



Revised Green Growth and Climate Resilience Strategy of Rwanda



15 June 2021

Foreword & Acknowledgements

EXECUTIVE SUMMARY

Rwanda's Vision 2050 articulates the bold long-term ambition of “**the Rwanda we want**” to be upper middle-income by 2035 and a high-income country by 2050, thereby transforming the economy and modernising the lives of all Rwandans. It outlines the strategic direction and the enabling pathways to achieve this ambition through the five pillars of Human Development, Competitiveness and Integration, Agriculture for wealth creation, Urbanisation and Agglomeration, and Accountable and Capable State Institutions.

Rwanda's **Green Growth and Climate Resilience Strategy** (GGCRS) was first adopted in 2011. It has now been revised to align with the Vision 2050 to ensure it defines a development pathway for Rwanda that is climate resilient and harnesses green economic innovation. These aspirations will continue to be embedded in Rwanda's Revised GGCRS through the ***Shared Vision for Rwanda to be a developed, climate-resilient, and low carbon economy by 2050.***

The GGCRS will ensure Rwanda remains responsive to rapidly evolving conditions spurred by development demands and global phenomena. It has considered global and regional development agendas to ensure harmonization of targets and indicators. These include: The Sustainable Development Goals (SDGs), African Union Agenda 2063, East African Community (EAC) Vision 2050, and Nationally Determined Contributions on for the Paris declaration on climate change among, other instruments.

The GGCRS has three **Strategic Objectives**:

- To achieve Energy Security and Low Carbon Energy Supply that supports the development of Green Industry and Services and avoids deforestation.
- To achieve Sustainable Land Use and Water Resource Management that results in Food Security, appropriate Urban Development and preservation of Biodiversity and Ecosystem Services.
- To ensure Social Protection, Improved Health and Disaster Risk Reduction that reduces vulnerability to climate change impacts.

Together these objectives relate to the elements upon which the Vision 2050 are built, namely the infrastructure and systems that enable low-carbon growth and sustainable resource use, the natural capital and associated spatial development that ensure sustainable development, and the human capital development and economic inclusion that will build the resilience of the Rwandan people.

To fulfil the aspirations of the Vision 2050 in an environmentally sound and climate resilient manner, the Revised GGCRS reflects an alternative green growth and climate resilient scenario that drives achievement of carbon neutrality by 2050, the transition to niche green industry and knowledge-based services, the creative agglomeration of urban settlements to minimise their ecological footprint and ensure resilience, ambitious levels of protection enabling sustainable use of ecological resources in rural landscapes, and appropriate decoupling of the economy and its dependence on primary natural resources.

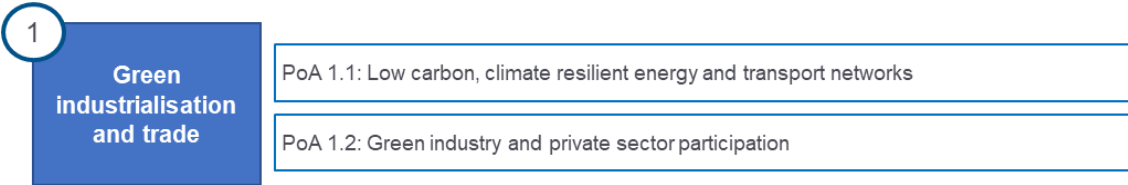
In guiding Rwanda's key economic sectors around the identification of measures, interventions and sector actions for green growth and climate resilience, it is important to understand both the individual roles of Rwanda's key economic sectors in catalysing and/or enabling green growth and climate resilience aspirations, as well as their cumulative, cross-sectoral impact at a national scale. The Revised GGCRS carries through core **Guiding Principles** that reflect the same values the Government of Rwanda has upheld in other key planning documents such as Vision 2050, National Strategy for Transformation I (NST I) and the National Environment and Climate Change Policy (2019). These principles are:

1. Achieving efficiency, productivity and prosperity through **Economic Growth and Poverty Reduction**
2. Increasing the quality of life for all Rwandans through an **Inclusion and People Focus**
3. Protecting the country's natural heritage through **Sustainability of the Environment and Natural Resources**
4. Connectivity and cooperation through **Good Regional and Global Integration**

To achieve a climate resilient and green economic future, the GGCRS is built around four **Thematic Programme Areas**, with each being focussed on two **Programmes of Action** (PoAs):

1. Green Industrialisation and Trade

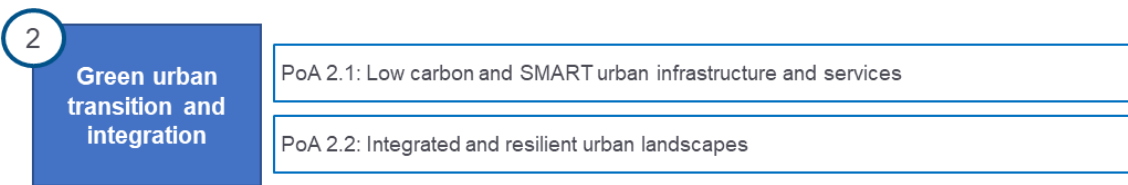
Industry and manufacturing is expected to increase to 24% of GDP by 2035 and 33% of GDP by 2050, while the country aspires to be carbon neutral by mid-century. This requires low-carbon and environmentally sound industrialisation supported by energy and infrastructure systems that promote green industry and increasing connectivity for regional and global trade. This includes resource-efficient infrastructure and physical capital to drive green industrial and trade growth, powered by low-carbon and climate-resilient energy and transport systems. Rwanda will support the development of niche green industrial intensification that increases the country's competitiveness and global integration. Focusing on GGCRS priority sectors Rwanda's green industry's value-added contribution to GDP will almost double (from 18% to 33%) over the 2020 – 2050 period. Underpinning this green industrial growth will be a concerted effort to increase and maintain the share of renewables in the energy generation mix at or above 60% from 2025 onwards. These actions will ensure a resilient and productive industrial sector enabling Rwanda to green its growth aspirations under Vision 2050.



2. Green Urban Transition and Integration

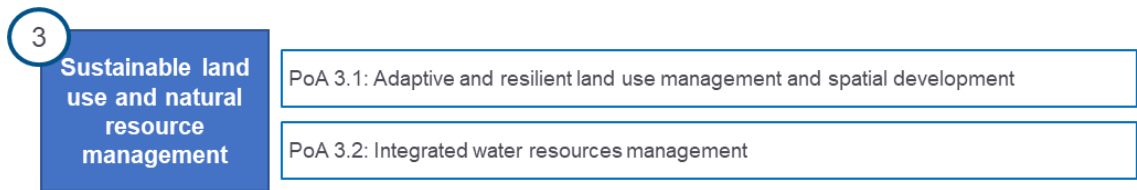
It is expected that half of all Rwandans will reside in urban areas by 2035 and 70% by 2050. This requires effective agglomeration of people into cities, towns, and rural settlements, linking them to green economic opportunities and climate resilient services. The intention is for sustainable and smart development of well-

served cities, towns, and settlements, to maximize the socio-economic benefits of agglomeration while ensuring urban landscape resilience and quality of life. The provisions of the revised GGCRS will support Rwanda’s achievement of its urbanisation targets under the Vision 2050, ensuring these targets are met in a green and resilient approach. Ensuring the majority of urban residents reside in smart/green city districts by 2050 is the overarching targets to qualify Rwanda’s particular urbanisation pathway. Ensuring compliance with Rwanda’ green building compliance system and ensuring 15 square metres of green space per capita in urban areas will ensure Rwanda’s cities are modern, efficient, liveable and resilient.



