climate change and adhere to international agreements aimed at reducing carbon emissions.

Figure 18: Embodied carbon in Ghana's building stock



Source: GlobalABC Gap Analysis & Projections.

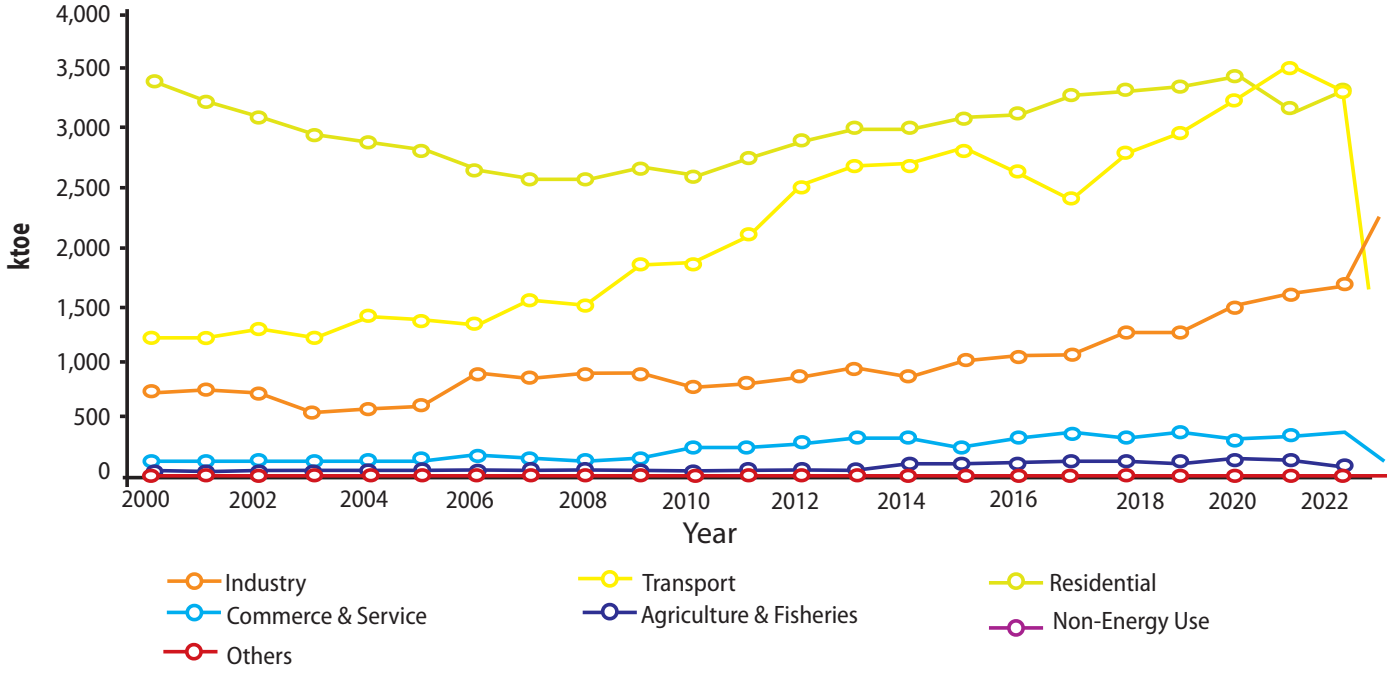
This is indicative of the fluctuation in the proportion of renewable sources over the years, with a decline from 52 per cent in 2012 to 38.7 per cent in 2022, underscoring the importance of strategic planning and policy interventions to promote sustainable energy development. Policies that incentivize investment in renewable energy infrastructure, such as solar and wind power, could help reverse this trend and contribute to a more sustainable energy landscape.

In Ghana, cooling systems account for a significant portion of building energy consumption. According to Ghana's Energy Commission, an evaluation of energy-efficiency policy measures for cooling appliances in Ghana between 2010 and 2020 identified **cooling appliances (refrigerators, freezers and non-ducted single split air conditioners) as the most electricity-consuming appliances in the residential sector** (31.5–36.5 per cent).[50] Whilst refrigerators and freezers consume averagely 25–30 per cent of the total electricity in the residential sector, air conditioners, on the other hand, consume 6.5 per cent. Figure 20 shows the annual estimates of carbon dioxide equivalent (CO2) emissions from the operation of buildings in Ghana.

Though the country has begun promoting passive design strategies in existing buildings to promote energy efficiency, many older buildings lack proper insulation and weatherproofing, resulting in heat gain or loss. Retrofitting is expensive because people tend to choose cement and metal sheets over more affordable, local materials, despite the fact that these materials can greatly decrease energy consumption and expenses.

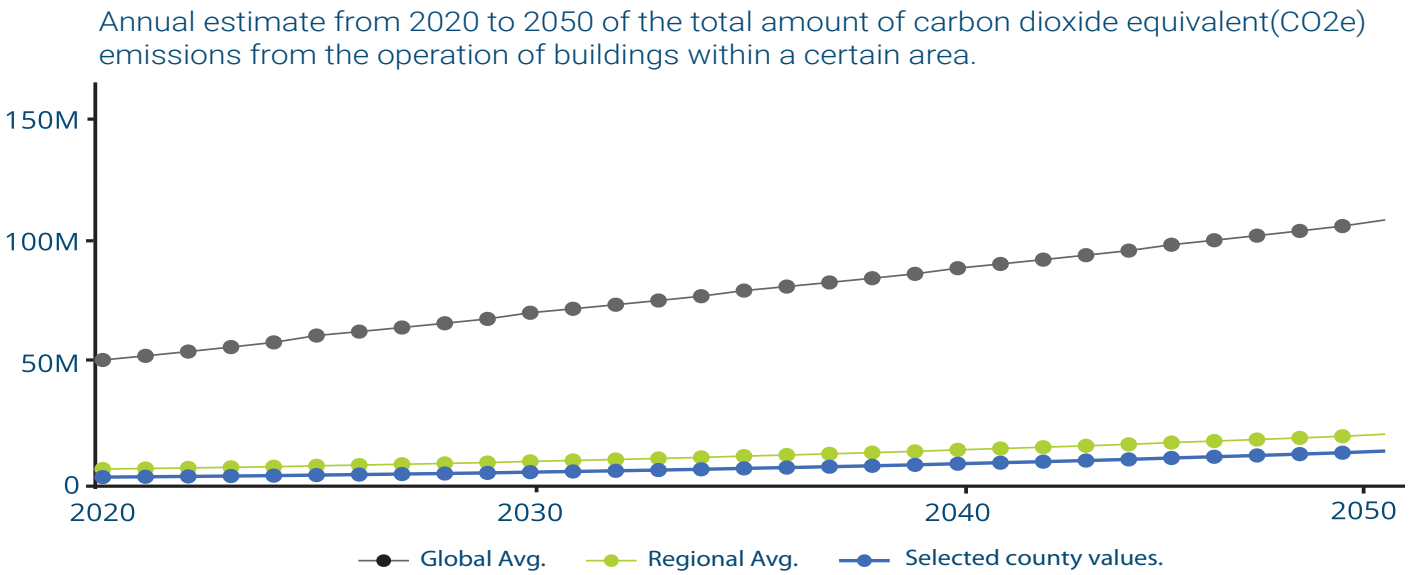
The Energy Commission also operates a Mandatory Appliance Standards and Labelling regime,[51] under which importers and retailers of room air conditioners are required to import and sell only products that meet minimum efficiency and performance criteria approved by the Ghana Standards Board. The minimum energy-efficiency norm for air conditioners acceptable in Ghana is an energy efficiency ratio (EER) of 2.8 watts of cooling per watt of electricity input. This is equivalent to 9.55BTU/W. However, air conditioners with a of 3.5W ratio and above are on the market.

Figure 19: Total energy consumption by sector



Source: National Energy Information Repository.

Figure 20: Operational carbon in Ghana's building stock



Source: GlobalABC Gap Analysis & Projections.

Adaptation

Several characteristics of Ghana's existing building stock impair their resilience to climate impacts like floods and heatwaves. Most residential buildings are constructed with single-layer techniques using cement blocks or clay brick walls with corrugated iron sheet roofs. While these materials are locally available and cost-effective, they provide little insulation against rising temperatures. Retrofitting buildings to meet modern standards of energy efficiency is often hindered by financial challenges, a poor maintenance culture, and an overall resistance to change.[52]

Ghana's Building Code, GS1207 of 2018[53] stipulates standards that promote building resilience, occupant health and well-being. However, developers and private building owners do not always comply with these codes when building. Additionally, municipal and district assemblies lack the logistical capacity to enforce these requirements. There is often a high incidence of the use of inappropriate materials and wrong construction techniques during construction design and implementation, leading to these buildings' inability to last very long and increasing their susceptibility to climate impacts.

The vulnerability of a building to climatic impacts and its effect on the environment depend on the type of materials used. The use of materials like cement blocks, concrete, and steel can lead to carbon emissions, while materials like clay bricks and corrugated iron sheets can absorb heat during the day and release it at night. Non-compliance with building standards results in susceptibility to damage, health and safety risks from poor indoor environments, and human-induced disasters like flooding.

Ghana's *National Adaptation Plan (NAP) 2018* provides a framework to guide the country in developing, coordinating and implementing its NAP process. The efforts of NAP are expected to affect decisions on renovations, retrofitting and affordable housing delivery, especially capacity gaps and weaknesses in housing provision tailored towards women, youth and persons with disability.[54]

Frequently, inappropriate materials and incorrect techniques are used in construction design and implementation, resulting in buildings with a short lifespan and being more vulnerable to climate impacts. The materials and components used in a building influence its susceptibility to weather-related damage and its environmental impact.

Well-being and inclusion

Housing in Ghana is generally not considered affordable for the majority of people. According to the Ghana Statistical Service, average monthly rent as a percentage of total household income exceeds 30 per cent for most Ghanaians. The country needs at least 100,000 housing units annually, while supply is estimated at 35 per cent of the total need.[55]

Many residential buildings are single-story structures that often lack essential accessibility features like ramps, support rails, wheelchair-accessible restrooms, and multi-story buildings without elevators. The National Council on Persons with Disability has produced national standard accessibility designs to guide builders and service providers to remove barriers impeding universal accessibility.

In terms of inclusion, Ghana's Disability Law, Act 715 enacted in 2006[56] presented a 10-year moratorium at the end of which buildings must be retrofitted to accommodate persons with disability (PWDs). Almost a decade after the expiration of the moratorium however, existing buildings in Ghana still present accessibility issues for the disabled.

