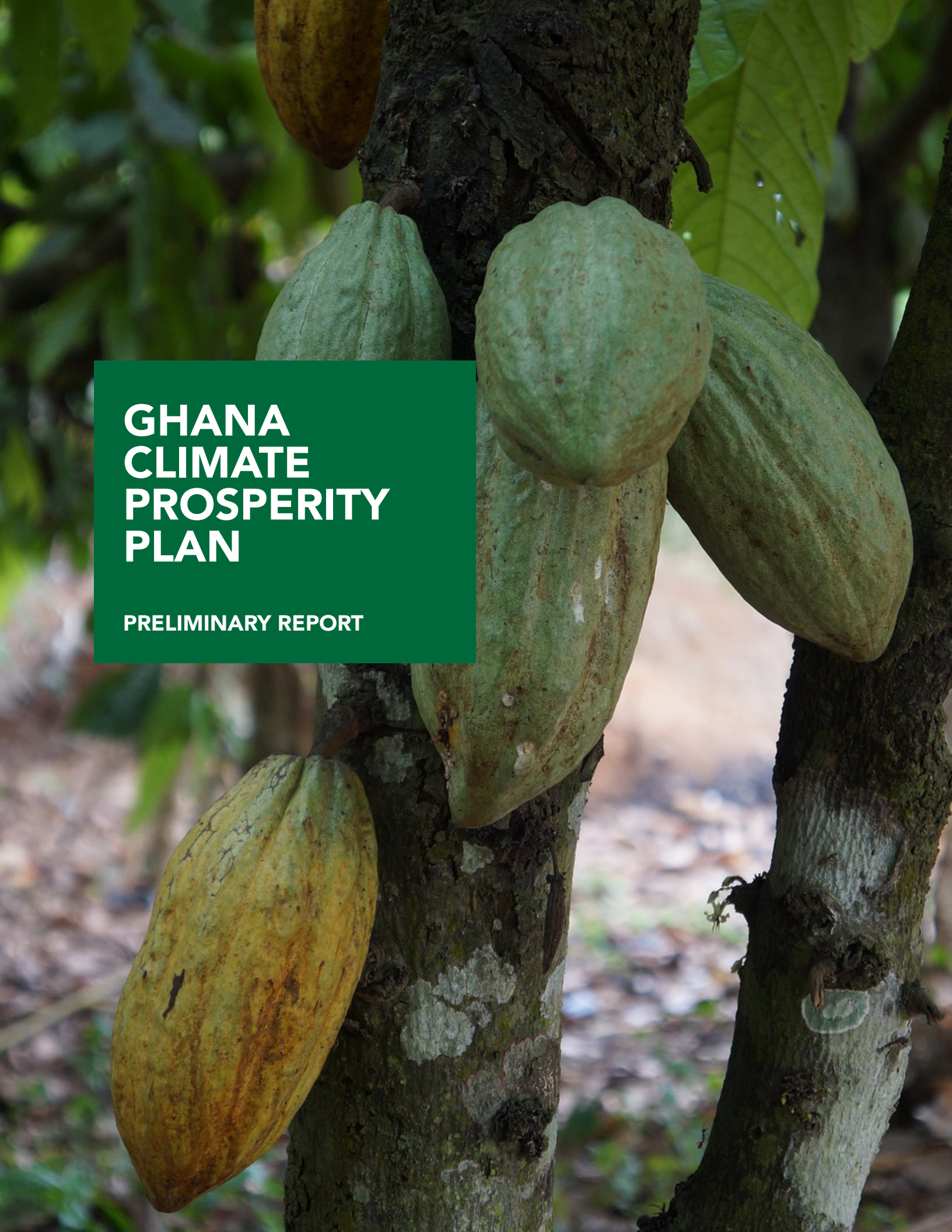


GHANA CLIMATE PROSPERITY PLAN

PRELIMINARY REPORT

Foreword

H.E. Nana Addo Dankwa Akufo-Addo

Hon. President of Ghana and Chair of the Climate Vulnerable Forum

Our planet is confronted with a challenge of epic proportions: the consequences of a warming globe are putting our populations and economic structures at risk. This is an existential crisis for Ghana, as well as for all nations part of the Climate Vulnerable Forum. It's a fight for survival. The call to climate action has been ignored for too long, yet the current decade is pivotal for safeguarding our collective future. We must act swiftly; there is no time to spare.

In facing this monumental task, I am confident that we can not only overcome but also reshape our economic and societal landscapes for the better. Within this crisis lies the seeds of opportunity. The CVF has consistently led by example, advocating for decisive climate action, and as its Chair, I am committed to propelling this mission with Ghana at the helm. Our strategies must be designed to not only withstand but prosper amid climatic challenges. The Climate Prosperity Plans (CPP) are critical milestones in this journey, and I am honoured to launch Ghana's very own CPP, which is set to catalyse our transition to a resilient, low-carbon economy.

To assure the well-being and prosperity of Ghanaians, we must overhaul our economic model, harnessing our abundant renewable energy sources; we must prioritise initiatives that will endow our entire economy with the robustness to withstand climate-related disruptions. What we require is a clear vision coupled with a tangible action plan, both of which are encapsulated in our CPP. This Plan serves as our guide to a flourishing future, offering a detailed blueprint for our path forward. Embracing this plan signifies a commitment to enhancing the living standards of Ghanaians, broadening access to sustainable employment, and fostering an environment that is resilient, secure, and prepared to confront the inevitable challenges posed by climate change.

The CPP aims to reduce our unemployment rates from 7 percent in 2022 to 1.8 percent by 2050, and anticipates a net economic gain of 75.3 billion USD by mid-century. Furthermore, Ghana's CPP is projected to boost governmental revenue, with fiscal gains averaging 58.4 percent higher than current trajectories from 2022 to 2050.

As we engage with the climate emergency, our economy must expand and innovate, rather than contract or rely on assets that will become obsolete. I advocate for a politics centred on prosperity and expansion, not restriction. We should be motivated by the potential for growth and how it can enhance climate-positive development. Let fear not steer our course; instead, let us be driven by the firm belief in a future filled with prosperity.

It fills me with pride to see Ghana taking its place among the ambitious climate pioneers within the CVF, contributing to the expanding portfolio of Climate Prosperity Plans.

I am proud that Ghana joins the rank of ambitious climate leaders from the CVF in adding its contribution to the growing coalition of Climate Prosperity Plans. The dismaying present state of the climate is not of our doing, but our own future will be - and we will work tirelessly to ensure it is one of hope, abundance, and prosperity for our nation.

Climate Prosperity Plan | Ghana 2023

Foreword

Hon. Ken Ofori-Atta

Minister for Finance and Economic Planning and Chair of the Vulnerable Group of 20

Ghanaians are already feeling the harsh effects of climate change in their everyday lives. Against this backdrop, adaptation transcends the need for mere business continuity and becomes vital for the very functioning of our economy. The traditional route of economic growth is no longer tenable for safeguarding the livelihoods and welfare of our citizens. It has become imperative to forge a new path—one that prioritises the transition to sustainable energy, ensures food security, strengthens community resilience, and enhances disaster readiness.

In my role as Chair of the V20, I am acutely aware of the collective challenge vulnerable countries face in securing climate finance. Ghana, alongside its fellow V20 nations, is pressing ahead with development, conscious that each climate-vulnerable project we undertake may embed further risks and exacerbate the global disparity of climate change effects. We stand at a pivotal moment, needing a solid investment strategy that diverts financial flows from traditional 'brown' investments towards 'green', sustainable projects, thereby ingraining resilience within our economic framework. Our Climate Prosperity Plan symbolises this strategic national investment.

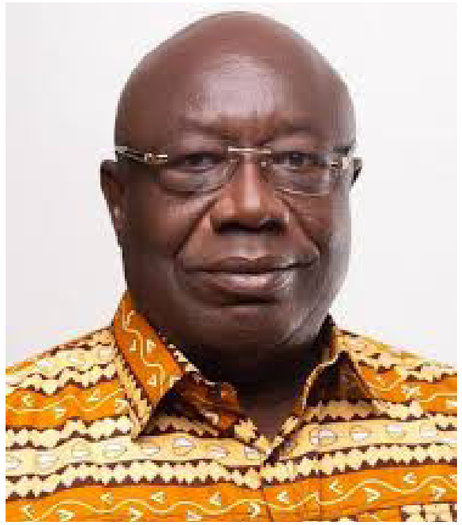
The goals and initiatives of this Plan represent more than a redirection towards climate-conscious investments in our energy and infrastructure. Their realisation will propel our economy to new heights, surpassing conventional expectations. The efficacy of these initiatives is captured by the outcomes of the Green Economic Model, which was instrumental in formulating this CPP. This Model meticulously evaluates and projects Ghana's prospects under the auspices of the CPP, contrasting them with a 'business-as-usual' scenario that perpetuates our current vulnerabilities. Our Plan's eight objectives cover all critical economic sectors to ensure resilience, climate-proofing, and the broadest spectrum of opportunities for our people. With the implementation of the CPP, we could see a 48% increase in GDP this decade and our energy bill, as a share of GDP, is expected to drop to less than 0.7% by 2050; which will transform into more accessible energy. The Plan will unlock funds for concrete projects and facilitate the creation of tens of thousands of quality jobs that are anticipated to be created in the coming decades.

As the Chair of the V20, I am privileged to lead a coalition of nations committed to pioneering innovative means of climate finance access, with the implementation of Climate Prosperity Plans being a key element of our strategy. Our nations deserve the best possible opportunities to prosper. By adopting our national Climate Prosperity Plan, we are embracing this opportunity. I am eager to witness the transformation laid out in this document into a reality that enriches the everyday lives of the Ghanaian people

Foreword

Hon. Dr. Kwaku Afriyie

Minister of Environment, Science, Technology & Innovation



Our country has seen the devastating impacts that climate change is having on communities and biodiversity. Not in the distant future, but as I write today. Disrupted raining patterns have become unpredictable, resulting in the loss of crops and livelihoods for our farmers in the North. Meanwhile, in the South, sea-level rise and coastal erosion, combined with a surge in storms, are threatening coastal residents in Accra and across the Volta Region. With every fraction of a degree of additional global warming, we know these impacts will worsen.

But our nation is not one to give up hope. We can and must seek innovative, creative solutions to climate threats. We believe in the facts, and the facts tell us: our pathway out of this crisis can also be a pathway of opportunity. Our country must focus on developing the resilient systems that will ensure a prosperous future. Concretely, what we need here is a whole-of-economy shift. Ghana aims to move in this direction, and take a bold turn that is urgent and necessary. With this Climate Prosperity Plan, we are engaging on a path that will take us from vulnerability through resilience and towards prosperity.

This Plan is intended to pave the way for Ghana to move from climate vulnerability to climate prosperity by 2030, while decoupling economic development from its greenhouse gas emissions pathway by ensuring that these are reduced. We, as a country, need to see this as a chance to accelerate our shift towards renewable energy, and take advantage of our resources to develop locally-led and nature-based adaptation solutions. Our Climate Prosperity Plan aims to do just that.

Through this Plan, we see that prioritising climate-compatible actions is not only good for the climate: it's also very good for the economy. This is what we call development-positive climate action: climate action that will create quality jobs, boost our growth, but also let us breathe cleaner air and reduce our greenhouse gas emissions (GHG). Indeed, under the CPP scenario, GHG emissions will reach net zero in the 2040s, while the elimination of PM2.5 and PM10 emissions will protect our people from dying of air pollution. I am convinced that this is the way to make a transformational impact on the lives of people most vulnerable to climate change. Let us harness this tremendous challenge to our advantage, and be bold when it matters the most: right now.

Climate Prosperity Plan | Ghana 2023

Foreword

Hon. Dr. Henry Kokofu

Executive Director of the Environmental Protection Agency and Special Envoy of the CVF Presidency of Ghana

In a climate-insecure world, where climate change continuously threatens our socio-economic, environmental and ecological systems, our country needs to be prepared and construct a resilient economy. Despite having contributed close to nothing to this crisis, we, alongside numerous CVF/V20 countries, have taken the decision to show leadership in the climate struggle through the Climate Prosperity Plan (CPP) program. Under the CPP vision, we strive to achieve a climate-secure and climate-prosperous Ghana. We show that the pathway towards the greatest prosperity for our people is one of energy transition and resilience-building.

In many CVF countries, current project pipelines are loaded with climate risk. At the same time, credible alternatives are lacking, and our nations' struggle with high capital cost when implementing climate-compatible projects. Our Climate Prosperity Plan provides a promising solution by building alternative project pipelines that are green, resilient, and future-oriented.

As the Executive Director of the Environmental Protection Agency and Special Envoy of the CVF Presidency, I look forward to supporting the successful finalisation and implementation of Ghana's Climate Prosperity Plan. I strongly believe this Plan will help us harness the full potential of our nation in every aspect, in the face of the unavoidable reality of climate change.

Our survival is on the line now. We must understand this to mean we need ambitious climate action today that will lead us to abundance and prosperity, as translated in this Plan. The sand keeps slipping through the hourglass for our vulnerable nations, and our Climate Prosperity Plan is a testimony of our intention to do everything in our power to fight that - and secure a future of abundance in the process.

Climate Prosperity Plan | Ghana 2023

Foreword

Nakeeyat Dramani Sam

Poet and CVF Youth Ambassador

My name is Nakeeyat Dramani Sam, and I am the Thematic Ambassador for Youth of the Climate Vulnerable Forum. It is my honour to represent the voice of my generation for Ghana and for all vulnerable countries.

Young people like me know that climate change is here. We can see it in our cities and in our fields. We can feel the threat growing bigger and bigger. Many of my brothers and sisters in climate vulnerable countries have already suffered loss and damage as no child should ever experience. My generation also knows that climate change will have a huge impact on our future. We are scared, and we are upset about this situation. But we are also hopeful, and brave, and we will not give up the fight for the future we want.

That is why I am proud to see the government of my country Ghana show its determination to build a different and better future by developing this plan. The Climate Prosperity Plan will help us find a new path. It will make our country safer from the negative impacts of climate change, and it will give young Ghanaians like myself the opportunity to participate in the development of a green and prosperous future.

Table of Contents

Table of Contents

Climate Prosperity Plan | Ghana 2023

Table of Contents

Table of Contents

Climate Prosperity Plan | Ghana 2023

Table of Contents

Table of Contents

Climate Prosperity Plan | Ghana 2023

Table of Contents

BRIEF INTRODUCTION TO CLIMATE PROSPERITY PLANS

What are Climate Prosperity Plans?

A national investment strategy and pathway to prosperity in a climate-insecure world

Climate Prosperity Plans seek to maximise socio-economic outcomes for countries on the frontline of the climate emergency.

A climate vulnerable country can no longer achieve its best socio-economic outcomes without becoming resilient to climate change.

We have a better chance at maximizing socio-economic outcomes if we leverage the maximum of domestic renewable energy resources and nature-based solutions

Climate Prosperity Plans...

- **... study optimizing economy-wide resilience, renewable energy and nature-based solutions**
- **... propose a plan over a specific timeframe (5 years, 10 years, to the 2040s)**
- **... propose projects to deliver the plan**
- **... detail financing and investment needed to realise them**

Why Climate Prosperity Plans?

The Problem

All CVF & V20 member states are struggling to mobilize the necessary finance and investment to realize climate action

The Consequences

Climate-smart approaches to social and economic development are prevented from being mainstreamed

Many countries are building in new vulnerabilities rather than becoming more resilient

Missed opportunities to have greater energy independence and access to green investment and export opportunities

The Solution

Climate Prosperity Plans seek to respond to this challenge by designing actionable investment and implementation pathways to

CPPs have three main dimensions

1 **We estimate how socio-economic outcomes could be improved**

2 **We outline what projects and programs can deliver those**

3 **We identify and itemise the financing and investment needed to deliver the project and achieve those outcomes**

Climate Prosperity Plan | Ghana 2023

Strategic Aims

This is the Preliminary Report of Ghana's Climate Prosperity Plan. This version aims to present to the international and national community the country's ambition of having a development-positive climate action. The CPP embeds the aspirational pathway for Ghana from climate vulnerability to climate prosperity, meanwhile creating quality jobs, stimulating the economy while making it resilient, and reducing greenhouse gas emissions.

Goals

Ghana's Climate Prosperity Plan is centered around two principal goals: Climate Secure Ghana and Climate Prosperous Ghana. These goals are focused on promoting a range of priority efforts in the following sectors: energy, water, human mobility, food security, and finance. Each goal is likewise underpinned by specific further objectives which are broken down into a number of targets that outline milestones every 5 years. The goals are also supported by a number of keystone projects that aim to launch a wider pipeline of over 130 projects. These targets and keystone projects reflect the country's aspirations in tangible terms, detailing the actions that can be taken to achieve a climate secure and climate prosperous Ghana.

I. Climate-secure Ghana

Target highlights

- Ghana achieves a 100% electrification rate through deployment of renewable energy by 2035.
- Ghana's population (100%) has access to at least basic water services by 2030.

The first goal of Ghana's Climate Prosperity Plan is to secure the nation from climate threats. This plan aims to achieve this through concerted efforts in the energy, health, water, and built environment, together with making full use of financial forms of protection and maximising nature-based solutions

and green spaces.

As a first step towards securing the nation, is the securing of its energy supply. Renewable energy offers significant advantages for extending last-mile energy access, which is indispensable for ensuring resilience of most vulnerable populations, while the combination of decentralised forms of renewable energy harvesting together with a fully modernised grid system will help Ghana to keep its population protected from climate risks like extreme heat, while also strengthening the disaster risk profile of the nation's energy system. Ghana therefore aims to tap into its own renewable energy abundance and wealth to the maximum extent that available financing will allow, including in relation to energy extraction from enhanced waste management.

To take advantage of the full potential of national renewable energy resources, Ghana is drawing from a range of technologies across the board to maximise the least-cost generation capacity from renewable resources in the country. The shift towards renewables, in electricity generation, will be leveraged to achieve full electrification and energy access, relying where necessary on decentralised systems. Renewables will also be harnessed towards securing reliable, disaster-resilient electricity supply for critical infrastructure such as health facilities. Ghana will also promote energy efficiency, especially in the industrial sector, in order to enhance the competitiveness and sustainability of the emergent manufacturing sector.

The second area of focus towards a climate-secure Ghana is health. The rise in temperature caused by climate change is posing risks to human health in the form of heat strokes and other heat-related illnesses as is the spread of infectious diseases that are sensitive to the climate including certain food and vector-borne diseases. Climate driven health challenges will threaten wellbeing, quality of life, and the lives of vulnerable groups and the safety of workers, while also acting as a significant drag to economic output as heat increasingly impacts worker productivity. The built environment, shade-enhancing green spaces, and access to public health and water services can be evolved and adapted to mitigate those risks, while the population can be informed about best practices, and counteracting standards in the workplace can be promoted, to minimise exposure. Advancing clean cooking practices can minimise deaths related to indoor air pollution. Sustainable water management practices and local, sustainable and traditional diets will also minimise threats to food security from more erratic and extreme hydro-meteorological regimes and international shocks.

In Ghana at present, most vulnerable communities and small businesses are not adequately financially protected in the event of a climate-related disaster. As the frequency and impact of environmental disasters grow with climate change, not addressing the prevailing financial protection gap will increasingly expose communities to economic shocks and slow recovery following disasters. Expanding the coverage of financial protection is therefore essential to making the economy more resilient to climate shocks and reducing the exposure of the most vulnerable. Ghana will seek to have financial protection initiatives deployed to weave a safety net for the most vulnerable community members and protect small businesses in the face of increasing climate disasters.

Finally, to achieve climate security for Ghana will require tapping into nature-based and infrastructure solutions in order to bolster the resilience of the built environment and protect the areas most exposed to climate risk. Coastlines can benefit from mangrove-planting to minimise their exposure to storms and erosion as sea-levels rise, while interventions to the built environment will further ensure that coastal residents are protected. Urban areas are another key point of vulnerability – much existing built infrastructure is not designed to withstand rising heat climate shocks such as due to a lack of insulation against heat. In some cases, urban infrastructure contributes to compounding negative impacts, as in the case of heat island effects. Adaptation interventions in urban areas present the opportunity to both strengthen their resilience while shaping a greener, more livable environment. The greening of urban spaces, as well as the establishment of biodiversity hotspots, will contribute to the safeguarding of biodiversity while also acting as carbon sinks leveraging, supporting the regulation of temperatures and providing shade and recreation areas. Lastly, climate-proofed housing is most essential especially for lower-income and vulnerable communities that are currently facing access challenges to affordable housing. Social programs to ensure constantly growing access to affordable, climate-proofed housing therefore form a further pillar of the results framework of Ghana's climate prosperity plan.

Objectives

1. Financing maximized resilient and renewable energy systems

Sustainably exploit the full potential of national renewable energy resources, optimising energy efficiency and ensuring complete energy access, minimizing power outages, and enhancing the disaster resilience of energy.

2. Resilient health and water access

Promote population health by enhancing climate-specific health responses and capacities, and by building resilience and ensuring dietary reliance on sustainable foods.

3. National financial protection

Promote risk-informed investment and enable progressive coverage of financial/social protection including insurance for all core climate and disaster risk, with a specific emphasis on resilience against agricultural losses.

4. Green and resilient built environment

Climate-proof the built environment and the economy by leveraging nature-based solutions and increasing resilience through both soft and hard engineering, leveraging local materials to increase build affordability.

Keystones and hallmark projects

Accelerated Energy Transformation for Power Resilience and Security

This keystone project aims to maximize domestic renewable energy options in order to displace high cost technologies via a portfolio of offshore/floating wind, tidal energy, solar energy, storage and grid modernization; achieving a 3GW of new capacity additions before 2030 with a lifespan of 8 years and a estimated level of investment of USD 16 billion.

Sustainable Safe Water and Sanitation Improvement Project

For Ghana the improvement of access to safely managed drinking water services is particularly important, this project aims to increase access to safe drinking water and improve sanitation and basic hygiene services of 1,700 communities and 150 schools with an investment of USD 198 millions for a six year period.

Micro, Small and Medium Enterprises (MSME) Climate Insurance

This keystone project´ s objective is to integrate MSME insurance as core offering on Ghana's wholesale buyer/seller associations, achieving a total sum assured of USD 1 billion in contingent savings by 2030 for businesses with less than 20 employees, helping unlock investments in climate adaptation equipment and business practices of an equal value. The project represents an investment of USD 5 millions from 2023 to 2028.

Urban Greening & Sponge Cities Project

This project aspires to increase resilience to floods through the implementation of strategically located green spaces and other nature-based interventions to regulate drainage. The project will be piloted in Accra, therefore the outcome for 2030 is to have 25% of roofs in major urban centers cultivated as green roofs which requires an investment of USD 415 million.

Result Indicator	#	Description	Timeframe			
			2025	2030	2035	2040
GOAL	**1**	**Climate Secure Ghana**				
DESCRIPTION		Resilient & sustainable transformation of energy, transportation, health and the built environment				
OBJECTIVE	**1**	Financing maximised resilient & renewable energy systems				
DESCRIPTION		Sustainably exploit the full potential of national renewable energy resources, optimising energy efficiency and ensuring complete energy access, minimizing power outages, and enhancing the disaster resilience of energy.				
TARGET	**1.1**	50% of least-cost renewable energy capacity potential is financed.		X		
		75% of least-cost renewable energy capacity potential is financed.			X	
		90-100% least-cost renewable energy capacity potential is financed.				X
TARGET	**1.2**	Commercialisation of 5GW of renewable energy on the green trade market			X	
		Commercialisation of 10 GW of renewable energy on the green trade market				X
TARGET	**1.3**	Biogas energy facilities are scaled up and expanded to double current (2022) capacity.				X
		50% of all processable waste is converted to energy through waste-to-energy facilities.		X		
		75% of all processable waste is converted to energy through waste-to-energy facilities.			X	
		90-100% of all processable waste is converted to energy through waste-to-energy facilities.				X
TARGET	**1.4**	50% of the workforce in the energy sector has access to upskilling training to transition into clean energy and waste to energy jobs.			X	
		90-100% of the workforce in the energy sector has access to upskilling training to transition into clean energy and waste to energy jobs.			X	
TARGET	**1.5**	35% of the outstanding progress to a full electrification rate is achieved through deployment of renewable energy technology (including off-grid electrification).			X	
		80% of the outstanding progress to a full electrification rate is achieved through deployment of renewable energy technology (including off-grid electrification).			X	
		95-100% of the outstanding progress to a full electrification rate is achieved through deployment of renewable energy technology (including off-grid electrification).				X
TARGET	**1.6**	50% of the country's grid infrastructure has been modernized, increasing efficiency, disaster resilience and renewable energy supply.			X	
		100% of the country's grid infrastructure has been modernized, increasing efficiency, disaster resilience and renewable energy supply.				X

Climate Prosperity Plan | Ghana 2023

TARGET	**1.7**	50% of health/medical facilities have a disaster resilient renewable energy supply.	X			
		100% of health/medical facilities have a disaster resilient renewable energy supply.		X		
TARGET	**1.8**	Cost of electricity generation is lowered to below 6 cents / kWh			X	
		Cost of electricity generation is lowered to below 4.5 cents / kWh				X
TARGET	**1.9**	Energy efficiency is improved by 30% through educational programs, clean appliances and cookstoves		X		
		Energy efficiency is improved by 50% through educational programs, clean appliances and cookstoves			X	
TARGET	**1.10**	Land requirements for renewable energy projects are proposed for the National Spatial Planning Framework		X		
		Land requirements for renewable energy projects are operational in the National Spatial Planning Framework			X	
OBJECTIVE	**2**	**Resilient health and water access**				
DESCRIPTION		Promote population health by enhancing climate-specific health responses and capacities, and by building resilience and ensuring dietary reliance on sustainable foods.				
TARGET	**2.1**	Training programs for medical personnel on climate-specific health responses are piloted in 15-20 medical facilities.	X			
		50% of all medical personnel have received training on climate-specific health responses.		X		
		90-100% of all medical personnel have received training on climate-specific health responses.			X	
TARGET	**2.2**	Program to increase shaded areas and reduce heat island effect through the promotion of biodiversity corridors and touch points is implemented in Accra.	X			
		Program to increase shaded areas and reduce heat island effect through the promotion of biodiversity corridors and touch points is implemented in all major cities.		X		
		Program to increase shaded areas and reduce heat island effect through the promotion of biodiversity corridors and touch points is expanded to regional cities with more than 25,000 people.			X	
TARGET	**2.3**	Education campaign on rehydration regimes and heat stress prevention is piloted in Accra.	X			
		Education campaigns on rehydration regimes and heat stress prevention are deployed across 50% of urban and rural areas.		X		
		Education campaigns on rehydration regimes and heat stress prevention are deployed across 90-100% of urban and rural areas.			X	
TARGET	**2.4**	100% of the population with access to at least basic water services		X		

		67% of the population with access to safely managed drinking water services		X		
		68% of the population have access to improved liquid waste management.		X		
TARGET	**2.5**	95% of solid waste properly disposed of in the 5 major towns/cities ((Accra, Tema, Takoradi, Tamale, Kumasi)		X		
TARGET	**2.6**	400 communities achieving open defecation-free (ODF) status	X			
		1400[1] communities (Accra, Tema, Takoradi, Tamale, Kumasi) achieving open defecation-free (ODF) status		X		
		1000[2] communities (Accra, Tema, Takoradi, Tamale, Kumasi) achieving open defecation-free (ODF) status			X	
		1000[3] communities (Accra, Tema, Takoradi, Tamale, Kumasi) achieving open defecation-free (ODF) status				X
TARGET	**2.7**	Medical centers, ambulance and paramedic services are expanded in at-risk rural areas to improve population access to basic health services.	X			
		Medical centers, ambulance and paramedic services are expanded to ensure that 100% of the population has access to basic health services.		X		

[1] Referring to a new set of additional communities, not to be cumulated with the previous target.
[2] Referring to a new set of additional communities, not to be cumulated with the previous target.
[3] Referring to a new set of additional communities, not to be cumulated with the previous target.

TARGET	**2.8**	Reduce premature deaths from indoor air pollution by 40%.		X		
		Reduce premature deaths from indoor air pollution by 60%.			X	
		Reduce premature deaths from indoor air pollution by 90-100%.				X
OBJECTIVE	**3**	**National financial protection**				
DESCRIPTION		Promote risk-informed investment and enable progressive coverage of financial/social protection including insurance for all core climate and disaster risk, with a specific emphasis on resilience against agricultural losses.				
TARGET	**3.1**	Extend financial protection against climate related disasters for 70% of the population living in poverty.	X			
		Extend financial protection against climate related disasters for 90-100% of the population living in poverty.		X		
TARGET	**3.2**	Complete access to risk analytics and resilience data through the Global Risk Modelling Alliance.	X			
OBJECTIVE	**4**	**Green and resilient built environment**				
DESCRIPTION		Climate-proof the built environment and the economy by leveraging nature-based solutions and increasing resilience through both soft and hard engineering, leveraging local materials to increase build affordability.				

TARGET	**4.1**	Afforestation projects to combat desertification and mitigate impacts of flooding are piloted in 10-15 at-risk areas.	X			
		Afforestation projects to combat desertification and mitigate impacts of flooding are active in 50% of at-risk areas.		X		
		Afforestation projects to combat desertification and mitigate impacts of flooding are active in 75% of at-risk areas.			X	
		Afforestation projects to combat desertification and mitigate impacts of flooding are active in 100% of risk areas.				X
TARGET	**4.2**	Undertake mangrove development projects (for coastal infrastructure protection) within 50% of erosion-prone coastline communities.		X		
		Undertake mangrove development projects (for coastal infrastructure protection) within 75% of erosion-prone coastline communities.			X	
		Undertake mangrove development projects (for coastal infrastructure protection) within 90-100% of erosion-prone coastline communities.				X
TARGET	**4.3**	Water management projects leveraging nature-based and infrastructural solutions are piloted in Accra.	X			
		Water management projects leveraging nature-based and infrastructural solutions are active in all major cities.		X		
		Water management projects leveraging nature-based and infrastructural solutions are active across all key at-risk urban and rural areas.			X	

TARGET	**4.4**	At least 50% of new buildings are equipped with insulation (using locally sourced materials) and high-efficiency HVAC.		X		
		75% of new buildings are equipped with insulation (using locally sourced materials) and high-efficiency HVAC.			X	
		90-100% of new buildings are equipped with insulation (using locally sourced materials) and high-efficiency HVAC.				X
TARGET	**4.5**	25% of existing built structures in Accra are equipped with insulation (using locally sourced materials) and high-efficiency HVAC.	X			
		50% of existing built structures in Accra are equipped with insulation (using locally sourced materials) and high-efficiency HVAC.		X		
		Programs equipping the existing built environment with insulation (using locally sourced materials) and HVAC are active in all major urban centers.		X		
TARGET	**4.6**	25% of roofs in major urban centers are cultivated as green roofs.		X		
		50% of roofs in major urban centers are cultivated as green roofs.			X	
TARGET	**4.7**	75-100% of new buildings in at-risk coastal areas are erected at elevation above ground level to increase flood protection.	X			
TARGET	**4.8**	25% of existing built structures on the Accra coastline are flood-protected.	X			

		50% of existing built structures on the Accra coastline are flood-protected.		X	
		50% of the at-risk inhabited coastlines have flood protection		X	
		75% of the at-risk inhabited Coastlines have flood protection.			X
		100% of the at-risk inhabited Coastlines have flood protection			X
		50% of new factories meet high energy efficiency standards, enhancing workers safety and minimizing productivity losses.	X		
		75% of new factories meet high energy efficiency standards, enhancing workers safety and minimizing productivity losses.		X	
TARGET	**4.9**	90-100% of new factories meet high energy efficiency standards, enhancing workers safety and minimizing productivity losses.			X
		50% of existing factories are renovated to meet high energy efficiency standards.		X	
		90-100% of existing factories are renovated to meet high energy efficiency standards.			X
		Social protection program to improve access to affordable climate-proof housing is piloted in Accra.	X		
TARGET	**4.10**	Social protection programs for affordable access to climate-proof housing are deployed in all major urban centers.		X	
		Social protection programs for affordable access to climate-proof housing are deployed across the country.			X

II. Climate-prosperous Ghana

Target highlights

- In 2035, 100% of major urban centers in Ghana benefited from an extended public transportation network running on electric vehicles.
- 90-100% of national food and beverage consumption is domestically produced by 2035.
- Ghana's coverage of biodiversity corridors and touch points to favor biodiversity conservation increases by 30% in 2035.