3. Sustainable Land Use and Natural Resource Management

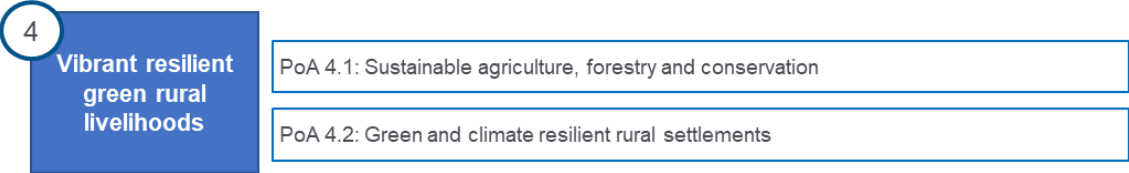
Balanced, resilient and sustainable growth will be underpinned by appropriate spatial development of land use considering natural resources availability and constraints, and disaster risk reduction. This includes strategic spatial planning tools and intelligent information and knowledge management systems to inform and implement effective land use and natural resource management, for resilient landscapes and communities. Rwanda’s National Land Use and Development Master Plan (NLUDMP) is one of the most prioritized plans stemming from Vision 2050. As such, the GGCRS aligns strongly with the NLUDMP to enable the achievement of coherent, optimised and resilient land and natural resource management to underpin Rwanda’s diversified economy of the future. The revised GGCRS support sector and district land use management plans achieving 100% alignment with the NLUDMP by 2025, and 100% of catchments supported by finalised management plans to ensure climate resilient infrastructure development integrated with catchment conservation.



4. Vibrant Resilient Green Rural Livelihoods

Inclusive growth over the next three decades requires the creation of green opportunities in the rural economy, and climate resilience through off-grid services specifically targeted to rural inhabitants. This includes resilient economic activities and support systems in Rwanda’s rural areas, to ensure sustainable growth opportunities and a high quality of life, with judiciously managed natural resources. The revised GGCRS enables Rwanda to maintain advantageous land use allocation as per NLUDMP for the highest value-added contribution to GDP from natural resource conservation and optimum integrated value chain development. Through the strong foundation of land allocation, natural resource-based tourism and agriculture can be sustainably intensified,

with the value added per worker exceeding US\$ 14,000 per year by 2050. Rwanda’s vibrant rural economy is underpinned by a strong focus on resilience and social protection for rural residents. The revised GGCRS supports the provision of universal access to integrated, planned, green and creatively clustered rural settlements for the rural population by 2050.



Each of the Programmes of Action comprise a number of **Strategic Interventions** that balance action between mitigation, adaptation and green growth. In as much as the GGCRS will guide ambitious low-carbon development and economic growth, it will also enable targeted action to build climate resilience and the adaptive capacity of Rwanda’s people. The Strategic Interventions outline priorities for policy actions and directing investment in green industrialisation and trade, green urban transition and integration, sustainable land and natural resource management, and vibrant, resilient, green rural livelihoods.

The Revised GGCRS envisions the long-term aspiration and policy orientation for Rwanda to position itself as a green industrial leader, an African pioneer of smart, eco-innovative cities, a biologically diverse and pristine natural eco-tourism destination, with a thriving rural economy. Rwanda will undertake an ambitious low carbon and climate resilient pathway by ensuring that all components of the existing economic model are as efficient and optimised as possible. By putting stringent conditions in place to ensure green urban and economic development, Rwanda will build comparative advantage in primary and secondary agricultural and mineral resource markets and will thereby ensure inclusive balanced green economic growth.



Low-carbon, climate resilient energy and transport networks

- Increasing renewable energy in the generation mix
- Increasing access to reliable, low-carbon energy to boost urbanisation and mobility
- Expanding sustainable initiatives in regional transport networks, freight, and logistics
- Promoting integrated, multi-modal transport systems with modern information and knowledge management systems
- Assuring universal access to energy through reliable grid connectivity



Low-carbon and SMART urban infrastructure and services

- Implementing Rwanda's Green Building Compliance System
- Providing high quality, affordable housing that is green, climate resilience and leverages urban density
- Creating and preserving rewarding and tradable off-farm jobs
- Accelerating the transition to green public and passenger transit
- Adoption of Smart approaches for municipal service management in Green Cities to achieve resource efficiency at the City Level



Adaptive and resilient land use management and spatial planning

- Ensuring integrated planning and monitoring for sustainable land management
- Developing sectoral sustainable land use strategies and national spatial data infrastructure (NSDI)
- Deploying GIS and ICT innovation throughout government, districts, and implementing agencies
- Developing an inclusive and automated land administration
- Maintain up-to-date risk assessment and vulnerability mapping for effective early warning systems



Sustainable agriculture, forestry and conservation

- Enhancing agro-ecology, crop variety development, and promoting climate-resilience for local and export markets
- Improved on-farm water and energy management incl. development of efficient irrigation and farming systems
- Value addition through diversification and manufacturing with expansion of local and export market access
- Developing agroforestry and soil management for sustainable agriculture and fruit production
- Rehabilitation of degraded forest resources (reforestation and afforestation) and improvement of forest management.
- Promoting conservation, community-based ecotourism, and enforcement of PES



Green industry and private sector participation

- Greening SEZs and industrial parks
- Increasing finance for technologies in industries to raise productivity
- Strengthening capacity in the industrial sector, including of the Cleaner Production and Climate Innovation Centre
- Greening the mining sector to ensure sustainability and responsiveness to the Green Economy.



Integrated, resilient urban landscapes

- Agglomeration, densification, mixed use and multi-functional urban spaces
- Greening urban landscapes through greenspace and urban agriculture
- Improving disaster resilience through integrated urban stormwater and drainage



Integrated water resources management

- Building climate resilient water infrastructure for storage, supply, efficiency
- Developing catchment restoration and soil erosion control strategies
- Strengthening disaster management and response



Well-functioning and thriving rural settlements

- Building decentralised water packaging plants and water treatment solutions
- Ensuring availability of reliable bus services through route franchising
- Assuring universal access to electricity through off-grid solutions
- Model Green Rural Villages for sustainable livelihoods and social protection

The “triple choice” of staying together, being accountable and thinking big is encapsulated in the **Enabling Pillars** which outline the cross-cutting arrangements of resources and capabilities that must be put in place in line with the prerequisites and success factors for the Vision 2050. A strong foundation for current and future actions requires adopting appropriate institutional arrangements; mobilising finance; building cross-cutting areas (training, capacity building and inclusion); and capitalising on digital transformation and innovation for enhanced green growth and climate resilience.

Rwanda’s **Institutional Arrangement** for the GGCRS must be responsive and capable to ensure effective flow of information and knowledge, and transparent deployment of financial resources. The Revised GGCRS proposes several institutional arrangements and governance mechanisms to support intersectoral coordination and multi-level governance. Importantly, technical working groups and committees to oversee and maintain comprehensive climate data and projections to underpin mainstreaming climate resilience into development planning. Importantly, mechanisms to enhance private sector and civil society involvement in the overall institutional structure for GGCRS implementation will draw on existing protocols and structures established through the updated NDC process, namely with support of broad sector and District based stakeholders through the SWG and the Joint Action Development Forum (JADF).

Financing the Revised GGCRS will be driven by FONERWA as the centrepiece of the **Finance Enabling Pillar**. Importantly, FONERWA will drive partnerships for leveraging additional finance from climate funds, the private sector, enhanced domestic revenues, and other innovative financing mechanisms. The Rwanda Green Investment Facility (RGIF) under FONERWA will serve as an emerging platform to catalyse climate finance flows to private sector actors and increase their participation in GGCRS implementation.