Despite these efforts, up to 80 per cent of public buildings surveyed by the National Disaster Management Organization failed to meet Ghana's accessibility standards.[57]

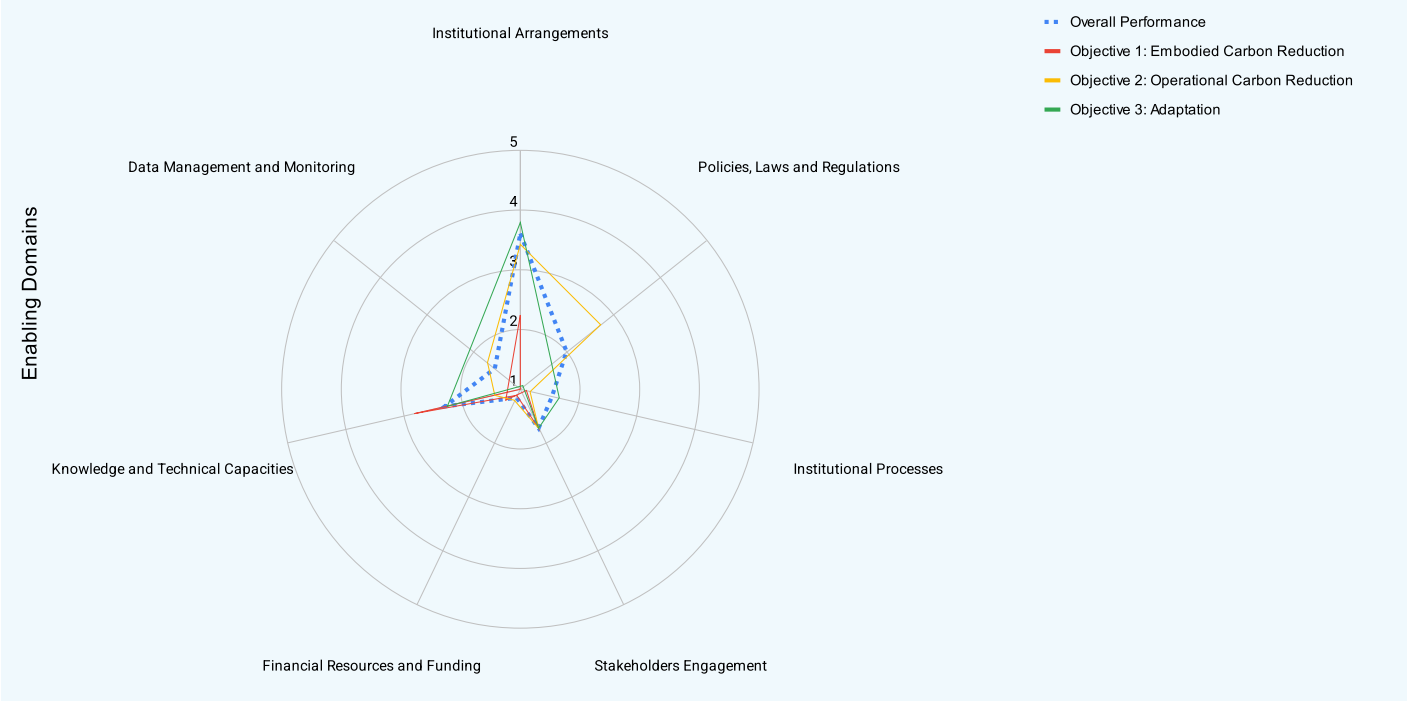
Residents with mobility challenges may become socially isolated due to inaccessible community spaces and services within buildings.

Challenges and opportunities

There are a number of challenges impeding the uptake of sustainable and environmentally friendly buildings. For example, despite the increasing attention attached to construction site waste management,[58] it was found out that this does not feature in most construction activities in Ghana. Despite the global concern, the issue is quite nascent among stakeholders, and it is a challenging task to construct sustainable buildings within certain thresholds. In a virtual workshop for new and existing theme group stakeholders in Ghana's baseline assessment, certain stakeholders in the construction industry did not show much interest in the sustainability of buildings. It is worthy to point out that there are some clients willing to consider this, but they belong to the minority. It was disclosed that there is minimal client interest in sustainable construction, which fails to inspire industry stakeholders.[59] In Ghana, enforcing regulations within the construction industry is made more challenging.[60] The lack of proper planning and execution of adoption strategies and methods in the industry is negatively impacting the growth of the green building market.[61] This situation is worsened by lack of understanding and knowledge of building sustainability. For example, in Ghana, when it comes to building energy efficiency, most clients lack awareness of the advantages and show no interest in learning or requesting such information.[62] Many false beliefs about the benefits of green building exist due to a limited understanding of the concept. Moreover, there is no Government policy or fiscal incentive to drive the initiative. There are no Government incentives to promote stakeholder involvement in sustainable construction. Figure 16 shows the performance of embodied carbon, operational carbon and adaptation across the seven enabling domains.

Despite these significant challenges, there are a number of opportunities that exist with regards to retrofitting buildings to be sustainable. Ghana's climate holds the potential for renewable energy generation towards achieving net zero energy.[63] The study showed the potential of passive design strategies such as natural ventilation, sun shading, daylighting and envelope tightness in reducing the total energy demand by up to 50 per cent. Despite this, it is worthy to point out that most existing residential buildings are designed to be operated without any artificial cooling (HVAC system). It is important to state that upgrading existing buildings through retrofitting can significantly enhance their energy efficiency. Raising of awareness about how buildings are being used can help tackle the problem of energy wastage in buildings. Ghana's housing profile is being revised and pointers from the update can be picked to improve the parameters that will be used during the next Ghana Living Standards Survey. Targeting public and private academic institutions in the built environment sector and funding research and development projects on decarbonisation and adaptation to climate change through retrofitting existing buildings can be harnessed.

Figure 21: Existing Buildings - Performance of the 7 Enabling Domains



Source: Authors, UN-Habitat-Ghana.

The way forward

Goals and targets

The goals and targets pertaining to the existing building action area are tailored to reducing carbon emission, promoting energy efficiency in homes while ensuring adaptation. Specific interventions and targets were developed to help achieve the defined objectives.

Effect on	Country Strategic Goals	Outcome	Baseline	2030 Target	2040 Target	2050 Target
Embodied carbon 	Develop a circular building supply chain that integrates low-carbon materials into the life-cycle assessments of existing buildings	Reduced dependency on cement and metal sheets as main retrofitting and renovation materials	Cement/concrete/ sandcrete/ shotcrete masonry building material is the de facto material in urban areas (82%) and representing close to 40% in rural areas	Rate of cement and metal sheet use as the main materials for outer walls in existing retrofit and renovation of public buildings reduced to 60%	Rate of cement and metal sheet use as the main materials for outer walls in existing retrofit and renovation of public buildings reduced to 50%	Rate of cement and metal sheet use as the main materials for outer walls in existing retrofit and renovation of public buildings reduced to 40%
Operational carbon 	Promotion of energy efficiency in homes, industry and commerce (NDC)	Increased usage of solar and other sustainable energy options in existing buildings	- Energy Commission of Ghana's Mandatory Appliance Standards and Labelling regime. - The National Rooftop Solar Programme aimed at installing 200.000 solar PV panels and reducing peak load (lighting load) up to 200MW in the medium term	Upscale the Capital Subsidy Scheme under the National Rooftop Solar Programme to increase the number of households from 200,000 to 1,000,000 and give subsidies for compliant producers and suppliers to the Mandatory Appliance and Labelling Regime	Upscale the Capital Subsidy Scheme under the National Rooftop Solar Programme to increase the number of households from 1,000,000 to 3,000,000 and give subsidies for compliant producers and suppliers to the Mandatory Appliance and Labelling Regime	Upscale the Capital Subsidy Scheme under the National Rooftop Solar Programme to increase the number of households from 3.000.000 to 10.000.000 and give subsidies for compliant producers and suppliers to the Mandatory Appliance and Labelling Regime

Adaptation 	Promote development of resilient building	Increased resilience of existing buildings	Not available	Update the Building Code to meet local and international standards and specifications, e.g. Section 13.6, Part 14 and Part 37 of Ghana's Building Code (GS 1207:2018) that covers building material emissions and pollutant control	Ensure enforcing through adequate publicity of conditions of Ghana's Building Code (GS 1207:2018): Sections 13.6, Part 14 and Part 37 during design and implementation to become common knowledge across the building sector for all existing buildings	Enforce the relevant sections of the Building Code during design and implementation of resilient buildings
		Increased climate resilient features in retrofit or renovation	Not available	Develop resilience standards into retrofitting or renovation designs for existing buildings to withstand the local climatic conditions and mandate MMDAs to enforce these standards	Ensure all 80% of public and 50% of private existing buildings to be retrofitted or renovated follow and meet the climatic resilient requirements of the standards	Ensure all 100% of public and 80% of private existing buildings to be retrofitted or renovated follow and meet the climatic resilient requirements of the standards
Well-being and inclusion 	Develop retrofitting programmes that present an opportunity to upgrade buildings to improve compliance with accessibility codes	Increased adoption of accessibility features in existing buildings, e.g. exterior ramps, widened pathways	According to NADMO, public buildings surveyed have only 20% with accessibility features, despite Ghana's Disability Law, (Act 715), 2006 and Ghana Standard Accessibility Designs (GSAD) having guidelines that mandate individuals and corporate bodies involved in designing, implementing, and supervising building projects to ensure accessibility features be a core component	The 10-year moratorium that made provisions for retrofitted buildings to accommodate Persons with Disability (PWDs) should be reviewed, revised and enforced to ensure accessibility features to meet 40% in all existing building and all new buildings	The 10-year moratorium that made provisions for retrofitted buildings to accommodate Persons with Disability (PWDs) should be reviewed, revised and enforced to ensure accessibility features to meet 50% in all new buildings	The ten-year moratorium which made provisions for retrofitted buildings to accommodate Persons with Disability (PWDs) should be reviewed, revised and enforced to ensure accessibility features to meet 60% in all new buildings
	Upgrade existing slums and prevent the occurrence of new ones	Increased supply of affordable housing	34% of urban population living in slums	Existing public buildings not in use should be redeveloped to meet affordable housing standards targeted to reduce to 30% persons living in slums	Existing public buildings not in use should be redeveloped to meet affordable housing standards targeted to reduce to 20% persons living in slums	Existing public buildings not in use should be redeveloped to meet affordable housing standards targeted to reduce to 10% persons living in slums

Prioritized actions

Effect on	Country Strategic Goals	Outcome	#	Name of Action	Short	Med	Long	Leading actor	Other actors
Embodied Carbon 	Develop a circular building supply chain that integrates low-carbon materials into the life-cycle assessments of existing buildings	Reduced dependency on cement and metal sheets as main retrofitting and renovation materials	1	Train and engage media networks, built environment professional bodies' stakeholders, e.g. designers and quantity surveyors and National Commission on Civic Education, in information dissemination on alternative low-carbon materials and their economic social benefits				National Commission on Civic Education and Ministry of Information	National Media Commission, Public Works Department, Ministry of Local Government, Rural Development and Decentralization, and Ghana News Agency
			2	Initiate partnerships between MMDAs and the private sector to engender the uptake of decarbonization actions to harmonize expertise on specifying vernacular materials in building designs and enforce their implementation				National Commission on Civic Education and Ministry of Information	National Media Commission, Environmental Protection Agency, Public Works Department, Architects Council and Energy Commission
			3	Engage the Commission for Technical and Vocational Education and Training (TVET) to develop and include content on local low-carbon materials science (e.g. bricks, thatch, laterite etc.) in their curriculum and leverage on their schools across the country to train local artisans and technical supervisors				Commission for Technical and Vocational Education and Training (TVET)	