The second goal of Ghana's Climate Prosperity Plan is to leverage the transition towards a climate resilient and sustainable, low-carbon economy to unlock maximized prosperity for the people of Ghana. To achieve this goal, the plan focuses on enhancing sustainable transportation and lifestyles, the creation of green jobs, the boosting of domestic markets including to take advantage of emerging interest in sustainable exports, and the leveraging of carbon and conservation opportunities.

The first focus area for a climate-prosperous Ghana is to transform the transport sector to expand access to mobility solutions, leveraging on the possibilities of alternative, electric and low-emissions vehicles and more sustainable and health-promoting lifestyles. Transportation is a key high-emitting sector for emerging and higher income economies to which Ghana aspires – and, at present, it is heavily reliant on imported fuels, exposing the national economy to the locked-in instability of international fossil fuel prices into the long-term. Transition to low emission transportation such as electrification reduces import dependencies and instead aims at private and public revenue generation from domestically produced renewable electricity. The current transportation infrastructure furthermore favors private vehicles or mini buses with low seating capacity, thereby contributing to congestion in densely populated urban areas. The prioritization of mass transport options through the development of a reliable, electric-run systems will support the decreased need for reliance on private modes of roadway transport, while the accommodation of road infrastructure to make space for bikes and other modes of non-motorized transport will further reduce congestion while also unlocking health benefits for the population by encouraging physical movement as well as reducing air pollution and carbon emissions. Rendering cities more walkable and favoring a shift towards low-impact modes of transportation is central to this plan.

In this way, the transport sector will be a key area in which the transition towards renewable energy sources will have transformative effects for Ghana's economy and prosperity. The growing potential and affordability of electric vehicles will be leveraged to transition the vehicle fleet to become electricity-based. Fiscal incentives will be availed to harness market-level shifts including through a time-bound, staged tax exemption on the importation of low emission vehicles. Further interventions in the transportation sector can take the form of promoting sustainable aviation fuels. Switching out energy sources for households and increasing the energy efficiency of appliances will further contribute to sustainable lifestyles.

The transformation of the economy towards increased resilience in the face of escalating climate dangers and effects, as well as the global transition towards renewable energy holds tremendous potential for the creation of new and green jobs. Unlocking climate prosperity for Ghana means ensuring that the population can play an active part in the transformation of the economy, gaining also maximum access to new employment opportunities, or retraining from sunset occupations to position workers for activities that will be strategic to in a future-oriented economy. This labor transition will be gender-sensitive and inclusive of migrant and other vulnerable communities, ensuring equal opportunity benefits that no one is left behind. Ghana has a tremendous potential for local innovation and creative solution-making which will be harnessed through the creation of a green entrepreneurial hub to catalyze ideas towards the realization of climate prosperity.

Focusing on sustainable industries and local produce plays to Ghana's strengths as an agricultural heavyweight. The targeting of high value chain acquisition including through orientating Ghana as emerging industrial processing and manufacturing powerhouse is part of this plan's strategy to ensure those strengths result in maximum reward for the domestic economy, and national job creation, especially among youth and household incomes. The strengthening of local industries and the reduction of reliance on imported goods especially foodstuffs are therefore particularly key to this plan.

The enhancement of climate security across the areas of energy, food security, heat protection and nature-based solutions are a priority for Africa and the world, not just Ghana. This transformation requires a range of products which can be domestically and sustainably sourced and oftentimes exported. This represents an opportunity to create new in-country value chains whereby the value-added of production is retained into the local economic fabric rather than captured into international value chains. Particular emphasis is put on the further development of national food and beverage industries focused on fresh produce and high-protein products, contributing both to better food security through reduced import dependence, and to improved nutrition and health benefits for the population.

The upcycling industry as well as green tourism represent further areas of significant potential that can be unlocked to provide new domestic revenue streams that take full advantage of a climate-compatible economy. Innovation and the leveraging of clean technologies will be mobilized to support the optimal development of these domestic supply chains.

Finally, another area that will be leveraged towards a climate-prosperous Ghana is that of carbon and conservation opportunities. The preservation of biodiversity yields important benefits towards the preservation of local ecosystems, which are crucial to improved climate resilience. These biodiversity hotspots also represent valuable carbon sinks which can be leveraged in the context of carbon financing opportunities to capture the monetary value of conservation and greening interventions, generating revenue streams that can be leveraged towards the acceleration of the economic transition. As such, the potential of carbon finance will be tapped into to valorize the enhanced biodiversity and additional carbon sinks generated through the development of biodiversity corridors and touchpoints across the country. The reduction or elimination of wasteful fugitive emissions is also addressed towards increasing Ghana's competitiveness and harnessing carbon finance opportunities.

Objectives

5. Sustainable transportation and lifestyles

Develop all forms of mobility through conventional, alternative and mass public transport, with rapidly growing shares of an electrified vehicle fleet.

6. Sustainable jobs, livelihoods, gender development and transformative human mobility

Promote sustainable economic transformation by incentivizing and leveraging local opportunities for climate resilient and green jobs, livelihood options and effective & responsive human mobility.

7. Developing domestic food and commercial markets

Reduce import burden and strengthen local industries to boost the resilience of the economy, with a specific focus on circular opportunities and strengthening national food systems, enhancing food security and improving nutritional value by incentivizing domestic production and boosting sustainable beverage, fresh produce and high-nutrient and high-protein industries.

8. Unlocking carbon & conservation opportunities

Maximize access to carbon financing to support investment efforts while supporting conservation and ecosystem services for multi-industries (agriculture, industry, tourism etc.)

Keystones and hallmark projects

Accra-Kumasi City Electric Bus Project

The project seeks to deploy 100 Battery Electric Buses to run services on major arterial routes in Accra benefiting 24,000 passengers; complemented by an intercity e-Bus operation between Accra and Kumasi

with a benefit to approximate 2,000 persons. The project will also involve the deployment of 10 solar-powered charging stations in Accra and along the Accra-Kumasi route. This deployment of electric buses will require USD 43.485 million investment over a 3 year period.

Ghana Green Entrepreneurs Hub

As part of Ghana's existing National Entrepreneurship & Innovation Program (NEIP), a dedicated program track will be establish to develop hubs as incubators to support young entrepreneurs, start-ups, and small local businesses with innovative business ideas, with a specific focus on sustainable agriculture and derived products, eco-tourism, up-cycling, capture of waste gasses from industrial processes, and other related areas of climate-compatible activities. The ultimate goal is that incubated projects represent 1% of GDP by volume of commercial revenue by 2030 which requires an investment of USD 55 million. As well, this project is gender-responsive since it aims to have 50% of projects led by women being financed.

Result Indicator	#	Description	Timeframe			
			2025	2030	2035	2040
GOAL	**2**	**Climate Prosperous Ghana**				
DESCRIPTION		Fully leverage the green and resilient transition to protect and propel food availability, jobs, markets, livelihoods and mobility opportunities for prosperity.				
OBJECTIVE	**5**	Sustainable transportation and lifestyles				
DESCRIPTION		Develop all forms of mobility through conventional, alternative and mass public transport, with rapidly growing shares of an electrified vehicle fleet.				
TARGET	**5.1**	35% of new road vehicles (public and private) are low emissions with enabling charging infrastructure.	X			
		70% of new road vehicles (public and private) are low emissions with enabling charging infrastructure.		X		
		100% of new road vehicles (public and private) are low emissions with enabling charging infrastructure.			X	
TARGET	**5.2**	Explore opportunities to develop a production hub for electric vehicles in Ghana		X		
		5% of new electric vehicles are produced domestically			X	
		10% of new electric vehicles are produced domestically				X
TARGET	**5.3**	75% of major urban centers benefit from an extended public transportation network running on low emission vehicles.		X		
		100% of major urban centers benefit from an extended public transportation network running on low emission vehicles.			X	
TARGET	**5.4**	50% expansion of rail haulage (electric powered)		X		
		150% expansion of rail haulage (electric powered)			X	
TARGET	**5.5**	500 km of bike and alternative transport lanes in urban centers.		X		
		1,500 km of bike and alternative transport lanes in urban centers.			X	
TARGET	**5.6**	Share of non-motorized transportation increases to 10% of all road trips.	X			
		Share of non-motorized transportation increases to 20% of all road trips.		X		
		Share of non-motorized transportation increases to 30% of all road trips.			X	

TARGET	**5.7**	Introduction of sustainable aviation biofuels for 10% of flights.			X	
		Use of sustainable aviation biofuels for 30% of flights.				X
TARGET	**5.8**	30% of major petroleum products include a 10% ethanol blend.	X			
		90-100% of major petroleum products include a 10% ethanol blend.		X		
TARGET	**5.9**	10% of water heating systems are solar heaters.		X		
		30% of water heating systems are solar heaters.			X	
		60% of water heating systems are solar heaters.				X
TARGET	**5.10**	20% of metro urban households and businesses use alternative and clean fuels for thermal applications such as electricity, LPG and ethanol.		X		
		40% of metro urban households and businesses use alternative and clean fuels for thermal applications such as electricity, LPG and ethanol.			X	
		60% of metro urban households and businesses use alternative and clean fuels for thermal applications such as electricity, LPG and ethanol.				X
TARGET	**5.11**	30% of household electrical appliances are best in class for energy efficiency.		X		
		60% of household electrical appliances are best in class for energy efficiency.			X	
		90% of household electrical appliances are best in class for energy efficiency.				X

OBJECTIVE	**6**	**Sustainable jobs, livelihoods, gender development and transformative human mobility**				
DESCRIPTION		Promote sustainable economic transformation by incentivizing and leveraging local opportunities for climate resilient and green jobs, livelihood options and effective & responsive human mobility.				
TARGET	**6.1**	50% of new jobs are supported by re-skilling and training for industries of the future.		X		
		75% of new jobs are supported by re-skilling and training for industries of the future.			X	
TARGET	**6.2**	50% of value chains are optimized through value engineering to ensure domestic retention of economic value-added.		X		
		75% of value chains are optimized through value engineering to ensure domestic retention of economic value-added.			X	
		90-100% of value chains are optimized through value engineering to ensure domestic retention of economic value-added.				X
TARGET	**6.3**	A green entrepreneur hub is established to enable local solution-making, support young entrepreneurs and foster MSME sectors, and promote gender development by financing over 50% of projects led by women through micro and nano incubation and financing.	X			
		Incubated projects represent 1% of GDP by volume of commercial revenue.		X		

TARGET	**6.4**	A national assessment is conducted to assess expected patterns of in- and out-of-border migration caused by climate change.	X			
TARGET	**6.5**	A national framework is developed to deploy appropriate response mechanisms and secure quality of life and opportunities for displaced and migrating people.	X			
		The national framework for the protection of displaced and migrating people is deployed country wide.		X		
TARGET	**6.6**	A national framework and functional mechanism in place for coordination of the creation of decent green jobs across the sectors.	X			
		Timely database on job losses and jobs created in the green sectors available		X		
		Decent work interventions deployed for workers in the green sectors		X		
TARGET	**6.7**	50% of the migrant poor is covered by social protection programs.		X		
		75% of the migrant poor is covered by social protection programs.			X	
		100% of the migrant poor is covered by social protection programs.				X
TARGET	**6.8**	5% of remittance flows are leveraged to support CPP activities.	X			
		10% of remittance flows are leveraged to support CPP activities.		X		
		30% of remittance flows are leveraged to support CPP activities.			X	

OBJECTIVE	**7**	**Developing domestic food and commercial markets**				
DESCRIPTION		Reduce import burden and strengthen local industries to boost the resilience of the economy, with a specific focus on circular opportunities and strengthening national food systems, enhancing food security and improving nutritional value by incentivizing domestic production and boosting sustainable beverage, fresh produce and high-nutrient and high-protein industries.				
TARGET	**7.1**	25% increase in production in domestic food and beverage, including fresh produce and high nutrient and protein food stocks, with an emphasis on plant crops and aquaculture.	X			
		75% of national food and beverage consumption is domestically produced.		X		
		90-100% of national food and beverage consumption is domestically produced.			X	
TARGET	**7.2**	50% of agricultural inputs such as fertilizers are sourced and produced domestically.		X		
		75% of agricultural inputs such as fertilizers are sourced and produced domestically.			X	
		90-100% of agricultural inputs such as fertilizers are sourced and produced domestically.				X
TARGET	**7.3**	50% of building insulation materials are sourced and produced domestically.		X		
		75% of insulation materials are sourced and produced domestically.			X	
		100% of insulation materials are sourced and produced domestically.				X

TARGET	**7.4**	The up-cycling industry represents 15% of all industrial production.	X			
		The up-cycling industry represents 30% of all industrial production.		X		
		The up-cycling industry represents 50% of all industrial production.			X	
TARGET	**7.5**	Green/eco-tourism contributes 10% of Ghana's GDP		X		
		Green/eco-tourism represents 20% of Ghana's GDP.			X	
TARGET	**7.6**	Clean technologies are leveraged to digitize or provide new digital support to 50% of the economy across all sectors.	X			
		Clean technologies are leveraged to digitize or provide new digital support to 75% of the economy across all sectors.		X		
		Clean technologies are leveraged to digitize or provide new digital support to 90-100% of the economy across all sectors.			X	
TARGET	**7.7**	Government concessions and finance are developed to support private sector development of renewable technologies.		X		
		Government concessions and finance are implemented to support private sector development of renewable technologies.			X	
OBJECTIVE	**8**	**Unlocking carbon & conservation opportunities**				
DESCRIPTION		Maximize access to carbon financing to support investment efforts while supporting conservation and ecosystem services for multi-industries (agriculture, industry, tourism etc.)				

TARGET	**8.1**	Projects representing 2-5% tons of Ghana's GHG emissions activated through carbon financing.	X			
		Projects representing 5-10% of Ghana's GHG emissions activated through carbon financing.		X		
		Projects representing 10-15% of Ghana's GHG emissions activated through carbon financing.			X	
TARGET	**8.2**	Coverage of biodiversity corridors and touchpoints increases land area under biodiversity conservation by 5%.	X			
		Coverage of biodiversity corridors and touchpoints increases land area under biodiversity conservation by 15%.		X		
		Coverage of biodiversity corridors and touchpoints to favor biodiversity conservation increases by 30%.			X	
TARGET	**8.3**	Gas flaring and fugitive emissions are reduced by 15% through carbon finance.	X			
		Gas flaring and fugitive emissions are reduced by 50% through carbon finance.		X		
		Gas flaring and fugitive emissions are reduced by 90-100% through carbon finance.			X	
TARGET	**8.4**	GHG emitting industries are required to establish carbon offset projects for 10% of their emissions.		X		
		GHG emitting industries are required to establish carbon offset projects for 20% of their emissions.			X	
		GHG emitting industries are required to establish carbon offset projects for 40% of their emissions.				X

Scenarios and Timeframes

The Climate Prosperity Plan considers the following key parameters which frame strategy design, macro-economic, fiscal and environmental modelling, and measures planning.

Scenarios

There are three Climate Prosperity Plan scenarios considered:

- **Business as usual (BAU):** This scenario represents the national development pathway that would automatically prevail as the case, and is a scenario absent any specific climate-related interventions of any kind. It represents a continuation of the current development trajectory and trends for the country.

- **Nationally Determined Contribution (NDC):** This scenario is a version of the BAU scenario that is modified by the core commitments presented in Ghana's NDC. It represents how the country would develop if the Paris Agreement NDC targets are met.

- **Climate Prosperity Plan (CPP):** This scenario simulates the macro socio-economic outcomes based on the strategic aims (goals, objectives and targets), key measures and investment and fiscal strategies defined in this Preliminary CPP report. It enables testing of strategies and interventions and the control for the difference in strategy outcomes for the economy and society versus the BAU and NDC scenarios.

Timeframes

The CPP spans the full period 2020 to 2050 in terms of modeled outcomes. The strategic aims of the CPP are mapped until 2040, while key measures (keystone, hallmark and other project and programme activities) are mapped through to 2030.

CPP Model

All scenarios are modelled using the bespoke CPP model, which is a highly modified and customised variation of the Green Economy Model (GEM) designed to suit the range and type of macro-economic and societal decision-making facing CVF and V20 countries due to accelerating global climate change, its adverse effects and transition pressures.

Elements of the scenarios and modeling are more fully described in the Macro-Economic Analysis section of this Preliminary CPP report.

Financing

In order to secure its successful implementation, the Climate Prosperity Plan of Ghana embeds investment and future fiscal strategies which function in tandem. The successful deployment of the two strategies outlined below will be a determining factor for the extent of implementation of strategic aims spelt out in the CPP. In particular, the international concessional finance and economic cooperation components included in the investment strategy are key catalysts to unlock the full implementation potential of the Plan.

Investment strategy

The total resource mobilization opportunity under this Plan is 76.2 billion USD with an initial investment opportunity of USD 17 billion through 2030 - a large share of this amount being sourced from international sources. The realization of the Plan hinges on the extent to which finance can be mobilized at quality, scale and speed. The following resource mobilization initiatives will be deployed in an effort to ensure the enabling of optimal Plan implementation:

1. carbon financing exchanges through the use of internationally transferred mitigation outcomes (ITMOs) through government-to-government and private actors with Special Drawing for Net Zero through off-balance-sheet investments

2. equity investment and concessional convertible debt in key institutions that can act as control levers

towards a transition;

3. project preparation towards bankability support including through reimbursable grants;
4. bringing down the cost of capital through credit strengthening, long-term financing, and local currency financing (including maximizing opportunities for domestic private sector participation across all investments and subsidy accounts for hedging options to enable international private sector);
5. increased multilateral resources from the the headroom to crowd in private sector participation;
6. blended finance can be used as catalytic capital from philanthropic or public sources to increase private participation;
7. broad technology partnerships through the promotion of innovative business models and technology;
8. credit strengthening for domestic banks can enable the financing of adaptation and resilience projects, including partial credit guarantees or insurance and risk sharing, including subordinated debt investment, thus lowering the cost of capital;
9. cost effective mechanisms to rebuild domestic balance sheets immediately after a shock created by climate-fueled risks;
10. export credit agencies in developed countries can reinforce the cooperative relationship among financial institutions and government agencies through financial support for resilient infrastructure projects;
11. use of IMF's Resilience and Sustainability Trust and other new climate-related trusts
12. comprehensive risk financing packages for pre-arranged and trigger based financing for business continuity and financial protection through the G7-V20 Global Shield against Climate Risks.

V20 economies cannot continue to sustain losses of this magnitude – about USD 500 billion in economic losses over two decades (2000-2019) due to human-induced global warming, and projections of USD 200 billion of losses through to 2027 should we manage to keep to 1.5 centigrade limit of the Paris Agreement. Very critical to the reversal of these misfortunes and the acceleration of climate-resilient growth is the transformation of the global financial architecture into one that is fit-for-climate, transparent, and equitable. It is important to have a system that aligns financial incentives with the goals of the Paris Agreement and supports the transition to a low-carbon and climate-resilient economy. There is thus an opportunity for the international community to support with enabling development positive climate action this decade through USD 6.4 billion in debt service relief through a portfolio of solutions including debt-for-climate swaps, guarantees for existing creditors with preferred investment access to the initial USD 17 billion of Climate Prosperity Plan opportunities and refinancing towards unlocking new capital and realising debt sustainability.

Table 1: Breakdown of the Total Initial Investment Opportunity of Climate Prosperity Plan programs

NO.	PROJECT NAME	INVESTMENT NEEDED (USD)	INVESTMENT HORIZON	YEARS	BREAKDOWN				INITIAL RESOURCE NEEDS
					GOVT.	OFFICIAL PUBLIC SOURCES (MDBs)	PRIVATE SECTOR	CONCESSIONAL / DE-RISKIKNG TOOL OR GRANT	OTHER FUNDING	
1	Accelerated Energy Transformation for Power Resilience and Security	$16,800,000,000	over 8 years	2023 - 2030		$4,800,000,000	$11,200,000,000	$800,000,000		$400,000
2	Sustainable Safe Water and Sanitation Improvement Project	$198,000,000	6 years	2023 - 2028	$9,900,000	$89,100,000		$99,000,000		$198,000,000
3	Ghana MSME Climate Insurance	$5,000,000	5 years	2024 - 2028		$3,000,000		$2,000,000		$600,000
4	Urban Greening & Sponge Cities Project	$415,000,000	8 years	2023 - 2030		$290,500,000	$83,000,000	$41,500,000		$2,000,000
5	Accra-Kumasi City Electric Bus Project	$53,754,581	over 3 years	2023 - 2025	$20,511,811		$26,776,388	$6,466,382		
6	Ghana Green Entrepreneurs Hub	$55,000,000	8 years	2023 - 2030			$50,000,000	$5,000,000		
	TOTAL	$17,526,754,581			$30,411,811	$5,182,600,000	$11,359,766,388	$953,966,382		$ 201,000,000

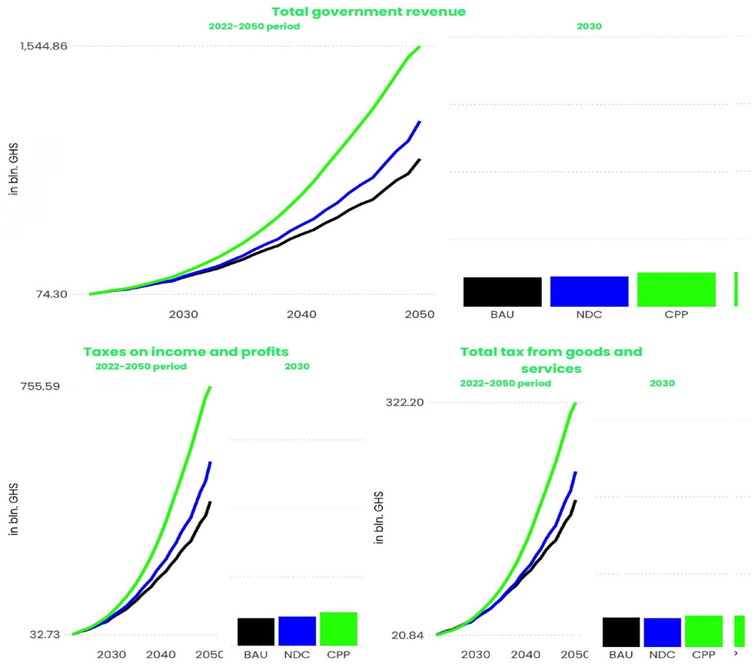
Climate Prosperity Plan | Ghana 2023

Fiscal strategy

Overview

The available fiscal tools will be mobilised to facilitate the deployment of the Climate Prosperity Plan to sustain macroeconomic stability and resilience through inclusive growth and value addition. The fiscal strategy is conceived to ensure that the CPP is continuously revenue-positive compared to business-as-usual for the government of Ghana throughout the entire time frame, thereby compensating for shifts in income and expenditure flows where necessary while at the same time implementing fiscal incentives that will facilitate the accomplishment of the strategic aims laid out in the Plan.

Over the period 2022-2050, government revenues are projected to increase in the BAU scenario thanks to economic growth, going from 32.7 billion GHS in 2022 to 877.0 billion GHS in 2050. However, government revenue grows even further under the implementation of the Climate Prosperity Plan, potentially reaching 1,544.9 billion GHS in 2050. This represents over a 75% increase when compared to business as usual.



Tax revenue and exemptions

The evolution of government revenue increases the domestic revenue base under the CPP scenario driven by the increase in GDP and disposable income through the achievement of the CPP's strategic aims, which lead to enhanced economic activity thanks to better financial protection, fewer climate losses, more efficient energy use, a workforce that is better protected against heat stress and other climate risks. This drives up the revenue accrued from taxes on income and profits, as well as goods and services. The revenue from VAT is further boosted by an increased consumption of electricity due to the expansion of grid connection towards complete electrification as well as the transition towards an electricity-based transportation system (though this eventually plateaus as a result of energy efficiency gains compared to BAU). The VAT on electricity in the model is estimated at 10%, accounting for exemptions, efficiency losses in tax collection, and electricity theft. The additional revenue generated under those tax streams largely make up for the loss of energy tax income due to the reduction of fossil imports. This progressive displacement of reduced fossil fuel revenue over time towards alternate revenue streams is what makes the Climate Prosperity Plan budget neutral (not requiring any net additional outlays in public expenditure over the medium or long term) and public revenue positive across the whole period of implementation.

In terms of fiscal measures proposed under this Plan, the CPP scenario integrates a temporary fiscal incentive in the form of a VAT and import taxes exemption on electric vehicles. This temporary tax break aims to make electric vehicles more fiscally attractive and competitive with other types of vehicles, thereby supporting the acceleration of a transition towards electric transportation, a key objective of the Plan. The tax break runs from 2023 to 2030, at which point it will be phased out as future electric vehicles become price-competitive.

Table 2: Fiscal recommendations

Fiscal recommendations programmed into the CPP scenario					
The following fiscal recommendations have been incorporated into the calibration of the CPP scenario. These recommendations are put forward in order to ensure that the national CPP is budget-positive throughout its deployment. Fiscal recommendations ensure that the transition towards a climate-compatible economy is harnessed into governmental revenue streams, shifting market-wide dynamics to promote higher public revenues; and they also serve to incentivize and accelerate the transition towards a climate prosperity pathway.					
Fiscal Instrument	**Type of recommendation**	**Applying to**	**Timeframe**	**Rationale**	**Comments**
VAT and import taxes	Exemption	Electric vehicles	2022-2030	Incentivize and accelerate transition to an electrical vehicle fleet	Temporary tax break then phase-out (projected future EV purchase costs reaching parity with fuel powered vehicles)

Key measures

Target 1.1 90-100% least-cost renewable energy capacity potential is financed.

CATEGORY	CONTENT
Project name	Accelerated Energy Transformation for Power Resilience and Security
Project type	Renewable energy and resilience
Project sector/subsector	A portfolio of offshore/floating wind, tidal energy, solar energy, storage and grid modernization to systematically displace high cost technologies
Project description	A maximised renewable energy strategy to displace uneconomic technology options through 3GW of new capacity additions before 2030. Technology options include offshore/floating wind, tidal energy, solar energy, storage and grid modernization
Project rationale	Considering Ghana's current power system with excess gas supply and overgeneration of power that runs short during delivery, the debt within the power sector is growing steadily coupled with the high cost of generation. The program will maximise domestic renewable energy options in order to displace high cost technologies such as gas.
Project beneficiaries	End-users (consumers and industry) of the generated electricity (direct beneficiaries), overall population of the country (indirect beneficiaries)
Project objectives	500 MW by 2025 1.5 GW by 2027 2 GW by 2028 2.5 GW by 2029 3 GW of installed capacity by 2030
Expected project impact, outcomes and outputs	Output: • Ghana Offshore Technologies and Investment Setup Outcomes: • At least 50% renewable energy produced by Ghana

	Impacts: • Increased energy security for Ghana
Key project/program components (milestones/ activities)	2023 – Transformation costing and displacement strategy of the power system 2024 – Tender documents 2030 – Ghana completes maximised offshore power
Project location	Keta, Volta Region

CATEGORY	CONTENT
Start date	2023
End date	2030
Key responsible entity(ies)	Coordination: Ministry for Finance and Economic Planning, Ministry of Energy Advisory: FFC and Transition Zero Implementation: Competitive procurement Oversight: SDGs Advisory Unit in the Office of the President
Project timeline	Activity 1: Transformation costing and displacement strategy of the power system Timeline 1: 2023 Activity 2: Feasibility study and identification of optimal project locations Timeline 1: Early 2024 Activity 3: Deployment of first set of renewable energy technologies to achieve generation capacity of 500 MW in 2025 Timeline 2: 2024-2025
	Activity 3: Further deployment of renewable energy technologies across locations to achieve 1.5 GW of in-stalled capacity in 2027, 2 GW in 2028, 2.5 GW in 2029 and 3 GW in 2030 Timeline 3: 2026-2030
Estimated level of investment and investment horizon	USD 16.8 billion over 8 years (including 5% in guarantees)
Financing and terms	Green SPV as off-taker with PPA BOT
Revenue options	PPA Ancillary services Carbon financing (through internationally traded mitigation outcomes)
Breakdown	Government: Support with a bankable PPA
	Official Public Sources (MDBs): 30% bilateral or MDB concessional debt
	Private sector: 50% private debt and 20% equity
	Concessional/de-risking tool or grant: 5% guarantees (including a subsidy account to index tariffs against the US dollar and to ensure local currency financing to the maximum)
	Other Funding (type and amount): N/A
Go-to market strategy and resource needs	• Feasibility study and bankability support • Roundtable with various renewable energy providers and government on the feasibility • Engagement with the government on next steps • PPA agreement

	• Procurement documents • Close financing • Implementation Initial resource needs: $400,000
Commercial viability, if relevant	
Commodities required (if relevant/any	N/A
Indicative implementation arrangements	The implementation will be set up with the Ministry of Energy as the lead. The project is foreseen to be a Public-Private Partnership, and the partner will be sought through competitive procurement
Opportunities for partnerships	• Private sector partner for technical feasibility • Private sector partner to build and operate
Roles and responsibilities of key stakeholders	• SDGs Advisory Unit in the Office of the President : oversight • Ministry of Energy: coordination and lead • Ministry for Finance and Economic Planning: lead in external financing • Technical partner: feasibility study • Private sector partner: construction and operation
Risks and mitigating measures	Risks include regulatory requirements and administrative hurdles, which will be mitigated by close monitoring of the project as well as continuous engagement with relevant administrative instances to ensure that all requirements are met.

Indicators to measure results	• Units of electricity generated • % of energy intensity lowered • Amount of public cost savings in fuel subsidy • Amount of investment • No. of jobs created
Policy/Regulation recommendations	N/A
CPP contributions	• Contribution to the objective of financing maximised resilient and renewable energy systems, with a view to sustainably exploit the full potential of national renewable energy resources, optimising energy efficiency and ensuring complete energy access, minimising power outages and enhancing the disaster resilience of energy, in particular to achieve the target of 50% of least-cost renewable energy capacity potential being financed by 2030; and to achieve 90-100% of least-cost renewable energy potential being financed by 2040. • Secondary contribution to the target of achieving 50% of the workforce in the energy sector having access to upskilling training to transition to clean energy and waste to energy jobs by 2030; and 90-100% by 2035.

Target 2.5 100% of the population with access to at least basic water services.