Ensuring the **Cross-Cutting areas** are in place for effective implementation of the Revised GGCRS will require broad-based skills development and green economy education, innovative approaches to service delivery and development that promote labour intensive and inclusive methods, and finally the stimulation of private sector and SMME driven exportable jobs in the service and knowledge economy. This needs to be built on and strengthen the relevant training and education initiatives adopted to achieve Vision2050.

Lastly, in moving towards a modern, knowledge-based economy, Rwanda must determine and navigate a **Digital Transformation** to ensure that data, information, science and technology, and smart digital systems are integral and efficient features of the Green Growth and Climate Resilient development pathway. Data-driven, SMART, and innovative technological and digital systems can be applied across all sectors implementing GGCRS interventions through the Digital Transformation Pillar.

On average, the investment required to implement the Revised GGCRS will reach US\$ 2 billion annually, of which approximately US\$ 700 million will come from government budgets and spending. The following figures highlight the proportion of GGCRS spending in relation to (a) annual public expenditure, and (b) as a share of annual GDP, respectively.

The first chart shows the share of public expenditure required to deliver the investments identified in the GGCRS, as a share of annual public budgets. This is included to provide a clear indication of the extent of the commitment required from the public purse to invest in green growth and climate resilience - much of which is for major infrastructure. The second chart shows the overall investment requirement (public and private) as a share of GDP. This is provided as a benchmark for the amount of capital that will need to be mobilised either through public sources, international investment, or domestic private sector investment.

The proportion of GDP declines over time as infrastructure is built, adaptation is achieved and the country's wealth increases on its trajectory to high income.

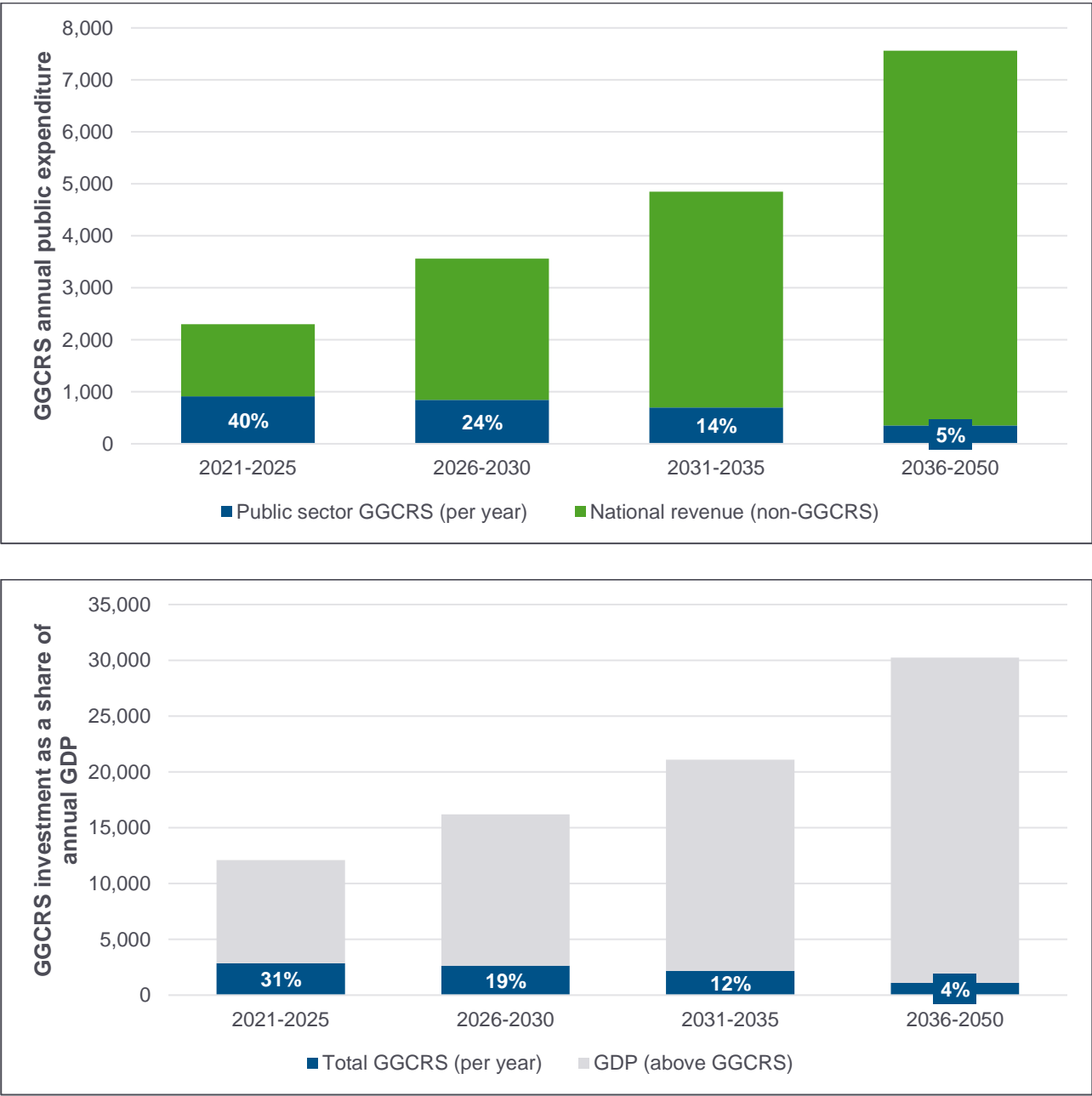


Figure 1: GGCRS Spending against key national benchmarks

Achievement of these aspirations must be effectively monitored, reported on, and verified through the indicators drawn primarily from the updated NDC MRV Framework, Vision 2050, various national strategies, and the Sector Strategic Plans. Annual planning and budgeting for the GGCRS will be done to ensure implementation, with regular strategic reviews every five years.



Figure 2: GGCRS MRV Mechanism

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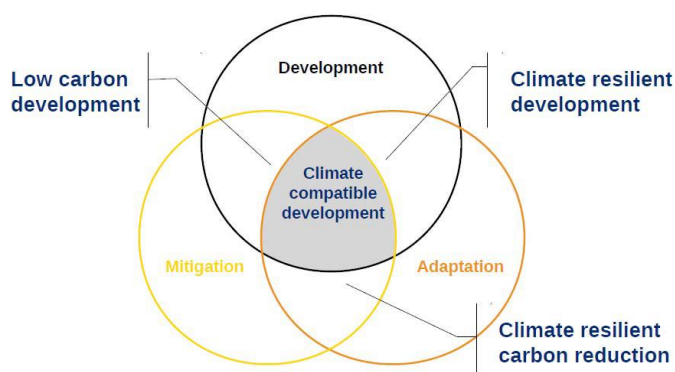
LIST OF ABBREVIATIONS

AFOLU	Agriculture, Forestry and Land Use
BAU	Business as Usual
D-DGE	Demographic Dynamic General Equilibrium
EDPRS	Economic Development and Poverty Reduction Strategy
GDP	Gross Domestic Product
GGCRS	Green Growth and Climate Resilience Strategy
GHG	greenhouse gas
GIS	Geographic Information System
IPPU	Industrial Processes and Product Use
ICT	Information and Communication Technology
IWRM	Integrated Water Resources Management
LAIS	Land Administration and Information System
MINAGRI	Ministry of Agriculture and Animal Resources
MINECOFIN	Ministry of Finance and Economic Planning
MoE	Ministry of Environment
MININFRA	Ministry of Infrastructure
MINICT	Ministry of Information Technology, Communication, and Innovation
MINALOC	Ministry of Local Government
NDC	Nationally Determined Contribution
NIRDA	National Industrial Research and Development Agency
NLUDMP	National Land Use and Development Master Plan
NSDI	National Spatial Data Infrastructure
NST	National Strategy for Transformation
PES	Payments for Ecosystems Services
PoA	Programme of Action
REMA	Rwanda Environment Management Authority
SDG	Sustainable Development Goal
SEZ	Special Economic Zone
SlS	Strategic Interventions
SMMEs	Small, Medium and Micro-Enterprises
TVET	Technical and Vocational Education and Training
UNFCCC	United Nations Framework Convention on Climate Change
WASH	Water, Sanitation and Hygiene
WDA	Workforce Development Agency

Glossary

The following key terms have been used in this document. The definitions are from the GGCRS (2011), IPCC (2012) and Rwanda's National Environment and Climate Change Policy (2019). Where the definitions exist in multiple documents the most updated version (i.e. 2019) is used.