Operational carbon 	Promotion of energy efficiency in homes, industry and commerce (NDC)	Increased usage of solar and other sustainable energy options in existing buildings	4	Review existing green building certification regime to match local built environment requirements and make certification a requirement for retrofitting works				Ministry of Environment, Science, Technology and Innovation and Energy Commission	Green Building Council, Environmental Protection Agency (EPA), CSIR, BRRI, IFC and MWH
			5	Develop guidelines and encourage specific training of Ministry of Energy staff to coordinate with Customs Excise and Preventive Service and Ghana Revenue Authority to enforce the Appliance Standards and Labelling Regime under which importers and retailers of room air conditioners and compact fluorescent lamps (CLF) operate				Ministry of Energy and Energy Commission	Ministry of Interior
			6	Develop campaigns using local languages (e.g. Ga, Adangme, Ewe, Twi, Dagbani) through NCCE, the media and local authorities to create awareness on the carbon emission footprints to regulate and enforce Legislative Instrument (L.I.) 1932, which bans the importation of used refrigerators and air conditioners and enforce appliance regimes				Ministry of Local Government, Rural Development and Decentralization, Ghana Standards Authority and Energy Commission	Ministry of Interior, local authorities, GNA, and Bureau of Languages

Adaptation 	Citywide resilient infrastructure planning (NDC)	Increased resilience of existing buildings	7	Develop resilient Green Building Guidelines and resource-built environment ecosystem stakeholders e.g. (GREDA, MMDAs, LUSPA, Building and Civil Engineering Contractors) to apply guidelines in retrofitting, renovation and maintenance designs				GREDA, MMDAs, LUSPA, Building and Civil Engineering Contractors	Department of Rural Housing, CSIR, BRRI, and regulators
			8	Build capacity of built environment sector players, designers, contractors and MMDA staff on application green guidelines, sustainability and accessibility in retrofitting and renovation construction				Ministry of Local Government, Rural Development and Decentralization	Professional bodies and regulators
Well-being and inclusion 	Upgrade existing slums and prevent the occurrence of new ones	Increased supply of affordable housing	9	Develop a social policy for affordable and energy-efficient housing retrofitting programmes using solar, photovoltaic and windmills subsidized for urban poor				Ministry of Works and Housing, Ministry of Energy, and Energy Commission	Ministry of Local Government, Rural Development and Decentralization, built environment professional bodies, and Association of Building and Civil Engineering Contractors

New buildings

The New Buildings action area focuses on the planning, design, procurement and construction of new buildings and actions to reduce the carbon footprint of future buildings while fostering well-being and inclusion.

According to (International Trade Administration, Market Intelligence, 2023), the Ministry of Works and Housing of Ghana, estimates that there is a housing unit deficit of 1.8 million units in Ghana. Over the past five years, Ghana's construction sector has expanded rapidly to accommodate the country's growing population and urbanisation. According to the Ghana Statistical Service, approximately 150,000 new residential units are completed each year across Ghana. Despite this, Government figures show that the housing backlog remains significant. There is a trend and continuous need to build more affordable houses as a result of the country's young and growing middle class, which comprises 40 per cent of the country's population.[64]

Ghana's building and construction sector is very fragmented, comprising formal and informal players. In terms of the materials used in housing development, the Ghana Statistical Service says that cement (64 per cent) and metal sheet (82 per cent) are the main materials for outer walls of dwelling units and roofing. The use of cement has shot up from 39 per cent in 2000 to 58 per cent in 2010 and 64 per cent in 2021. In contrast, the use of mud bricks and earth declined over the same period (50.0 per cent in 2000; 34.2 per cent in 2010 and 29.6 in 2021).[65] These materials make buildings contribute significantly to greenhouse gas emissions, which are a major driver of climate change.

Current building designs and practices also do not adequately consider future climate risks. Many new buildings without resilient features could be vulnerable to climate impacts like flooding. This challenges Ghana's ability to adapt critical infrastructure to climate change. Additionally, construction trends, poor coordination across sectors and enforcement of policies, and lack of strengthening accessibility standards could price out low-income groups from adequate housing, leading to informal settlements and under-achievement of social inclusion.

Current status, projections and progress

Embodied carbon

According to the Ghana Statistical Service, approximately 150,000 new residential units are completed each year nationwide.

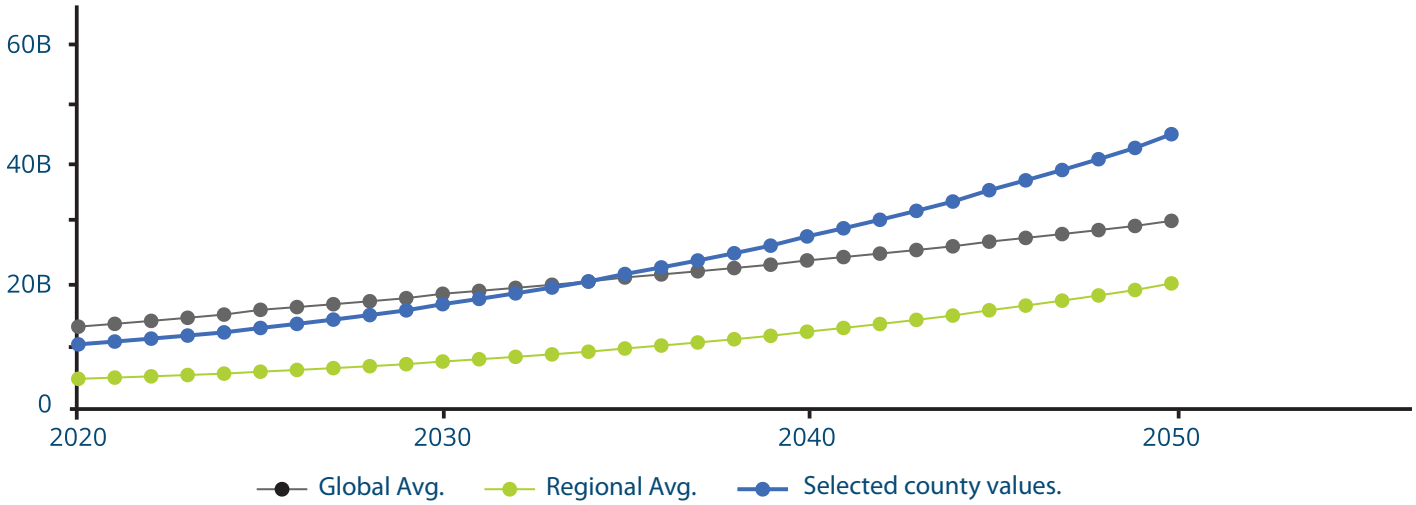
Physical developments are controlled by metropolitan, municipal and district assemblies (MMDAs). The bodies are mandated by the Local Government Act 1993, (Act 462). They issue building permits, a legal document, to prospective developers permitting them to build, renovate and retrofit structures in accordance with specifications in drawings and in line with the development codes and guidelines.

Most buildings in Ghana are made of reinforced concrete, blocks and metal sheets.[66] According to (PEEB, 2021), cement and steel are among the highest contributors to building and construction emissions. Green building technologies have been promoted in Ghana's construction industry to deal with sustainability issues, but their adoption has been plagued with several barriers. Figure 22 shows the annual estimates of the total amount of carbon dioxide equivalent emissions released during the construction of new buildings or during the renovation of existing building. Passive design features have been limited, roof designs tend not to incorporate rainwater harvesting or solar panels and mechanical systems are increasingly present in middle- and high-income homes.

The Government has introduced the Ghana Energy Transition and Investment Plan, which now aims for net zero by 2060 rather than the initial goal of 2070. This plan outlines how Ghana can reach net-zero energy-

Figure 22: Embodied carbon in Ghana's building stock

Annual estimate for 2020- 2050 of the total amount of carbon dioxide equivalent (CO2e) emissions released during the construction of new buildings or existing building renovation.



Source: GlobalABC Gap Analysis & Projections.

related carbon emissions by 2060 by implementing low-carbon emission solutions in key sectors of its economy. Yet the task may be difficult given that the idea of green building is relatively new in Ghana's construction industry.

Operational carbon

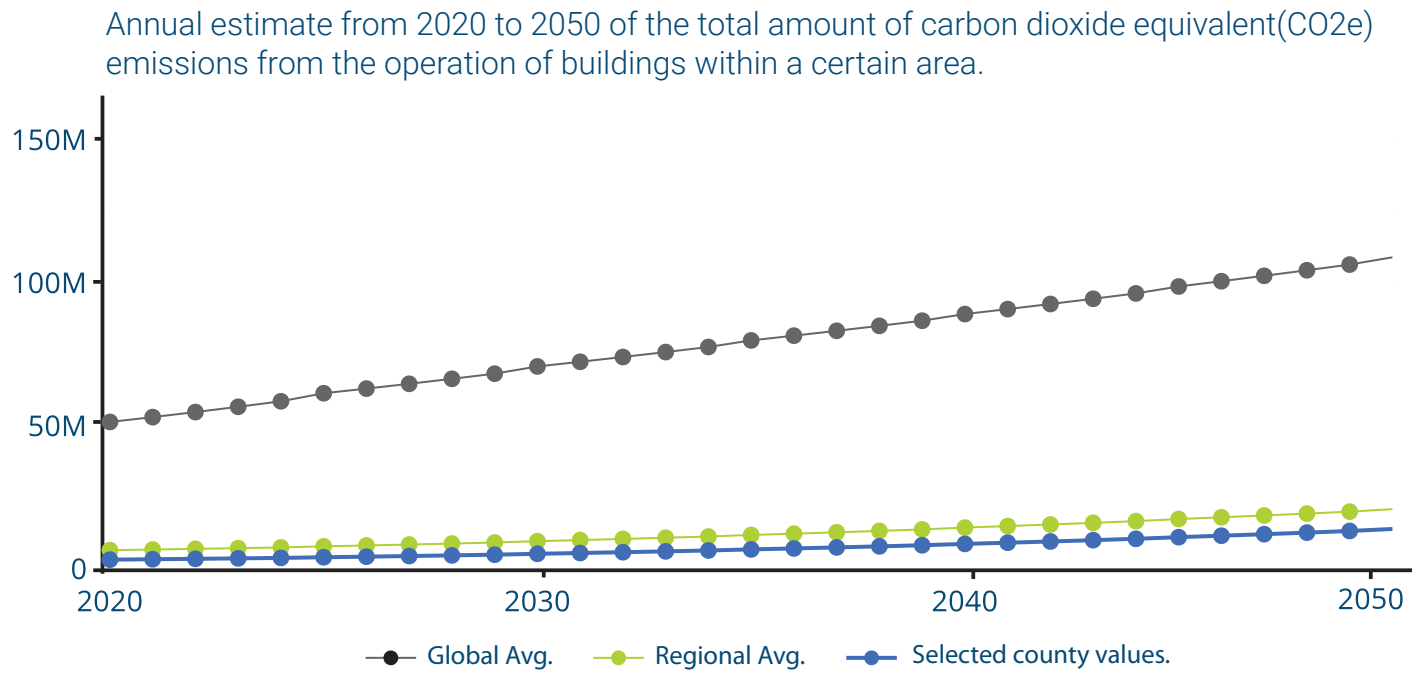
The climate zone of Ghana is predominantly warm to humid. These climatic conditions demand a gradual shift from the traditional approach of outdoor processes of habitation to the indoor ones, coupled with an ingress of solar radiation, which liberates excess heat into buildings and makes occupants feel uncomfortable. A straightforward response has been the adoption of cooling appliances as air conditioners. This has resulted in high-peak electricity demand and excess emissions of greenhouse gasses into the atmosphere. Comfort cooling is reported to be required for 50–100 per cent of the annual occupied hours in buildings.[67] According to Ghana's Energy Commission, in 2019, 3,423 Ktoe of energy was consumed by the residential sector alone;[68] a sector which accounts for 38.9 per cent of the country's total final energy consumption.[69] Figure 23 shows the annual estimates of carbon dioxide equivalent emissions from the operation of buildings in Ghana.