CATEGORY	CONTENT
Project name	Sustainable Safe Water and Sanitation Improvement Project
Project type	Social Development
Project sector/subsector	Water access; water sanitation; sustainable environmental sanitation
Project description	This project aims to improve access to safely managed drinking water services, particularly in rural areas. This will include the deployment of safe water infrastructure, the implementation of WASH programs in school and the promotion of sanitation and hygiene practices.
Project rationale	At the current rate of urbanisation, the provision of water is unable to keep pace with demand, with the attendant adverse effect on public health. This project will increase access to safe drinking water and improved sanitation and basic hygiene services. Safe water supplies are ever more crucial in the context of climate change, where climate-induced disasters and disrupted weather patterns can threaten water sources, heightening the need for safe and reliable access.
Project beneficiaries	Communities, families, schools, commercial and industrial establishments
Project objectives	• improved sanitation and basic hygiene services in 53 communities and 150 schools • 4 new and 39 existing solar-powered pipe water systems constructed • Potentials created for 411,000 household connections • Commercial and industrial establishments connected • 600 school toilet facilities constructed • 1,700 communities and 150 schools sensitised on improved sanitation • 560 water system management staff trained
Expected project impact, outcomes and outputs	Outputs: • Deployment of safe drinking water infrastructure • Implementation of trainings/ information campaigns Outcomes: • Increase access to affordable drinking water, improved sanitation and basic hygiene services in 53 communities and 150 schools Impacts: • Improved access to safe drinking water; • Wider-spread implementation of standard sanitation and hygiene practices
Key project components (milestones/activities)	Activity 1: Undertake community sensitisation and mobilisation Activity 2: Undertake feasibility studies

	Activity 3: Carry out procurement and undertake boreholes of siting, drilling and civil works contractors Activity 4: Construct solar power facilities Activity 5: Construct toilet facilities Activity 6: Recruit and train water system management staff
Project location	Across 53 communities and 150 schools
Start date	2023
End date	2028
Key responsible entity(ies)	Coordination and oversight: Ministry of Sanitation and Water Resources Advisory: local water sector NGOs Implementation: Community Water and Sanitation Agency (CWSA)
Program timeline	2023: Feasibility studies; technical assessment and design/redesign of pipe water systems; procurement of contractor for construction and civil works 2024-2027: Construction of water systems and solar power facilities; installation of packaged water treatment plants; construction of school toilet facilities; construction of calibration centers and water quality testing laboratories;

		Procurement of equipment for water systems operation; hygiene education and sensitization 2025-2028: Recruitment, training and deployment of water system management staff
Estimated level of investment and investment horizon		$198M
Financing and terms		Funded exclusively through grants and loans from the development partner
Revenue options		Tariffs
Breakdown	Government	5% and Establish a tariff methodology and/or setting and updating prices or supervising the tariff setting process, determining tariffs by consumer group, establishing caps on revenues or rate of return on investment
	Official Public Sources (MDBs)	~45%
	Private sector	To be determined
	Concessional/de-risking tool or grant	~50%
	Other Funding (type and amount)	

Go-to market strategy and resource needs	• Go-to-Market Strategy: • Preparation of project concept notes has been completed • Pre-feasibility and feasibility studies will be conducted in the first year • Procurement of consultants for technical assessment, design/ redesign and construction supervision • Technical assessment and design/ redesign of pipe water systems • Procurement of contractors for construction and civil works • Construction of water systems and solar power facilities • Installation of packaged water treatment plants • Construction of school toilet facilities • Construction of calibration centers and water quality testing laboratories • Procurement of equipment for water systems operation • Hygiene education and sensitization • Recruitment, training, and deployment of water system management staff • Establishment of support mechanism for sustainable management of point water systems • Supervision, monitoring and evaluation • Closure and reporting Resource needs: $198,000,000
Commercial viability, if relevant	N/A
Commodities required (if relevant/any)	Water Various infrastructure costs (sanitation facility, water treatment plants, etc.)

Indicative implementation arrangements	CSWA will handle the deployment of the project on the ground and be responsible for the identification of contractors
Opportunities for partnerships	Private sector contractors for the design and installation of pipe water systems, construction and civil works
Roles and responsibilities of key stakeholders	Ministry of Sanitation and Water Services: oversight and coordination of the project CSWA: deployment and implementation of the project on the ground Ministry for Finance and Economic Planning: financing
Risks and mitigating measures	Risks include administrative hurdles, to be mitigated through continuous coordination with various entities; lack of community mobilisation and conflict related to land acquisition, to be mitigated through close and continuous engagement with the Ministry of Local Government, Decentralization and Rural Development, the Regional Coordinating Councils; District Assemblies; Traditional Authorities and Opinion Leaders.
Indicators to measure results	• kilometres of pipes installed • number of people and communities newly accessing safe drinking water services • number of schools benefiting from newly installed toilet facilities • number of people benefiting from training • operational efficiency of services

Policy/Regulation recommendations	N/A
CPP contributions	Contribution to Objective 2 resilient health and water access through improving access to safe water and sanitation. The project will also promote Objective 4, through eco-friendly innovations such as energy efficiency improvements, renewable energy such as solar, materials reduction and carbon emission elimination / reduction.

Target 3.1 Extend financial protection against climate related disasters for 90-100% of the population living in poverty.

CATEGORY	CONTENT
Program name	Ghana MSME Climate Insurance
Program type	Resilience / Insurance
Program sector/subsector	Economic growth / Livelihoods / Poverty reduction
Program description	Integration of climate smart insurance through the V20's Sustainable Insurance Facility as core offering for MSMEs via Ghana wholesale buyer / seller associations: CocoBod (national cocoa association), Ghana Incentive-based Risk-Sharing System for Agricultural Lending ("GIRSAL" a non-bank financial institution supported by ministry of Finance and African Development Bank)

	and Ghana Tourism Federation ("GHATOF" apex association >20 tourism sector associations). by the V20 Sustainable Insurance Facility.
Program rationale	Micro and small enterprises are severely affected by climate risk but uninsured in Ghana's core economic sectors of agriculture and tourism. This negatively impacts their ability to recover from loss events as well as to invest in adaptation measures. An active insurance industry, supported by reinsurers, is prepared to underwrite but lacks an efficient and effective last mile. As a result, product tailoring for each sector is also constrained as underwriters require representatives of the insured's to propose their need for quotation.
Program beneficiaries	Businesses with less than 20 employees including survivalist farmers, delivery truck drivers, input providers, hospitality sector businesses, and their families (direct beneficiaries). Ghana's large corporations and economy which rely on the MSMEs (indirect beneficiaries).
Program objectives	2024 – Bundled climate-smart insurance product plus tangible extension service launched via Cocobod and/or GIRSAL 2025 – Launch of climate-smart insurance bundle via GHATOF 2027 – Scale-up / adjustment of product offering

Expected program impact, outcomes and outputs	• Total sum assured of USD$1B (contingent savings) provided to target segment by 2030 to unlock investments in climate adaptation equipment and business practices of an equal value (~750,000 individual business investments in adaptation @ $1,000 per) • Claims payments prevent business failure and poverty conditions for ~5% of all covered businesses (~37,500 businesses representing >500,000 individual employees and their dependant families)
Key program components (milestones/activities)	• 2024 Demand based product design and insurance infrastructure implementation • 2025 Implementation, training, and adjustment in associations • 2026 Continued roll-out to associations / re-quoting of products and addition of new products
Program location	Country-wide
Start date	2024
End date	2028
Key responsible entity(ies)	Coordination: Local business administration service provider selected via competitive tender Advisory: International / national insurance advisor selected via competitive tender Implementation: (1) wholesale buyer / seller associations COCOBOD, GIRSAL, and GHATOF (2) insurers selected by competitive quotation Oversight: V20 Sustainable Insurance Facility
Program timeline	Activity 1: Insurance product / bundle tailoring Timeline 1: 1H23 Prioritise product set with end- MSME clients via wholesale buyer/sellers; competitive bid for top three insurance (risk absorption) / assistance (risk mitigation) bundle elements; 2H23 launch first bundle; 1H24 repeat process for GHATOF organisations. Activity 2: Insurance infrastructure implementation Timeline 2: 1H23 Confirm detailed requirements, code, & deploy 1H24 Train the trainer / first launches Activity 3: Minimum viable product launches Timeline 3: 2H23-1H24 Training and support of product rollout in CocoBod / GIRSAL; 2H24-1H25 Training and support of rollout in GHATOF Activity 4: Scale-up branches & expand offer Timeline 4: 2H25-2H28 Training and support of product integration in 500 branches; 2H25-2H26 Additional product bundle development and portfolio adjustments

Estimated level of investment and investment horizon		USD 5,000,000 investment 2023-2028
Financing and terms		Insurance Purchase Agreement (equivalent to Power Purchase Agreement) to buy future insurance sales of bank and association channels
Revenue options		Off-shore cell-captives for associations Value added services with insurance
Breakdown	Government	0
	Official Public Sources (MDBs)	$3M Insurance purchase agreement value at risk
	Private sector	To be determined
	Concessional/de-risking tool or grant	$1.0M Grant for initial set-up, training, management $1.0M Credit/incentive wrappers for IPA
	Other Funding (type and amount)	
Go-to market strategy and resource needs		• Buyer/Seller associations on-boarding • Engagement with finance ministry • IPA agreement • Technology business requirements and workflow mapping • Insurance product business requirements with end beneficiaries and commercial tender • Contracting Initial resource needs: $600,000
Commercial viability, if relevant		Project is self-funding by 2028 with IPA return of capital by 2033

Commodities required (if relevant/any)	None
Indicative implementation arrangements	Associations discussions indicate interest but also highlight need for funding and technical advisory; Insurers & products have been reviewed
Opportunities for partnerships	Reinsurance market for parametric climate index, Private market farm input producers
Roles and responsibilities of key stakeholders	V20 Sustainable Insurance Facility will manage the project through to hand-off to local actors, including local project manager Associations are responsible for promotion and placement of offers Local insurance actors, selected by quotation, are responsible product pricing and risk acceptance
Risks and mitigating measures	Change of laws/regulations mitigated by interface by V20 support with Ghana finance ministry Low uptake / retention by MSMEs mitigated by product design phase and integration of insurance product with tangible services Claims exceed premiums mitigated by reinsurance placements of insurers
Indicators to measure results	• New access implemented (branches prepared and client-facing staff trained) • # of coverage months (as a factor of the number of policies and the retention rate)

	• Working capital unlocked in target segment i.e., $ sum assured (total face value of policies purchased by end customers) • Risk-based insurance capital allocated on insurer balance sheet (anticipated losses over multi-year) • Actual insurance claims paid • % of insured businesses continuing operations after claims payment
Policy/Regulation recommendations	None identified to date
CPP contributions	• Contribution to objective 3 on national financial protection to promote risk-informed investment and enable progressive coverage of financial/social protection including insurance for all core climate and disaster risk, with a specific emphasis on resilience against agricultural losses, particularly target 3.1 of extending financial protection against climate-related disasters for 70% of the population living poverty by 2025 (and 90-100% by 2030) • Establish insurance last-mile infrastructure for MSMEs in Ghana to provide contingent risk capital these businesses require to invest in climate adaptation (energy efficient and low carbon working implements and methods) • Ameliorate negative welfare impact of climate risk on small-holders through formal risk transfer and claims payments.

Target 2.2 Program to increase shaded areas and reduce heat island effect through the promotion of biodiversity corridors and touch points is expanded to regional cities with more than 25,000 people.

Target 4.3 Water management projects leveraging nature-based and infrastructural solutions are active across all key at-risk urban and rural areas.

Target 4.6 50% of roofs in major urban centres are cultivated as green roofs.

CATEGORY	CONTENT
Project name	Urban Greening & Sponge Cities Project
Project type	Resilience
Project sector/subsector	Nature-based solutions; flood protection
Project description	This project will aim to increase resilience to floods through the implementation of strategically located green spaces and other nature-based interventions to regulate drainage, with the goal to create a “sponge city” that can soak up as much extra water as possible. Nature-based solutions will be complemented by grey solutions where needed. This project will be piloted in Accra and expanded to other urban areas prone to flooding in the future. The urban greening under this project will also contribute to reducing heat island effects through heat absorption and capture of rainwater and moisture, contributing to an overall regulation of climate extremes in urban areas.

	As part of the deployment of this project, a specific component will also target the greening of roofs to further contribute to heat regulation. The deployment of new green spaces across urban areas will also be a way to foster biodiversity.
Project rationale	Due to inadequate drainage, coastal cities are threatened by climate hazards such as flooding, exposing roads, buildings, natural areas, and other assets. Sponge cities are designed to soak up as much extra water as possible. These measures can support the improvement of the drainage system by using a mixture of green & grey solutions, including urban forests and parks. Prioritising green and nature-based solutions will contribute not only to the regulation of water and drainage systems, but also make cities cooler by providing shade, and enhancing the walkability of cities by creating recreational green areas.
Project beneficiaries	Inhabitants of Accra and other coastal cities in which the project is deployed
Project objectives	• Leverage nature-based solutions to diminish flood intensity and frequency in Accra and other coastal cities • Enhancement of green spaces in urban areas to reduce heat island effects, increase shade, and provide new recreational areas • Increased water quality and groundwater, with co-benefits to ecosystems, health and recreation • Foster biodiversity through the establishment of green areas and biodiversity touch points throughout urban areas

Expected project impact, outcomes and outputs	Output: • Deployment of nature-based solutions such as parks and urban forests, to be complemented where needed by grey infrastructure, to help regulate water drainage in Accra and other urban areas prone to flooding, following the principles of a sponge city • Deployment of green roofs and biodiversity touch points throughout urban areas to further combat heat island effects and foster biodiversity Outcome: • Increased green cover in Accra and other targeted urban areas • 25% of roofs in major urban centres are cultivated as green roofs by 2030 Impact: • Improved water management and reduced risk of flooding • Increase in shaded areas and reduction of heat island effects • Greener cities that are more walkable • Richer biodiversity in urban areas
Key project components (milestones/activities)	Activity 1: Identification of appropriate mix of interventions and target locations for project deployment in Accra Activity 2: Selection of buildings for piloting green roofs Activity 3: Definition of the ideal format and composition of biodiversity touch points

	Activity 4: Deployment of all identified measures in pilot areas Activity 5: Scale up and expansion of measures city-wide Activity 6: Replication of the process in other relevant cities with flood risk
Project location	Accra and other cities at risk of flooding
Start date	2023
End date	2030
Key responsible entity(ies)	Coordination: Ministry of Environment, Science, Innovation and Technology, supported by local municipalities Advisory: Ministry of Sanitation and Water Services Implementation: identification of contractor through competitive tender
Project timeline	Activity 1: Identification of appropriate mix of interventions and target locations for project deployment in Accra Timeline 1: 2023 Activity 2: Selection of buildings for piloting green roofs Timeline 2: 2023 Activity 3: Definition of the ideal format and composition of biodiversity touch points Timeline 3: 2023

		Activity 4: Deployment of all identified measures in pilot areas Timeline 4: 2024-2025 Activity 5: Scale up and expansion of measures city-wide Timeline 5: 2026-2028 Activity 6: Replication of the process in other relevant cities with flood risk Timeline 6: 2026-2030
Estimated level of investment and investment horizon		USD 415 million
Financing and terms		Concessional loan, grants and equity
Revenue options		Revenue from enhanced property and sales taxes, service charges, and land value uplift around sponge projects could then be used to finance more sponge construction.
Breakdown	Government	0
	Official Public Sources (MDBs)	70% of long-term and concessional loans from a mix of Green Belt and Road Initiative and Africa Adaptation Acceleration Program (AAAP)
	Private sector	20% of equity and joint venture support
	Concessional/de-risking tool or grant	10% in grants and de-risking in order to enable local currency financing
	Other Funding (type and amount)	

Go-to market strategy and resource needs	USD 2 million in initial project preparations
Commercial viability, if relevant	Mixed
Commodities required (if relevant/any)	N/A
Indicative implementation arrangements	Contractor to be identified for the implementation of the project under the oversight of the Ministry of Environment, Science, Technology and Innovation
Opportunities for partnerships	Private sector for supporting the implementation of nature-based and infrastructure solutions Collaboration partnership with Africa Adaptation Initiative (AAI) Financing partnership with Green Belt and Road Initiative and Africa Adaptation Acceleration Program (AAAP)
Roles and responsibilities of key stakeholders	Ministry of Environment, Science, Technology and Innovation will be responsible for coordinating with municipal authorities and overseeing project deployment and contractor selection. Ministry of Sanitation and Water Services will be consulted for advice.
Risks and mitigating measures	Coordination and administrative hurdles to be mitigated through an effective and inclusive coordination process; public resistance and land conflicts to be resolved through community engagement for the length of the project and awareness raising campaigns.

Indicators to measure results	• Acres of green areas created and corresponding water absorption capacity • Number of buildings equipped with green roofs • Number of biodiversity touchpoints established
Policy/Regulation recommendations	N/A
CPP contributions	Contributions to the objective related to green and resilient built environment, to climate-proof the built environment and the economy by leveraging nature-based solutions and increasing resilience through both soft and hard engineering, leveraging local materials to increase build affordability, in particular targets 4.3 related to the implementation of water management projects in at-risk areas; target 4.6 to have 25% of roofs in major urban centers cultivated as green roofs by 2030 (and 50% by 2035); as well as target 2.2 related to resilient health and water access, through the increase of shaded areas and reduction of heat island effects through the promotion of biodiversity corridors and touch points.

Target 5.1 100% of new road vehicles (public and private) are electric with enabling charging infrastructure.

Target 5.3 100% of major urban centers benefit from an extended public transportation network running on electric vehicles.

CATEGORY	CONTENT
Project name	Accra-Kumasi City Electric Bus Project
Project type	Transportation
Program description	Introduction of 100 Battery Electric Buses to run scheduled bus services on major arterial routes in Accra, complemented by an intercity e-Bus operation between Accra and Kumasi. The project will also involve the deployment of 10 solar-powered charging stations in Accra and along the Accra-Kumasi route. The project also includes a component of skills development and engagement to train service providers, build capacity and enhance technical support.
Program rationale	Accra is one of the fastest urbanising cities in Africa and the largest city in Ghana, while Kumasi is the second-largest. Both cities have above average population density and suffer from traffic congestion. There is a need to plan and implement sustainable mass transit solutions to deal with growing congestion, poor air quality, and transportation sector emissions. This project will phase out the use of diesel-powered urban buses in Accra and Kumasi within the short to medium term and a long-term perspective of greening public transport as a whole. Investing in high-occupancy buses will also support the shift away from the currently predominant minibusses, thereby helping to reduce both congestion and emissions from transport.
Program beneficiaries	The introduction of 100 high-occupancy buses will improve clean, reliable and safe public transport to nearly 24,000 passengers daily in Accra and 2,000 commuting between Accra and Kumasi. Secondary beneficiaries include all city residents benefitting from reduced traffic and air pollution.
Program objectives	• Identify relevant routes for a new fleet of electric buses • Operationalize and deploy a new fleet of 100 high-occupancy electric buses in and between Accra and Kumasi as well as 10 solar-powered charging stations • Capacity-building of bus operators and relevant transportation sector actors to ensure the successful deployment of the fleet
Expected program impact, outcomes and outputs	Outputs: • New fleet of electric buses in both Accra and Kumasi • Design for a training program for bus operators and relevant transportation sector actors Impacts: • Decrease in emissions from the transport sector • Improved air quality • Improvement of traffic and reduced need for individual cars Outcomes: • 46.684 tons of GHG emissions avoided

Key program components (milestones/activities)	Activity 1: Selection and design of transportation routes Activity 2: Needs assessment for training of bus operators and transportation sector actors Activity 3: Pilot test of key transport routes (intra- and inter city) Activity 4: Deployment of training program Activity 5: Deployment of new fleet of buses on intra- and intercity routes and installation of charging stations
Program location	Accra and Kumasi
Start date	2023
End date	2025
Key responsible entity(ies)	Coordination: Ministry of Transport; Ministry of Environment, Science, Technology and Innovation; Environmental Protection Agency Advisory: UN Environment, Copenhagen Climate Centre Implementation: competitive procurement; managed by Accra and Kumasi Metropolitan Districts Oversight: Ministry of Transport; Ministry for Finance and Economic Planning

Program timeline	2023 – Selection and design of transport routes, including approval of proposals for for key infrastructure needed e.g. smart charging stations, network; trainings needs assessment of buses operators and other transportation sector actors; development of suitable training and certification programs 2024 – Pilot test of key intra city transport routes (building infrastructure, implementation, training); deployment of training programs 2025 – Installation of charging stations and full rollout of intracity and intercity routes
Estimated level of investment and investment horizon	53,754,581 million USD over 3 years
Financing and terms	• For the Route Infrastructure Deployment component, a 20% grant and a 60% loan with a 10% interest rate (in local currency)will be provided for both the vehicle (without battery) and battery capitalization costs for both intracity and intercity routes. • For the charging infrastructure capitalization costs, an 80% loan with a 10% interest rate will be provided for both intracity and intercity routes. • The charging services will be operated by a special purpose vehicle (SPV) and the electric bus original equipment manufacturer (OEM), with costs recovered from collected revenue. • The government of Ghana will provide a 5% interest rate subsidy (50% subsidy) for both intracity and intercity routes.

		• The government of Ghana will also provide a 20% subsidy over the industrial tariff for electricity costs for both intracity and intercity routes. • Maintenance costs will be operated by the SPV and the e-Bus OEM, with costs recovered from collected revenue. • Private sector investment will also be sought to support the financing needs of the project
Revenue options		Revenue from bus tickets
Breakdown	Government	$20,511,811 in subsidy from Ghana Ministry of Transport
	Official Public Sources (MDBs)	
	Private sector	$26,776,388 in loans from Ecobank
	Concessional/de-risk-ing tool or grant	$6,466,382 in grants from GCF
	Other Funding (type and amount)	
Go-to market strategy and resource needs		Go-to market strategy: • Develop a comprehensive electric bus system for Accra's public transportation, starting with the Accra-Tema and Accra-Adenta high ridership routes. • Deploy a total of 100 low/high floor battery electric buses (BEB) on selected routes, with 75 for intra-city operations and 25 for intercity operations.

	• Install solar-powered fast-charging stations at predetermined equidistant locations along each route, from the start to the route's terminal nodes, with a central charging station for bulk overnight charging. • Develop three components for the project, namely, Route Infrastructure Deployment, Skills development and engagement, and Monitoring and Reporting. • Route Infrastructure Deployment component includes the deployment of necessary infrastructure, including charging stations, selecting the energy-efficient route, laying out efficient operating systems, and smart charging stations and signalling network on the route. • Model the BEB as an opportunity electric bus with battery package that offers a range of up-to 150 km at a full charge efficiency of 80-100%. • Operate charging services through Special Purpose Vehicle (SPV) and e-Bus Original Equipment Manufacturer (OEM) and recover costs from collected revenue. • Provide 2-year servicing built into the procurement contract and ensure the supply of genuine parts. • Resource needs – in total $53,754,581 • Procure 100 BEB buses costing US$ 35.4 million at a market price of US$361,154 per bus.
Commercial viability, if relevant	Intended to become self-sustaining after the first few years

Commodities required (if relevant/any)	• Electric vehicles • Batteries • Charging infrastructure • Electricity
Indicative implementation arrangements	Tender process to be initiated
Opportunities for partnerships	• Private sector partner for technical assessment • Private sector partner to procure the technology
Roles and responsibilities of key stakeholders	• Ministry of Transportation: Lead in the coordination and deployment of the project; design of the training programs • Ministry of Environment, Science, Technology and Innovation; Environmental Protection Agency: support coordination and provide technical advice • Authorities of the Accra and Kumasi Metropolitan Areas: support deployment of implementation and engagement with city stakeholders • UN Environment, Copenhagen Climate Centre: provision of technical advice • Competitively recruited provider: delivery and installation of buses and charging stations • Identified service providers: deployment of the bus lines; identification and training of relevant personnel • Ministry of Finance: international resource mobilization, oversight
Risks and mitigating measures	Risks include regulatory requirements and administrative hurdles, which will be mitigated by close monitoring of the project and continuous coordination between entities. Awareness raising will also need to be deployed to ensure public buy-in of the new system.

Indicators to measure results	• Number of daily passengers using the new bus system • Number of transportation sector actors trained through the training program • On the medium-term, evolution of the number of individual cars/ minibuses on the road
Policy/Regulation recommendations	N/A
CPP contributions	Contribution to Objective 5 on sustainable transportation and lifestyle, in particular target 5.1 to achieve 35 of new road vehicles (public and private) to be electric with enabling charging infrastructure by 2025 (with a view to reach 100% by 2035); and 5.3 to achieve 75% of major urban centers benefiting from extended public transportation network running on electric vehicles by 2030 (and 100% by 2035). The electric bus system is expected to deliver multiple results in the following areas: GHG emission reduction; improvement in local pollutants (avoided NOx and PMs); improvement in fuel economy in public transport, and above all, facilitate the transfer of low carbon technology through the training of artisans, operators and garages

Target 6.2 90-100% of value chains are optimized through value engineering to ensure domestic retention of economic value-added.

Target 6.3 A green entrepreneur hub is established to enable local solution-making, support young entrepreneurs and foster MSME sectors, and promote gender development by financing over 50% of projects led by women through micro and nano incubation and financing.

Target 7.2 90-100% of agricultural inputs such as fertilizers are sourced and produced domestically.

Target 7.3 100% of insulation materials are sourced and produced domestically.

Target 7.4 The up-cycling industry represents 50% of all industrial production.

Target 7.5 Green/eco-tourism tourism represents 20% of Ghana GDP.

Target 8.3 Gas flaring and fugitive emissions are reduced by 90-100% through carbon finance.

CATEGORY	CONTENT
Program name	Ghana Green Entrepreneurs Hub
Program type	Innovation, domestic production
Program sector/subsector	Sustainable jobs, livelihoods, youth and gender development
Program description	As part of Ghana's existing National Entrepreneurship & Innovation Program (NEIP), a dedicated program track will be establish to develop hubs as incubators to support young entrepreneurs, start-ups, and small local businesses with innovative business ideas, with a specific focus on sustainable agriculture and derived products (such as locally-sourced insulation materials), eco-tourism, up-cycling, capture of waste gasses from industrial processes, and other related areas of climate-compatible activities.
Program rationale	This will aim to promote sustainable economic transformation by incentivizing and leveraging local opportunities for climate-resilient and green jobs, while also harnessing the potential for locally-led innovation towards the establishment of a green economy. Small and growing businesses often need a range of advisory and support services to help them ideate, set up and grow. Such services are even more relevant for green and climate entrepreneurs. To develop their businesses in a niche area, they need specific expertise and tailored approaches to environmental solutions. Green hubs can help green entrepreneurs think out of the box and test locally relevant solutions to pressing environmental problems. Fostering local innovation will support Ghana in strengthening its domestic economy and reducing reliance on imports to fulfill the needs of its growing green economy. Supporting the development of business ideas related to topics such as sustainable insulation, waste gasses capture, eco-tourism and the development of upcycling activities is aligned with the objectives set out under the national CPP and will contribute increased resilience, reduced emissions, and accelerate the shift towards a climate-compatible economy.
Program beneficiaries	Entrepreneurs as direct beneficiaries through increased income and better work environment, Ghana's economic fabric at large

Program objectives	• Young entrepreneurs and MSME sectors are fostered; • 50% of projects led by women are financed through micro and nano incubation and financing; • Innovation is fostered in fields related to eco-tourism, upcycling, sustainable agricultural products for the purpose of value-added processes such as the production of insulation materials, and other fields centering around sustainable domestic production and climate-compatible innovations
Expected program impact, outcomes and outputs	Output: • Ghana Green Entrepreneurial Hub set up as part of the National Entrepreneurship & Innovation Program (NEIP) Outcome: • Incubated projects represent 1% of GDP by volume of commercial revenue by 2030 • Over half of projects incubated and financed are led by women Impact: • Diversification of the economic fabric and incentivization of future-oriented innovations • Creation of green jobs • Greening of the economy as developed products are deployed on the market
Key program components (milestones/activities)	Activity 1: Feasibility study and scoping of potential entrepreneurs for a pilot of the program

	Activity 1: Feasibility study and scoping of potential entrepreneurs for a pilot of the program Activity 2: Identification of a location for the hub Activity 3: Pilot run Activity 4: Scaling up and full deployment of the hub
Program location	Accra
Start date	2023
End date	2030
Key responsible entity(ies)	Coordination: Ministry of Business Development Implementation: National Entrepreneurship & Innovation Program
Program timeline	Activity 1: Feasibility study and scoping of potential entrepreneurs for a pilot of the program Timeline 1: 2023 Activity 2: Identification of a location for the hub Timeline 2: 2023 Activity 3: Pilot run (First batch of entrepreneurs to receive support) Timeline 3: 2024 Activity 4: Scaling up and full deployment of the hub Timeline 4: 2025-2030

Estimated level of investment and investment horizon		USD 55 million dollars to 2030 including physical and online infrastructure and equity participation
Financing and terms		
Revenue options		
Breakdown	Government	0
	Official Public Sources (MDBs)	0
	Private sector	USD 50 million in equity
	Concessional/de-risk-ing tool or grant	USD 5 million in grants
	Other Funding (type and amount)	
Go-to market strategy and resource needs		Feasibility study and incubator model design
Commercial viability, if relevant		Commercially viable
Commodities required (if relevant/any)		N/A
Indicative implementation arrangements		The Program will be implemented as part of the National Entrepreneurship and Innovation Program with Ministry of Business Development Implementation
Opportunities for partnerships		Local and international investors to engage in collaboration and support with targeted incubated projects where interest and areas of expertise overlap.

Roles and responsibilities of key stakeholders	Ministry of Business Development: Oversight of the Program and coordination National Entrepreneurship and Innovation Program: Effective deployment of the program and integration into existing the work program
Risks and mitigating measures	Risks include lack of interest or reluctance to join hub from targeted entrepreneurs, which can be mitigated through information campaigns and effective promotion of the program highlighting clearly the benefits for entrepreneurs
Indicators to measure results	• No. entrepreneurs trained • No. of businesses supported • No. of jobs created • No. of projects supported that are led by women • % of GDP represented by the commercial revenue of incubated projects
Policy/Regulation recommendations	N/A
CPP contributions	Contribution to the objective of sustainable jobs, livelihoods, gender development and transformative human mobility through the promotion of sustainable economic transformation by incentivizing and leveraging local opportunities for climate resilient and green jobs, and livelihood options, in particular target 6.3 of establishing a green entrepreneur hub to enable local solution-making, support young entrepreneurs and foster MSME sectors, and promote gender gender development by financing over 50% of projects led by women through micro and nano incubation and financing.

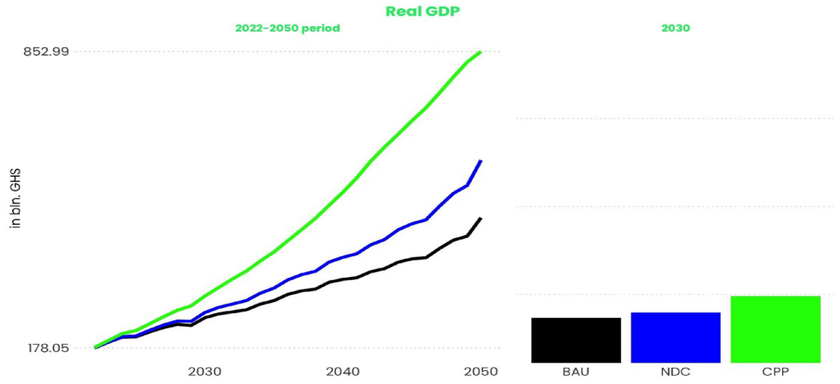
Through the projects that will be supported, contribution to targets related to the optimization of value chains and domestic retention of economic value-added; the sourcing and production of sustainable insulation materials; the development of an upcycling industry and that of green and ecotourism; and the reduction of gas flaring and fugitive emissions.

Macro-economic outcomes

The successful deployment of Ghana's Climate Prosperity Plan is expected to maximize positive outcomes on a range of socio-economic indicators compared with BAU. Indeed, improvements in relation to BAU can be observed across economic, social, environmental, and energy-related indicators - these span higher disposable income, the creation of green jobs and enhanced affordability of energy, eradication of death from air pollution, as well as the acceleration of progress towards the achievement of the SDGs.

Economic

- Ghana´s CPP accelerates the country's growth, with an average real GDP growth rate of 5.6 percent per year between 2022 and 2050, compared to the BAU scenario of average growth rate between the same period of 3.4 percent per year.
- The CPP scenario presents an increase of total government revenue between 2022 and 2050 of 58.4% compared to the baseline.
- With the implementation of the CPP, the real disposable income per capita is projected to be on average over the period 2022-2050, 47% higher than in the BAU scenario.
- Driven by this Plan, the poverty rate decreases by 20.6% driven by a 47% increase in the per capita disposable income compared to the baseline scenario.
- The total employment by the implementation of the CPP amounts to 21.8 million people in 2050. More specifically, it goes from 13.0 million people in 2022 to 15.7 million people (+3.9% vs BAU) in 2030, 18.9 million people in 2040 (+5.1% vs BAU) and 21.8 million people in 2050 (+5% vs BAU). Also, the Prosperity Plan generates green jobs which could amount to 236.1 thousand people in 2050. This highlights that, in addition to the benefits generated in terms of economic growth and fiscal space, the CPP interventions contribute to the continuous generation of green jobs until 2050.