Adaptation:	additional activities needed to prepare for climate change. This typically involves specific interventions (larger storm drains or new crop varieties) but can also involve broader social or economic strategies (e.g. migration to urban centres could be an adaptation strategy in some contexts).
Adaptive Capacity:	the ability or potential of a system to respond successfully to climate variability and change and includes adjustments in both behaviour resources and technologies.
Biodiversity:	the variability among living organisms from terrestrial, marine and other ecosystems. It includes variability at the genetic, species and ecosystem levels.
Circular economy:	an industrial system that is restorative or regenerative by intention and design. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models.
Climate:	usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years. The relevant quantities are most often surface variables such as temperature, precipitation and wind.
Climate compatible development:	the intersection of development, climate resilience (see definition below) and low carbon development (see definition below) as demonstrated by the diagram below.



Climate Change:	a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
Climate Finance:	there is no agreed definition of climate finance. The term climate finance is applied both to the financial resources devoted to addressing climate change globally and to financial flows to developing countries to assist them in addressing climate change.

Climate Resilience:	can be used to describe a broader agenda than adaptation as defined above. It captures activities which build the ability to deal with climate variability – both today and in the future.
Disaster risk:	the likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.
Drivers of growth:	in this document are key building blocks that form the basis for Rwanda's Vision 2050 and the economic growth trajectory for Rwanda is effectively built on them. These four drivers, which can be related to four distinct types of capital, are infrastructural, human, natural and financial capital.
Green city:	the concept prioritises policies and investments in public, non-motorised and low-emission transport, building efficiency, renewable energy and efficient waste management.
Green Growth:	fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which Rwanda's well-being relies.
Low carbon development:	distinct from mitigation. Mitigation is about cutting emissions. Low carbon development reframes this challenge and argues that in some cases, the low carbon option is also the best development option for low-income countries. (See diagram above).
Mitigation:	refers to efforts to limit or absorb gas emissions which contribute to climate change. Emissions can be limited by moving away from dirty fossil fuels (i.e. wind power) or by being more efficient when using energy (reducing consumption). Greenhouse gases can also be removed from the atmosphere by plants (called carbon sequestration).
Payment for Environmental Services (PES):	a market-based approach to conservation based on the twin principles that those who benefit from environmental services (such as users of clean water) should pay for them and those who generate these services should be compensated for providing them.
Resilience:	the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a potentially hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.
Scenarios:	<p>in this document these are several development pathways on which Rwanda may embark to achieve its green and resilient vision. The team crafted three scenarios:</p> <ol style="list-style-type: none"> 1. Scenario One: Foundational Ambition Adoption of the already ambitious green growth, carbon commitments in the Vision 2050 and related sector strategies. 2. Scenario Two: Green Industrialisation building on scenario one while adopting more aggressive low-carbon and niche green industrial development. 3. Scenario Three: Green Transformation Building on scenarios one and two but transforming towards a strongly natural resource decoupled knowledge-based services economy.

- Smart cities:** encompasses optimal space utilisation, connectivity with broadband systems and the internet of things, with efficient planning, services and utilities, and localised innovation for social and economic development.
- Vulnerability:** the propensity or predisposition to be adversely affected. This includes the characteristics of a person or group and their situation that influences their capacity to anticipate, cope with, resist, and recover from the adverse effects of physical events.

1. Introduction

The Government of Rwanda has a strong history in demonstrating its commitment to addressing the challenge of climate change. In 1998, Rwanda ratified the United Nations Framework Convention on Climate Change (UNFCCC) and later the Kyoto Protocol in 2003. Since 2005, Rwanda has submitted National Communications to the UNFCCC, National Adaptation Programmes of Action (NAPA), and most recently, its Updated Nationally Determined Contributions (NDCs) to the UNFCCC. In 2009 a Climate Change Unit was set up within the Rwanda Environmental Management Authority (REMA), overseeing the Designated National Authority (DNA) to coordinate carbon market activities, and a study was done on the Economics of Climate Change for Rwanda. In 2010 the application was submitted for a Rwanda National Implementing Authority (NIE) to access international resources under the UNFCCC's Adaptation Fund. As a Partner State to the East African Community (EAC), Rwanda contributed to the EAC Climate Change Policy in 2010 and EAC Climate Change Strategy in 2011. Rwanda's Ministry of Environment has since become an accredited entity for the Green Climate Fund and the country has committed to the African Agenda 2063 of the African Union.

As a Least Developed Country (LDC), Rwanda has priority status for adaptation and is not required to take action to reduce its greenhouse gas (GHG) emissions. However, Rwanda has emerged at the forefront with to push for action in the international climate negotiations. It is a member of the Climate Vulnerable Forum (V11) and the Cartagena Dialogue group. Rwanda's climate action focus has shifted to climate resilience and low carbon development which addresses both adaptation and mitigation, whilst focusing on sustainable economic growth and poverty reduction. Rwanda has the opportunity to leapfrog old technologies and destructive development pathways, and build a green and resilient economy.

Rwanda's Green Growth and Climate Resilience vision and Vision 2050 is for ***Rwanda to be a developed, climate-resilient, and low carbon economy by 2050.***

In achieving this vision there are three Strategic Objectives:

- To achieve Energy Security and Low Carbon Energy Supply that supports the development of Green Industry and Services and avoids deforestation.
- To achieve Sustainable Land Use and Water Resource Management that results in Food Security, appropriate Urban Development and preservation of Biodiversity and Ecosystem Services.
- To ensure Social Protection, Improved Health and Disaster Risk Reduction that reduces vulnerability to climate change impacts.

Together these refer to the elements upon which the Vision 2050 are built, namely the infrastructure and systems that enable low-carbon growth and sustainable resource use, the natural capital and associated spatial development that ensure sustainable development, and the human capital and inclusion that build resilience of the Rwandan people.