This notwithstanding, a survey conducted in 2022 by the Energy Commission of Ghana shows that an average of 99.65 per cent of refrigerating appliances and air conditioners being sold on the Ghanaian market meet the energy efficiency and performance standards. Findings from the survey also revealed that an average of 99.3 per cent of refrigerating appliances and air conditioners are properly labelled. Importers of non-compliant appliances have been contacted to submit appropriate documentation and duly correct mislabelled ones as part of the enforcement actions taken so far.[70]

Adaptation

Construction industries in developed countries are better equipped to pursue sustainable construction than those in developing nations. Despite this, sustainable construction is yet to be widely adopted in developing countries of which Ghana is one.[71] In Ghana, the domain of adopting new and existing buildings is gaining more attention and is gradually becoming a viable option. Nonetheless, stakeholders in the building adaptation sector are of varying viewpoints, resulting in diverse priorities during the consideration of building adaptation.[72]

Figure 23: Operational carbon in Ghana's building stock



It is apparent in all cases that incorporating adaptive design philosophy during the initial planning stages of new buildings provides a successful and productive method for tackling low-carbon, energy efficiency and environmentally sustainable buildings challenges. It also increases the chances of reducing the disturbances caused by hazardous materials, contaminated grounds, and risk of dusk and quarry activities on the atmosphere.

Well-being and inclusion

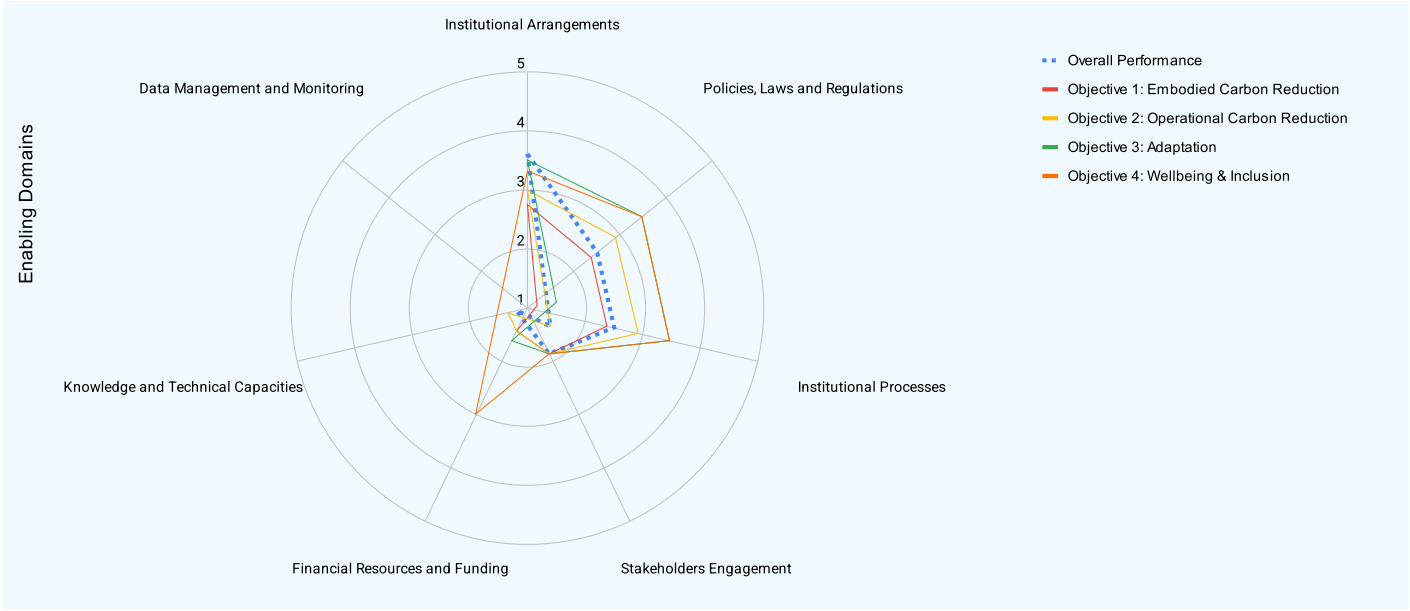
Housing supply by conventional means is not only insufficient in Ghana but has been skewed towards the high-end households in the housing markets and those from the diaspora (Arku, 2009).[73] The trend in Ghana is the development of luxurious houses and apartments whose prices are beyond the reach of most Ghanaians. This leaves the majority (low- to middle-income households) to build their own homes privately through self-help. Despite Government efforts to provide "affordable" housing to the public, the cost of these homes remains is too high for many, leading them to choose self-help housing methods for construction.

Buildings in Ghana face a myriad of accessibility issues that impact the quality of living and mobility of persons with disability. In order to meet the varied and conflicting accessibility requirements of individuals from different backgrounds, a building must consider the elderly, physically challenged, the low-income individuals, recreational users, and other essential elements that contribute to social, economic and environmentally sustainable conditions.

Challenges and opportunities

The rate of urbanisation and concentration of persons in large cities in Ghana is increasing and at variance with the rate of housing delivery, particularly affordable housing and infrastructure for the urban poor. Limited resources are competing for different national needs and these challenges have saddled Ghana with many setbacks when it comes to provision of affordable public housing.[74] The baseline assessment of Ghana's built environment sector has revealed the limited availability of low-carbon eco-friendly materials, the absence of a localized green building certification regime, and importation of building materials devoid of sustainability

Figure 24: New Buildings - Performance of the 7 Enabling Domains



Source: Authors, UN-Habitat-Ghana.

features. It has also identified that MMDAs do not have the capacity to review sustainability concepts and enforcing green building designs before granting building permits. The study found that the current stock of property developers are unaware of carbon emissions and its implications on the environment. The sector is made up of formal and informal players, with the informal players being the majority. They lack capacity and understanding of the local context, materials and sustainability technologies.

All these notwithstanding, the assessment has identified some opportunities that can have a positive impact on Ghana's sustainability agenda. Among these are revisiting, resourcing and building capacities of the country's local authority structures and mandating them to ensure sustainability, adaptability and affordability in housing delivery. The update to Ghana's Housing Profile is also an opportunity for the Government to increase stakeholder participation in harnessing appropriate policies and countrywide opportunities to decarbonize the sector.

The performance and gaps of Ghana's new buildings relative to the GlobalABC objectives and the seven enabling domains is shown in figure 24.

The way forward

Goals and targets

The goals and targets pertaining to the new building action area are tailored towards reducing carbon emission while promoting adaptation and inclusion. The main areas of intervention are increasing the use of low-carbon cement and concrete, for example low-clinker cement like calcined clay cement and metal sheets as main building materials, integrating climate change response measures into construction designs, and incorporation of accessibility features in building designs for the physically challenged. Specific interventions and targets were developed to help achieve the defined objectives.

Effect on	Country Strategic Goals	Outcome	Baseline	2030 Target	2040 Target	2050 Target
Embodied carbon 	Promote the adoption and use of robust and sustainable local materials in building and construction	Increased use of low-carbon cement and concrete, e.g. low clinker cement like calcined clay cement	Cement (64%) and metal sheet (82%) are the main materials for outer walls and roof of buildings in Ghana, respectively	Rate of cement use as the main materials for outer walls reduced to 60%	Rate of cement use as the main materials for outer walls reduced to 50%	Rate of cement use as the main materials for outer walls reduced to 40%
		Alternative low-carbon materials, e.g. thatch and bricks adopted				
Operational carbon 	Integrate the concept of green design in the building code to support emission reduction	Integrate climate change response measures into construction designs for retrofitting existing buildings and constructing new ones (use of local low-carbon eco-friendly materials)	Currently, the residential sector remains the largest consumer of energy in Ghana, accounting for 43% of the total energy consumed by all sectors of the economy in 2019	Implement and enforce green building certification regimes aimed at reducing energy to 40%	Implement and enforce green building certification regimes aimed at reducing energy to 34%	Implement and enforce green building certification regimes aimed at reducing energy to 28%
Adaptation 	Ensure the widespread implementation of climate change and disaster-resilient construction and infrastructure standards across all built environment sectors, encompassing public and private buildings	Building designs are climate resilient	Not available	Enforce provisions that govern the design and construction of buildings for energy efficiency, e.g. Section 13.6, Part 14 and Part 37 of Ghana's Building Code (GS 1207:2018) that covers building material emissions and pollution control	Ensure enforcing through adequate publicity of conditions of Ghana's Building Code (GS 1207:2018): Sections 13.6, Part 14 and Part 37 during design and implementation to become common knowledge across the building sector for all new buildings	Fully review and add new parts and sections to the building code to meet local and international standards and specifications, and update the enforcement through adequate publicity on the implementation of the conditions of Section 13.6, Part 14 and Part 37 of Ghana's Building Code (GS 1207:2018) during design and implementation so it becomes common knowledge across the building sector