	Scenario	2022-2030	2030-2040	2040-2050	2022-2050
1	BAU (percent)	4.0	3.3	3.0	3.4
2	CPP (percent)	5.9	5.9	5.0	5.6
3	CPP vs BAU	+48.2%	+79%	+67.5%	+64.9%

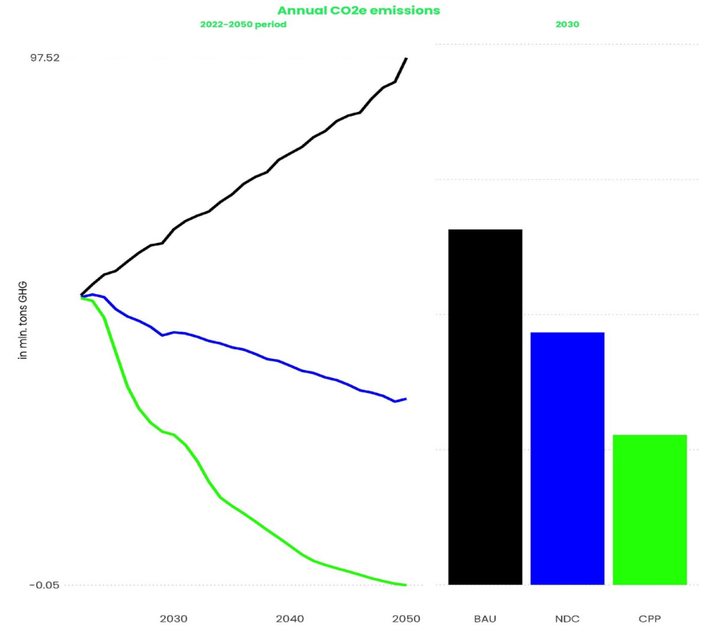
Energy

- As Ghana electrifies its transport and implements energy efficiency measures, it reduces energy consumption and cost. The CPP indicates the reduction of the unit cost of energy consumed with an average of -7.6% between 2022 and 2050.
- The CPP alludes that the country can generate a share of power generation capacity from renewables of 89.4 percent by 2030, 92.1 percent by 2040, and 95.6 percent by 2050. In addition, the electricity generation rate amounts to 66.7 million MWh in 2050.

Environment

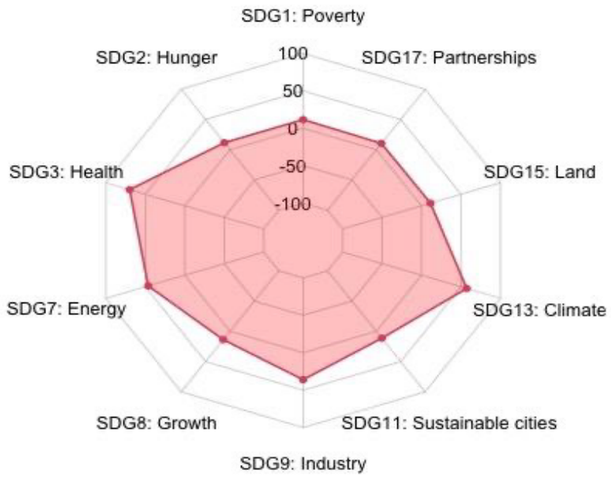
- The CPP scenario presents an opportunity to increase forest coverage on an average of +4.8% between 2022 and 2030 and +18.5% between 2022 and 2050 for the country. This will also have a significant impact towards biodiversity and desertification.

- GHG emissions decline steadily in the prosperity scenario, allowing a dynamic of CO2e emissions reductions of 27.8 million tons by 2030, 7.2 million tons by 2040, and -0.1 million tons GHG by 2050.
- Related to Air pollutants, in the CPP scenario, the PM2.5 emissions from energy and power reach during the period 2022-2050 is -78.4% compared to the BAU scenario. And even more significantly, the implementation of the prosperity measures allows a dynamic of -81.6% by 2030 and a -98.4% by 2040 of the mortality rate related to air pollution.
- In the CPP scenario, between 2022 and 2050, Ghana reduces its cumulative damages from climate change on average of -14.1% compared to the BAU.



SDGs

- The CPP impulses the achievement of the SDGs implementation in Ghana, compared to a BAU scenario. The SDGs that improve the most are SDGs 1, 5, 3, 7, 8, 9, 13, and 15.
- The performance on SDG 1, no poverty, increases by 11.6 % in 2030. This indicates that the CPP scenario significantly delivers improvements, both in terms of reducing poverty relative to the BAU as well as generating additional income per capita.



Detailed macro-economic analysis

Overview

The Climate Prosperity Plan (CPP) is a new framework for energy transition and resilient development conceived for the Climate Vulnerable Forum (CVF) and the Vulnerable 20 (V20) members to prosper in a context of climate change. The CPP aims at planning energy transition and advocating for a faster implementation of climate adaptation measures to ensure a more sustainable and prosperous development trajectory. In this context, the Green Economic Model (GEM) is used to simulate the impact of a government-endorsed CPP strategy at the country level, based on different scenarios and pathways to identify the most viable investments. The analysis is multidimensional and takes into consideration many variables relevant to sustainable development: economic (e.g., GDP growth or trade balance), social (e.g., employment) and environmental (e.g., air pollution) indicators. The results provide a robust perspective on the benefits associated with the implementation of the CPP in Ghana.

The CPP scenario, one of the scenarios tested by GEM, is a competitive economic development strategy and is profitable for Ghana as it allows significant improvements in various sectors of the society. Indeed, it accelerates the country's growth, increasing the real GDP by 64.9% between 2022 and 2050. In the same way, under this scenario, the poverty rate decreases by 20.6% driven by a 47% increase in the per capita disposable income compared to the baseline scenario.

The trade balance (measured as share of GDP) of Ghana compared to business as usual (BAU) will be on average +1.1% in the CPP scenario. Another perspective of this analysis is to see how the CPP scenario impacts the fiscal space at the national level. In Ghana, the government revenue will vary on average during the period 2022-2050 by +58.4% compared to the baseline supported by the +62.7% and +44% change in the taxes on income and profit and the total taxes on goods and services.

From a social perspective, the CPP scenario also generates employment and supports a resilient economic growth in the future. In fact, the unemployment rate goes from 7.0 percent in 2022 to 1.8 percent in 2050. On average this represents a decrease of 56.8% over the period of 2022 to 2050 between the scenarios. In the CPP scenario, +676.6% more green jobs (see glossary for details on definition) are created compared to the baseline scenario.

From an energy perspective, the implementation of the CPP also yields meaningful benefits. It allows the energy bill as a share of GDP (see glossary) to go from 5.1 percent in 2022 to 0.6 percent in 2050. On average this is a decrease of 60.2% compared to the BAU scenario over the period. Energy becomes more affordable overall (+294.9%), an outcome driven by increased economic growth, the transition to renewables and higher energy efficiency. The unit cost of energy consumed in the CPP scenario goes from 8.7 thousand USD/TJ in 2022 to 8.2 thousand USD/TJ in 2050 pushed by the increase in the use of renewables. The electrification and higher efficiency also reduce energy demand and support the decoupling of economic growth and energy consumption. The CPP scenario, considering maximum effort for both energy transition and adaptation, stimulates economic performance and job creation both by reducing costs of climate change (adaptation) and by increasing economic productivity (transition).

From a health perspective, the CPP strategy will allow a complete removal of the mortality related to air pollution by 2050 due to the average 78.4% decrease of PM2.5 index over the course of the next 28 years compared to the BAU scenario. The mortality risk related to cardiovascular diseases and diabetes is respectively impacted by -25.7% and -30.4%.

The prosperity measures also lead to a significant reduction in GHG emissions down to negative 53.1 tons GHG by 2050. The cumulative damages of climate change (see glossary for details on definition) will be reduced to 182.2 billion GHS in 2050 in comparison to 239.2 billion GHS in BAU. The implementation of the CPP scenario increases the capacity for loss and damage payments by 45% compared to the baseline.

The implementation of the CPP scenario will require an average annual investment of 8.2 billion USD over the 2022-2050 period. This represents an additional investment of 7.3 billion USD compared to BAU. The investments in adaptation will result in 28.8 billion USD in avoided damage cost. The funding requirement to implement the CPP is commensurate with its impacts and the expected gains largely compensate for the investments, already by 2030. These investments in the CPP are economically viable as they stimulate economic activity, reduce poverty, generate jobs, and curb emissions and air pollution. Several funding

options are available, and a good balance between public and private financing should be sought, based on the benefits accrued by different economic actors.

As a whole, the CPP scenario generates a benefit to cost ratio of 2.3, meaning that every dollar invested in transition and low-carbon activities will result in a gain of 2.3 USD.

Modeling guidelines and findings

Scenario overview

The CPP strategy is a development framework that has the objective of supporting a faster transition towards a low-carbon and climate-resilient development model through policy making, programs and investments. The pertinence of the CPP is here simulated and tested through GEM which has been augmented with new indicators relevant for the strategy. For that GEM is structured into four components: 1) The creation of several low carbon development pathways that maximize economic and social development; 2) The identification of the most viable resilient investments that strengthen the economy and society by ensuring their ability to withstand climate shocks; 3) The assessment of the most relevant mechanisms for risk transferring; And 4) The production of a Cost Benefit Analysis (CBA).

The CPP strategy's impact is simulated through three scenarios: 1) The Business as usual (BAU) scenario; 2) The Nationally Determined Contribution (NDC scenario); And; 3) The Climate Prosperity Plan (CPP) scenario which follows the policy's target of the strategy.

The BAU scenario constitutes the baseline scenario in which no additional adaptation nor mitigation measures (beyond those that are currently approved by law) are implemented. In essence, the BAU scenario represents the scenario of inaction in which current trends continue to play out according to past behaviour.

The Nationally Determined Contribution (NDC) is the scenario where the climate change mitigation and adaptation ambitions for reducing sectoral emissions outlined in the official NDC document are implemented.

The Climate Prosperity Plan (CPP) scenario shows the pathway where the country leverages the maximum potential of its domestic renewable energy resources and fully climate-proofs its economy. The assumptions for mitigation and adaptation considered in the CPP scenario are presented in the annex.

On top of each of these scenarios GEM provides the possibility to invest in reconstruction after an extreme climate event, via the use of a loss and damage fund. This investment resulting from loss and damage payments is reactive (triggered by climate damage), it is assumed to be conventional, and hence not climate resilient. The adaptation investment of the CPP scenario is instead assumed to be fully climate resilient. Adaptation investments implemented in the CPP anticipate future climate impacts, increase systemic resilience and thereby contribute to reducing future climate damage.

Key CPP objectives

The implementation of the CPP is tailored according to the country's objectives. For the case of Ghana the expected achievements through the implementation of the CPP scenario are:

- Financing maximized resilient and renewable energy systems
- Implementing grid modernization potential and connectivity
- Creating a green and resilient built environment
- Sustainable transportation and lifestyles
- Financially protect the economy and livelihoods
- Developing domestic food and commercial markets

Key CPP targets

The main targets of the CPP strategy in Ghana are:

- Realization of renewable energy potential, full electrification and increased energy efficiency
- Implementation of climate smart agriculture and adaptation measures
- Electrification of transport and shift in mobility towards NMT
- Additional resource allocation for compensating loss and damages
- Reforestation and restoration
- Implementation of adaptation measures across various sectors

Simulation outcomes

This chapter presents the results of the simulations of GEM in various spheres of the economy. The results presented demonstrate the impact of the strategy on the economy, society, the energy sector, the environment, and the SDGs.

Economic

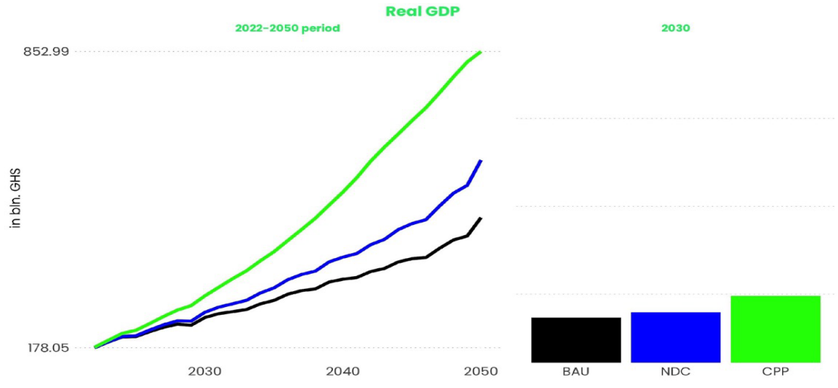
The economic section presents the results of the CPP scenario simulation on the GDP growth and Ghana's disposable income indicators allowing to access the graduation to another income level, the stock performance, the trade balance both overall and adjusted for energy trade, the poverty level, the fiscal space and carbon credits.

GDP growth

The total real GDP is the Gross Domestic Product in constant terms, which is calculated by GEM, calibrated to match the data obtained from the World Bank and the IMF. The base year of the GDP deflator, which is used to calculate the nominal GDP (or GDP in current terms), is based on the World Bank Data Portal (2021). The real GDP growth rate is the annual percent change in the real GDP.

In the BAU scenario, the real GDP reaches 178.0 billion GHS in 2022 and 247.0 billion GHS (2030), 334.2 billion GHS (2040), 474.7 billion GHS (2050) respectively. The average growth rate between 2022 and 2050 is 3.4 percent per year. This is due to the impacts of climate that continue to affect growth and become worse in the future, mainly driven by heat-related labor productivity impacts as well as increasing temperature-related impacts on agriculture production.

In the CPP scenario the total real GDP is projected to grow to 296.4 billion GHS and continue to increase to 532.8 billion GHS in 2040 (+59.4% vs BAU) and 853.0 billion GHS in 2050 (+79.7% vs BAU) respectively. The average real GDP growth rate in this scenario is 5.6 percent per year between 2022 and 2050. Through the earlier implementation of renewable power generation ambitions and higher transport electrification rates, the benefits of reducing the impact of energy cost and air pollution on total factor productivity are realized, contributing to additional growth. Added to that, compared to the BAU scenario, the volatility of growth is removed almost entirely thanks to the implementation of climate adaptation measures, indicating a more sustainable growth trajectory. The cumulative additional real GDP generated in the CPP scenario totals 49.4 billion GHS by 2030, 198.6 billion GHS by 2040 and 378.3 billion GHS by 2050 relative to BAU scenario.



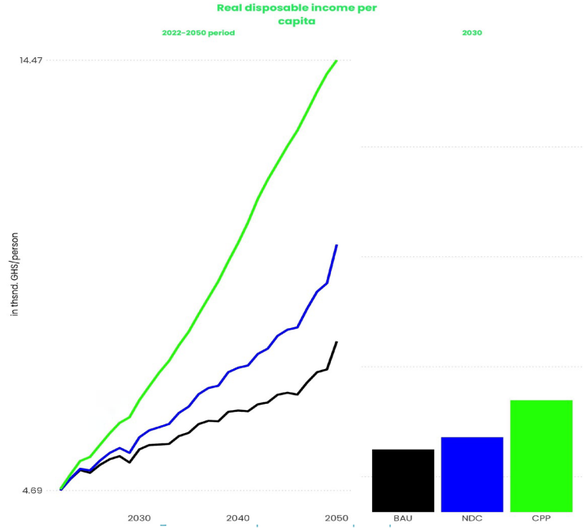
	Scenario	2022-2030	2030-2040	2040-2050	2022-2050
1	BAU (percent)	4.0	3.3	3.0	3.4
2	CPP (percent)	5.9	5.9	5.0	5.6
3	CPP vs BAU	+48.2%	+79%	+67.5%	+64.9%

Disposable income

The real disposable income per capita is the disposable income divided by total population. It indicates the average income (at country level) per person in real terms.

The real disposable income in the BAU scenario increases from 4.7 thousand GHS/person in 2022 to 5.6 thousand GHS/person in 2030 and 8.1 thousand GHS/person by 2050.

In the CPP scenario, the real disposable income is projected to be on average, over the period 2022-2050, 47% higher than in the BAU scenario. It increases from around 4.7 thousand GHS/person in 2022 to 6.7 thousand GHS/person in 2030 and 14.5 thousand GHS/person by 2050 which is respectively 19.9% and 79.1% higher compared to BAU.

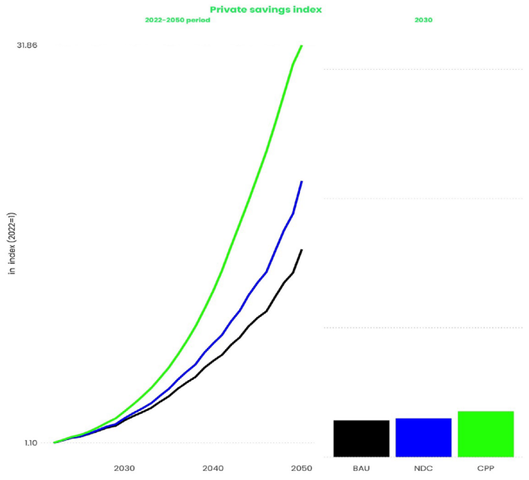


The increase in disposable income is driven by higher economic growth (+64.9% in the CPP scenario).

The private savings index allows the comparison of the change in private savings at national level with base year 2020 depending on the simulated scenario.

In the BAU, the private savings index is projected to 1.1 in 2022, 2.8 in 2030, 7.4 in 2040 and will reach 16.1 in 2050.

By comparison, the private savings index is projected to be higher in the CPP scenario thanks to the stimulation by additional growth. It is expected to reach 3.5 (+24.4% vs BAU) in 2030, 12.8 (+72.8% vs BAU) in 2040 and finally 31.9 (+98.3% vs BAU) in 2050, which represents an average gain of +78.4% over the period.



This index increases as a result of higher economic performance and income leading to higher savings.

The table below presents the year in which the country will graduate to another income level.

In both the BAU and CPP scenarios, Ghana will shift to an upper-middle income country in the year 2026.

The threshold for becoming a high-income country will be crossed in 2036 in the CPP scenario, which is five years earlier compared to the BAU scenario, where Ghana shifts to a high-income country in 2041.

Table 3: Income Level Shift

Income Level	Year of Graduation (BAU)	Year of Graduation (cpp)
Middle Income	2026	2036
High Income	2041	2036

Stock performance

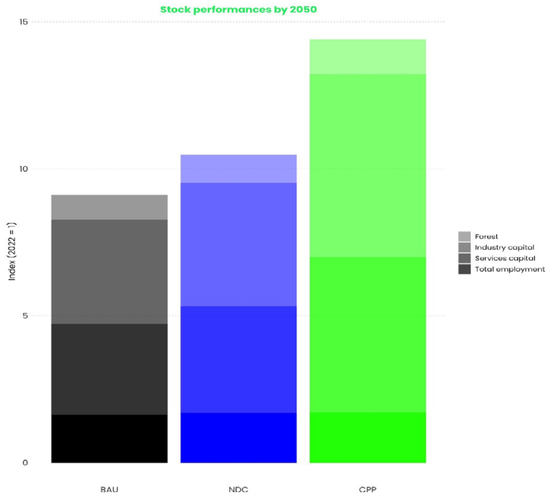
The base year for all the indexes is 2022 and captures the change across multiple scenarios. The total employment index indicates the change in total employment relative to the base year. It serves for comparing the development of total employment, or more specifically the total number of jobs in the economy across agriculture, industry, and services sectors. The services and industry capital indexes indicate the change in total services capital and total industrial capital relative to the base year. The indexes serve for comparing the performance of the services and industrial sectors, or more specifically their capital accumulation. The forest index indicates the change in total forest land. It serves for comparing the amount of forest land compared to the year 2022, hence the total hectares covered by trees, across multiple scenarios.

The employment index in the CPP scenario is projected to reach 1.2 in 2030, 1.5 and 1.7 in 2040 and 2050

respectively. This represents a gain of performance of +3.9% by 2030, +5.1% by 2040 and +5% by 2050 compared to the BAU scenario.

The industry and services indexes are projected to reach 1.7 and 1.5 in 2030, 3.3 and 2.9 in 2040 and 6.2 and 5.3 in 2050. This represents a gain of performance of +34.5% and +31.1% over the period 2022-2050 in comparison to BAU scenario.

The forest index, in the CPP scenario also increases to 1.1 in 2030, 1.1 and 1.2 in 2040 and 2050 respectively. The gain of performance is therefore +11.8% by 2030, +25.2% by 2040 and +38.7% by 2050 compared to the BAU scenario.



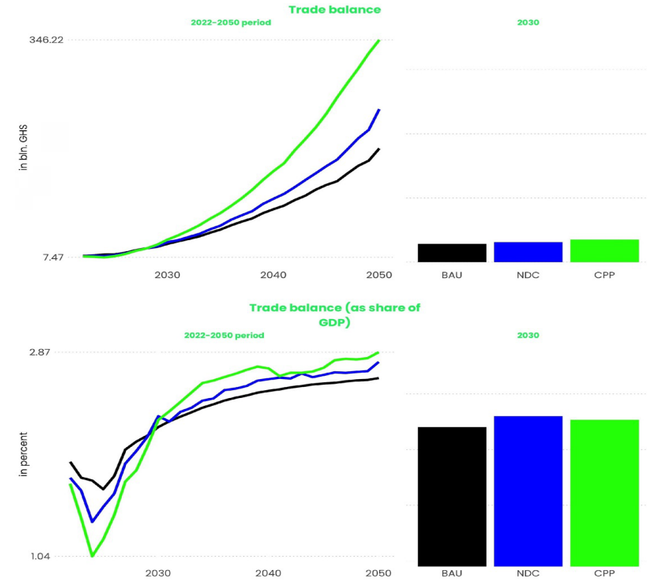
The changes in industry, services and employment stock performances are driven by higher economic performance unlocked from reduced energy spending and energy related externalities, as well as reductions in climate change damages (CPP scenario). For the forest stock, the land use change and reforestation ambitions are triggering the increase.

Trade balance

The trade balance is calculated by deducting total imports from total exports. It indicates whether a country is a net exporter or net importer.

The trade balance rises from 9.9 billion GHS in 2022 to 177.1 billion GHS in 2050 by gradually reaching 28.6 billion GHS and 82.5 billion GHS in 2030 and 2040. When reported to the share of GDP, these amounts represent respectively 2.2 percent, 2.5 percent, and 2.6 percent of the country's GDP.

In the CPP scenario, the trade balance amounts to 9.0 billion GHS (2022), 35.2 billion GHS (2030), 141.8 billion GHS (2040) and 346.2 billion GHS (2050). The implementation of the prosperity measures then allows a dynamic of +23.2% (2030), +71.9% (2040), +95.5% (2050) compared to the baseline. In terms of trade balance as share of GDP, an average +1.1% change is observed over the period 2022 to 2050.

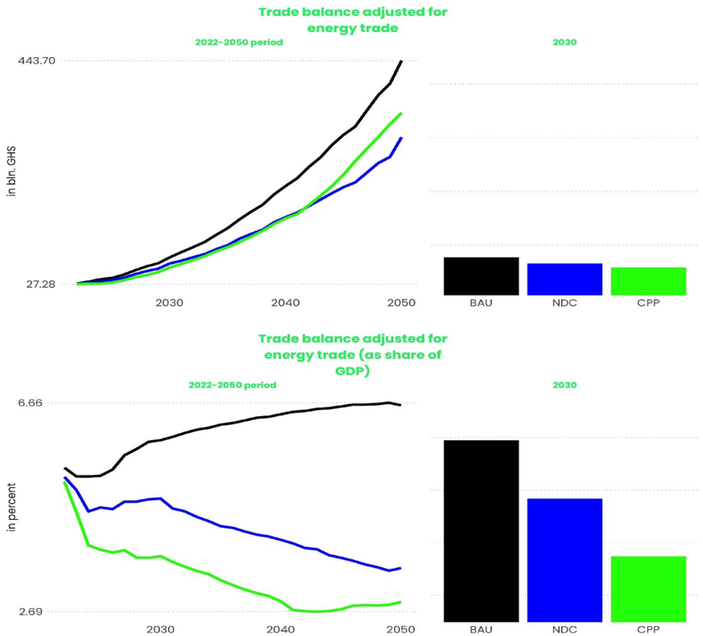


The trade balance is driven by nominal GDP, imports, and exports. More specifically, imports and exports are affected by the dynamics between consumption, investment, and total nominal GDP.

The trade balance adjusted for energy trade is calculated by deducting non-energy imports from non-energy exports. The evolution is presented in absolute values and as a share of nominal GDP.

It illustrates how CPP ambitions and related interventions lead to higher independence from fossil fuels (and related price volatility), which makes the economy more competitive relative to the BAU scenario. In the BAU scenario, the trade balance adjusted for energy trade reaches 77.1 billion GHS (2030), 210.1 billion GHS (2040) and 443.7 billion GHS (2050). These values represent respectively 6.0 percent , 6.4 percent and 6.6 percent as share of GDP.

In the CPP, the trade balance adjusted for energy trade changes in comparison to BAU by -24.6% by 2030 -28.6% in 2040 and reaches a deviation of -22% in 2050. This average change when considered as a share of GDP is -45.4% over the period 2022-2050.



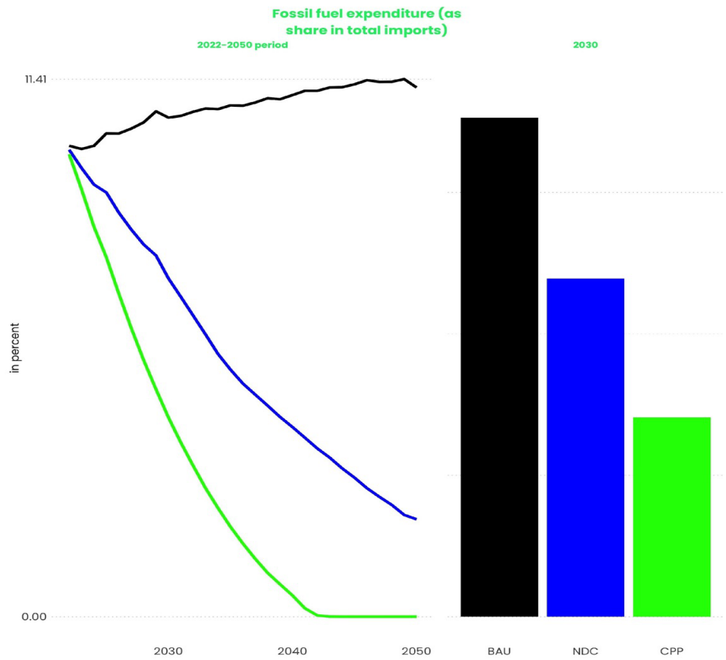
The trend observed in these variables comes from the imports and exports dynamics and the nominal GDP. It is also influenced by the country's energy expenditure and potential energy exports revenues.

The fossil fuel expenditure as share in total imports indicator shows how the share of fossil fuel costs in total imports develops over time.

In the BAU, the fossil fuel expenditure (as share in total imports) is projected to reach 10.0 percent in 2022 to 10.6 percent in 2030, 11.1 percent in 2040 and will reach 11.2 percent in 2050.

In the CPP scenario, the fossil fuel expenditure (as share in total imports) amounts to 9.8 percent (2022), 4.2 percent (2030), 0.4 percent (2040) and 0.0 percent (2050). The implementation of the prosperity measures then allows a dynamic of -60.1% (2030), -95.9% (2040), -100% (2050) compared to the baseline. The implementation of the CPP scenario results in a decline of the fossil fuel expenditure compared to BAU, eventually fully phasing out fossil fuel imports.

The change in this indicator is driven by total imports and the reduction in total country cost of fossil fuels (-7.6% in the CPP scenario) resulting from electrification ambitions and the implementation of energy efficiency measures.



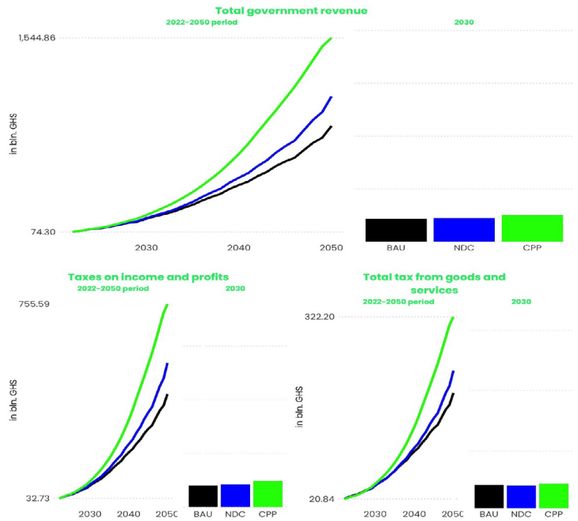
The change in this indicator is driven by total imports and the reduction in total country cost of fossil fuels (-7.6% in the CPP scenario) resulting from electrification ambitions and the implementation of energy efficiency measures.

Fiscal revenue

The total government revenues represent the total annual revenues for the government from taxes, grants and other sources. The taxes on income and profits are the sum of income taxes paid by private individuals and profit taxes paid by corporations and the tax from goods and services constitutes the VAT category of government revenues. The last one is estimated as the sum of energy tax income and the residual VAT. Tax breaks for electric vehicles (EVs) are accounted for in this category.

Total government revenues are projected to go from 74.4 billion GHS in 2022 to 877.0 billion GHS in 2050 in the BAU scenario with an average of 345.2 billion GHS during the period. When focusing on the taxes on income and profits and the total tax from goods and services, these values are projected to be 32.7 billion GHS in 2022, 80.9 billion GHS in 2030, 204.2 billion GHS in 2040 and 420.9 billion GHS in 2050 for the income and profits taxes. The projected amounts in the BAU for the goods and services taxes are 44.1 billion GHS in 2030, 99.6 billion GHS in 2040 and 196.1 billion GHS in 2050.

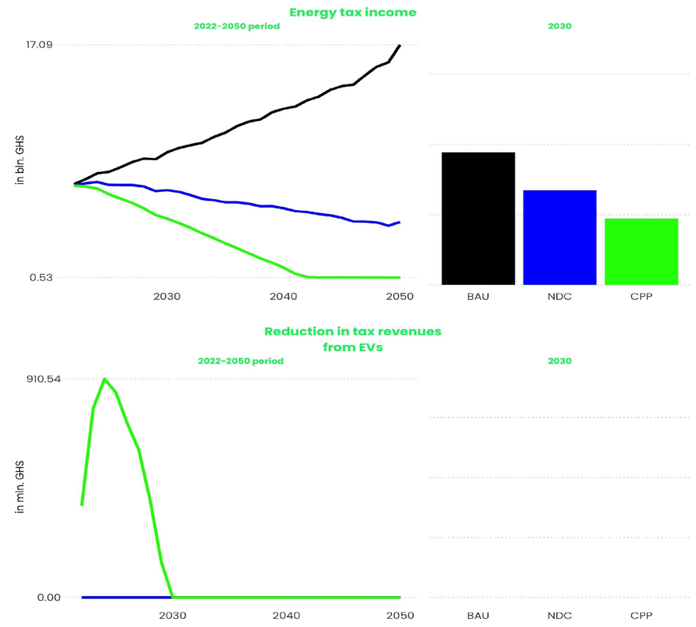
In the CPP scenario, total government revenues increase from 74.3 billion GHS in 2022 to 1,544.9 billion GHS in 2050 (+76.2% vs BAU) by gradually reaching 203.7 billion GHS (+16.2% vs BAU) in 2030 and 666.4 billion GHS (+54.9% vs BAU) in 2040. This represents an increase of government revenue between 2022 and 2050 of 58.4% compared to the baseline. The income and profits as well as goods and services taxes are also projected to 33.0 billion GHS (+0.7% vs BAU) and 20.8 billion GHS (-1.8% vs BAU) in 2022 and 755.6 billion GHS (+79.5% vs BAU) and 322.2 billion GHS (+64.3% vs BAU) in 2050 which represent an average increase over the period 2022-2050 of respectively +62.7% and +44% compared to the BAU scenario.