Rwanda's **Green Growth and Climate Resilience Strategy** (GGCRS) was first adopted in 2011. Having been under implementation for the last ten years there is a need to revisit the Strategy with a view to ensuring it remains adaptable to rapidly evolving conditions spurred by development demands. In 2018 an evaluation was commissioned to determine the key achievements, shortcomings and lessons learned in implementing the GGCRS (2011), with the aim of ensuring it continues to serve as a relevant, effective and implementable guiding national document. The evaluation concluded with key recommendations, including a need to:

- i) enhance / update GGCRS actions and indicators across sectors;
- ii) ensure alignment with more recent national policies and strategies (Vision 2050, NST 1, Environment and climate change policy, 2019) and international commitments (SDGs and NDC, 2030);
- iii) allowing for a more realistic and targeted implementation plan including consolidating Programs of Action (POAs) to align with Vision 2050 desired outcomes. and
- iv) improve costing information to allow for more accurate budgeting and forecasting at national and sectoral levels.¹

There are also important economic development ambitions that need to be taken into consideration, i.e. being an upper middle-income country by 2035 and higher income country by 2050. These recommendations collectively demonstrate the need to strengthen certain aspects of the Strategy through a robust analysis and revision process. Therefore, a process has been conducted to update the 2011 GGCRS, to be more relevant, responsive to trends, and be an implementation-ready, costed and workable instrument for three key time horizons: 2030, 2035 and 2050. The areas of significant revision in the latest GGCRS include the following:

Rwanda's Development Pathway: the revised strategy contains a much clearer link to Vision 2050, along with a description of the preferred trajectory that has emerged as Rwanda's desired green growth and climate resilient future. The scenario allows the revised GGCRS to focus on those interventions that will provide an adequate platform for this preferred trajectory, but also does not foreclose future opportunities to scale up ambition as conditions evolve beyond 2030.

Thematic Programme Areas: the revised strategy has identified four main Thematic Programme Areas, underpinned by a fresh, consolidated set of eight Programmes of Action (PoAs) to ease and improve implementation planning and monitoring. The Strategic Interventions that comprise the programmes of action support the identification of clear sector-specific policy actions.

Enabling Pillars: the revised strategy has updated the enabling pillars to reflect the prerequisite arrangements, resources and capabilities for the PoAs to be effectively implemented in the short, medium, and long term, to help better operationalize the GGCRS.

¹ Rugege, D (2018). Evaluation of the Green Growth and Climate Resilience Strategy (GGCRS) Implementation: Evaluation Report.

Implementation Roadmap: the revised strategy is accompanied by clear and timebound implementation guidance, including estimations of what the strategy will cost as the Government of Rwanda greens its development trajectory and pursuit of Vision 2050.

This revised Green Growth and Climate Resilience Strategy (GGCRS) seeks to guide development and prioritise interventions that drive an economic trajectory in line with Vision 2050, that ensures a resilient and low-carbon future for Rwanda. Reflecting these aims, the Revised GGCRS is also mainstreamed within broader economic planning. The GGCRS is aligned with the recently developed National Strategy for Transformation (NST) (2018 – 2024) in conjunction with Rwanda's 7-year Government Program. The NST is a high-level planning policy that frames the country's subsequent local government and sector plans and includes specific projects or actions along three pillars for economic, social and governance transformation. The GGCRS builds upon and complements the recently updated Nationally Determined Contributions (NDCs) made under Rwanda's commitment to the UNFCCC, as well as other key national guiding documents informing the country's low carbon development, such as the National Environment and Climate Change Policy enacted in 2019 with the goal of achieving a climate resilient nation with a clean and healthy environment. This strategy has been designed to remain adaptable to possible future scenarios, responsive to trends, and serve as an implementation-ready, costed and workable instrument to guide green growth and climate resilient development.

The purpose of the Strategy is threefold:

1. To guide national policy and planning in an integrated way, ensuring alignment with other key documents in Rwanda's
2. To mainstream climate change into all sectors of the economy, and
3. To position Rwanda to access international funding to achieve climate resilience and low carbon development.

The Strategy calls upon national planners to chart a new development pathway for integrated sector planning that focuses on balancing cross-cutting issues of resource management. The Strategy is the first step in a continuous process, geared to set Rwanda on a course to identify, describe and monitor its current and future vulnerabilities, and take self-determined actions towards building a robust economy.

METHODOLOGY FOR REVISION

A robust and analytical process has been taken to update the 2011 GGCRS, to be more relevant, responsive to trends, and be an implementation-ready, costed and workable instrument for three key time horizons: 2030, 2035 and 2050.

The foundation of this process has been the identification of **sector specific green growth and climate resilience interventions** through extensive review of literature and iterative engagement with key stakeholders. Sectoral Stocktaking assisted in developing an appropriate understanding of the current status of GGCRS implementation across key sectors, climate change impacts and priorities in major sectors, key

sectoral trends and characteristics, and major national socio-economic and political trends that could drive future scenarios. This stage included the assessment of crucial instruments such as the National Environment and Climate Change Policy, the National Strategy for Transformation (and its provisions on Environment, Natural Resources and Climate Change), Rwanda's NDC (original and recently updated), its national communications to the UNFCCC, Vision 2050, Macroeconomic Framework and development projections for 2035 and 2050, the National Land Use and Development Masterplan 2020, Future Drivers of Growth in Rwanda 2019, the Fifth Integrated Household Living Survey (EICV 5), the Roadmap for Payments for Ecosystem Services 2019, amongst others. The product of this stage in the project was a **collection of Sector Working Papers** that detail these interventions as well as a number of key considerations for their implementation. The Sector Working Papers cover:

1. Urbanisation and Human Settlements
2. Agriculture
3. Mining
4. Industry
5. Forestry and Land Use
6. Water Resources
7. Water, Sanitation and Hygiene (WASH) and Waste
8. Energy
9. Transport

Following the production of the Sector Working Papers, the research team entered a period of **focused stakeholder engagement**. During this period, the contents of the working papers were presented in a sector-based working committee meetings held at the ministry level, which allowed for further feedback from participants, which included representations from non-governmental organisations, donor groups, private sector and research institutes.

Once an accurate and up-to-date picture of each of Rwanda's key economic sectors was developed the team synthesized sector-specific recommendations into **Thematic Programme Areas**. This synthesis established a key link to the 2011 GGCRS where in the original **Programmes of Action** were refined and mapped onto the thematic areas. These programmes underwent a further review and approval process through stakeholder engagement to be refined and ensure that they could be implemented

Overall, the team ensured the GGCRS revision process was grounded in the most current information about climate change impacts, green growth needs, and major trends and developments in each sector. This informed the consideration of several pathways (scenarios) on which Rwanda may embark to achieve its green and resilient vision. The team proposed options for Rwanda's level of ambition for green growth and climate resilience achievement. The team crafted three **Scenarios (development pathways)** to facilitate engagement with alternative perspectives for Rwanda's Future, and implications for investment requirements and timeframes that could guide strategic decision making for the Revised GGCRS implementation planning. The

product of this stage of the project was a **Scenarios Briefing Note** which could guide the identification of strategic options around which the Government of Rwanda can make key decisions about allocations and sequencing, toward an ultimate green and resilient future.

Ultimately, the revised GGCRS is the product of iterations within the process described above, as the team will now engage critically with the interventions that will make up the Programmes of Action and examine the costing, and other implementation considerations determined by chosen the level of ambition and preferred scenario. The Revised GGCRS product is informed by the original GGCRS, the Sector Working Papers and the Scenarios Briefing note as outlined in Figure 3.