Well-being and inclusion 	Provide social inclusion of marginalized persons and communities	Increased adoption of accessibility features and all new buildings	According to NADMO, public buildings surveyed have only 20% with accessibility features despite Ghana's Disability Law, (Act 715) 2006, and Ghana Standard Accessibility Designs having guidelines that mandate individuals and corporate bodies involved in designing, implementing, and supervising building projects to ensure accessibility features be a core component	The 10-year moratorium that made provisions for buildings to be retrofitted and new buildings to accommodate persons with disability should be revised and enforced to ensure accessibility features meet 40% in all new buildings	Provision of accessibility features in all new buildings to accommodate persons with disability should increase to meet 60% in all new buildings	Ghana should have 85% of accessibility features in all new buildings to accommodate persons with disability
	Upgrade existing slums and prevent occurrence of new ones	Increased supply of affordable housing	34% of urban population living in slums	Government interventions on affordable housing should be targeted to reduce to 30% persons living in slums and low-income groups	Government interventions and public private partnerships on affordable housing should be targeted to reduce to 25% persons living in slums and low-income groups	Government interventions and public private partnerships on affordable housing should be targeted to reduce to 20% persons living in slums and low-income groups

Prioritized actions

Effect on	Country Strategic Goals	Outcome	#	Name of Action	Short	Med	Long	Leading actor	Other actors
Embodied carbon reduction 	Promote the adoption and use of robust and sustainable local materials in building and construction	Increased use of low-carbon cement and concrete, e.g. low clinker cement like calcined clay cement	1	The Ministry of Works and Housing should develop guidelines that mandates building sector players (e.g. designers, architects, engineers, quantity surveyors etc.) to comply with the mandate to specify the use of local eco-friendly low-carbon materials for construction of public sector led projects				Ministry of Works and Housing and Department of Rural Housing	Ghana Standards Authority, and appropriate research institutions (BRRI, CSIR etc.)
			2	Develop green building guidelines that promote the use of local low-carbon building materials such as pozzolana cement, compressed earth, laterite, bamboo, and empower MMDAs to enforce them				Ministry of Environment, Science, Technology and Innovation, Architectural Council, and Energy Commission	MMDAs and built environment private sector players
			3	Engage the Commission for TVET to develop and include content on local low-carbon materials and construction science (e.g. bricks, thatch, laterite) in their curriculum and leverage on their schools nationwide to train local artisans and technical supervisors				Ghana TVET Service and Commission for Technical and Vocational Education and Training (TVET)	Ministry of Works and Housing and Ministry of Local Government, Decentralization and Rural Development, and Ghana Education Service
		Alternative low-carbon materials e.g. thatch and bricks adopted	4	Implement demonstration projects to showcase successful use of local low-carbon materials				Ministry of Works and Housing	
			5	Train and engage country communication networks and built environment professionals' stakeholders (e.g. designers, quantity surveyors and designers etc.) and National Commission on Civic Education in information dissemination on alternative low-carbon materials and their economic and social benefits				National Commission on Civic Education and Ministry of Information	Built Environment Professional bodies, Environmental Protection Agency, and Ghana News Agency

Operational carbon 	Integrate the concept of green design in the building code to support emission reduction	Integrate climate change response measures into construction designs for retrofitting existing buildings and constructing new buildings (use of local low-carbon eco-friendly materials)	6	Subsidize the importation and installation of solar panels, wind farms, heat inversion pumps and inverter air conditioners, and set up a taskforce to monitor and evaluate the work of the beneficiary organizations				Ministry of Energy and Energy Commission	Ministry of Works, Ghana Standards Authority, and housing and built environment professional bodies
			7	Revise existing green buildings certification regimes to match local built environment requirements (e.g. using inverter air conditioners that reduce cooling loads)				Ministry of Energy and Energy Commission	Local Green Building Council, Standards Authority, and housing, and built environment professional bodies
Adaptation 	Review building regulations and implement climate change and disaster resilient construction and infrastructure standards including for public and private sector buildings to include (public health, education, WASH, private housing etc.	Building designs are climate resilient	8	Review by-laws and empower local authorities' staff to enforce them to prevent siltation of drains and dumping solid waste in and around building settlements to avoid flooding				MMDAs	Ministry of Local Government, Decentralization and Rural Development, Ghana Standards Authority, and CTCN-UNEP
			9	Enforce building regulations and streamline building permitting guidelines to empower MMDAs to enforce new building developments that are climate resilient				Ministry of Works and Housing, and MMDAs	

Well-being and inclusion 	Upgrade existing slums and prevent occurrence of new ones	Increased supply of affordable housing	10	Design guidelines that enforce housing designs to adequately accommodate all-inclusiveness and accessibility of vulnerable groups				Ministry of Works and Housing	
			11	Coordinate with and revise curriculums of TVET and technical universities' academic programmes to include training of artisans and professionals in the science and practical implementation of low-carbon eco-friendly materials				Commission for TVET	Master craft persons and trade associations, Ghana Standards Authority, TVET Service, and professional built Environment bodies and regulators
			12	Establish MMDA funds to be used to develop temporary accommodations for most vulnerable groups in society, manage collection of daily or weekly rents for repayment for the use of the houses.				MMDAs and Ministry of Finance	
			13	Promote participatory slum upgrading and community-led initiatives, e.g. by developing models similar to UN-Habitat's Participatory Slum Upgrading Programme funded by the European Union with Slum Dwellers International through Ghana Federation of the Poor to fund housing programmes for the poor and use their contributions to repay and develop new housing schemes				Ministry of Works and Housing, donor agencies	Slum Dwellers International, Ghana Federation of the Poor, and Ghana Standards Authority

Construction supply chain

Importing, producing, and relying on high-carbon constructions result in increased embodied and operational carbon emissions, affecting the availability of affordable housing. Building materials are elements used in construction projects starting from the ground level, known as the substructure up to the finishing.[75] They loosely describe every material used in the building process.

Data from Ghana Statistical Service (2021)[76] indicated that the predominant construction material for the outer wall is sandcrete or concrete blocks constituting 64.1 per cent. Imported metallic roofing sheets also constitute 82.1 per cent with the rest slate and asbestos, concrete, raffia palm frond, mud, wood, roofing tiles, bamboo, tarpaulin, and others forming 17.9 per cent. For floors, concrete constitutes 77.8 per cent; others are porcelain, clay, marble tiles, earth, vinyl tiles, terrazzo, wood, and burnt bricks. Cement, iron rods, glass, tiles and roofing sheets are all produced in Ghana. These materials are predominantly used in building and constructions despite concerns about their carbon footprint. In addition, the materials have recurring operational carbon costs driven by increased access to fossil fuel-based energy services and energy-intensive building technologies. This leads to construction energy-inefficient building material systems.[77]

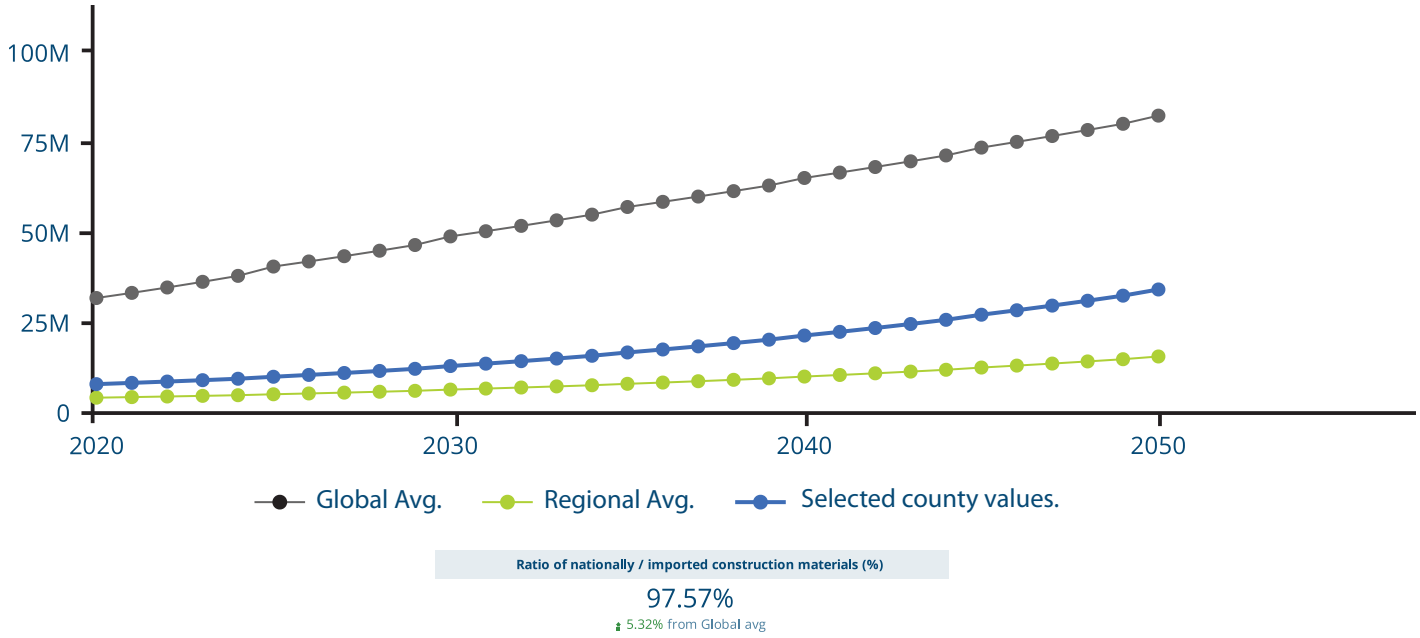
Current status, projections and progress

Embodied carbon

Ghana is traditionally a clinker- and cement-importing region due to the lack of suitable limestone reserves. The adoption of cement, concrete, sandcrete, shotcrete masonry building materials in Ghana for external wall construction has also risen sharply, becoming the de facto material in urban areas (82 per cent) and representing close to 40 per cent in rural areas.[78] Sandcrete blocks of 150 to 200 mm thickness are made from a mixture of ordinary Portland cement, local sand and water, which is poured into moulds, compressed and air dried. The sandcrete wall system is then plastered with a 15 mm thick ordinary Portland cement. The shotcrete system, on the other hand, is composed of a 70 mm thick expanded polystyrene core sandwiched between 40 mm thick reinforced layers of shotcrete. The problem of cement and its products is that it alone contributes to 10 per cent of Ghana's total carbon dioxide emissions in 2019.[79, 80] Figures 25 and 26 indicate the annual estimates of carbon dioxide emissions released during the extraction and import of construction materials.