The energy tax income is the sum of taxes from the sales and production of petroleum products and electricity. The reduction in tax revenues from EVs indicates the tax breaks that are paid for the transition phase until cost parity between EVs and internal combustion engine vehicles is reached.

One of the special interests of tax revenues from goods and services is the energy tax income. It is composed of the revenues from sales and production of petroleum (e.g., royalties) and electricity tax income. In the baseline scenario, the total energy tax revenues are projected to be 7.2 billion GHS in 2022, 9.4 billion GHS in 2030, 12.5 billion GHS in 2040 and 17.1 billion GHS in 2050. It means an average variation of 8.4 billion GHS between 2022-2030 and 11.2 billion GHS between 2022 and 2050.

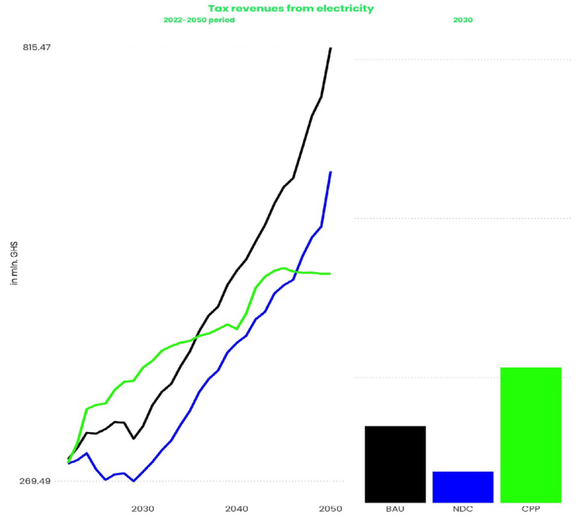
In the prosperity scenario, the phase out of fossil fuel vehicles, the electrification of the economy in combination with higher energy efficiency cause energy tax revenues to decline. More specifically the energy tax income goes from 7.1 billion GHS in 2022 to 0.5 billion GHS in 2050 by reaching 4.7 billion GHS1.2 billion GHS in 2030 and 2040. This is respectively a change of -50% in 2030, -90.2% in 2040 and -96.9% in 2050 in comparison to the BAU.



Tax revenues from electricity are the revenues generated from electricity sales.

In the BAU scenario, the tax revenues from electricity goes from 296.9 million GHS in 2022 to 338.7 million GHS in 2030, 534.4 million GHS in 2040 and 815.5 million GHS in 2050.

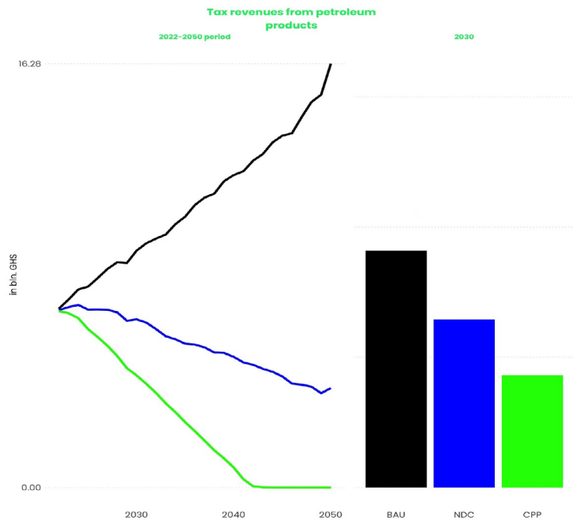
In the prosperity scenario the tax revenues from electricity amounts 292.4 million GHS (2022), 412.4 million GHS (2030), 460.9 million GHS (2040) and 530.4 million GHS (2050). The implementation of the prosperity measures then allows a dynamic of +21.8% (2030), -13.8% (2040), -35% (2050) compared to the baseline. This means an average of +11.4% change between 2022 and 2030 and -5.6% between 2022 and 2050 of the tax revenues from electricity. This change in energy tax income is driven by multiple dynamics. On the one hand, the CPP scenario assumes that all of Ghana's population will be connected to the electricity grid by 2030. This increases total electricity demand, which increases revenues from electricity sales. On the other hand, total energy demand declines as a consequence of higher energy efficiency improvements relative to the BAU. This leads to a temporary increase in energy tax income to the point where energy efficiency improvements reduce the demand for electricity below the baseline. The impact of energy efficiency is supported by a decline in the cost of electricity, caused by the implementation of more renewable capacity relative to the BAU.



Tax revenues from petroleum products constitute the excise taxes paid on petroleum products as well as income related to petroleum production (e.g. royalties).

In the BAU scenario, the tax revenues from petroleum products goes from 6.9 billion GHS in 2022 to 9.1 billion GHS in 2030, 12.0 billion GHS in 2040 and 16.3 billion GHS in 2050.

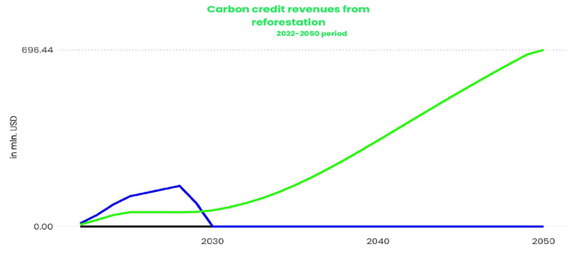
In the Prosperity Plan, the tax revenues from petroleum products amounts to 0.0 billion GHS in 2050. More specifically, it goes from 6.8 billion GHS in 2022 to 4.3 billion GHS (-52.7% vs BAU) in 2030, 0.8 billion GHS in 2040 (-93.6% vs BAU) and 0.0 billion GHS in 2050 (-100% vs BAU).



Carbon credits

Carbon credits from energy exports are generated if policies foresee an export of energy in the CPP scenario. The value of credits hereby depends on the grid emission factor of the export destination and the average value per ton of CO2e avoided through exports. Total tons avoided multiplied by the value per ton yields the value of credits generated from energy exports (assuming that all exported energy is generated by renewables exclusively). GEM also estimates carbon credits that can be generated at country level, either by exporting clean energy products, which avoids GHG emissions at the import destination, as well as through additional reforestation and restoration, contributing to domestic sink capacity. The total value of carbon credits is calculated as the sum of carbon credits from energy exports, mangrove restoration and reforestation

In the CPP scenario, the total value of carbon credit is in average 47.5 million USD between 2022 and 2030, 123.0 million USD between 2022 and 2040 and 255.6 million USD between 2022 and 2050. By focusing on the carbon credit generated by reforestation the average gains are respectively over the period 2022-2050, 255.6 million USD.



The total value of carbon credits is driven by credits generated from energy exports and reforestation and the dynamic of the carbon credits from exports is explained by the total amount of emissions avoided from the export of clean energy products and the value of carbon credits.

The CPP scenario has an overall positive impact on the economic dimensions of Ghana by notably increasing growth and reducing poverty levels. This impact could also be assessed on the social dimensions of the country which will be presented in the following part.

Social

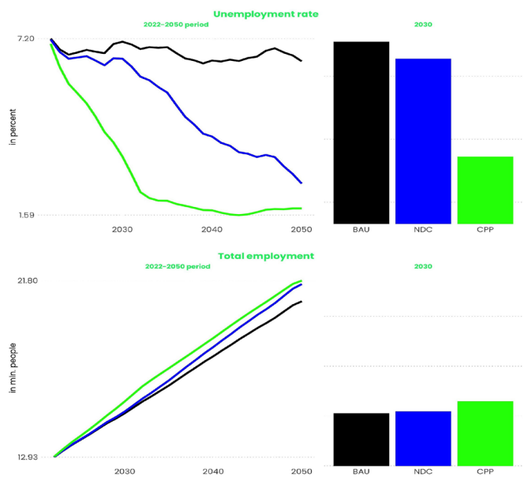
Following the impact on the economic aggregates, within this section the impacts of the CPP scenario on the level of employment, both in relative and absolute terms, are evaluated. Added to that, as one of the targets of the CPP, the number of new green jobs is also estimated.

Employment

The unemployment rate corresponds to the ratio of total unemployed individuals to active population across all sectors, including green jobs. The total employment is the total number of jobs in the economy across agriculture, industry, and services sectors, including additional green jobs resulting from interventions.

In the case of Business As Usual, the unemployment rate is projected to reach 7.1 percent (2030), 6.5 percent (2040) and 6.5 percent (2050). In the case of Business As Usual, the total employment is projected to reach 15.1 million people (2030), 18.0 million people (2040) and 20.8 million people (2050).

In the CPP scenario the unemployment rate reaches 1.8 percent in 2050 (-72.2% vs BAU) with a value of 3.4 percent (-51.4% vs BAU) in 2030 and 1.7 percent (-73.2% vs BAU) in 2040. The average variation over BAU during the period 2022-2050 is -56.8%. In the Prosperity Plan, the total employment amounts to 21.8 million people in 2050. More specifically, it goes from 13.0 million people in 2022 to 15.7 million people (+3.9% vs BAU) in 2030, 18.9 million people in 2040 (+5.1% vs BAU) and 21.8 million people in 2050 (+5% vs BAU), due to additional growth induced from the implementation of CPP ambitions.



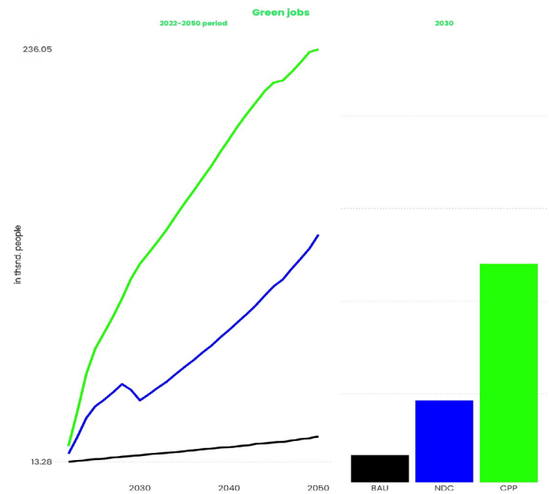
The dynamic of these variables is induced by the change in the different sectors. Employment from agriculture is driven by the total amount of agriculture land and an employment intensity per hectare. Employment from industry and services is driven by economic growth and investments, leading to higher capital accumulation, and hence accelerated job creation. Additional green jobs result from the use of more sustainable technologies and land-based interventions.

Green jobs

Green jobs are considered jobs that result from the implementation of interventions in the CPP scenario. The total number of green jobs in GEM consists of the sum of jobs generated from climate change mitigation actions (e.g., reforestation, renewable energy, energy efficiency, etc.) as well as climate adaptation (e.g., flood proofing of houses, installation of irrigation systems, implementation of CSA practices, etc.).

In the baseline, the green jobs will vary from 13.3 thousand people in 2022 to 27.0 thousand people in 2050, by gradually reaching 16.8 thousand people in 2030 and 21.2 thousand people in 2040.

In the Prosperity Plan, the green jobs amount to 236.1 thousand people in 2050. More specifically, it goes from 21.8 thousand people in 2022 to 120.2 thousand people (+613.4% vs BAU) in 2030, 187.6 thousand people in 2040 (+786.5% vs BAU) and 236.1 thousand people in 2050 (+774.1% vs BAU). This highlights that, in addition to the benefits generated in terms of economic growth and fiscal space, the CPP interventions contribute to the continuous generation of green jobs until 2050. The estimation of employment creation in all scenarios is performed considering that the manufacturing of EVs, electric buses etc. happens internationally, so only jobs from installation and maintenance are considered. In addition, there will be indirect employment creation in other sectors (e.g. agriculture, mangrove restoration, waste management).



The main boosters for green jobs are the implementation of CPP interventions (e.g., electrification, sustainable agriculture, energy efficiency, flood protection of roads and buildings, etc.) and the respective ambition of each intervention.

The decrease of the unemployment level and the increase in green jobs are an expected consequence of the implementation of the CPP strategy for Ghana as shown by the CPP scenario. The impact of the CPP strategy on the energy sector is estimated in the following section.

Energy

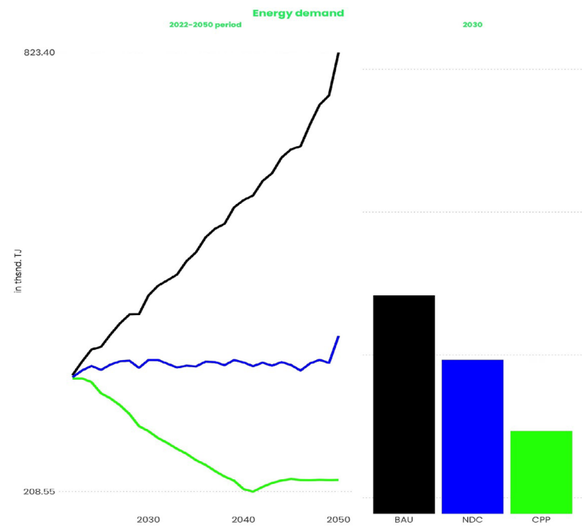
The energy section allows the comparison between the baseline and the CPP scenario of the total energy demand, the affordability through the comparison of disposable income and the energy bill, and the unit cost of energy. Energy efficiency, as well as power generation (power generation capacity and electricity generation rate), are as well evaluated.

Energy demand

The energy demand corresponds to the total final energy consumption at country level. It is calculated as the sum of demand across all fuels (petroleum, coal, electricity, natural gas and biomass) and sectors (residential, commercial, industrial and transport).

In the baseline, the energy demand variates from 371.7 thousand TJ in 2022 to 823.4 thousand TJ in 2050, by gradually reaching 483.3 thousand TJ in 2030 and 616.7 thousand TJ in 2040. This is mainly driven by economic growth.

Vehicles electrification and additional energy efficiency measures implemented in the CPP scenario reduce total energy demand below the BAU scenario, despite higher economic growth. In the Prosperity Plan, the energy demand amounts to 225.1 thousand TJ in 2050. More specifically, it goes from 367.0 thousand TJ in 2022 to 293.3 thousand TJ (-39.3% vs BAU) in 2030, 212.2 thousand TJ in 2040 (-65.6% vs BAU) and 225.1 thousand TJ in 2050 (-72.7% vs BAU). Furthermore, given the differential in energy use per km traveled between EVs and ICE vehicles, the full electrification of the vehicle fleet leads to additional energy savings relative to the other scenarios.



Breaking down the different components of the energy demand helps to understand its dynamic. The CPP scenario allows on the one hand more ambitious electrification of vehicles that leads to a decline in petroleum demand between 2022 and 2050 relative to the BAU scenario. On the other hand, the demand for electricity, driven by a combination of increased air conditioning, economic growth, and vehicle electrification, is foreseen to increase at the beginning. As the transition to EVs and air conditioning is assumed to be completed by the year 2040, the additional energy efficiency measures implemented lead to a reduction in electricity demand by 2050.

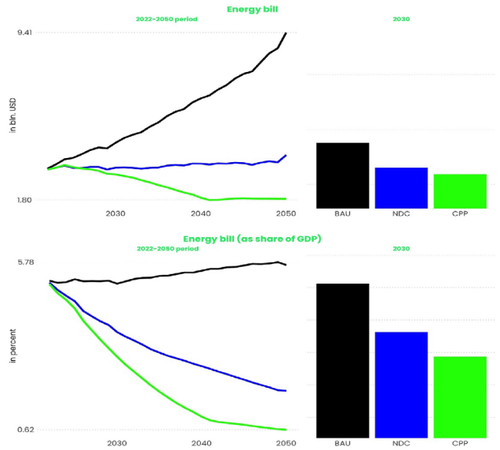
Energy affordability

The energy bill variable indicates the total country energy cost resulting from final energy consumption. It is calculated as the sum of costs for petroleum products, natural gas, coal and electricity. The cost of biomass is excluded. It is presented in absolute value, but also as a share of total real GDP.

In the baseline, the energy bill variates from 3.2 billion USD in 2022 to 9.4 billion USD in 2050, by gradually reaching 4.4 billion USD in 2030 and 6.4 billion USD in 2040. In the BAU scenario, the energy bill (as a share of GDP) goes from 5.2 percent in 2022 to 5.1 percent in 2030, 5.5 percent in 2040 and 5.7 percent in 2050.

In the prosperity scenario the energy bill amounts 3.2 billion USD (2022), 3.0 billion USD (2030), 1.9 billion USD (2040) and 1.8 billion USD (2050). The implementation of the prosperity measures then allows a dynamic of -32.7% (2030), -70.4% (2040), -80.4% (2050) compared to the baseline. This means an average of -17.5% change between 2022 and 2030 and -56% between 2022 and 2050 of the energy bill. In the CPP scenario the energy bill (as share of GDP) reaches 0.6 percent in 2050 (-89.1% vs BAU) with a value of 2.9

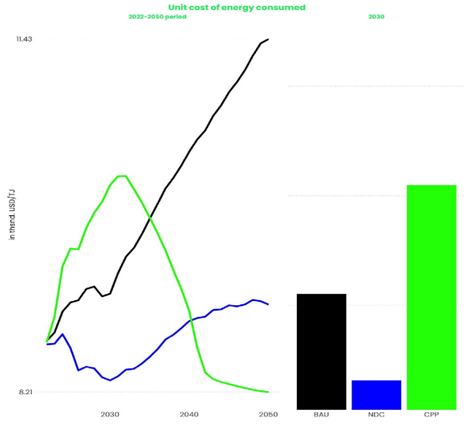
percent (-43.9% vs BAU) in 2030 and 1.0 percent (-81.5% vs BAU) in 2040. The average variation over BAU during the period 2022-2050 is -60.2%.



The unit cost of energy is the average cost per TJ of final energy consumed and is calculated by dividing the total energy bill (=cost of energy at country level) by total final energy consumption.

In the baseline, the unit cost of energy consumed variates from 8.7 thousand USD/TJ in 2022 to 11.4 thousand USD/TJ in 2050, by gradually reaching 9.1 thousand USD/TJ in 2030 and 10.4 thousand USD/TJ in 2040.

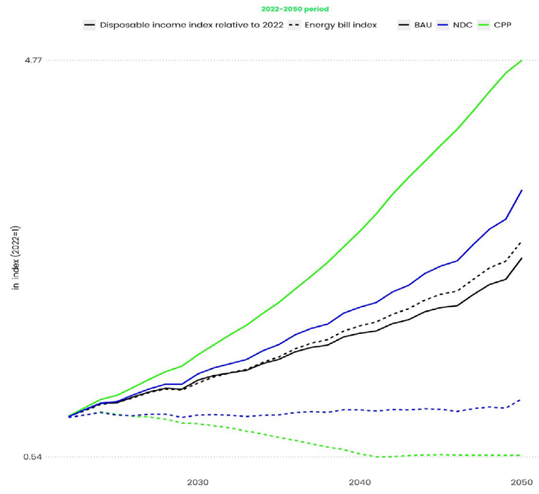
In the prosperity scenario the unit cost of energy consumed amounts 8.7 thousand USD/TJ (2022), 10.1 thousand USD/TJ (2030), 8.9 thousand USD/TJ (2040) and 8.2 thousand USD/TJ (2050). The implementation of the prosperity measures then creates a dynamic of +10.9% (2030), -14% (2040), -28.2% (2050) compared to the baseline. This means an average of +5.7% change between 2022 and 2030 and -7.6% between 2022 and 2050 of the unit cost of energy consumed.



A change in energy affordability can also be assessed by comparing the change in disposable income to the change in total country energy cost. This can be done by calculating the indexes of both variables relative to the year 2022 and comparing their respective growth. These indicators are respectively the index of real disposable income and the index of total country energy cost with base year 2022.

In the BAU scenario, real disposable income relative to 2022 increases from 0.97 in 2022 to 1.36 in 2030 while the energy bill index goes from 0.97 in 2022 to 1.33 in 2030. By 2050, these values amount to 2.66 for the disposable income index and 2.85 for the cost of energy index indicating that income grows faster than the cost of energy.

In the CPP scenario, the income index increases from 0.98 in 2022 to 1.63 in 2030 and 4.77 in 2050. This shows that the disposable income index is projected to be +50.9% higher than in the BAU scenario. On the other hand, the index for energy cost goes from 0.96 in 2022, 0.9 in 2030 and ends up at 0.56 in 2050. This dynamic of indexes indicate that, while income increases in the intervention scenarios, the total country's cost of energy starts declining from the year 2022.

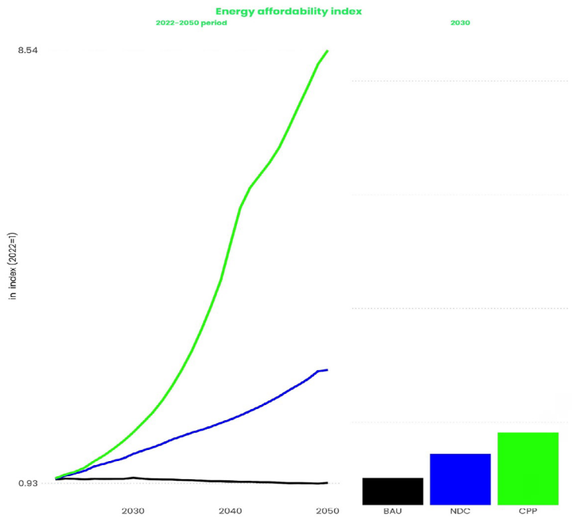


The main driver for the change in the disposable income index is economic growth, while the main drivers for the change in the energy bill index are total energy demand (by fuel) and the cost of energy (by fuel) (-52% in the CPP scenario). An increase in electrification and energy efficiency measures drive the decline of the energy bill index, leading to improved affordability of energy.

The energy affordability index is calculated by dividing the disposable income index (2022=1) by the energy bill index (2022=1). The base year of this index is hence 2022 and it indicates how the total (real) disposable income develops in relation to total country energy cost. An increase in this index signifies that energy becomes more affordable, while a decrease indicates that energy cost rises faster than income.

In the case of Business As Usual, the energy affordability index is projected to reach 1.0 (2030), 1.0 (2040) and 0.9 (2050).

In the Prosperity Plan, the energy affordability index amounts to 8.5 in 2050. More specifically, it goes from 1.0 in 2022 to 1.8 (+78.3% vs BAU) in 2030, 5.1 in 2040 (+436.9% vs BAU) and 8.5 in 2050 (+812.6% vs BAU).

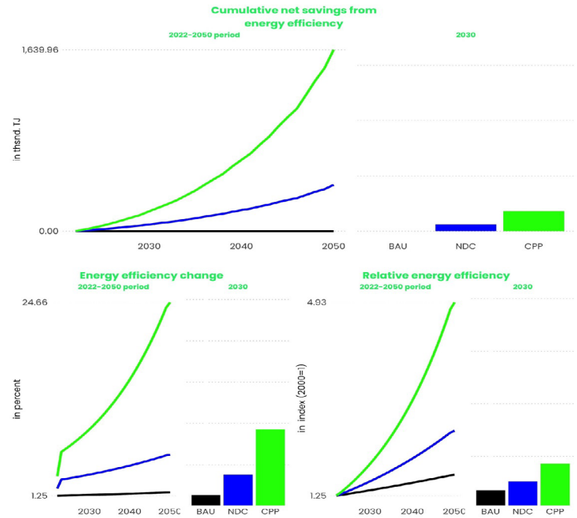


Energy efficiency

The cumulative net savings from energy efficiency is the cumulative net amount of final energy use that is avoided (relative to the baseline) thanks to the implementation of additional energy efficiency measures. The energy efficiency change indicates the rate of variation that is applied to the stock of energy efficiency. The indicator is subject to policy decisions, allowing for the simulation of different energy efficiency trajectories. The relative energy efficiency is an index relative to the year 2000 that indicates how energy efficiency is developing over time. This stock is modified by the "energy efficiency change", which is an annual growth rate applied to the stock level. This means that GEM uses a dynamic formulation (=stock * growth rate) for estimating energy efficiency improvements.

In the BAU scenario, the energy efficiency change variates from 1.3 percent in 2022 to 1.6 percent in 2050, by gradually reaching 1.4 percent in 2030 and 1.5 percent in 2040. The relative energy efficiency goes from 1.3 in 2022, 1.4 in 2030, 1.5 in 2040 and 1.6 in 2050.

In the prosperity scenario, the cumulative net savings from energy efficiency reaches 2.01 thousand TJ (2022), 179.94 thousand TJ (2030), 644.65 thousand TJ (2040), 1,639.96 thousand TJ (2050). The energy efficiency change amounts 3.6 percent in 2022 and reaches 24.7 percent by 2050 by gradually reaching 9.3 percent (2030) and 15.3 percent (2040) which represent a variation of +586% (2030), +922.3% (2040), +1396.2% (2050) in comparison to BAU. This is an average of +817.8% over the period 2022-2050. The relative energy efficiency goes from 1.3 in 2022, 1.9 in 2030, 3.1 in 2040 and 4.9 in 2050. The CPP scenario then allows a dynamic of +37.2% (2030), +104.5% (2040), +199.2% (2050) compared to the baseline. This means an average of +18% change between 2022 and 2030 and +84.9% between 2022 and 2050 of the relative energy efficiency.



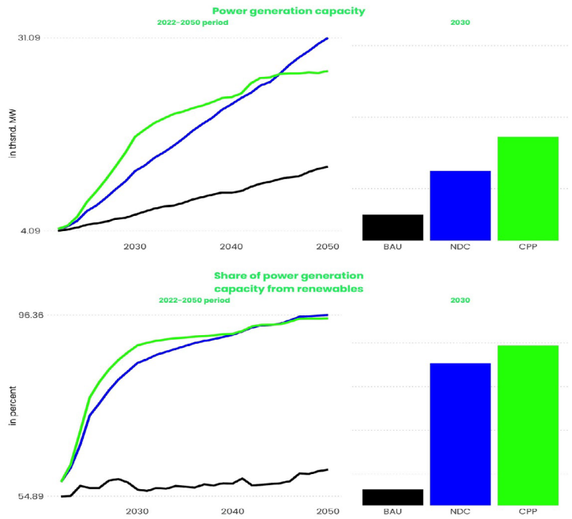
Power generation

The power generation capacity captures the total MegaWatts (MW) of power generation capacity installed at country level. This variable is calculated by summing up the total capacity installed across all technologies considered in GEM.

In the baseline, the power generation capacity variates from 4.1 GW in 2022 to 13.1 GW in 2050, by gradually reaching 6.4 GW in 2030 and 9.4 GW in 2040. In the case of Business As Usual, the share of power generation capacity from renewables is projected to reach 56.5 percent (2030), 57.8 percent (2040) and 61.0 percent (2050).

In the prosperity scenario the power generation capacity amounts 4.4 GW (2022), 17.3 GW (2030), 22.8 GW (2040) and 26.5 GW (2050). The implementation of the prosperity measures then allows a dynamic of +171.2% (2030), +141.4% (2040), +102.6% (2050) compared to the baseline. This means an average of +93% change between 2022 and 2030 and +129.2% between 2022 and 2050 of the power generation capacity. In fact, there is intense electrification of the transport sector and more electricity generated from renewable capacity. Power generation capacity initially increases up to 2040 to supply the desired

electricity but starts dropping later on as a consequence of efficiency induced reductions in total electricity demand. In the prosperity scenario the share of power generation capacity from renewables amounts 58.2 percent (2022), 89.4 percent (2030), 92.1 percent (2040) and 95.6 percent (2050). The implementation of the prosperity measures then allows a dynamic of +58.4% (2030), +59.3% (2040), +56.8% (2050) compared to the baseline. This means an average of +35.7% change between 2022 and 2030 and +52.5% between 2022 and 2050 of the share of power generation capacity from renewables.

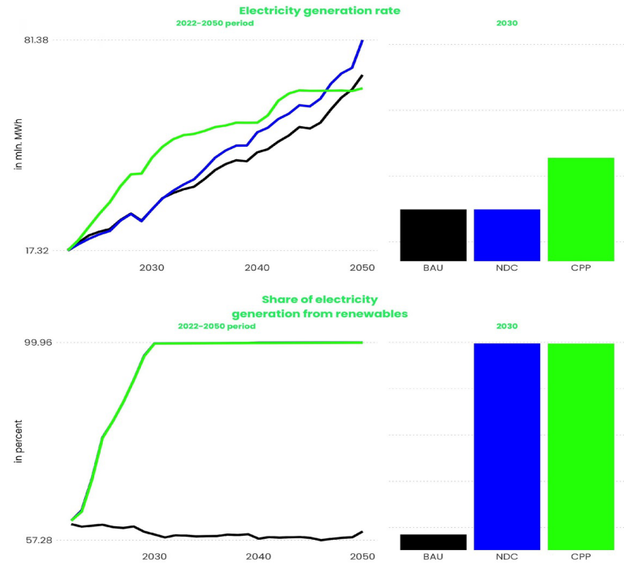


The dynamic of the power generation capacity is explained by the total demand for electricity (driven by population, economic growth, and energy efficiency) as well as electricity imports and exports. Added to that, the increase observed in the prosperity scenario is explained by the technology load factor. As it is typically lower for renewable capacity, more capacity is required to produce the same amount of electricity.

In the case of Business As Usual, the electricity generation rate is projected to reach 29.9 million MWh (2030), 47.2 million MWh (2040) and 70.8 million MWh (2050). In the case of Business As Usual, the share of electricity generation from renewables is projected to reach 58.5 percent (2030), 57.6 percent (2040) and 59.2 percent (2050). Electricity generation in the BAU scenario is affected by (i) the impacts of heat and water scarcity on the load factor of thermal capacity, as well as (ii) heat and wind related impacts on transmission lines, both of which leads to strong fluctuations in total electricity supply.

Total electricity generation follows the trend in demand for electricity. In the Prosperity Plan, the electricity generation rate amounts to 66.7 million MWh in 2050. More specifically, it goes from 17.4 million MWh in 2022 to 45.6 million MWh (+52.7% vs BAU) in 2030, 56.2 million MWh in 2040 (+19.1% vs BAU) and 66.7 million MWh in 2050 (-5.7% vs BAU). In the prosperity scenario the share of electricity generation from renewables amounts 61.5 percent (2022), 99.7 percent (2030), 99.9 percent (2040) and 99.9 percent (2050). The implementation of the prosperity measures then allows a dynamic of +70.5% (2030), +73.4% (2040), +68.9% (2050) compared to the baseline. This means an average of +35.9% change between 2022 and 2050

of the share of electricity generation from renewables. Renewable power generation and comprehensive climate proofing of power infrastructures eliminate the fluctuations in final electricity almost entirely.



In the CPP scenario, the energy sector is widely influenced by the CPP implementation throughout the course of the next 28 years and as shown in the previous sections, leads to positive economic and social impacts. Furthermore, the next section will capture its influence at the environmental level.

Environment

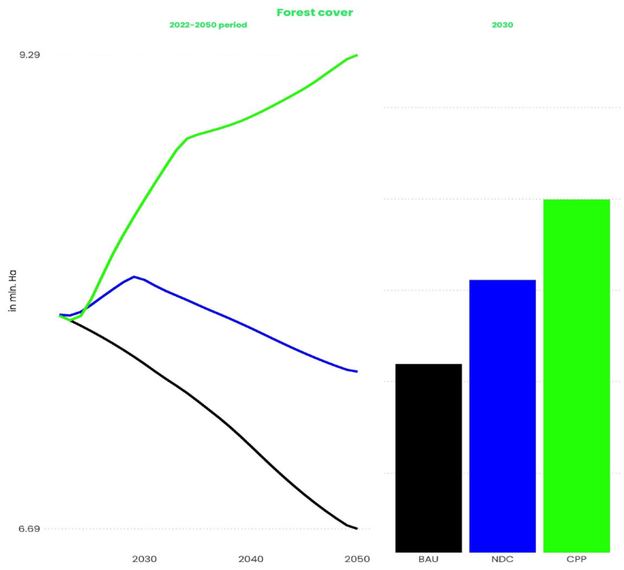
This section is composed of the evaluation of the volume of air pollutants such as the PM2.5 and black carbon emissions from energy and power, but also the air pollution by assessing the PM2.5 emissions index, the mortality rate and the total annual death resulting from air pollution, the impact of installed non-motorized transport infrastructure and the cost of obesity. Other items covered include the climate damages by comparing the cumulative damage resulting from climate change in the baseline and the CPP scenario, but also the money accumulation for loss and damages payments. The repercussions on the level of CO_2e emissions and the forest cover are also predicted.