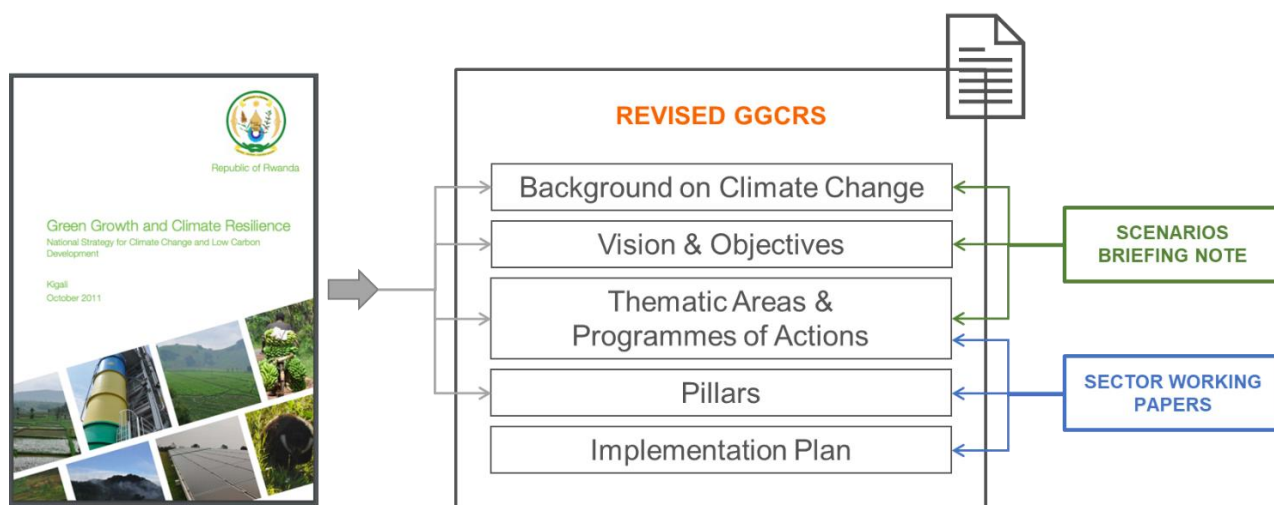


Figure 3 Key products informing the Revised GGCRS

2. Rwanda's Development Pathway

Rwanda's longer-term demographic, economic, societal, climatic and environmental development aspirations are defined in the country's key national guiding document "Vision 2050" (Republic of Rwanda, 2020), which sets a new pathway for promoting Economic Growth, Prosperity and a High Quality of Life for Rwandans. The Vision 2050 is informed by a Demographic Dynamic General Equilibrium (D-DGE) model for High-Growth Scenarios for Rwanda (Kalisa, 2019) amongst other key national instruments.

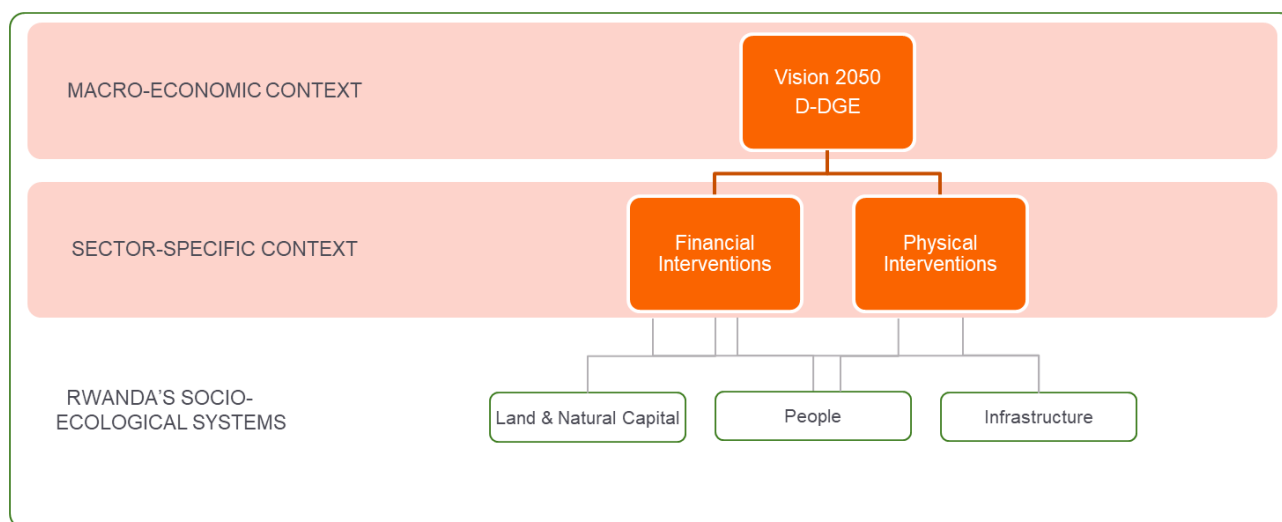


Figure 4: Point of Departure for 'greening' the Vision 2050 Economic Trajectory

The Vision 2050 is anchored around Human Development, Competitiveness and Integration, Agriculture for Wealth Creation, Urbanisation and Agglomeration, and Accountable and Capable State Institutions. To support these foundational anchors, the D-DGE model defines key building blocks ("drivers of growth") – summarised in the figure below. As such the economic growth trajectory for Rwanda is effectively built on these four drivers, which can be related to four distinct types of capital, namely infrastructural, human, natural and financial capital. These four drivers may also be used to identify fundamental questions to guide the development of a green growth and climate resilience strategy, as indicated in the figure below.

These drivers of growth provide an important conceptual framework within which the revised GGCRS aims to enable the attainment of Vision 2050 through measures that foster higher quality of life, social equity and shared economic opportunities, enhance the resilience of society and the ecosystems upon which they depend, while also reducing environmental risks, and minimizing inefficient use of natural resources. Understanding how these drivers interact with Rwanda's environment, and the country's future climate and associated risks and vulnerability for key economic sectors in Rwanda is foundational for effective, sustainable green growth and building a climate resilient economy. Rwanda's environmental status and an overview of its climate context are outlined in the sections that follow.