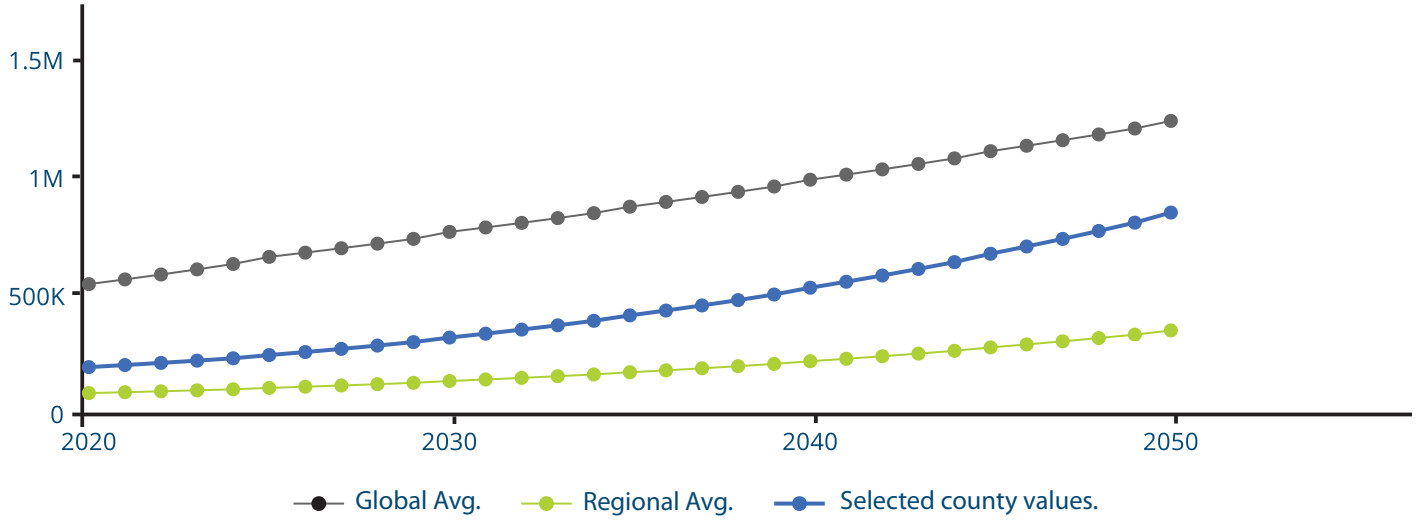
Earth-based masonry has potential to replace concrete in many low-rise applications but needs development and regulation. Diverse earth masonry materials made from clay-rich soil and natural fibres, that are sun dried or fired, have been used for much of human history and are often reused. The use of low-carbon, earth-based building materials for wall construction has been on a sharp decline, from 50 per cent in 2010 to 30 per cent in 2021.[81] The earth-based materials are used for wall, roof and floor constructions. The available earth-based materials include laterite for adobe, compressed earth bricks (interlocking and whole brick), fused laterite, wattle and daub, and atakpame walls. There is clay for burnt clay brick and tile and stone walls.

Figure 25: Carbon emission of construction materials nationally produced and consumed



Source: GlobalABC Gap Analysis & Projections.

Figure 26: Carbon emission of imported construction materials



Source: GlobalABC Gap Analysis & Projections.

Operational carbon

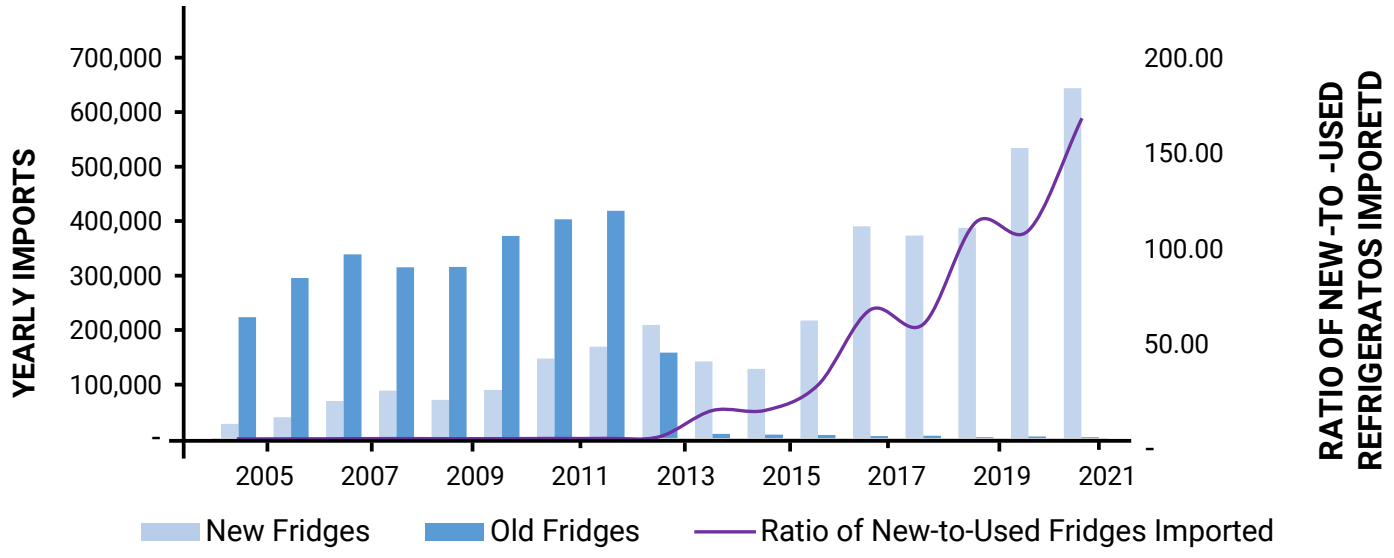
Refrigerators, air conditioners and fans are the main appliances used in homes. However, the focus is on room air conditioners and refrigerators as these are responsible for the increase in household electricity demand. Data from the Energy Commission[82] indicate that a total of 643,942 units of new refrigerating appliances were imported and inspected at Tema Port in accordance with Legislative Instrument (L.I. 1958) - Energy Efficiency Standards and Labelling, in 2021. The number imported of units represent an increase of about 23.0 per cent of the total for 2020 (see figure 27). Out of this number, 632,341 units, representing 98.2 per cent of the total imports, were regulated appliances, while 11,601 units, accounting for 1.8 per cent of the total imports, were unregulated.

Data from the Energy Commission indicate that a total of 158,892 units of new room air conditioners were inspected at the Port of Tema in 2021 in accordance with L.I. 1815, showing a drop of 6.8 per cent over 2020 total imports (see figure 28). Out of this number, 158,537 units, representing 99.8 per cent of the total imports, were regulated appliances. The remaining 355 units, accounting for just 0.2 per cent of the total imports, were unregulated appliances (cassette, commercial and other ducted or commercial types). The average energy efficiency of the room air conditioners was 3.09W/W, which is above the minimum energy performance standards of 2.80W/W.

Adaptation

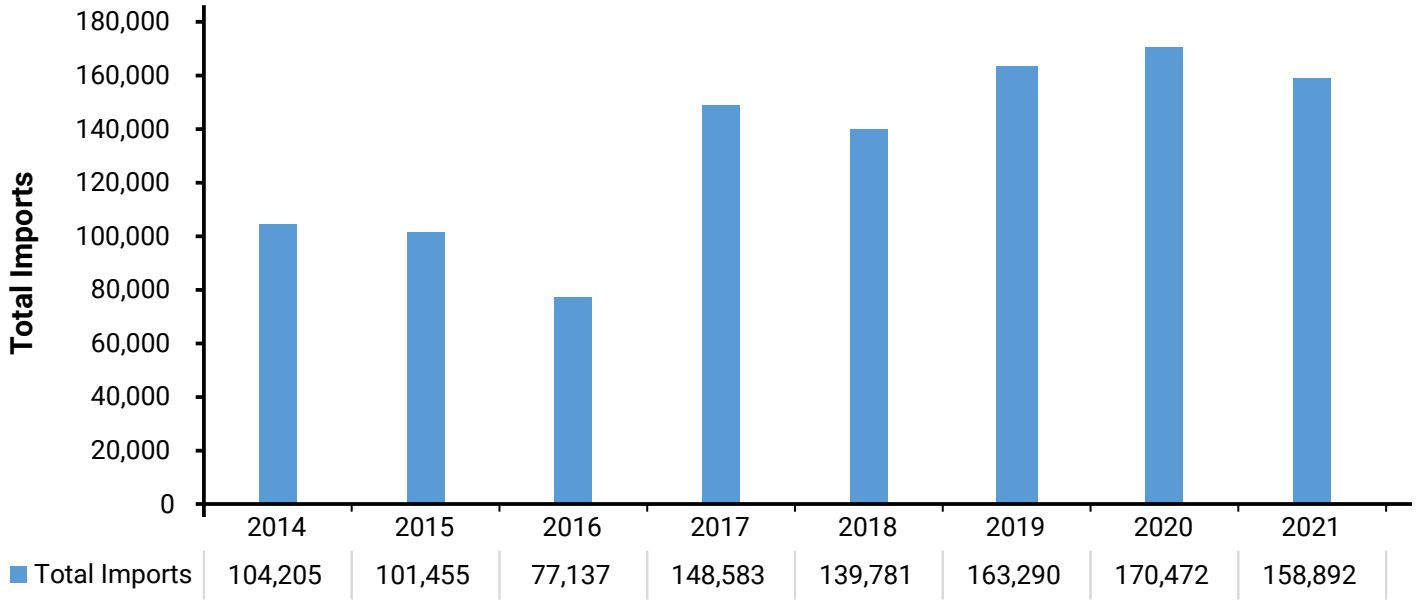
Sand, stones, wood and bamboo are raw materials extracted and used in the building and construction in Ghana. While quarrying industries are regulated to a limited extent, sand mining is characterized by weak regulatory regimes, poor surveillance and corruption. Other reasons for the non-regulation of sand extraction stem from the lack of clearly defined ownership, relative abundance and cheapness of this resource. Sand mining activities negatively impact the environment, and agricultural lands, affecting livelihoods of peri-urban dwellers.[83, 84] Sand mining, particularly coastal sand mining, impacts the ability of coastal areas to protect lives and properties against sea level rise. Coastal settlements, especially those in low-lying areas, become more susceptible to floods when sand is removed from

Figure 27: Trends in new versus used refrigerators imports (2005–2021)



Source: Energy Commission (2022).[83]