Forest cover

The forest cover represents the total amount of hectares (at country level) that is covered by forests.

In the BAU scenario, the forest cover goes from 7.86 million Ha to 7.60 million Ha in 2030, 7.15 million Ha in 2040 and 6.69 million Ha in 2050.

In the CPP scenario, additional reforestation and restoration are required to generate the sink capacity required for reducing total GHG emissions. The forest cover amounts to 7.86 million Ha (2022), 8.50 million Ha (2030), 8.95 million Ha (2040), 9.29 million Ha (2050). The implementation of the prosperity measures then allows a dynamic of +11.8% (2030), +25.2% (2040), +38.7% (2050) compared to the baseline. This means an average of +4.8% between 2022 and 2030 and +18.5% between 2022 and 2050 of the forest cover.



The variable share of land that is covered by forests provides an overview of the total land area that is covered by forests over time. It is estimated by comparing total forest land to the total land area.

In the baseline, the forest cover (as share of total land) variates from 28.8 percent in 2022 to 24.5 percent in 2050, by gradually reaching 27.8 percent in 2030 and 26.1 percent in 2040.

The forest share starts increasing as soon as reforestation sets. In the CPP scenario the forest cover (as share of total land) reaches 34.0 percent in 2050 (+38.7% vs BAU) with a value of 31.1 percent (+11.8% vs BAU) in 2030 and 32.8 percent (+25.3% vs BAU) in 2040. The average variation over BAU during the period 2022-2050 is +18.5%.

Table 3: Forest Cover (as share of total land)

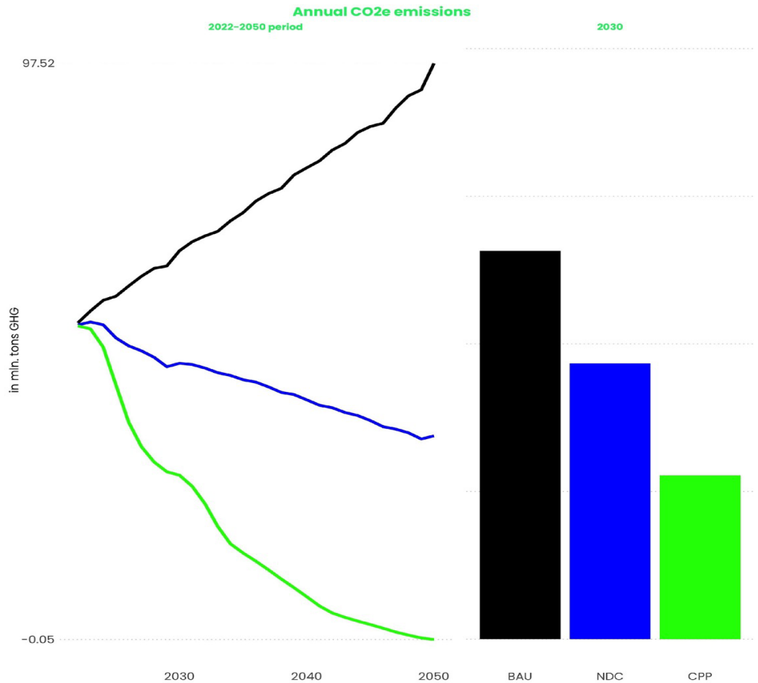
Scenario	2022-2030	2030-2040	2040-2050	2022-2050
BAU (%)	28.3	27.0	25.3	26.8
CPP (%)	29.7	32.2	33.3	31.8
CPP vs BAU	+4.8%+	+19.1%	+31.6%	18.5%

Emissions

The annual CO2e is the sum of total greenhouse gas (GHG) emissions emitted at country level. It is derived by summing up the emissions generated across all IPCC categories (i.e., energy, industrial product use, land, managed soils, livestock, land use, and waste).

In the baseline, the annual CO2e emissions variates from 53.6 million tons GHG in 2022 to 97.5 million tons GHG in 2050, by gradually reaching 65.8 million tons GHG in 2030 and 79.8 million tons GHG in 2040.

In the prosperity scenario the annual CO2e emissions amounts 53.1 million tons GHG (2022), 27.8 million tons GHG (2030), 7.2 million tons GHG (2040) and -0.05 million tons GHG (2050). The implementation of the prosperity measures then allows a dynamic of -57.8% (2030), -91% (2040), -100.1% (2050) compared to the baseline. This means an average of -34.2% change between 2022 and 2030 and -74.4% between 2022 and 2050 of the annual CO2e emissions.



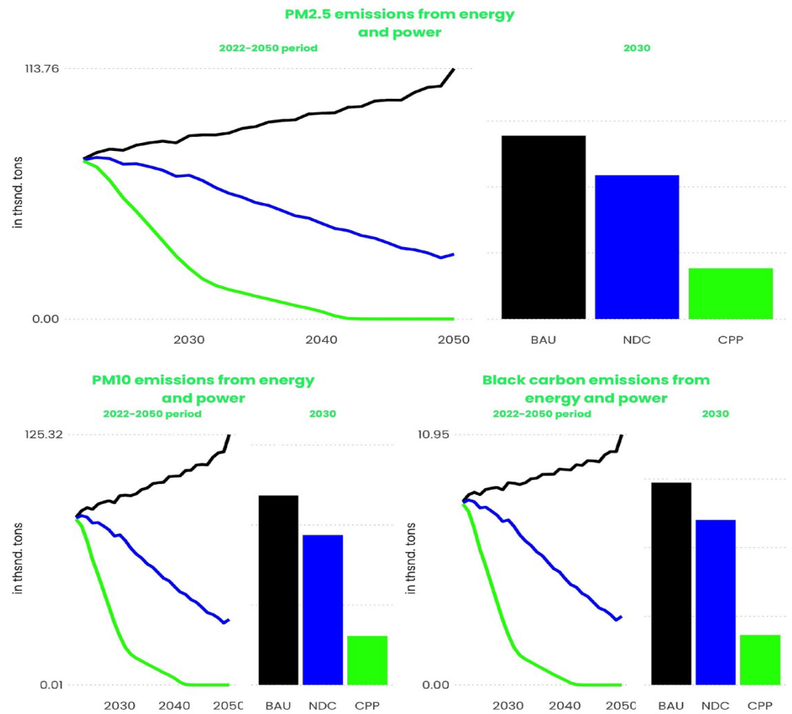
The country's total emissions change because of changes across all IPCC sectors considered (energy, IPPU, livestock, managed soils, land and waste). A change in total emissions relative to the BAU scenario is hence the sum of all policy induced changes across all sectors.

Air pollutants

GEM forecasts air pollutants based on total final energy use (by type of fuel) and the total fuel used for power generation. This indicates that the degree of electrification in conjunction with the decarbonization of the power generation sector drives the amount of air pollutants in the different scenarios. For this assessment, PM2.5 emissions, PM10 and black carbon emissions are of particular interest, as they are assumed to be key drivers for air pollution related mortality, both ambient as well as indoor.

In the BAU scenario, the PM2.5 emissions from energy and power goes from 72.7 thousand tons in 2022 to 83.3 thousand tons in 2030, 93.5 thousand tons in 2040 and 113.8 thousand tons in 2050. In the BAU scenario, the PM10 emissions from energy and power goes from 83.9 thousand tons in 2022 to 94.7 thousand tons in 2030, 104.5 thousand tons in 2040 and 125.3 thousand tons in 2050. In the BAU scenario, the black carbon emissions from energy and power goes from 8.0 thousand tons in 2022 to 8.8 thousand tons in 2030, 9.4 thousand tons in 2040 and 10.9 thousand tons in 2050.

In the CPP scenario the PM2.5 emissions from energy and power reaches 0.0 thousand tons in 2050 (-100% vs BAU) with a value of 23.0 thousand tons (-72.3% vs BAU) in 2030 and 3.4 thousand tons (-96.4% vs BAU) in 2040. The average variation over BAU during the period 2022-2050 is -78.4%. In the prosperity scenario the PM10 emissions from energy and power amounts 82.9 thousand tons (2022), 24.4 thousand tons (2030), 3.4 thousand tons (2040) and 0.0 thousand tons (2050). The implementation of the prosperity measures then allows a dynamic of -74.2% (2030), -96.8% (2040), -100% (2050) compared to the baseline. This means an average of -38.8% change between 2022 and 2030 and -78.7% between 2022 and 2050 of the PM10 emissions from energy and power. In the CPP scenario the black carbon emissions from energy and power reaches 0.0 thousand tons in 2050 (-100% vs BAU) with a value of 2.2 thousand tons (-75.3% vs BAU) in 2030 and 0.2 thousand tons (-97.8% vs BAU) in 2040. The average variation over BAU during the period 2022-2050 is -78.6%.



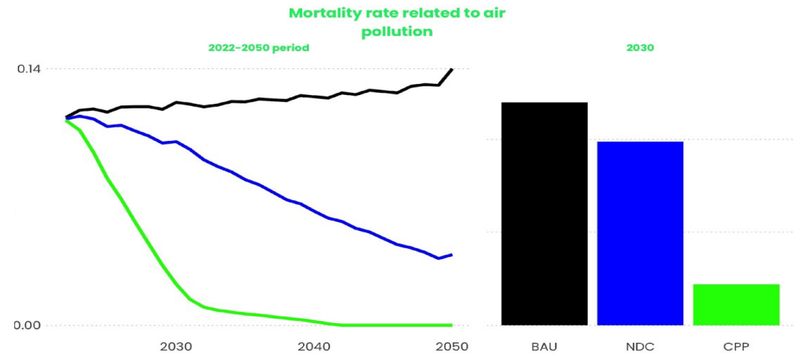
The final energy consumption (by fuel) and fuel use for power generation explain the trend of the air pollutants. While energy consumption is driven by population, GDP, and energy efficiency (+84.9% in the CPP scenario), fuel use for power generation is driven by electrification ambitions and the share of electricity generated by renewables. In the CPP scenario, full electrification and the full transition of the power sector enable the eradication of all air pollutants in the year 2050. This significantly improves air quality and contributes to avoiding premature deaths from air pollution induced impact.

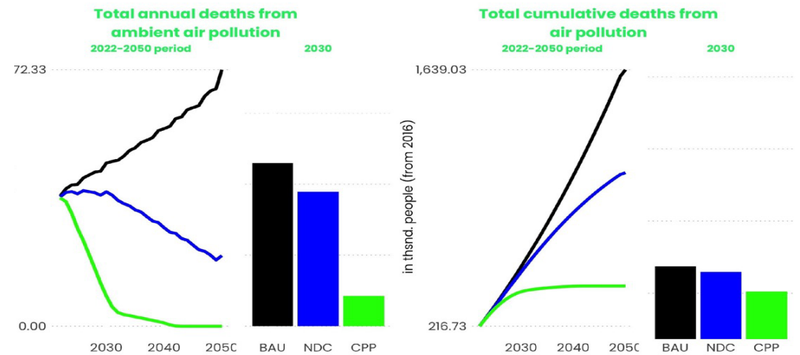
Air pollution

The following indicator corresponds to the mortality rate that is attributable to air pollution, both ambient as well as indoor. This variable is calculated as the sum of the death rate from ambient air pollution and the death rate from indoor air pollution. The variable below presents the total number of deaths per year related to ambient and indoor air pollution.

In the BAU scenario, the mortality rate related to air pollution goes from 0.11 percent in 2022 to 0.12 percent in 2030, 0.12 percent in 2040 and 0.14 percent in 2050. The total annual deaths from ambient air pollution variates from 36.7 thousand people in 2022 to 72.3 thousand people in 2050, by gradually reaching 46.0 thousand people in 2030 and 55.7 thousand people in 2040. This represents a cumulated number of deaths of 216.8 thousand people in 2022, 548.0 thousand people in 2030, 1,051.6 thousand people in 2040 and 1,639.0 thousand people in 2050.

In the prosperity scenario, the mortality rate related to air pollution amounts to 0.11 percent (2022), 0.02 percent (2030), 0.00 percent (2040), 0.00 percent (2050). The implementation of the prosperity measures then allows a dynamic of -81.6% (2030), -98.4% (2040), -100% (2050) compared to the baseline. This means an average of -41.8% between 2022 and 2030 and -80.2% between 2022 and 2050 related to air pollution. The total annual deaths from ambient air pollution amounts to 36.2 thousand people in 2022 and reaches 0 people by 2050 by gradually reaching, 8.5 thousand people (2030) and 0.9 thousand people (2040) which represent a decline of -81.6% (2030), -98.4% (2040), -100% (2050) in comparison to BAU. This is an average of -83.5% over the period 2022-2050. The cumulative deaths from air pollution reaches 216.7 thousand people in 2022, 408.1 thousand people in 2030, 438.3 thousand people in 2040 and 439.3 thousand people in 2050. The CPP scenario then allow a dynamic of -25.5% (2030), -58.3% (2040), -73.2% (2050) compared to the baseline. This means an average of -12.7% change between 2022 and 2030 and -52.8% between 2022 and 2050 of the cumulative deaths from air pollution. This trend is a consequence of implementing the envisaged electrification and power generation ambitions. This implies that, once the economy is fully electrified and all power generated by renewable sources, there will be no mortality related to air pollution anymore.



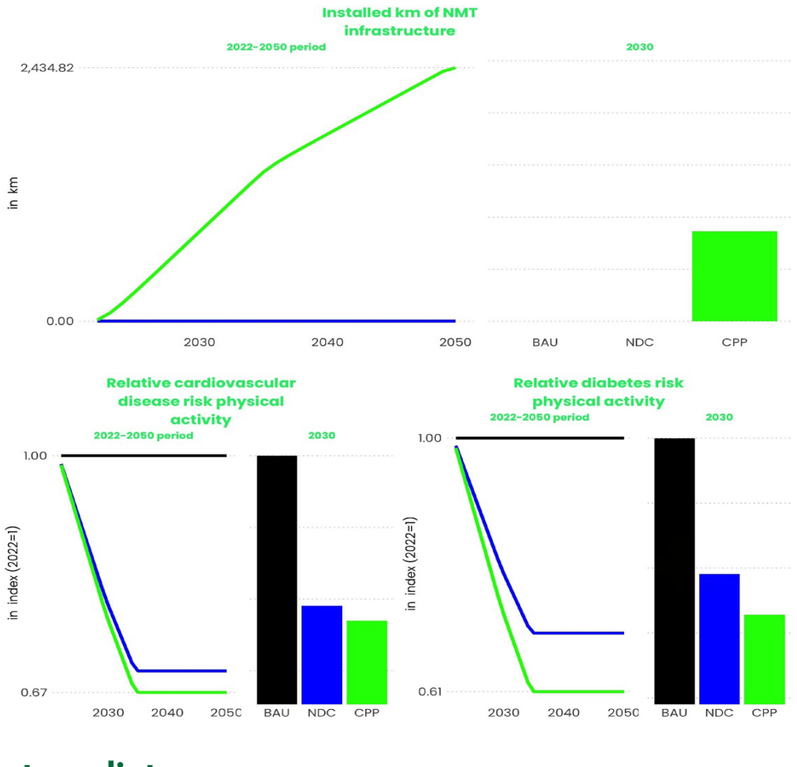


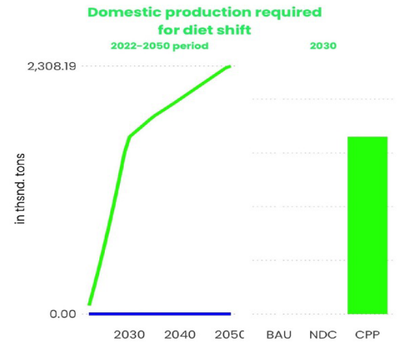
The main factor that drives the mortality related to air pollution are PM2.5 emissions from final energy consumption and power generation (-78.4% in the CPP scenario), whereby (i) final energy consumption is driven by population, GDP and energy efficiency measures and (ii) emissions from power generation depend on the amount of fossil fuel-based capacity and generation.

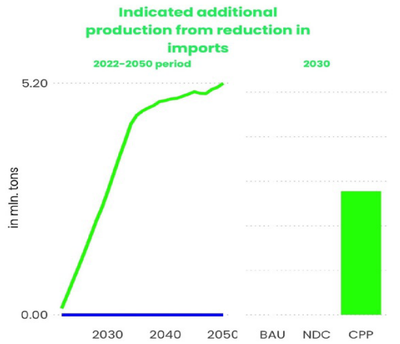
The relative cardiovascular disease, diabetes risk and cancer related mortality indicate respectively the change in overall cardiovascular diseases, diabetes risk and cancer related mortality.

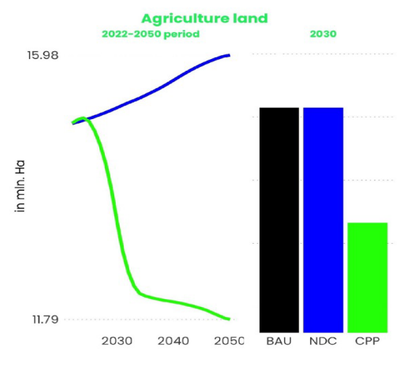
In the BAU scenario, no shift in transport modes is assumed. In the CPP scenario, the installed kilometers of non-motorized transportation (NMT) infrastructure increase on average by 1,333.7 km over the period 2022-2050 and is expected to reach at the end of the period 2,434.8 km.

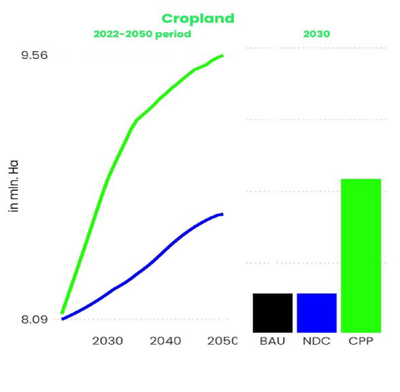
The shift in transport mode towards NMT modes such as walking and cycling leads to a reduction in the relative risk for various diseases. GEM projects the change in the relative risk for overall mortality, cardiovascular diseases, diabetes and cancer-related mortality based on the modal share that is moved to NMT. The results suggested that once the NMT infrastructure is fully implemented, the relative risk for diabetes declines by 0.6 (index), while the relative risk for cardiovascular diseases is impacted by 0.7 compared to the BAU scenario.











Impact on diet

This subsection presents the requirements for a shift in diet. The cropland is the total agriculture land that is used for crop production.

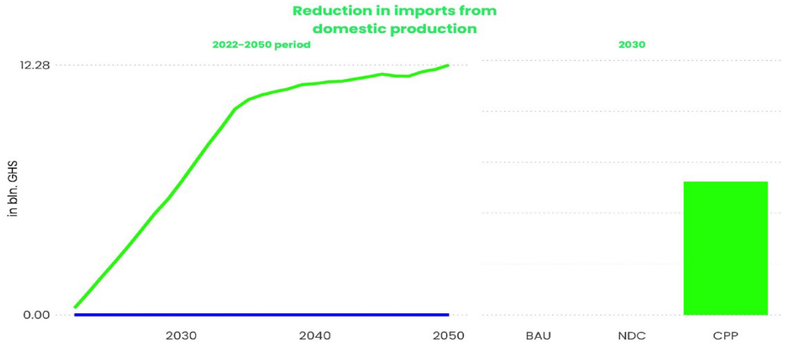
The shift towards plant-based diets affects the total amount of land used for agriculture and leads to reductions in the cost of obesity as a share of GDP. Agriculture land is hereby affected by the additional land requirements to shift towards plant-based diets, the land requirements for enabling full self-sufficiency in food production and the reductions in pasture land from the phase out of livestock. The additional crop production requirements for the shift in diet in Ghana are projected, in the CPP scenario, at 1,649.7 thousand tons in 2030, 2,001.8 thousand tons in 2040 and 2,308.2 thousand tons in 2050 with an average variation between 2022 and 2050 estimated at 1,634.3 thousand tons. At the same time the phase out of food imports leads to an increase in the production of 4.8 million tons by 2030 and 4.8 million tons by 2050.

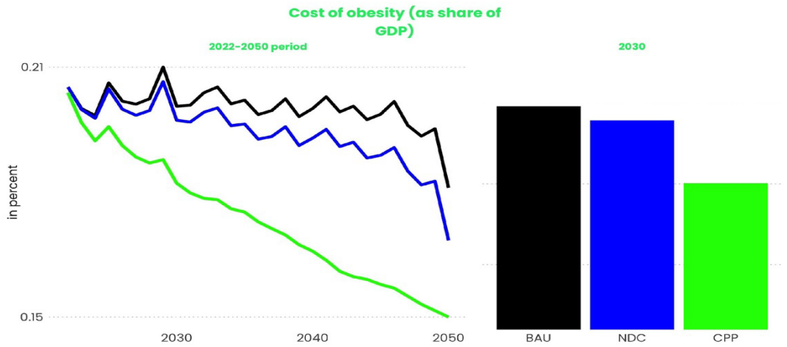
In the BAU scenario, the total agricultural land goes from 14.90 million Ha in 2022 to 15.98 million Ha in 2050 while these values are respectively 14.90 million Ha and 11.79 million Ha in the CPP. This represents a change of -26.2% compared to the BAU. At the same time, the need to produce more crops locally impacts the cropland compared to the baseline. In the CPP scenario, the shift in diet causes the cropland to reach 9.6 million Ha by 2050 which is +10.2% compared to BAU.

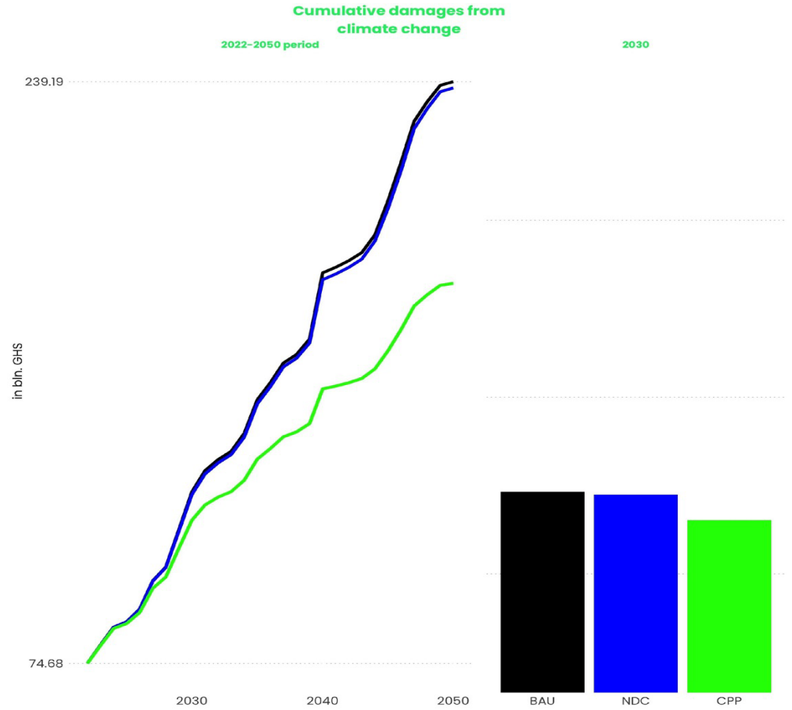
The shift in diets also has macroeconomic implications. On the one hand, the shift towards full domestic food production leads to reduction in total imports and on the other hand, it reduces the cost of obesity and implications for macroeconomic productivity. Import savings accrue gradually in alignment with the ambition for local production. The import saving goes gradually in the CPP scenario to 6.5 billion GHS in 2030, 11.4 billion GHS in 2040 and 12.3 billion GHS in 2050 with an average growth of 8.5 billion GHS over the period.

Another benefit of the implementation of the CPP scenario is its impact on the cost of obesity as a share of GDP. In fact, this cost is projected to decline, and variate from 0.20 percent in 2022 and will reach 0.15 percent by 2050 driven by economic performance while these amounts in the BAU are estimated at 0.20 percent in 2022 and 0.18 percent in 2050.

Climate Prosperity Plan | Ghana 2023







Climate damage

Climate damage refers to the cumulative amount of damages resulting from climate change, regardless of whether reparation takes place. It provides an overview of the total damages that result from climate change impacts and hence allows for assessing the avoided damages from the implementation of interventions for adaptation.

In the BAU, the cumulative damages from climate change between 2022 and 2030 are projected to reach 123.2 billion GHS and damages between 2022 and 2050 are indicated around 239.2 billion GHS in 2050. This increasing amount is due to the reconstruction of assets and infrastructure, which can in turn be damaged again by future climate events.

In the CPP, between 2022 and 2050, 182.2 billion GHS are projected in climate change damages with an average value of 130.6 billion GHS per year which is on average -14.1% lower compared to the BAU because of the reduced damage in the CPP scenario.

The cumulative climate change damages are driven by the size of the economy and the implementation of climate adaptation measures (CPP scenario). As the economy grows (+64.9% in the CPP scenario) because of prosperity measures, the potential for damages increases as well. The implementation of climate change adaptation measures reduces the risk of damages and hence reduces cumulative damages below the other two scenarios (CPP scenario).

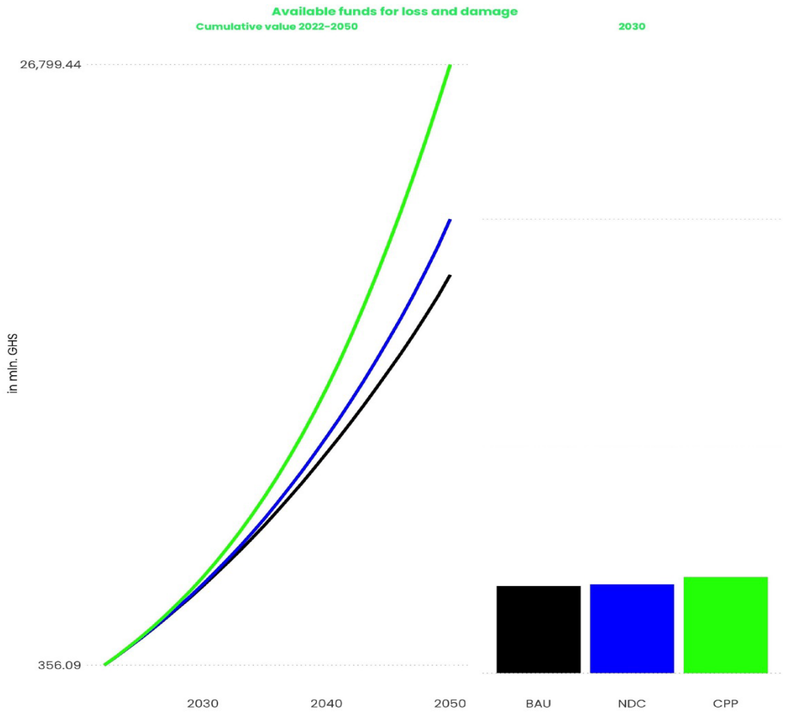
The available funds for loss and damage represents the amount of money available for compensating losses and damages incurring from climate change.

In the baseline, the available investment for loss and damage culminates to 3,845.2 million GHS in 2030, 9,700.0 million GHS in 2040 and reaches 17,543.8 million GHS in 2050.

In the case of CPP, the average value of this available investment over the same period is projected at 898.6 million GHS with a cumulative value of 26,799.4 million GHS by 2050. As a result of the reduced damage in the CPP scenario, the available funds for loss and damage may not be fully depleted in the medium and longer term. In this case, the funds would accumulate over time, as higher climate resilience is realized. Additional growth generated from the prosperity plan in the economy contributes to higher resource availability for loss and damage payments, enabling a more reliable recovery from damages. At the same time, there is a higher potential for damages through increased capital accumulation relative to the BAU scenario. However, the CPP scenario benefits from climate proofing the economy, which reduces

Climate Prosperity Plan | Ghana 2023

damages and maintains productivity. This both increases growth relative to the BAU scenario and reduces the volatility of growth, leading to a more sustainable development trajectory.



The availability of money for loss and damage depends on the GDP and hence economic growth and the annual climate change damages that incur in each of the scenarios. A higher amount in the prosperity scenarios indicates a higher availability of funds for reparation payments, driven by increased economic growth.

The environmental variables are positively impacted by the CPP scenario thanks to the reduction of emissions, the decrease in the number of deaths, the increase in the forest cover but also the reduction of climate damages. As the economic, social, energy and environment variables have been evaluated in the previous section, it will be possible to assess the boost in the SGDs linked to the implementation of the Prosperity Plan.

SDGs assessment

Driven by the increase of growth, reduction of poverty, the new gain in energy efficiency, etc, the section below evaluates the improvement of the SDGs.

SDGs boost

The figure below presents the boost in the achievement of the SDGs induced by the implementation of the CPP.

There is an overall improvement in the SDGs indicators through time in the CPP compared to BAU. The performance on SDG 1, no poverty, improves by 11.6 % in 2030. This indicates that the CPP scenario significantly delivers improvements, both in terms of reducing poverty relative to the BAU as well as generating additional income per capita.

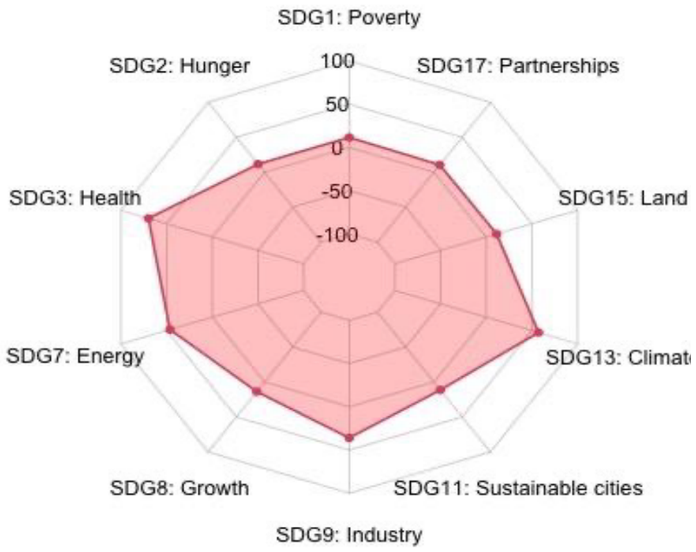
For the SDG 2, the analysis indicates that there are improvements in agriculture production per capita and the value added from the agriculture sector. Both trends show a growth in sectoral output and value added, contributing to development, and reducing hunger below the baseline scenario. The boost in the SDG 2, zero hunger, is indicated at 11.56 % in 2030.

The SDG 3, good health and well-being is measured by the total PM2.5 emissions at country level. The improvement of 69.94 % in 2030 in the CPP is attributable to significant reduction in air pollution which contributes to reducing air pollution related morbidity and mortality.

Improved energy productivity contributes to reducing the SDG 7, affordable and clean energy, and allows a boost of 46.36 % in the same target year.

Driven by the supplementary growth in the CPP and the better performance of the industry capital, the improvement in the SDG 8 (decent work and economic growth) and SDG 9 (industry, innovation and infrastructure) will respectively reach 13.82 % and 36.01 % by 2030.

Same for example for the SDG 13 (life on land) and SDG 15 (life on land) for which the improvement will be 57.31 % and 11.41 % in 2030 pushed by the CPP ambition in terms of land management and climate resilience.



As the CPP positively boosted the SDGs, the subsequent section will provide the necessary investments for its implementation in the context of Ghana.

Investment and financing

The subsequent section will present the investment requirements for the different scenarios and the cost benefit analysis performed.