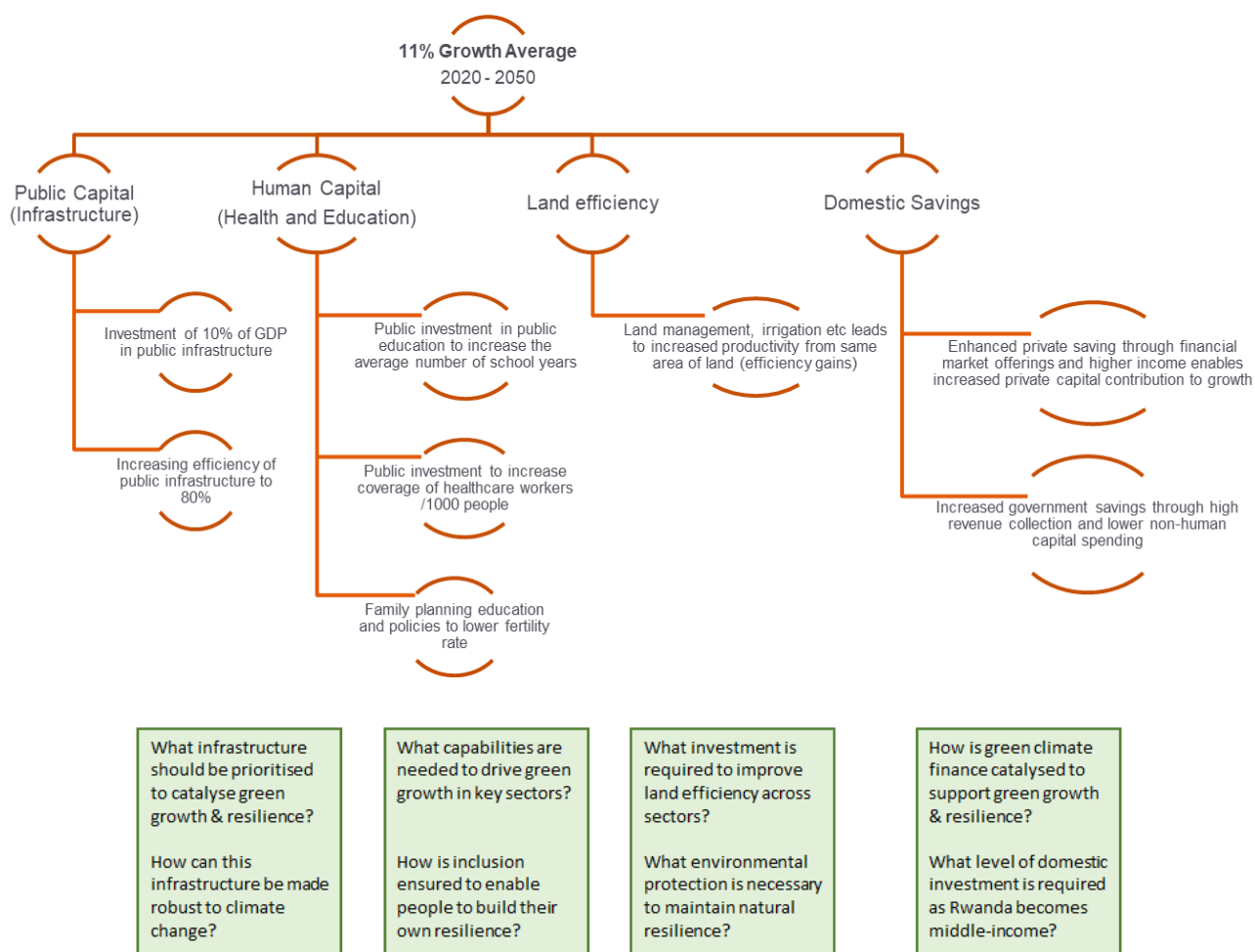


Figure 5: D-DGE Model Growth Drivers for Vision 2050, with critical questions for green growth and climate resilience

STATUS OF THE ENVIRONMENT

Rwanda's environment is inextricable from its economy as it supports its primary export sectors, livelihoods and its attractiveness as a tourism destination. According to the Fifth National Report to the Convention on Biological Diversity (REMA, 2014), Rwanda is rich in biodiversity which is mainly conserved in protected areas (national parks, natural forests, wetlands). The Natural Capital Account Report (2017) suggests that over 74% of national territory is used for agriculture (including cultivated lands, cultivated marshlands, pasture and fallow, agro-forestry, woodlots and others) (REMA, 2017). Currently, forests in Rwanda cover 30.4 % of the surface area of the national territory of which plantation covers a greater share than natural forests. Rwanda's water resources consists of freshwater systems of the country's lakes, rivers, marshlands and ground water, all supplied by rainfall. The lakes in Rwanda cover more area than the rivers. The hydrological system is divided into two river basins, the Congo and Nile River basins; the latter contributing approximately 90 per cent of the total national surface water stock (REMA, 2019).

Rwanda has played an active role managing and responding to key dynamics affecting its environment, including climate change and urbanisation, in order to identify sustainable development mechanisms to maintain its natural capital and heritage (REMA, 2017). The main environmental challenges facing Rwanda have been summarised in SIDA (2019), and include: i) land scarcity, ii) soil degradation and soil erosion, iii) deforestation, iv) climate change, v) loss of biodiversity, vi) water pollution and access, vii) urban pollution and natural resources pressures, viii) generation of hazardous and solid waste, ix) natural resource depletion.

HISTORICAL AND CURRENT CLIMATE OVERVIEW

Rwanda has a temperate climate, with considerable differences across the country, owing to the varying topography: mountains, valleys, and low-lying areas influence the temperature and rainfall. Despite being in an equatorial zone, which would result in a tropical climate, Rwanda's current climate is temperate due to the moderating effects of its hilly topography. It is typically cooler and wetter in the west, mainly because of the high mountains, and warmer and drier in the east, where the elevation is lower (Future Climate for Africa, 2016).

The country is divided into four main climatic regions: eastern plains, central plateau, highlands, and the Lake region (around Lake Kivu). The warmest annual average temperatures are found in the eastern plateau (20°C to 21°C) and Bugarama Valley (23°C to 24°C), and cooler temperatures in the central plateau (17.5°C to 19°C) and highlands (less than 17°C) (USAID, 2012).

Historically, the eastern plains have received annual rainfall of between 700 mm and 1,100 mm, with average annual temperature between 20°C and 22°C. The central plateau region has historically received rainfall of between 1,100 mm and 1,300 mm, with an annual average temperature of between 18°C and 20°C. The highlands, including the Congo-Nile Ridge and volcanic mountain chains of Birunga, have historically received rainfall of between 1,300 mm and 1,600 mm, with annual average temperatures ranging between 10°C and 18°C. Regions around Lake Kivu and the Bugarama have displayed a historic trend of annual rainfall of between 1,200 mm and 1,500 mm, and annual mean temperature between 18°C and 22°C (Republic of Rwanda, 2018).

Like much of East Africa, Rwanda has two rainy seasons, the 'long' rains from March to May, and the 'short' rains from September to December. However, there are large variations in rainfall between years, driven by global and regional weather systems (Future Climate for Africa, 2016). Shifts in the timing of precipitation, which have important implications for agriculture, natural resources management, sanitation and hygiene, as well as hydroelectricity, have been reported in certain regions (USAID, 2012).

In the last half-century, with the onset of climate change, there have already been noticeable changes in Rwanda's average temperature. A general progressive increasing trend in temperature, i.e. warming, has been observed across the country for the period of 1961-2016. Specifically, observations indicate a rise in average annual temperatures of about 0.7 - 0.9°C since 1950. At the same time, for rainfall, in the period between 1961

and 2016, annual rainfall in Rwanda exhibited very high levels of fluctuations. Studies suggest that mean rainfall dominantly decreased in January, February, May and June but at the same time there has been a dominant trend of increasing rainfall in the remaining months of the year across the country (Republic of Rwanda, 2018).

Thus, Rwanda's natural climate is already variable, and prone to extremes. Rainfall varies throughout the year, and across the country, resulting in floods and landslides in the western and northern regions, but droughts in the east. Flooding has caused loss of human lives, and damaged crops and infrastructure. Similarly, historical drought events have caused famines (MIDIMAR, 2015). The impacts of these hazards are exacerbated due to Rwanda's high population density. Addressing these current risks is a priority for early adaptation efforts (Future Climate for Africa, 2016).

Climate change is expected to further alter temperature and rainfall, and likely amplify the kinds of extreme events, such as flooding and drought, that Rwanda already experiences (Future Climate for Africa, 2016).

FUTURE CLIMATE

Climate model projections indicate that temperatures across Rwanda will increase with climate change. This is true of both monthly maximum temperatures, as well as (to a lesser degree) monthly minimum temperatures. Models suggested increasing trends in minimum and maximum temperatures, during both the short and long dry seasons, through 2050. This is consistent with the majority of models for East Africa that predict a 2.5°C rise in temperature by the 2050s (over the historic 1960 baseline) (Republic of Rwanda, 2018). This analysis is based on data obtained from key weather stations that provide representative geographical evidence for the country. **The stations were selected during the Third National Communication (2018) as the reliable stations to provide climate change data over 45 years period (since 1970s). The four stations represent western, eastern lowlands, highlands and central plateau regions of Rwanda.** It should be noted that even with this broadly increasing trend in annual average temperature across the country, there are still marked regional variances, with some locations projected to warm more than others, and certain locations even possibly experiencing a slight decrease in annual average temperatures. **The further out in time one looks, however (i.e. closer to 2050), the increasing trend is more discernible and consistent across regions.**