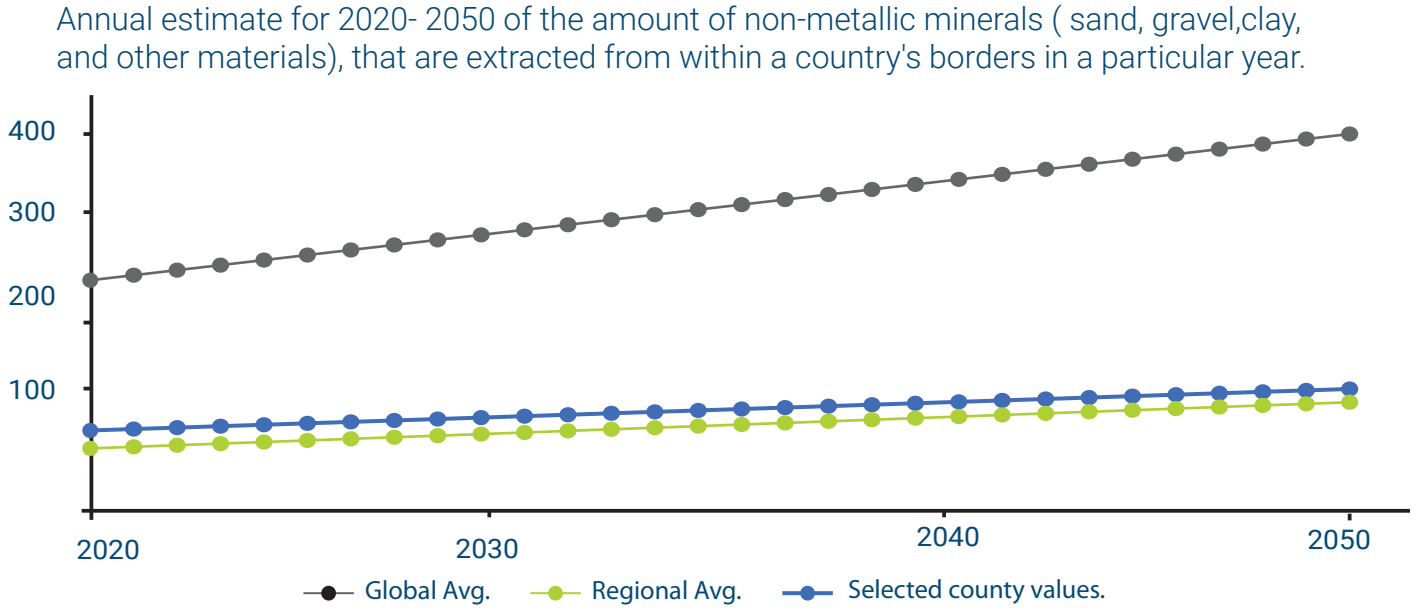
Figure 28: Yearly trend in air conditioners imports (2014–2021)



Source: Energy Commission (2022)

the shore. In many coastal communities, where tourism is a major part of the local economy, sand mining has contributed to the degradation of beaches, negatively impacting livelihoods.[85] Figure 29 shows the annual estimates of the amount of sand, gravel and other materials that are extracted in Ghana.

Figure 29: Domestic annual extraction of non-metallic minerals



Source: GlobalABC Gap Analysis & Projections.

Well-being and inclusion

The growing importation of refrigerators and air conditioning will compound the problem of e-waste in the coming decades. E-waste poses substantial environmental effects, which are detrimental to the ecosystem. Several studies in Ghana have demonstrated the negative impact of e-waste activities on the environment.[86, 87] E-waste constitutes 70 per cent of all toxic and hazardous chemicals in the environment.[88] The concentration of antimony, Cd (cadmium), and Pb (lead) in soils in Agbogbloshie and Koforidua has increased by over 100 per cent due to the burning of electronic waste.[89] In areas like Agbogbloshie, the unchecked burning of e-waste has destroyed the ecosystem and the river, causing the extinction of all forms of aquatic life.[90]

Challenges and opportunities

Ghana is traditionally a clinker- and cement-importing country due to the lack of suitable limestone reserves. As indicated earlier, the adoption of cement, concrete, sandcrete, shortcrete masonry building materials in Ghana for external wall construction have also risen sharply, becoming the de facto material in Ghana (64 per cent). The problem of cement and its products is that it alone contributed to 10 per cent of Ghana's total carbon dioxide emissions in 2019. The challenges to transitioning to low-carbon building materials include the limited availability of such materials for use in building and construction (e.g. compressed air bricks, adobe, and bamboo), lack of a localized green building certification regime, limited technical capacities of MMDAs to review sustainability concepts and enforce green building designs before granting building permits for construction, and non-adherence to building permit conditions and material specifications. Other challenges include poor regulation of natural resource extraction, among them quarrying and sand mining. Sand mining is characterized by weak regulatory regimes, poor surveillance and corruption. This mining activity degrades the environment and agricultural lands, affecting livelihoods of peri-urban dwellers.

There is a great potential to shift to low-carbon earth building materials through sensitization in academia, built environment professionals, and the public. There is a need to prioritize incentivising the managers of factory-produced modular concrete that is designed for reuse and expanding the production of low-carbon local building materials.

The way forward

Goals and targets

The goals and targets pertaining to the construction supply chain action area are tailored to reducing carbon emission while promoting adaptation. The main areas of intervention are reducing the demand for high-carbon content building materials, cooling appliances, sustainability in the extraction of raw materials, and adoption of low-carbon and less harmful local materials. Specific interventions and targets were developed to help achieve the defined objectives.

Effect on	Country Strategic Goals	Outcomes	Baseline	Target 2030	2040 Target	2050 Target
Embodied carbon	Sustainable production in the construction industry and to identify, develop and promote the use of sustainable local materials in building and construction	Reduced demand for high carbon content materials (e.g. cement, metal sheets)	Cement, concrete, sandcrete, shotcrete masonry building material is the de facto material in urban areas (82%) and representing close to 40% in rural areas	30% new government and public buildings are developed using low-carbon construction materials and techniques	Ensure that at least 50% of construction materials used for public buildings are low-carbon alternatives such as recycled materials, sustainably sourced timber, and innovative low-carbon bricks	Ensure that at least 70% of construction materials used for public buildings are low-carbon alternatives like recycled materials, low-carbon cement, sustainably sourced timber, and innovative low-carbon bricks
Operational carbon	To promote energy efficiency in homes, industry and commerce leading to emission reduction	Reduced importation of cooling appliances	Not available	All cooling appliances strictly meet the energy efficiency legislative instruments provisions	At least 30% of cooling needs are met through alternative solutions such as passive cooling, natural ventilation, and solar cooling technologies	At least 50% of cooling needs are met through alternative solutions such as passive cooling, natural ventilation, and solar cooling technologies
Adaptation	To safeguard the viability of base resources used in the production of new homes	Reduced environmental damage associated with extraction of construction materials	Not available	Stricter regulations and enforcement in place for the extraction of construction materials such as sand and gravel, including mandatory environmental and social impact assessments of all new extraction projects	At least 50% of construction material extraction operations follow best practices for sustainability, including land rehabilitation, water management, and waste reduction	At least 80% of construction material extraction operations follow best practices for sustainability, including land rehabilitation, water management, and waste reduction
Well-being and inclusion	Promote the use of sustainable local materials in pro-poor housing delivery	Developed market for local building materials	Not available	Financial incentives such as subsidies and tax credits in place for developers of sustainable local materials	Local sustainable building materials make up at least 30% of the construction market	Local sustainable building materials make up at least 50% of the construction market

Prioritized actions

Effect On	Country Strategic Goals	Outcomes	#	Name of Action	Short	Med	Long	Leading actor	Other actors
Embodied carbon reduction 	Sustainable production in the construction industry to identify, develop and promote the use of sustainable local materials in building and construction	Reduced demand for high carbon content materials (e.g. cement, metal sheets)	1	Provide funding support for research into low-carbon materials, recycling and reuse value chain				Ministry of Environment, Science, Technology and Innovation, and Ministry of Works and Housing	Sector Professional Bodies, BRRI
			2	Develop policies and incentives for adoption of local low-carbon and vernacular construction				Ministry of Works and Housing	Local Government Service, all sector players
			3	Implement demonstration projects to showcase successful use of local low-carbon materials				Ministry of Works and Housing/ BRRI	
			4	Launch public awareness campaigns using the media, e.g. radio and television and National Commission on Civic Education (NCCE) to promote the benefits of using low-carbon building materials				National Commission on Civic Education, and Ministry of Information (ISD)	
			5	Develop and implement building materials Environmental Product Declaration (EPD) standards and eco-labelling regime				Ministry of Environment, Science, Technology and Innovation, Ghana Standards Authority (GSA)	All sector professional bodies
			6	Develop a database of materials and associated embodied-carbon content properties to guide building designs.				Council for Scientific and Industrial Research (CSIR), GSA	Ministry of Works and Housing
			7	Mandate the use of low-carbon building materials for all public buildings				Ministry of Works and Housing	MMDAs
			8	Engage the Commission for Technical and Vocational Education and Training (TVET) to develop content on local low-carbon materials, e.g. bricks, thatch, laterite and leverage on their schools across the country to train local artisans and technical supervisors				Commission for Technical and Vocational Education and Training (TVET)	

Operational carbon 	To promote energy efficiency in homes, industry and commerce leading to emission reduction	Reduced importation of cooling appliances	9	Revise existing standards and labelling regulations on cooling appliances to cover unregulated air conditioners and the importation of high-energy used appliances				Energy Commission, and Ghana Standards Authority	
Adaptation 	To safeguard the viability of base resources used in the production of new homes	Reduced environmental damage	10	Enforce by-laws that involve local communities in the management of natural resources, e.g. sand and stones				MMDAs	RCC/EPA
Well-being and inclusion 	Promote the use of sustainable local materials in pro-poor housing delivery	Developed market for local building materials	11	Expand access to local eco-friendly building materials by providing incentives for mass production of these materials, e.g. tax breaks				Ministry of Works and Housing, and Ministry of Finance	

Project concepts for implementation

The previous chapters of this roadmap provided details on the current status quo of the buildings and construction sector in Ghana and suggested actions moving forward across the 5 key action areas. The following chapter presents prioritized projects that are considered essential for advancing Ghana's decarbonization of the building and construction sectors.

These projects are described using a one-page concept note to communicate key information that will be critical to developing and implementing the projects in Ghana. Beyond the details of each project, these concept notes contain key pieces of information typically required by potential financiers, such as alignment with global agendas, alignment with national development objectives, and social impact.