Financing

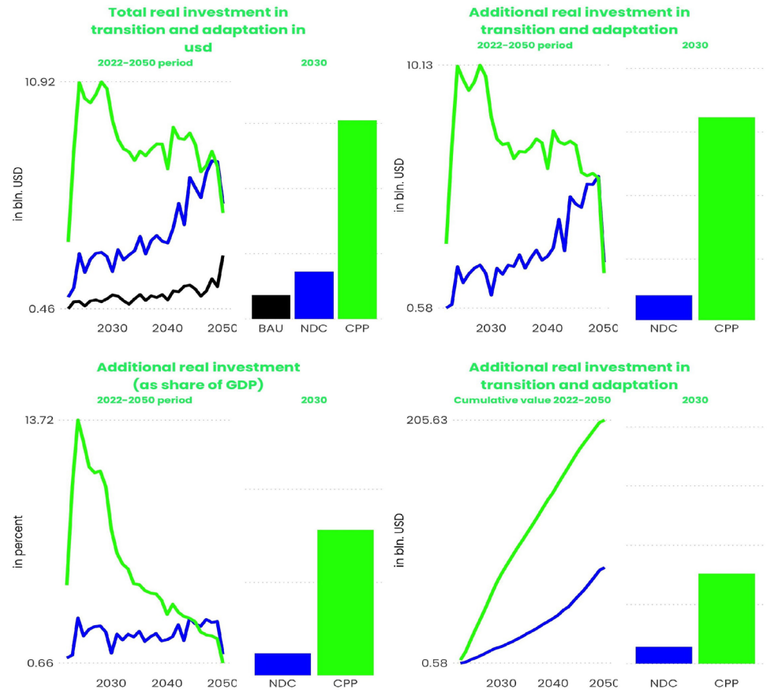
The financing section gives an overview of the investment required for the implementation of transition and adaptation measures. These amounts are presented compared to BAU to assess the additional necessary investment. The investments are also broken down between public and private, transition and adaptation to fully appreciate the share allocated to each component.

Total investment

The total investment in transition and adaptation is the total investment required for implementing the interventions for climate change transition and adaptation envisaged in the CPP scenario. It is calculated by multiplying the respective ambition (e.g., ha of land, buildings secured, etc) by a cost factor.

The total real investment in transition and adaptation averages 8.2 billion USD over the period 2022 to 2050 which represents, as a share of GDP, an average of 6.6 percent ; with a cumulative additional amount compared to BAU reaching 205.6 billion USD. As, in the CPP scenario, additional ambition is assumed both for transition and adaptation, by 2030, the cumulative additional investment required amounts to 76.2 billion USD.

To reach the transition ambitions and full climate proofing of the economy, the additional investment (as share of GDP) required is 7.8 percent in 2030, 3.3 percent in 2040 and 0.7 percent in 2050. In Ghana, 7.3 billion USD is required each year to achieve the CPP goals.



One of the main factors behind the change in this indicator, as illustrated in the graph, are total GDP (+51.4% in the CPP scenario) and the total annual cost of implementing prosperity and adaptation measures.

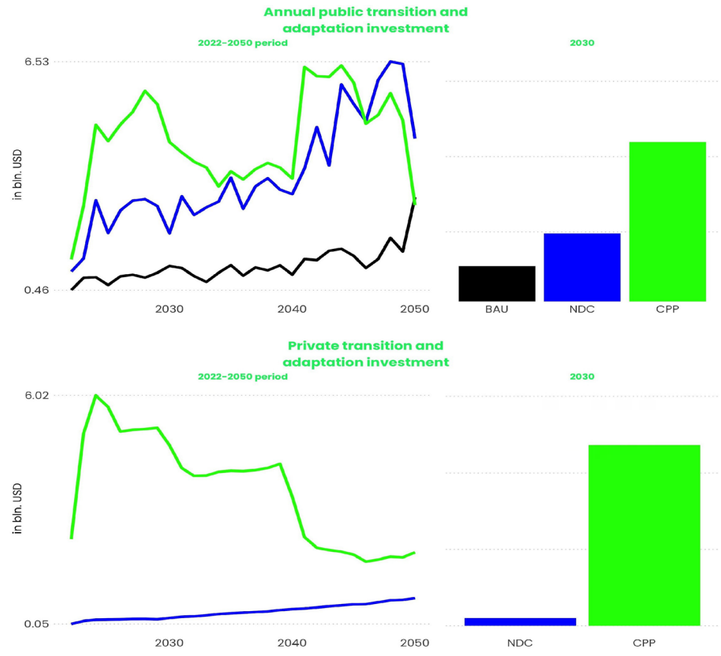
Breakdown between public and private investment

This annual public investment is the share of climate change transition and adaptation investments that is assumed to be borne by the public sector. The interventions include transition and adaptation investments for power generation and related infrastructure, investments in flood proofing buildings, the cost of waste management, the installation of charging networks for electric vehicles, greening urban areas, and the cost for electric buses. The private transition and adaptation investment represents the share of climate change transition and adaptation investments that is assumed to be borne by the private sector. The interventions include investments in electric vehicles, livestock emission reductions, cost of sustainable agriculture practices, investments in air conditioning and cost of carbon capture and storage in the industrial sector.

Several types of investments are considered in climate transition and adaptation. Some of these are typically public (e.g. power generation, public transport, waste management) while others are typically private (e.g. agriculture, energy efficiency, and purchase of private vehicles). In reality the government may provide incentives for the adoption of new, more efficient, and low carbon technologies by the private sector. Similarly, public-private partnerships can be established for the private sector to build and operate public infrastructure on behalf of the government. However, for the analysis of funding requirements, we assume that certain investments would be the responsibility of the government, while others of the private sector. This is required to inform the creation of a financing strategy for the implementation of the CPP strategy.

In the prosperity scenario, the total cumulative public investment in transition and adaptation required between 2022 and 2030 is estimated at 38.8 billion USD and averages 4.5 billion USD per year over the next 28 years, whereby the majority of investments required between 2030 and 2040 with respectively 4.4 billion USD and 3.4 billion USD.

The total private sector investment requirement additional to BAU is indicated at 44.3 billion USD for the period from 2022 to 2030 and at 103.3 billion USD from 2022 and 2050. The average annual investment over the course of the 28 years is 3.6 billion USD.



These values of the annual public and private investment are mainly driven by the intervention considered to be implemented by the respective sector, their ambition, and the respective cost of implementation.

Breakdown between transition and adaptation

The investment in transition is the total investment and O&M cost resulting from the implementation of climate change transition actions while the investment in adaptation presents the annual investment required for the implementation of the adaptation ambitions. It is calculated based on the units implemented and a respective unit cost.

The total additional investment compared to BAU is broken down here to appreciate the investment allocated to transition and to adaptation. The adaptation investment is zero because there is no quantified adaptation ambition in the baseline scenario.

In the CPP scenario, the average growth of the investment in transition is indicated at 4.3 billion USD in 2030 and reaches 3.9 billion USD in 2050 which represents an additional investment of 3.2 billion USD in 2030 and 0.9 billion USD in 2050. However, when reported as a share of GDP, this additional effort requirement represents 3.1 percent (2030) and 0.3 percent (2050) boosted by the additional growth induced by the implementation of CPP ambitions. The cumulative additional investment in transition required by 2050

reaches 113.0 billion USD and the accumulated value for adaptation (i.e., the adaptation portion of the CPP scenario) is projected to be 92.7 billion USD at the same period. The annual average adaptation investment over the next 28 years is 3.3 billion USD which allows the diversification of intervention and offers co-benefits. When looking at annual value as a share of GDP, the additional investment represents 4.7 percent in 2030 and ends up being 0.3 percent by 2050.

The implementation of the CPP scenario would require additional efforts compared to BAU, but is beneficial for the country as these values decrease over the years. To fully capture the benefit of the implementation of the prosperity scenario, the next section will present the cost and benefit analysis performed.

Cost-benefits analysis

The CPP scenario requires, as stated before, some additional investments. This section will provide a full overview of this required investment evolution, but also the avoided cost as well as the added benefits and conclude with a benefit to cost assessment.

An integrated Cost Benefit Analysis (CBA) was created to assess the economic viability of the scenarios analyzed. In this assessment the following are considered:

- required capital investment and operation & maintenance cost (i),
- avoided costs resulting from the implementation of the investment (ii), and
- added benefits generated beyond the BAU scenario (iii).

Concerning (i) investments, for climate mitigation it is considered:

- energy efficiency,
- industrial carbon capture and sequestration,
- fuel switching,
- land-based interventions,
- livestock management,
- sustainable agriculture,
- waste management,
- transport electrification and
- power generation.

Climate adaptation also require investments in the following areas:

- flood protection for buildings,
- irrigation infrastructure,
- drainage systems,
- road network,
- shading and
- livestock adaptation.

Concerning (ii) avoided costs the followings are considered:

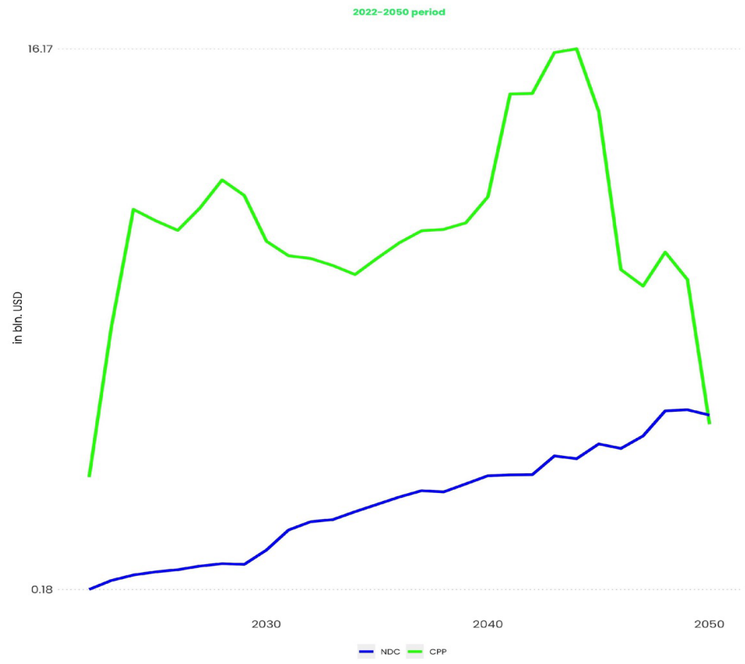
- reduced energy spending,
- reduced social cost of carbon,
- avoided costs for the purchase of internal combustion engine vehicles (replaced by EVs),

Total investment required

The total investment required is the total cumulative investment and O&M cost related to the implementation of transition and adaptation interventions. Furthermore, this category also includes the total loss and damages payments required (i.e. the payments required for repairing climate change related damages). The values are presented for the period 2022 to 2050, discounted at a specific country discount rate.

The total investment required in CPP goes from 3.5 billion USD in 2022 to 10.5 billion USD in 2030, and 11.8 billion USD in 2040.

This amount will reach 5.1 billion USD in 2050.



Total avoided cost

The avoided cost corresponds to both tangible as well as intangible costs that are avoided as a result of implementing climate change adaptation and transition interventions. Examples are energy expenditure savings, reductions in climate change damages relative to the baseline or avoided investment in conventional vehicles resulting from the electrification of the fleet. The values presented are cumulative for the period 2022 to 2050 and discounted at a specific country discount rate.

The total avoided cost in CPP goes from 0.7 billion USD in 2022 to 12.6 billion USD in 2030, and 24.0 billion USD in 2040.

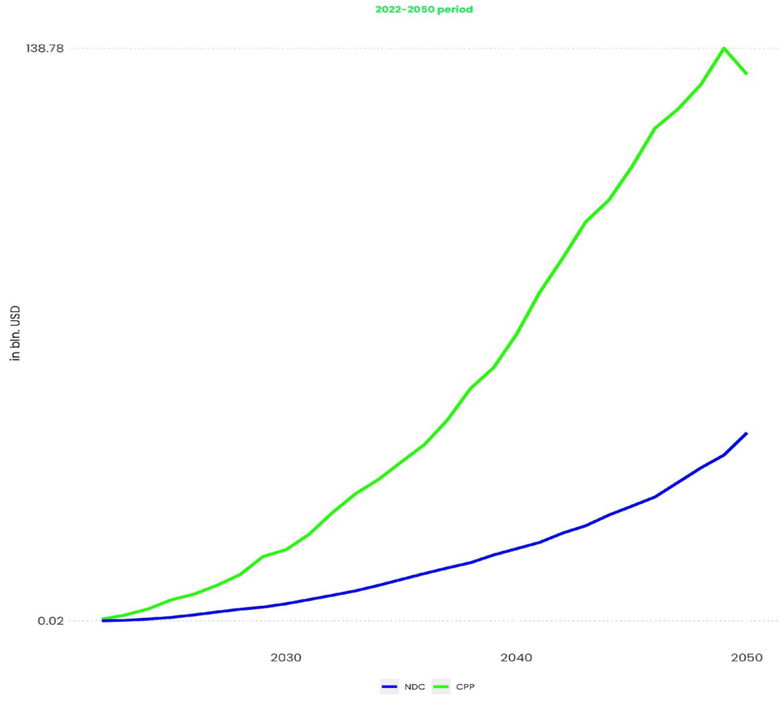
This amount will reach 28.8 billion USD in 2050.

Total added benefits

The added benefits correspond to the additional real GDP and labor income materializing because of implementing climate change adaptation and mitigation interventions. The values presented are cumulative for the period 2022 to 2050 and discounted at a specific country discount rate.

The total added benefits in CPP goes from 0.4 billion USD in 2022 to 17.3 billion USD in 2030, and 69.5 billion USD in 2040.

This amount will reach 132.4 billion USD in 2050.



Cost Benefit

The net benefits are calculated based on cumulative total investment and O&M cost, avoided cost and added benefits; being cumulative, the result is indicative for total system wide net benefits (or additional net costs) for the period 2022 to 2050. The difference between the sum of avoided costs and added benefits and total investment and loss and damages cost are considered net benefits. If the sum of avoided costs and added benefits is larger than the total investment and loss and damage payments, a net benefit emerges. In other words, the cumulated investments required for the scenario as well as the loss and damage costs incurred under the scenario are weighed against the added benefits and avoided costs that are generated under the same scenario - when the total benefits outweigh the total investment, we see a net benefit from the scenario.

The implementation of CPP will generate for Ghana a net benefit of 5.4 billion USD by 2030 and 75.3 billion USD by 2050.

The net investment for the country is 38.8 billion USD by 2030 and 47.6 billion USD by 2050.

Table 5: Cost Benefit

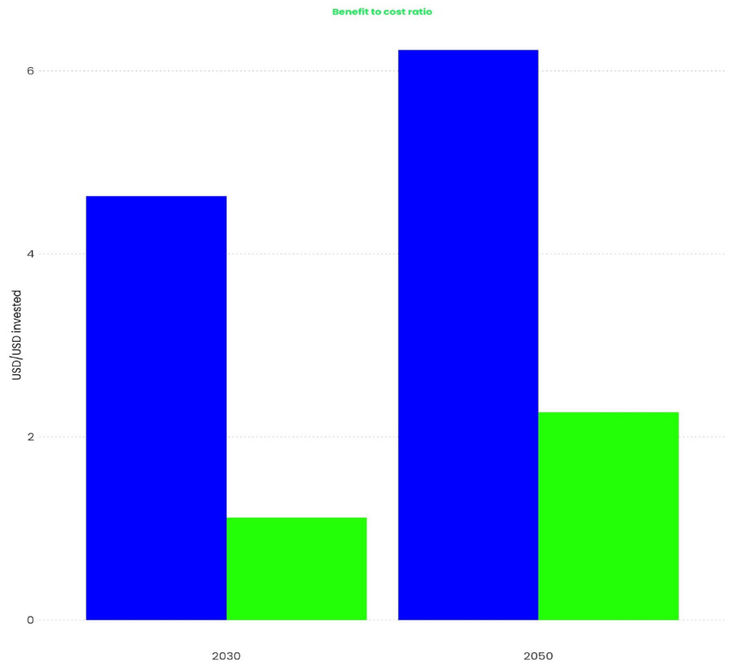
CBA indicators (in billions USD)	2030	2050
Investments in transition	22.7	32.0
Investments in adaptation	22.9	27.3
Loss and damage payments	0.0	0.0
Total investment required	45.6	59.3
Total avoided cost	24.5	48.7
Total added benefits	26.5	85.9
Net integrated benefits	5.4	75.3
Net investment	38.8	47.6

Benefit to cost ratio

The Benefit to Cost Ratio (BCR) is calculated by dividing the sum of avoided costs, and added benefits by the sum of total investment, O&M and loss and damage payments. A value larger than 1 indicates that per USD invested, more than one dollar results in system wide benefits as a result of intervening.

In 2030, the cost-benefit ratio of the CPP is 1.1 and it reaches 2.3 in 2050. Practically, this means that for every dollar invested, the investor generates a present value benefit of 2.3 dollars by 2050. The net benefit of the CPP increases with time and amounts to 47.57 billion USD by 2050. This is because there is more time for the benefits of the investments to accumulate (e.g., energy efficiency investments result in energy and related cost savings every year, once new and more efficient equipment is adopted). The CPP scenario, despite being more ambitious than the NDC and considering more, and higher cost investments, is also economically viable.

Further, it is noted that the avoided costs are larger than the investment required by 2030 (ratio of 0.8), indicating that avoided costs alone would be sufficient to repay the investment.



The positive cost to benefit ratio demonstrates the overall interest of implementing the CPP ambitions. The CPP scenario is therefore profitable and provides positive outcomes for Ghana but also generates an interesting net benefit.

Table 6: Glossary

TERM	DEFINITION
Additional investment in adaptation	The annual investment required for the implementation of the adaptation ambitions, as additional to BAU.
Additional real investment in transition	The additional real investment in transition presents the additional annual amount required for implementing transition ambitions compared to the baseline.
Annual CO2e emissions	The sum of total greenhouse gas (GHG) emissions emitted. This indicator is calculated by summing up the emissions generated across all IPCC categories.
Annual public transition and adaptation investment	The share of transition and adaptation investments by the public sector. Interventions include investments for power generation and related infrastructure, flood proofing buildings, waste management, charging networks for electric vehicles, greening urban areas and electric buses.
Benefit to cost ratio	The Benefit to Cost Ratio (BCR) is calculated by dividing the sum of avoided costs and added benefits by the sum of total investment, O&M and loss and damage payments. A value above 1 indicates that one USD invested generates more than one USD.
Carbon credit revenues from energy exports	The number of tons avoided multiplied by the value per ton yields the value of credits generated from energy exports
Carbon credit revenues from mangrove restoration	Carbon credits from mangrove restoration are estimated based on the change in carbon stock resulting from converting one hectare of land to mangroves.
Carbon credit revenues from reforestation	Carbon credits from reforestation are estimated based on the change in carbon stock resulting from reforesting one hectare of barren land.

Cropland	Cropland is the total agriculture land that is used for crop production.
Cumulative damages from climate change	The cumulative amount of damages resulting from climate change impacts.
Cumulative net savings from energy efficiency	The cumulative net amount of final energy use avoided as a result of implementing energy efficiency measures.
Disposable income index relative to 2022	Index of real disposable income with respect to base year
Energy affordability index	The energy affordability index is calculated by dividing the disposable income index by the energy bill index. It indicates how the total disposable income develops in relation to total energy cost. An increase signifies that energy becomes more affordable.
Energy bill	Energy bill indicates the total energy cost resulting from final energy consumption, it is the sum of costs for petroleum products, natural gas, coal and electricity.
Energy bill (as share of GDP)	Energy bill (as share of GDP) presents the total energy cost resulting from final energy consumption in relation to total GDP.
Energy bill index	Index of total country energy cost with respect to base year.
Energy demand	Total final energy consumption is calculated as the sum of demand across all fuels (petroleum, coal, electricity, natural gas and biomass) and sectors (residential, commercial, industrial and transport).
Energy efficiency change	The rate of change that is applied to the stock of energy efficiency.
Energy tax income	Energy tax income is the sum of taxes from the sales and production of petroleum products and electricity.
Forest cover	The total amount of hectares covered by forests.

Forest cover (as share of total land)	This indicator provides information about the total share of land that is covered by forests. Estimated by dividing total forest by total land.
Forest index	The forest index indicates the change in total forest land relative to the base year.
Fossil fuel expenditure (as share in total imports)	This indicator shows how the share of fossil fuel costs in total imports develops over time.
Green jobs	Green jobs are jobs that result from the implementation of interventions in the CPP scenario.
Industry capital index	The industry capital index indicates the change in total industrial capital relative to the base year.
Installed km of NMT infrastructure	This indicator provides insight into the total kilometers of Non Motorized Transport (NMT) infrastructure installed.
Investment in transition	Total investment and O&M cost resulting from the implementation of mitigation actions.
Mortality rate related to air pollution	Mortality rate attributable to air pollution, both ambient and indoor.
PM2.5 emissions Index	Index of death rate related to ambient air pollution.
PM2.5 emissions from energy and power	The sum of PM2.5 emissions from final energy consumption and power generation fuel use.
Percentage of population below poverty line	The percentage of population below the poverty line indicates the share of the total population that lives in poverty.
Population below poverty line	Total number of people living below the poverty line.
Power generation capacity	The total MegaWatts (MW) of power generation capacity installed at country level.

Private savings index	The index of private savings at country level with respect to the base year.
Private transition and adaptation investment	The share of transition and adaptation investments borne by the private sector. Interventions include electric vehicles, livestock emission reductions, cost of sustainable agriculture practices, investments in air conditioning and cost of carbon capture and storage in the industrial sector.
Real GDP	Total real GDP is the Gross Domestic Product in constant terms.
Real GDP growth rate	The real GDP growth rate is the annual percent change in real GDP.
Real disposable income per capita	The real disposable income per capita is the disposable income divided by total population.
Relative cardiovascular disease risk physical activity	Indicates the change in risk of cardiovascular diseases resulting from the model shift towards non-motorized transport.
Relative diabetes risk physical activity	Indicates the change in overall diabetes risk resulting from the model shift towards non-motorized transport.
Relative energy efficiency	Relative energy efficiency is an index relative to base year that indicates how energy efficiency develops over time.
Services capital index	The services capital index indicates the change in total services capital relative to the base year.
Taxes on income and profits	Taxes on income and profits is the sum of income taxes paid by private individuals and profit taxes paid by corporations.
Total annual deaths from ambient air pollution	The total number of deaths per year related to ambient and indoor air pollution.

Total avoided cost	Avoided costs are avoided tangible and intangible costs resulting from implementing adaptation and transition interventions (ex: energy expenditure savings, reductions in damages). The values are cumulative for the 2022-2050 period and discounted.
Total cumulative deaths from air pollution	Total cumulative number of people that died from ambient and indoor air pollution since 2016.
Total employment	The total number of jobs across all sectors, including green jobs.
Total employment index	The total employment index indicates the change in total employment relative to the base year.
Total government revenue	Total government revenues represent the total annual revenues for the government from taxes, grants and other sources.
Total investment required	The total cumulative investment and O&M cost related to the implementation of transition and adaptation interventions, including total loss and damages payments required. The values are cumulative for the 2022-2050 period and discounted.
Total real investment in transition and adaptation	Total investment required for implementing the interventions for transition and adaptation.
Total tax from goods and services	The tax from goods and services constitutes the VAT category of government revenues. It is estimated as the sum of energy tax income and the residual VAT.
Total value of carbon credits	The total value of carbon credits is calculated as the sum of carbon credits from energy exports, mangrove restoration and reforestation
Trade balance	This indicator is calculated by deducting total imports from total exports.
Trade balance (as share of GDP)	This indicator is calculated by deducting total imports from total exports and dividing it by GDP.

Trade balance adjusted for energy trade	This indicator is calculated by deducting non-energy imports from non-energy exports.
Trade balance adjusted for energy trade (as share of GDP)	This indicator provides an overview of the trade balance adjusted for energy trade and its evolution in comparison to GDP.
Unemployment rate	The ratio of total unemployed people to total population across all sectors, including green jobs.
Unit cost of energy consumed	The average cost per TJ of final energy consumed is calculated by dividing the total energy bill by total final energy consumption.

Annex

Scenario assumptions

The table below presents the modeling assumptions that were used to simulate the NDC and CPP scenarios. For the NDC scenario, the model assumptions were calibrated in alignment with the ambitions described in the official NDC documents. The emission reductions in the NDC scenario are hence aligned with official conditional contributions. In the CPP scenario, additional ambition for climate change mitigation was simulated on top of the NDC ambitions. Furthermore, the CPP scenario also assumes the implementation of prosperity measures to achieve targets and objectives outlined in the official target document, such as for example adaptation measures for agriculture production and infrastructure (e.g. roads, buildings, power generation).

Climate change mitigation							
Intervention/indicator	Unit	NDC scenario			CPP scenario		
		2030	2040	2050	2030	2040	2050
Sustainable agriculture							
Adoption rate	%	60%	90%	90%	60%	90%	90%
Share of cropland requiring sust. Practices	%	20%	20%	20%	20%	20%	20%
Additional productivity per hectare	%	10%			10%		
Additional employment per hectare	%	10%			10%		
Additional value added per ton	%	10%			10%		
Reduction in fertilizer use per ha	%	50%			50%		
Additional CO2e sequestration	ton/ha/year	1 Ton/Ha/Year			1 Ton/Ha/Year		
Livestock							
Oilseed feeding							
Adoption rate	%	20%	40%	60%	20%	40%	60%
Expected reduction from feeding	%	20%			20%		
Days per year on diet	days/year	250			250		
Genetic improvements							
Assumed reduction in CH4 emissions from genetic improvements	%	14%	32,2%	50%	25%	37,5%	50%
Land based interventions							
Reforestation (cumulative)	Ha	420 385	420 385	420 385	422 885	1 022 885	1 622 885
Forest restoration (cumulative)	Ha	0	0	0	131 250	1 031 250	1 931 250
Mangrove restoration (cumulative)	Ha	0	0	0	0	0	0
Energy sector interventions							
Additional EE growth	%/Year	1,5%	1,5%	1,5%	4%	4%	4%
Reduction in transport demand from NMT	%	0,0%	0,0%	0,0%	0%	0%	0%
Fuel switching							
Electrification of petroleum demand							
Residential	%	5%	25%	45%	25%	60%	100%
Commercial	%	5%	25%	45%	25%	60%	100%
Industry	%	5%	25%	45%	25%	60%	100%
Transport	%	5%	25%	45%	25%	60%	100%
Electrification of coal demand							
Residential	%	14%	32%	50%	25%	60%	100%
Commercial	%	14%	32%	50%	25%	60%	100%
Industry	%	14%	32%	50%	25%	60%	100%
Transport	%	14%	32%	50%	25%	60%	100%
Electrification of biomass demand							
Residential	%	0%	20%	35%	60%	90%	100%
Commercial	%	0%	20%	35%	25%	60%	100%
Industry	%	0%	20%	35%	25%	60%	100%
Transport	%	0%	20%	35%	25%	60%	100%
Electrification of natural gas demand							
Residential	%	20%	30%	40%	20%	30%	40%
Commercial	%	20%	30%	40%	20%	30%	40%
Industry	%	20%	30%	40%	20%	30%	40%
Transport	%	20%	30%	40%	20%	30%	40%
Power generation							
Share of electricity generated from renewables	%	100%	100%	100%	70%	100%	100%
Reduction in transmission losses	%	25%	50%	50%	25%	50%	50%
Waste management							
Waste collection rate	%	25%	38%	50%	25%	38%	50%
Additional waste recycled	%	14%	14%	14%	14%	14%	14%
Reduction in wastewater related GHG	%	15%	30%	50%	30%	60%	90%
IPPU emissions							
Reduction from improved processes	%	20%	40%	60%	25%	50%	75%
Residual GHG: reduction from CCS	%	10%	25%	40%	25%	66%	90%

For the implementation of adaptation measures, the assumptions below were taken.

Climate Prosperity Plan | Ghana 2023

Climate change adaptation							
Intervention/indicator	Unit	NDC scenario			CPP scenario		
		2030	2040	2050	2030	2040	2050
Agriculture land							
Temperature and drought protection							
Share of cropland requiring net shading	%	20%	20%	20%	20%	20%	20%
Share of land protected by net shading	%	0%	0%	0%	66%	100%	100%
Share of cropland requiring adaptation	%	20%	20%	20%	20%	20%	20%
Share of land using resilient practices	%	0%	0%	0%	12%	18%	18%
Share of land covered by drip irrigation	%	0%	0%	0%	6%	10%	10%
Flood protection							
Share of cropland requiring adaptation	%	20%	20%	20%	20%	20%	20%
Share of cropland equiped with drainage	%	0%	0%	0%	66%	100%	100%
Livestock							
Cattle							
Technology-based heat protection	%	0%	0%	0%	30%	50%	50%
Nature-based heat protection	%	0%	0%	0%	30%	50%	50%
Pigs							
Technology-based heat protection	%	0%	0%	0%	30%	50%	50%
Nature-based heat protection	%	0%	0%	0%	30%	50%	50%
Poultry							
Technology-based heat protection	%	0%	0%	0%	30%	50%	50%
Nature-based heat protection	%	0%	0%	0%	30%	50%	50%
Labor productivity							
Share of buildings requiring temperature adaptation	%	25%	25%	25%	25%	25%	25%
Additional buildings with airco	%	0%	0%	0%	18%	40%	40%
Buildings with retrofit insulation	%	0%	0%	0%	27%	60%	60%
Livable cities (green spaces)	%	50%	100%	100%	50%	100%	100%
Decrease in WBGT from greening cities		2 °C at 100% adaptation			2 °C at 100% adaptation		
Flood protection for infrastructure							
Share of buildings requiring flood protection	%	14%	14%	14%	14%	14%	14%
Share of buildings with flood protection	%	0%	0%	0%	50%	100%	100%
Share of buildings with high cost flood protection	%	46%	46%	46%	46%	46%	46%
Industry capital with flood protection	%	0%	0%	0%	50%	100%	100%
Services capital with flood protection	%	0%	0%	0%	50%	100%	100%
Power generation							
Wind protection							
Share of power generation capacity requiring adaptation		100%	100%	100%	100%	100%	100%
Thermal generators	%	0%	0%	0%	66%	100%	100%
Wind generators	%	0%	0%	0%	66%	100%	100%
Solar generators	%	0%	0%	0%	66%	100%	100%
Share of transmission network requiring adaptation	%	100%	100%	100%	100%	100%	100%
Electrical substations/transmission lines	%	0%	0%	0%	0%	0%	0%
Flood protection							
Share of power generation capacity requiring adaptat	%	100%	100%	100%	100%	100%	100%
Thermal generators	%	0%	0%	0%	66%	100%	100%
Hydropower	%	0%	0%	0%	66%	100%	100%
Wind generators	%	0%	0%	0%	0%	0%	0%
Solar generators	%	0%	0%	0%	0%	0%	0%
Share of transmission network requiring adaptation	%	100%	100%	100%	100%	100%	100%
Electrical substations/transmission lines	%	0%	0%	0%	66%	100%	100%

Disaggregated CBA tables

The cost benefit table here is disaggregated to present all the components between 2022 and 2030 as well as 2022 and 2050.

		NDC scenario		CPP scenario	
CBA indicator	Unit	2022-2030	2022-2050	2022-2030	2022-2050
Investments in mitigation	**USD million**	**3 101,22**	**6 664,51**	**22 737,84**	**32 030,63**
Power generation	USD million	5 413	7 384	9 948	11 405
Transmission lines	USD million	266	650	1 422	2 240
Energy efficiency	USD million	258	345	465	629
Industrial CCS	USD million	10	15	28	42
Fuel switching	USD million	33	148	501	808
Land-based interventions	USD million	273	273	289	384
Livestock related emission reductions	USD million	130	298	56	65
Sustainable agriculture	USD million	0	0	1 021	1 561
Waste management	USD million	339	687	399	864
Investment in NMT infrastructure	USD million	0	0	22	29
Total cost of transport electrification and power generation	USD million	1 792	4 249	8 587	14 003
Investment in fast chargers	*USD million*	111	274	526	873
Chargers investment	*USD million*	68	137	317	473
Chargers O&M	*USD million*	11	45	57	153
Electric buses	*USD million*	24	55	114	187
Electric vehicles	*USD million*	1 552	3 637	7 438	11 971
O&M electric buses	*USD million*	2	8	10	27
O&M EV	*USD million*	25	97	125	325
Investments in adaptation	**USD million**	**0**	**0**	**22 877**	**27 300**
Flood protection (buildings)	USD million	0	0	2 065	2 675
Drip irrigation	USD million	0	0	135	190
Drainage systems	USD million	0	0	1 848	2 531
Road network	USD million	0	0	9	17
Net shading	USD million	0	0	15 570	17 611
Retrofitting	USD million	0	0	2 237	2 993
Livestock adaptation	USD million	0	0	37	39
Power generation	USD million	0	0	501	641
Contingency payments	**USD million**	**-1,81**	**-2,45**	**0,54**	**1,05**
Total investment required	**USD million**	**3 099**	**6 662**	**45 615**	**59 332**
Avoided cost					
Energy bill	USD million	2 154	4 979	2 379	6 324
Social Cost of carbon	USD million	262	589	604	1 408
Cost of ICE vehicles	USD million	1 387	3 579	6 606	11 434
Cost of gasoline infrastructure	USD million	42	104	200	333
Cost of air pollution	USD million	2 376	5 691	6 786	13 573
Cost of air pollution (power)	*USD million*	*14*	*55*	*7*	*48*
Cost of air pollution (final consumption)	*USD million*	*2 362*	*5 636*	*6 779*	*13 525*
Avoided CC damages	USD million	105	128	1 160	2 024
Total avoided cost	**USD million**	**8 704**	**20 763**	**24 522**	**48 668**
Added benefits					
Additional real GDP	USD million	5 253	20 337	26 324	85 452
Agriculture	*USD million*	*0*	*0*	*4 292*	*7 648*
Industry	*USD million*	*2 685*	*10 616*	*11 297*	*40 711*
Services	*USD million*	*2 568*	*9 721*	*10 735*	*37 094*
Government revenues	USD million	1 363	16 527	10 526	74 597
Household savings	USD million	20 932	140 995	98 253	560 076
Carbon credits	USD million	397	397	201	464
Total added benefits	**USD million**	**5 650**	**20 734**	**26 525**	**85 916**
Net integrated benefits	**USD million**	**11 254**	**34 835**	**5 431**	**75 253**
Ratio avoided cost to investment	USD/USDinvested	2,81	3,12	0,54	0,82
Ratio added benefits to investment	USD/USDinvested	1,82	3,11	0,58	1,45
Ratio avoided cost and added benefits to investment	USD/USDinvested	4,63	6,23	1,12	2,27
Net investment	**USD million**	**1 670**	**6 662**	**38 809**	**47 565**

Mapping of existing and proposed projects

Transition

TARGET NO.	SECONDARY TARGET NO. (IF APPLICABLE)	NAME	REFERENCE	INVESTMENT AMOUNT WHEN KNOWN (MILLIONS)	CURRENCY	TIMESPAN (YEARS)
1.1	1.3	Accelerated Energy Transformation for Power Resilience and Security	New CPP Project	16,000	USD	7
1.1		Low carbon electricity generation	Ghana's Updated Nationally Determined Contribution to the UNFCCC	141.4	USD	
1.1		Expand the adoption of market- based cleaner cooking solutions.	Ghana's Updated Nationally Determined Contribution to the UNFCCC	386.4	USD	
1.1	1.4	Promote clean rural households lighting.	Ghana's Updated Nationally Determined Contribution to the UNFCCC	35.7	USD	
1.1		Scale-up renewable energy penetration by 10% by 2030."	Ghana's Updated Nationally Determined Contribution to the UNFCCC	2,296.90	USD	
1.1		Captive Solar energy for industry	MoFEP's list of projects (Energy Commission)	5.00	USD	
1.1		Renewables and Conversion of simple cycle to dual plants	MoFEP's list of projects (Energy Commission)	142.00	USD	
1.1		Scale-up the 200,000 solar systems for lightening in residential and non-residential buildings	MoFEP's list of projects (Energy Commission)	5.00	USD	
1.2		Accra Waste to Energy Plant	N/A (China Railway Construction)	88.764	USD	4
1.2		Promoting the construction and commercialization of biogas plans in Ghana	MoFEP's list of project (EPA)	20	USD	
1.3		National Green Jobs Strategy: Suppporting Green Entreprises for Decent Job Creation	National Green Jobs Strategy			4
1.4	1.5	Ghana Mini Grid and Solar PV Net Metering	African Development Bank: Ghana Mini Grid and Solar PV Net Metering	85.18	USD	4
1.4	4.5	"new Ghana Building Code (GS1207 of 2018) "	Accra Climate Action Plan			
1.4		Self-help electrification project (SHEP)	National Medium-Term Development Policy Framework			3
1.5		Ghana transmission project (Kumasi-Bolgatanga)	Power Africa Transmission Roadmap to 2030: a Practical Approach to Unlocking Electricity Trade (USAID)	161	USD	
1.5		Energy Sector Transformation Initiative Project for Ghana	World Bank: Ghana Energy Sector Transformation Initiative Project	20	USD	4
1.5		Promotion of energy efficiency in homes, industry and commerce	Ghana's Updated Nationally Determined Contribution to the UNFCCC	786.94	USD	
1.5		Ghana-Burkina Faso transmission project (Bolgatanga-Ouagadougou)	Power Africa Transmission Roadmap to 2030: a Practical Approach to Unlocking Electricity Trade (USAID)	93	USD	
1.5		Ghana-Mali transmission project (Bolgatanga-Bamako)	Power Africa Transmission Roadmap to 2030: a Practical Approach to Unlocking Electricity Trade (USAID)	230	USD	

1.5		Côte d'Ivoire-Ghana transmission project (Bingerville-Dunkwa)	Power Africa Transmission Roadmap to 2030: a Practical Approach to Unlocking Electricity Trade (USAID)	178	USD	
1.5		Togo-Ghana transmission project (Dapaong-Bawku)	Power Africa Transmission Roadmap to 2030: a Practical Approach to Unlocking Electricity Trade (USAID)	<100	USD	
1.5		Refrigeration and Air Conditioning (RAC).	Ghana's Updated Nationally Determined Contribution to the UNFCCC	3.2	USD	
2.2		The Giving Shade Project	The Giving Shade Project			
2.2		Shade-Tree Cover and Carbon Stock Assessment for Cocoa Agroforests	ETH Zürich & Lindt Cocoa foundation			2
2.2		Fruits and Shade for Schools (FSS) Project	Future Connect Ghana	0.3	USD	
2.5		The Greater Accra Sustainable Sanitation and Livelihoods Improvement Project	AfdB: The Greater Accra Sustainable Sanitation and Livelihoods Improvement Project	35.95	UA	7
2.5	1.2	Adopt alternative urban solid waste management	Ghana's Updated Nationally Determined Contribution to the UNFCCC	60.4	USD	
4.1		Lahagu Housing project	EDGE Buildings			
4.1		"Ghana Land Restoration and Small-Scale Mining Project "	Ghana Landscape Restoration and Small-Scale Mining Project	103.36	USD	
4.1	6.2	"Ghana Cocoa Forest REDD+ Programme (GCFRP) "	World Bank Documents: Ghana Cocoa Forest REDD+ Programme			7

4.1		"FP137: Ghana Shea Landscape Emission Reductions Project "	Ghana Shea Landscape Emission Reductions Project	54.5	USD	7
4.1		"Form Ghana Reforestation Project "	AfDB portal: Form Ghana Reforestation Project	9.9	UA	
4.5		Accelerating the transition to climate- friendly and energy - efficient air conditioning: Green Cooling	MoFEP's list of projects (EPA)	2.5	USD	
4.9	7.2, 7.4	Sustainable production in Industry.	Ghana's Updated Nationally Determined Contribution to the UNFCCC	7.4	USD	
4.9		Energy efficiency in industry	MoFEP's list of projects (Energy Commission)	5	USD	
5.1		National Electric Mobility Policy Framework for Ghana	National Electric Mobility Policy and Market Readiness Framework for Ghana			
5.1	5.2	Accra-Kumasi City Electric Bus Project	New CPP Project	43.485	USD	3
5.2	5.3	Expansion of inter-and-intra-city transportation modes.	Ghana's Updated Nationally Determined Contribution to the UNFCCC	392.5	USD	
5.2		Transition to a low emission bus rapid transit system	Accra Climate Action Plan			
5.3		Tema-Mpakadan Railway Project	Tema-Mpakandan Railway Project	230	USD	4
5.3		Ghana's Railway Master Plan	Transforming Ghana's railway infrastructure			15

5.4		Ghana NMT Strategy	Ghana NMT Strategy			9
5.5		AMA Pedestrian Road Safety Action Plan	Accra Climate Action Plan			
5.5		"Accra Low Emission Travel Strategy "	Accra Climate Action Plan			4
6.1		"Jobs and Skills Project for Ghana "	World Bank: Ghana Jobs and Skills Project	200	USD	6
6.1	6.3	Program on Affirmative Finance Action for Women in Africa (AFAWA): Financing Climate Resilient Agricultural Practices in Ghana	Green Climate Fund: Program on Affirmative Finance Action for Women in Africa (AFAWA)	25.6	USD	5
6.1	6.3	Promote sustainable charcoal production, including youth and women entrepreneurs.	Ghana's Updated Nationally Determined Contribution to the UNFCCC	292.1	USD	
6.3	6.2, 6.3, 7.3, 7.4, 7.5, 8.3	Ghana Green Entrepreneurs Hub	New CPP Project	N/A	N/A	7
7.1		National Entrepreneurship and Innovation Programme (NEIP) Greenhouse Estate Project	National Medium-Term Development Policy Framework	N.A.		3
7.1		Planting for Export and Rural Development (PERD)	National Medium-Term Development Policy Framework	N.A.		3
1.1		FP168: Leveraging Energy Access Finance (LEAF) Framework (Multiple Countries)	Green Climate Fund Website	959.9	USD	

4.1		FP128: Arbaro Fund – Sustainable Forestry Fund (Multiple Countries	Green Climate Fund Web-site	200	USD	16
7.1		FP183: Inclusive Green Financing Initiative (IGREENFIN I): Greening Agricultural Banks & the Financial Sector to Foster Climate Resilient, Low Emission Smallholder Agriculture in the Great Green Wall (GGW) countries - Phase I (Multiple Countries)	Green Climate Fund Web-site	172	USD	
8.1		NDC Carbon Financing	MoFEP's list of projects (EPA)	75	USD	
8.2	4.1	Forest Emissions Capture and Ecosystem Resilience Building in Degraded High Forest Carbon Sinks in Ghana with Cocoa Agroforestry through Application of SAFSTA Technology and CREMA approach	MoFEP's list of projects (The Institute of Green Growth Solutions)	10	USD	
8.2		Ecologically representative areas and biological corridors established	Forestry Development Master Plan	205	USD	20
8.2		Conservation and enhancement of carbon stocks in forest, and other land uses, and support climate smart agriculture	Forestry Development Master Plan	20	USD	20

Resilience

TARGET NO.	SECONDARY TARGET NO. (IF APPLICABLE)	NAME	REFERENCE	INVESTMENT AMOUNT WHEN KNOWN (MILLIONS)	CURRENCY	TIMESPAN (YEARS)
1.1		Resilient and Green energy access in drought-prone districts	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
1.1		Capacity Development and Regulatory Frameworks to Support Local Renewable Energy Generation to Enhance Resilience of Remote, Vulnerable communities	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
1.5		Adopting an energy generation mix that reduces the vulnerability of current energy infrastructure to climate change while building resilience to future climate change	Ghana's Adaptation Strategy and Action Plan for the Infrastructure Sector (Water, Energy, and Transport Sectors)			
1.5		Update Energy Sector Design Standards to Incorporate Climate Adaptation Risk	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
2.1		Integrating climate change into the management of priority health risks in Ghana	Climate Change-Health Project			
2.2		Green Recreative Areas and Riparian Vegetation to Protect Exposed Road and Rail between Urban Centers	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
2.2	2.6	Urban Drainage Measures in Accra	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
2.3		Manage climate-induced and gender-related health risks	Ghana's Updated Nationally Determined Contribution to the UNFCCC	117	USD	
2.4		Ghana Nutrition Improvement Project (GNIP) - "KOKO Plus"	The Aijnomoto Foundation			
2.5		Accra sea water desalination plant (through reverse osmosis)	"Ghana's Adaptation Communication to the United Nations Framework Convention on Climate Change (November 2021)"			
2.5	4.3	Sustainable Safe Water and Sanitation Improvement Project	Community Water and Sanitation Agency - Project Concept Note: Sustainable Safe Water and Sanitation Improvement Project	198	USD	5
2.6		Ghana's Roadmap for Attaining Universal Health Coverage	UHC Roadmap 2020-2030			10
3.1		FP078: Acumen Resilient Agriculture Fund (ARAF) (Multiple Countries)	Green Climate Fund Website	56	USD	12
3.1		Ghana Incentive-Based Risk-Sharing Scheme for Agricultural Lending (GIRSAL) programme	National Medium-Term Development Policy Framework (2022-2025)			
3.1		"Ghana Productive Safety Net Project: The Complimentary Livelihood Asset Support Scheme (CLASS) "	National Medium-Term Development Policy Framework (2022-2025)			
3.1		MSME Climate Insurance	New CPP Project	7	USD	5
3.2		Centralised Climate-Risk Data Management System	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.1		Ensure effective and efficient prevention and control of wildfires in all ecological zones	Forestry Development Master Plan (2016-2036)	500	USD	
4.1		Institutional frameworks for effective participation of key stakeholders in forest and wildlife resource management at all levels of governance developed and operational by 2035	Forestry Development Master Plan (2016-2036)	31	USD	

4.1	8.1	Sustainable management of forests	Forestry Development Master Plan (2016-2036)	209.25	USD	
4.1	8.1	Sustainable management of off-reserve forest production areas.	Forestry Development Master Plan (2016-2036)	65	USD	
4.1		Traditional autonomy for the protection and management of sacred forests and community dedicated forests for biological and cultural diversity on and off reserves enhanced	Forestry Development Master Plan (2016-2036)	135	USD	
4.1		National plantation development in FRs areas	Forestry Development Master Plan (2016-2036)	4550	USD	
4.1		Degraded landscapes in off reserve areas restored through plantations development, community forestry, and natural regeneration	Forestry Development Master Plan (2016-2036)	2220.5	USD	
4.1		Retroffiting Adaptation Measures in the Akosombo Dam	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.1		"Natural Flood Adaptation of Bui Dam "	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.1		Natural Restoration around Tono and Vea Dams	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.1		Slope Stabilisation, Forestation, and Terracing at Barekese Dam	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.1		Upstream Afforestation of the Volta River Reservoir to Build Resilience to Flood and Drought	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			

4.2		Nature-based Adaptation through Creation of Intertidal Habitat at Takoradi	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.3	2.2, 4.6	Urban Greening & Sponge Cities Project	New CPP Project		USD	8
4.3	2.3	Design and implement a communication strategy for creating awareness and increasing public sensitization for the judicious management and protection of water resources in a changing climate.	Ghana's Adaptation Strategy and Action Plan for the Infrastructure Sector (Water, Energy, and Transport Sectors)	213.07	USD	
4.3		Building resilience in the water sector by mainstreaming climate change adaptation.	Ghana's Adaptation Strategy and Action Plan for the Infrastructure Sector (Water, Energy, and Transport Sectors)	5,075.50	USD	
4.3		Develop multipurpose water harvesting and storage facilities	Ghana's Adaptation Strategy and Action Plan for the Infrastructure Sector (Water, Energy, and Transport Sectors)			
4.3		Promote local research into water–climate linkages for effective water resource management	Ghana's Adaptation Strategy and Action Plan for the Infrastructure Sector (Water, Energy, and Transport Sectors)	18.7	USD	
4.3		Improve human and institutional capacity to implement IWRM, including transboundary cooperation in the management of shared river basins.	Ghana's Adaptation Strategy and Action Plan for the Infrastructure Sector (Water, Energy, and Transport Sectors)	18.7	USD	
4.3		Integrated water resources management	Ghana's Updated Nationally Determined Contribution to the UNFCCC	108	USD	
4.3		Catchment-level water Management in the Accra Plains	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			

4.3		Water Supply Resilience through Regional Harvesting and Storage Solutions	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.5	4.8	City-wide resilient infrastructure planning	Ghana's Updated Nationally Determined Contribution to the UNFCCC	827	USD	
4.6		Urban forestry introduced to accommodate human, social, cultural and economic factors	Forestry Development Master Plan (2016-2036)	50	USD	
4.6		Sponge City Measures to Provide Ecosystem-Based Urban Adaptation to Climate Change	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			7
4.8		New Takoradi Sea Defence Project	"Ghana's Adaptation Communication to the United Nations Framework Convention on Climate Change"	35	USD	
4.8		Adjua coastal bed reclamation Project	"Ghana's Adaptation Communication to the United Nations Framework Convention on Climate Change"	51	USD	
4.8		Aboadze Sea Defence Project	"Ghana's Adaptation Communication to the United Nations Framework Convention on Climate Change"	28.5	USD	
4.8		Axim Coastal Protection Works - Western Regio	"Ghana's Adaptation Communication to the United Nations Framework Convention on Climate Change"			
4.8		Komenda coastal land reclamation Project	"Ghana's Adaptation Communication to the United Nations Framework Convention on Climate Change"			
4.8		"Coastal Flood Defence of Thermal Power Plants in the Western Region "	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.8		Coastal Flood Protection of the Sunon-Asogli Power Plant	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			

4.8		Built and Natural Coastal Defence Options for Tema Port	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.8		Airport Flood Resilience through Elevation of Runways and Other vulnerable Components	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.8		Safeguarding Vulnerable Substations Against Floods and Landslides	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.8		Natural Flood Adaptation of the Weija Dam through Greening and Vegetation along the Densu River	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.8		Flood Resilience Improvements to the Weija Dam through Release Scheduling and Spillway Improvements	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
5.2		Risk-informed, Multi-modal Transport Master Plan and Investment Plan	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
6		Promoting of poverty reduction in rural communities through access to and benefits from plantation resources	Forestry Development Master Plan (2016-2036)	2	USD	
6.2		Savannah Investment Program (SIP): Enhancing Value Chains (component 3)	AfDB portal: Savannah Investment Program (SIP)	25	UA	5
6.3		Savannah Investment Program (SIP): Institutional Strengthening through storage and processing standards, establishment of MSMEs, coordinating services etc (Component 4)	AfDB portal: Savannah Investment Program (SIP)	25	UA	5
6.3		Build resilience and promote livelihood opportunities for the youth and women in climate-vulnerable Agriculture landscapes and food systems	Ghana's Updated Nationally Determined Contribution to the UNFCCC	1,855	USD	
7.1		"Aquaculture for Food and Jobs (AFJ) programme "	National Medium-Term Development Policy Framework (2022-2025)			

7.1		"Rearing for Food and Jobs Program (RFJ) "	"National Medium-Term Development Policy Frame-work (2022-2025) "			5
7.1		Savannah Investment Program (SIP): Access to Agricultural Finance (Component 1)	AfDB portal: Savannah Investment Program (SIP)	25	UA	5
7.1		Savannah Investment Program (SIP): Production Development (Component 2)	AfDB portal: Savannah Investment Program (SIP)	25	UA	5
7.1		Ghana Low Carbon Rice Project	MoFEP's list of projects (EPA)	5	USD	
7.1	7.2	Adoption of modified community-based conservation agriculture/climate smart agriculture in selected districts	MoFEP's list of projects (MoFA)	32	USD	
7.1		Scale-up penetration of climate smart technologies to increase fisheries and livestock productivity by 10%	MoFEP's list of projects (Fisheries' commission)	100	USD	
7.1		Integrated multi-Cropping, Animal husbandry, Agroforestry and Clean Energy Project (CAACEP) in Ghana	MoFEP's list of projects (Catholic Church, Kumasi)	60	USD	
7.1		The Africa Program in Ghana	MoFEP's list of projects (Akuaffo Pa Foundation, Eni)	238.5	USD	
7.1		Climate - Smart Adaptation Strategies for Enhanced Resilience Agricultural Practices in Northern Ghana	MoFEP's list of projects (The Institute of Green Growth Solutions)	10	USD	
7.3	7.2, 7.1	The Ghana Commercial Agricultural Project (GCAP) for boosting local supply of raw materials, and agricultural productivity of both smallholder and nucleus farmers	National Medium-Term Development Policy Frame-work (2022-2025)			4
7.6		Enhance climate services efficient weather information management	Ghana's Updated Nationally Determined Contribution to the UNFCCC	10	USD	

		Early warning and disaster risk management	Ghana's Updated Nationally Determined Contribution to the UNFCCC	15	USD	
1.5		Resilient Cooling Systems for Thermal and Solar plants	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.3	2.5	Climate Adaptation Alignment Accorss Water Ministries and Planning Mechanisms to Ensure IWRM	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.9	1.5, 4.5	Proactive risk-informed asset management	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.8		Bridges and Underpasses to Ensure Community Access to Services	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			
4.2 4.3 4.6		Prioritise Nature-Based Solutions in Planning, Design and Operation of Infrastructure	Ghana: Roadmap for Resilient Infrastructure in a Changing Climate			

Bui Dam Solar Energy Expansion

Investment Potential and Growth

Investment Requirement: BPA is seeking an investment of $2.2 billion to enhance renewable energy (RE) penetration by 10% by 2030.

Strategic Position: BPA, with a strong foundation in hydro and solar energy projects, is strategically positioned to lead these efforts. Since the Paris Agreement, 55MW of solar PV generation has been added to the RE mix.

Support and Partnerships: With the backing of international partners like Germany and a solid lineup of projects, BPA is poised to surpass the 10% RE penetration target well ahead of 2030.

Legislative Backbone: The amended BPA and Renewable Energy (RE) Acts provide a robust legal framework, empowering BPA to effectively execute these ambitious projects.

BPA's Role in the Green Market

Industry Support: BPA aids industries in transitioning to clean energy, thereby reducing their carbon footprint and facilitating carbon credit acquisition.

Energy Supply Assurance: Through its diverse portfolio of renewable energy sources, BPA guarantees a reliable supply of clean energy, meeting various industries' needs and enabling them to comply with green market standards.

Cost-Effective Solutions: Industries can leverage BPA's renewable energy resources without diverting from their core business operations, benefiting from attractive green tariffs and strategic energy partnerships.

Commitment to Sustainable Energy

BPA's initiatives are central to Ghana's efforts in achieving its Energy Transition and Net Zero Emission goals, aligning with the INDC targets under the Paris Agreement on Climate Change. The expansion of the Bui Dam Solar Energy Project represents a significant investment opportunity, driving forward Ghana's Climate Prosperity Plan.

Microgrids in Off-Grid Communities

Overview of Microgrid Implementation in Ghana

Ghana's plan to implement microgrids targets 2,000 lakeside communities and 200 islands across 23 districts, each with populations exceeding 1,000 inhabitants. These regions are unlikely to be connected to the national grid soon, making mini-grids a strategic choice. This initiative is key to accelerating the commercialization of renewable energy (RE) technologies and contributing to the national goal of 10% RE penetration by 2030. It also addresses the rising energy demand and diversification needs while reducing greenhouse gas emissions.

Key Projects and Their Investment Appeal

1. **Ada Mini-Grids and Rehabilitation Projects:** Covering communities in the Greater Accra, Oti, and Bono East regions, this project includes rehabilitating five existing mini-grids and adding new customer service connections. By the end of 2023, these grids are expected to reach 90% completion, involving the replacement of lead-acid batteries with lithium-ion batteries. Investment in these areas is crucial for enhancing electricity supply reliability.

2. **Afram Plains Mini-Grid Project:** This project aims to electrify off-grid communities in the Afram Plains South and North Districts. With socioeconomic data collection completed for 101 communities and feasibility studies underway, this project presents a significant opportunity for investors looking to contribute to rural electrification.

3. **35 Mini-Grids for Island/Lakeside Communities under SREP:** Including the Okpalama and Lala Mini-Grid projects, this initiative focuses on providing energy to remote settlements. With feasibility studies completed and EPC procurement in progress, funded by AfDB, CIF, and the Government of Ghana (GoG), these projects offer attractive prospects for investors interested in supporting universal electricity access.

Investment Significance

These microgrid projects not only promise to transform the energy landscape in off-grid communities but also offer lucrative opportunities for investors. By investing in these projects, stakeholders can be a part of Ghana's journey towards sustainable energy, contributing to both environmental goals and socio-economic development in remote areas. The progress in these initiatives underscores their potential for high impact and return, aligning with global sustainability and clean energy targets.

Keystone Project with Disaster Risk Financing: Enhancing Adaptive Capacity of The Akosombo Dam and Lower Volta Communities

The Akosombo Dam disaster highlights an urgent need for enhanced climate risk management and adaptive capacity in infrastructure and community resilience. This project calls for immediate and long-term support from global and local stakeholders, emphasizing the integration of disaster risk financing strategies to manage the impacts of such events, address risk management gaps, and strengthen the dam and nearby communities against future climate threats.

Investment and Disaster Risk Financing Opportunities

Preventive and Early Warning Systems: A $4.2 million investment in advanced planning policies, emergency preparedness, and climate monitoring tools is critical. Integrating disaster risk financing, like catastrophe bonds or insurance-linked securities, can offset financial burdens from unexpected disasters.

Resilient Infrastructure Development: An $8 million allocation for building flood barriers and other infrastructure, coupled with disaster risk financing instruments, can provide a safety net for recovery costs.

Sediment Management Initiatives: With a $2.2 million budget, sediment management can be supported by establishing a disaster relief fund or public-private partnerships to ensure sustained financing.

Adaptive Emergency Protocols and Community Engagement

Investing $1.15 million in community systems and evacuation plans can be bolstered by community-based insurance schemes to cover losses from climate-induced incidents.

Integrated Reservoir Management: A $10.5 million investment in reservoirs and conservation, complemented by climate risk insurance, can mitigate financial risks associated with extreme weather events.

Technological Integration: The $3.5 million investment in technology upgrades can be safeguarded by risk transfer solutions, providing financial resilience against technology-related failures or inefficiencies.

Research, Collaboration, and Financial Readiness: Allocating $1.2 million for research and a $5.5 million emergency reserve fund, enhanced with international funding and risk-sharing mechanisms, will ensure preparedness and adaptive response capacity.

Rebuilding and Community Support: The $25 million required for rebuilding and social support should include strategies for disaster risk financing, like resilience bonds, to support sustainable recovery and resilience building.

Adaptive Emergency Protocols and Community Engagement

The total investment of $66.25 million, incorporating disaster risk financing solutions, will not only provide the necessary funds but also create a buffer against future risks, ensuring long-term sustainability and financial resilience.

Conclusion

Enhancing the Akosombo Dam's adaptive capacity and surrounding communities is a vital and complex task. Incorporating disaster risk financing into this investment creates a multifaceted approach, ensuring financial stability and resilience. This project, therefore, offers a sustainable and financially prudent model for managing climate risks, urging global and local stakeholders to prioritize this initiative for the enduring safety and prosperity of the Volta River basin communities and the Akosombo Dam infrastructure.

Advancing Ghana's Low-Carbon Transition with Solar-Powered Green Hydrogen and Blue Hydrogen Development

This project proposes an ambitious plan to advance Ghana's low-carbon transition by integrating the production of both green and blue hydrogen. Leveraging excess energy from the expansion of solar projects under the Bui programme, the initiative aims to produce green hydrogen, while also developing blue hydrogen production as part of a comprehensive energy strategy.

Investment Opportunities and Industrial Applications

Green Hydrogen Production from Solar Energy: Investment in electrolysis facilities to produce hydrogen using surplus solar energy from the expanded Bui solar projects offers a sustainable and environmentally friendly energy source for industrial applications.

Blue Hydrogen Development: Investing in blue hydrogen production using natural gas with carbon capture and storage (CCS) technology provides a pragmatic transition solution towards low-carbon energy.

Infrastructure for Hydrogen Economy: Developing storage, transportation, and distribution infrastructure for hydrogen is critical, providing ample investment opportunities in creating a robust hydrogen supply chain.

Industrial Applications of Hydrogen:

Chemical Industry: Hydrogen is crucial for ammonia and methanol production, key in fertilizer and plastics manufacturing.

Steel Manufacturing: Hydrogen can significantly reduce emissions in steel production by replacing coal.

Transport Sector: Hydrogen fuel cells offer a cleaner alternative for vehicles, particularly in public and commercial transport.

Energy Storage: Hydrogen serves as an effective storage medium for balancing the intermittent nature of renewable energy sources.

Integration with Renewable Energy Projects

The synergy between the expanded solar projects and hydrogen production promotes energy diversification and sustainability.

Environmental and Economic Impact

Producing hydrogen through renewable and transitional methods aligns with global sustainability efforts, reducing carbon emissions and fostering a cleaner environment. It also stimulates economic growth through job creation and technological innovation.

Business Case for Investment

Investing in this dual approach of green and blue hydrogen production presents an opportunity to participate in an emerging, diversified energy market. It offers a balanced path to a low-carbon future, combining immediate feasibility with long-term sustainability goals.

Conclusion and Recommendations

Implementing this integrated hydrogen production strategy is essential for Ghana's transition to a sustainable, low-carbon economy. A pilot project and collaborative efforts among stakeholders are recommended to establish a regulatory framework and market infrastructure. This initiative not only contributes to Ghana's energy security but also sets a model for sustainable industrial development leveraging hydrogen as a key energy resource.

End matter

The CPP Program is led by the CVF-V20 Secretariat and supported by a range of technical partners who provide their valuable expertise to priority areas identified in the CPP. They develop models, make policy recommendations, project suggestions, provide technical advice or review the report to ensure it reflects the best practices of their area of expertise.

In 2023, the following organizations contribute to the CPP Program:

- Climate Advisers
- Global Center on Adaptation
- Global Renewables Congress
- Infrastructure Development Company Limited
- Insurance Development Forum/KFW
- Institute for Energy Economics and Financial Analysis
- International Labor Organization
- International Organization for Migration
- International Renewable Energy Agency
- KnowlEdge
- Platform on Disaster Displacement
- TransitionZero
- United Nations Conference on Trade and Development
- UN Environment Program / UN University
- UN Industrial Development Organization

Climate Prosperity Plan | Ghana 2023

About the Green Economy Model

The macro-economic model used for the CPPs is based on the Green Economy Model (GEM). The GEM offers an integrated representation of socio-economic and environmental dynamics, and the natural capital that supports them, at country-level. It is built using Systems Dynamics methodology (Bassi, 2014; Bassi, 2015; Bassi et al., 2022).

GEM has been used by more than 40 countries to develop various types of low-carbon development plans, including Indonesia, Ethiopia, Burkina Faso, India, Vietnam and Colombia. GEM has also been deployed by a range of international institutions, including UNEP, Global Green Growth Institute, World Resources Institute, and the World Wide Fund for Nature.

For the purpose of the Climate Prosperity Plan development, the GEM-CPP version of the model has been augmented with 11 additional climate impacts as well as 19 additional climate intervention options. This allows to create a complete integrated, as well as economic and financial assessment of climate action for both climate change adaptation and mitigation.

Bibliography

Bassi, A.M. (2014).

Using Simulation Models for Green Economy Policy Making: A Comparative Assessment. Review of Business and Economics Studies. Volume 2, Number 1, 2014.

Bassi, A.M. (2015).

Moving towards integrated policy formulation and evaluation: the Green Economy Model (GEM). Environmental and Climate Technologies, Volume 16, Issue 1.

Bassi, A.M., Garrido, L., Pallaske, G., Guzzetti, M. (2022).

Exploring the virtuous interdependencies existing between climate action and sustainability in the context of low carbon development. Handbook of Innovation, Society and the Environment (In Press).

World Bank Group & ESMAP. (2020).

Offshore Wind Technical Potential in Sri Lanka. Retrieved from: https://esmap.org/offshore-wind.