Spatial planning for low-carbon development	Objective
Urbanization in Ghana underlies the rapid unsustainable expansion of cities. The average annual rate of built-up expansion over the last 30 years, i.e., between 1990 and 2020 was 2.75%, which is slightly higher than the average annual rate of population increase of 2.5% over the same period[1]. Built-up expansion is linked to the destruction of open spaces and the natural environment[2], reducing the coverage of protected areas from 15.06 percent in 2017 to 14.84 percent in 2020[3]. Loss of protected areas negatively impacts biodiversity and the multiple ecosystems benefits they provide, including carbon sequestration[4]. For instance, Land Use, Land-use Change and Forestry (LULUCF) accounts for 24.3% of the 2019 total estimated national greenhouse gas emissions of 59.8 MtCO2e[5]. This project aims to develop spatial plans for all regions and districts that will provide for the establishment of urban growth boundaries, preservation of areas and towns of historical importance and creation of low-carbon districts. Out of the 261 MMDAs, only 33 (less than 13%) have SDFs while only three (3) – Greater Accra, Greater Kumasi, and Western regions – out of the 16 regions have SDFs. The lack of SDFs not only hampers realization of critical social, economic, and environmental policies but also SDG 11 and the New Urban Agenda. Business As Usual (BAU) development of MMDAs without SDFs will lead to lower densities, increase cost of infrastructure provision, destruction of natural areas, and increase carbon emissions associated with LULUCF.	Embodied carbon **Link to national and global agendas** Sustainable Development Goal 11 & 13. The initiative will enhance sustainable urban development in Ghana, and contribute to mitigation and adaptation initiatives. The project will help achieve the goals of Ghana's Nationally Determined Contribution 2015 (NDC), the Long-Term National Development Plan (2018-2057), The National Spatial Development Framework (2015-2035) and the National Climate Change Policy (2013). This project is also linked to the revised National Urban Policy (2024-2033).
Enabling environment recommendations	**Institutions**
Conduct baseline assessment to understand which MMDAs are most vulnerable to the threats of urbanization and climate change Enhance technical capacities of selected MMDAs to develop Spatial Development Frameworks Build technical capacities of the MMDAs for implementation and monitoring of SDFs	UN-Habitat LUSPA, MLGDRD **Potential funding sources** Transforming the Built Environment through sustainable materials
Expected outputs and impacts	**Capital/ upfront costs**
Spatial Development Frameworks in place to guide the sustainable development and transformation of MMDAs in Ghana.	Medium
Supporting actions	**Operational costs**
	Low **Implementation time** High

[1] UN-Habitat (2024). Ghana Baseline Assessment for Climate Action Buildings and Construction Roadmap.
[2] Asabere et al (2020). Urbanization, land use transformation and spatio-environmental impacts: Analyses of trends and implications in major metropolitan regions of Ghana. https://doi.org/10.1016/j.landusepol.2020.104707
[3] NDPC (2022). Report on implementation of the New Urban Agenda. Available at https://ndpc.gov.gh/media/new_urban_15_Aug_fin-1_0HaFk58.pdf
[4] Cobbinah et al (2022). Available at https://www.sciencedirect.com/science/article/abs/pii/S0264275121003887
[5] Ghana's Fifth National Greenhouse Gas Inventory, p. 23. https://unfccc.int/sites/default/files/resource/gh_nir5_15052022_final.pdf

Resilience against heat	Objective
Ghanaian cities are increasingly warming under a changing climate, impacting wellbeing and necessitating the need for cooling systems in buildings. Average annual temperatures in Ghana are predicted to increase between 1.4–5.8°C by 2080, with the greatest increases in the north[1][2]. Historical temperature records suggests that the observed rate of change in minimum temperature between 1960 and 2010 was 2% for southern Ghana and 37% for the northern part[3]. A higher projected mean temperature in the coming decades, rapid urbanization, and unregulated conversion of natural areas to urban land will predispose majority of the inhabitants in Ghanaian cities to extreme heat. The impacts of this extreme heat will be significant in slums and low-income urban communities, which are densely populated, characterized by poor housing quality, and lack access to basic amenities such as water, electricity, and green spaces. The frequency of extreme heat events amidst rapid urbanization presents a challenge for adapting Ghanaian cities to be resilient while at the same time being safer for all urbanites as envisaged in SDG 11. Cities could benefit from the integration of nature-based solutions such as increasing tree canopies and green spaces in urban development. Yet, it is evident that the MMDAs in northern Ghana are least prepared to deal with the imminent increase in temperature and currently lack the capacities to adapt and plan for heat mitigation. This project aims to develop guidelines for integrating climate change adaptation and mitigation in zoning and spatial development plans, including measures to reduce urban heat island effect, and provision of green and blue infrastructure.	Operational carbon **Link to national and global agendas** Sustainable Development Goal 11 & 13. The initiative will enhance sustainable urban development in Ghana, and contribute to mitigation and adaptation initiatives. The project will help achieve the goals of Ghana's Nationally Determined Contribution 2015 (NDC), the Long-Term National Development Plan (2018-2057), and the National Climate Change Policy (2013). This project is also linked to the revised National Urban Policy (2024-2033).
Enabling environment recommendations	**Institutions**
Develop guidelines for integrating urban heat island mitigation strategies in city-wide spatial plans Enhance technical capacities of MMDAs to integrate climate change adaptation and mitigation in zoning and spatial development Provide logistical support to MMDAs for monitoring and enforcement of spatial plans	UN-Habitat LUSPA, NDPC **Potential funding sources** Transforming the Built Environment through sustainable materials
Expected outputs and impacts	**Capital/ upfront costs**
Developed guidelines for integrating climate change adaptation and mitigation in zoning and spatial development plans. Measures to reduce urban heat island effect, and provision of green and blue infrastructure in place, including tree planting in cities in place	Low
Supporting actions	**Operational costs**
	Low **Implementation time** Low

[1] USAID. Climate change risk profile of Ghana. https://www.climatelinks.org/sites/default/files/asset/document/2017_USAID_Climate%20Change%20Risk%20Profile%20-%20Ghana.pdf

[2] Republic of Ghana. Ghana's Third National Communication Report to the UNFCCC. https://unfccc.int/resource/docs/natc/ghanc3.pdf.

[3] Republic of Ghana. Ghana's Third National Communication Report to the UNFCCC. https://unfccc.int/resource/docs/natc/ghanc3.pdf.

Develop a national digital land-use database	Objective
This project aims to develop a national digital land-use database for real-time monitoring of spatial and urban development by leveraging advances in Satellite Earth Observations (EO) and cloud computing platforms such as Google Earth Engine, and build capacities at the Metropolitan, Municipal, and District Assemblies to regularly update this database.	Embodied carbon **Link to national and global agendas** Sustainable Development Goal 11 & 13. The initiative will enhance monitoring and urban development control to ensure sustainability. The project will help achieve the goals the Long-Term National Development Plan (2018-2057), The National Spatial Development Framework (2015-2035) and the National Climate Change Policy (2013). This project is also linked to the revised National Urban Policy (2024-2033). The project will support the country's reporting on the emissions associated with land use land use change and forestry under the National Greenhouse Gas Inventory.
Enabling environment recommendations	**Institutions**
Undertake comprehensive mapping of land use/cover across all MMDAs leveraging EO and cloud computing platforms. Enhance technical capacities of selected MMDAs to map land use information using remote sensing and cloud computing platforms.	UN-Habitat LUSPA, MLGDRD, Academia, Forestry Commission **Potential funding sources** Transforming the Built Environment through sustainable materials
Expected outputs and impacts	**Capital/ upfront costs**
A national digital land-use/cover database that can be updated annually and used to guide urban planning and development control.	Medium
Supporting actions	**Operational costs**
	Medium **Implementation time** High

Demonstration project to showcase the successful use of local low-carbon materials	Objective
This project aims to showcase the successful use of low-carbon materials for building in the country by developing a model house using low-carbon materials, develop training modules, and build the capacities of key construction industry stakeholders on the use of low-carbon materials	Embodied carbon
	Link to national and global agendas
	Sustainable Development Goal 11 & 13, and the NDCs, Long-Term National Development Plan (2018-2057), the National Climate Change Policy (2013), The National Housing Policy (2015), the Revised Housing Profile (2024), and the revised National Urban Policy (2024-2033).
Enabling environment recommendations	**Institutions**
Develop a model building using local low-carbon building materials Enhance technical capacities of selected key stakeholders in the building and construction sector, e.g., MMDAs, artisans, and professional bodies on use of low-carbon building materials.	UN-Habitat MWH, Academia, Ghana Standards Authority
	Potential funding sources
	Transforming the Built Environment through sustainable materials
Expected outputs and impacts	**Capital/ upfront costs**
A physical model building project developed and the processes documented and used to develop training manuals for capacity building of stakeholders in the building and construction industry.	Low
Supporting actions	**Operational costs**
	Low
	Implementation time
	Low

Funding for low-carbon materials research	Objective
This project aims to increasing funding support for research into low-carbon materials, recycling and reuse value chain and promote uptake of findings among industry stakeholders	Embodied carbon and operational carbon reduction **Link to national and global agendas** Sustainable Development Goal 13, and the NDCs, The National Housing Policy (2015).
Enabling environment recommendations	**Institutions**
Institute a grant scheme for innovative proposals exploring local low-carbon materials, recycling, and reuse value chain Facilitate uptake of research findings and the overall use of low-carbon building materials among developers	MESTI, MWH **Potential funding sources** International climate funds (Green Climate Fund), BMZ, Central Government budgetary allocation
Expected outputs and impacts	**Capital/ upfront costs**
1. Research and innovations in the use of low-carbon building materials 2. Reduced dependence on high-carbon content materials	Moderate
Supporting actions	**Operational costs**
	Medium **Implementation time** Low

Develop curricula for low-carbon content building materials	Objective
This project aims to develop content on local low-carbon materials, e.g., bricks, thatch, laterite, for training students and artisans.	Embodied carbon reduction
	Link to national and global agendas
	The NDCs, National Climate Change Policy (2013), The National Housing Policy (2015), the Revised Housing Profile (2024).
Enabling environment recommendations	**Institutions**
Develop curricula on the use of low-carbon building materials Train students on low-carbon materials construction techniques	Commission for Technical and Vocational Education and Training (TVET), Academia, Ghana Standards Authority,
	Potential funding sources
	International climate funds (Green Climate Fund), BMZ, National budgetary allocations
Expected outputs and impacts	**Capital/ upfront costs**
1. A database of materials and associated embodied carbon content properties to guide building designs 2. A reduction in the use of high-carbon content building materials such as cement products.	Moderate
Supporting actions	**Operational costs**
	Medium
	Implementation time
	Medium

Develop and implement building materials Environmental Product Declaration (EPD) standards and eco-labelling regime	Objective
This project aims to reduce GHG emissions from building materials by developing and implementing materials EPD standards and eco-labelling regime to guide the use of low-carbon building materials for building.	Embodied carbon and operational carbon reduction **Link to national and global agendas** Sustainable Development Goal 11 & 13, and the NDCs, Long-Term National Development Plan (2018-2057), the National Climate Change Policy (2013), The National Housing Policy (2015), the Revised Housing Profile (2024), and the revised National Urban Policy (2024-2033).
Enabling environment recommendations	**Institutions**
Develop an eco-labelling regime for building materials including low-carbon building materials Enhance technical capacities of MMDAs to enforce the use of low-carbon building materials.	UN-Habitat MWH, Academia, Ghana Standards Authority, CSIR **Potential funding sources** International climate funds (Green Climate Fund), BMZ.
Expected outputs and impacts	**Capital/ upfront costs**
1. A database of materials and associated embodied carbon content properties to guide building designs 2. A reduction in the use of high-carbon content building materials such as cement products.	Moderate
Supporting actions	**Operational costs**
	Medium **Implementation time** Low

Annexes

1. Stakeholder mapping

2. Baseline assessment

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