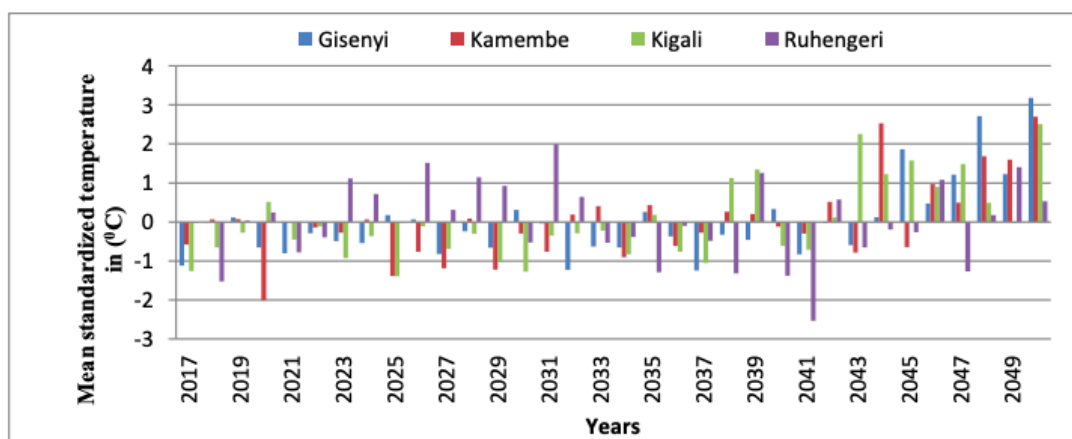


Figure 6: Projected Mean Annual Standardized Temperatures, 2017 - 2050 (Source: Republic of Rwanda, 2018)

There is an extremely high level of variance between climate model projections for rainfall in Rwanda, both through mid-century (2050) and end-century (2099). Some models suggest a slight overall increase in mean annual rainfall totals of between 0.1 – 0.64 mm per year by 2050. However, the predominant trend amongst models appears to be a general decrease in mean rainfall across the country by 2050, by up to 5 mm per decade, with the exception of the western region which will likely receive an additional 8.59 mm of annual mean rainfall by 2050. **The implication is that the central and eastern regions will be exposed to more dry spells than before** (Republic of Rwanda, 2018).

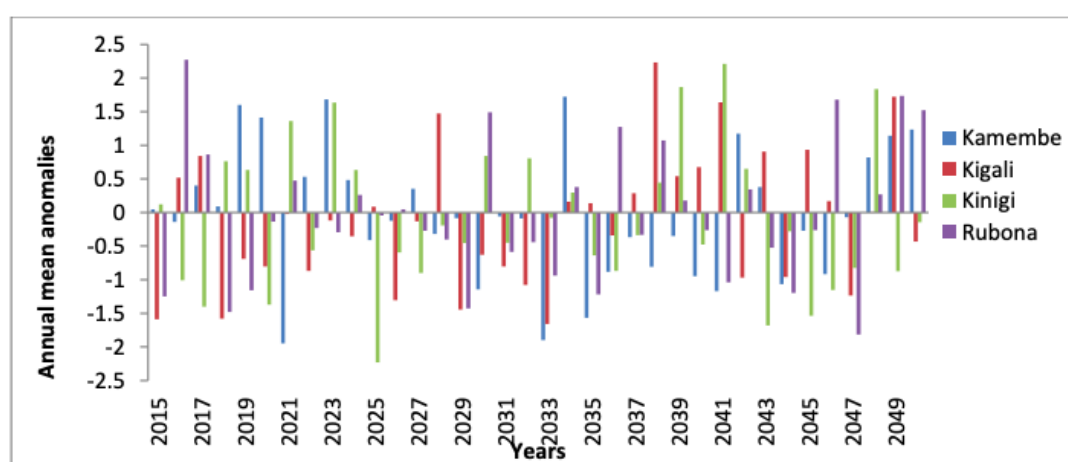


Figure 7: Projected Variation in Mean Annual Standardized Rainfall, 2017 - 2050 (Source: Republic of Rwanda, 2018)

In summary, temperatures are expected to rise across Rwanda, especially in the 2040s and 2050s. Rainfall trends offer less predictability. Rainfall variability will continue, with more intense rainfall events expected, leading to more flooding events. Overall rainfall levels are expected to increase in Western Rwanda, and decrease in central and Eastern Rwanda, with the semi-arid eastern region likely to suffer from more droughts. **Climate adaptation must focus on coping with rainfall variability, and the extreme events that result from more intense rainfall events (floods, landslips, and landslides).**

Beyond Rwanda-specific projections, a vast number of studies exist that offer growing consensus on climate change trends in East Africa. The table below reflects a synthesis of literature that focuses on impacts in East Africa for different global temperature rise thresholds (noting that mid-century rise in Rwanda and globally could be in the 1.5°C - 2°C range, depending on global emissions trajectories) (Carbon Brief , n.d.).

Table 1: Impacts of Climate Change in East Africa, at Different Temperature Rise Thresholds (Source: CarbonBrief, n.d.)

Climate Variable	1.5°C Global Rise	2.0°C Global Rise	3.0°C Global Rise
Annual highest maximum temperature	+0.9°C	+0.9°C	
Duration of warm spells (number of days/year)	+25 days	+55 days	
Annual hot nights (number of nights/year)	+65 nights	+107 nights	+170 nights
Periods of 3 consecutive heatwave days (number of periods/year)	+5 periods	+7 periods	+10 periods
Frequency of warm extremes over land (% change annually)	+282%	+822%	
Frequency of cold extremes over land (% change annually)	-69%	-93%	
Rainy season length – first rainy season (number of days/year)	- 2 days	- 3 days	- 6 days
Rainy season length – second rainy season (number of days/year)	+ 6 days	+/- 0 days	+ 5 days
Total rainfall in season – first rainy season (% change annually)	+5%	-2%	-4%
Total rainfall in season – second rainy season (% change annually)	+17%	+23%	+42%
Dry days during rainy seasons – first rainy season (number of days/year)	-1 days	-2 days	-4 days
Dry days during rainy seasons – second rainy season (number of days/year)	+2 days	+1 days	+2 days
Rainfall totals on extremely wet days (mm/day)	+7 mm/day	+5 mm/day	+11 mm/day
Rainfall intensity (% change annually)	No change	+1%	
Frequency of rainfall extremes over land (% change over historic baseline)	+23%	+50%	
Average drought length (months)	+3	+5	+12
Frequency of extreme high river flows in the Congo basin (%)	+25%	+75%	
Frequency of extreme high river flows in the Nile basin (%)	+9%	+82%	

Greenhouse Gas Emissions to 2030

Rwanda does not have projections of its greenhouse gas emissions through mid-century. It does, however, have projections for 2030, i.e. the close of the current NDC period (Republic of Rwanda, 2020).

Rwanda's total GHG emissions in its baseline year of 2015 were 5.3 million metric tonnes of CO₂e (MtCO₂e). If emissions trajectories continue to rise on a Business-as-Usual trajectory, this pathway would lead Rwanda to annual GHG emissions of 7.42 MtCO₂e in 2020, 9.61 MtCO₂e in 2025, and 12.1 MtCO₂e in 2030. The greatest increases in emissions over the 2020 – 2030 period are expected to emerge from the energy and agriculture sectors (Republic of Rwanda, 2020). However, both the energy and agriculture sectors have strong potential to implement low-carbon innovations. If Rwanda is to meet its climate change mitigation commitments, whilst also achieving its ambitious 11% economic growth targets, **it must adopt concerted green growth measures to ensure lower carbon-intensity of its economic activities and shift to lower-carbon approaches in the energy and agriculture sectors.** As the Vision 2050 urges, this will be critical to

ensure that Rwanda meet its ambition to become carbon neutral economy by 2050 (Republic of Rwanda, 2020).

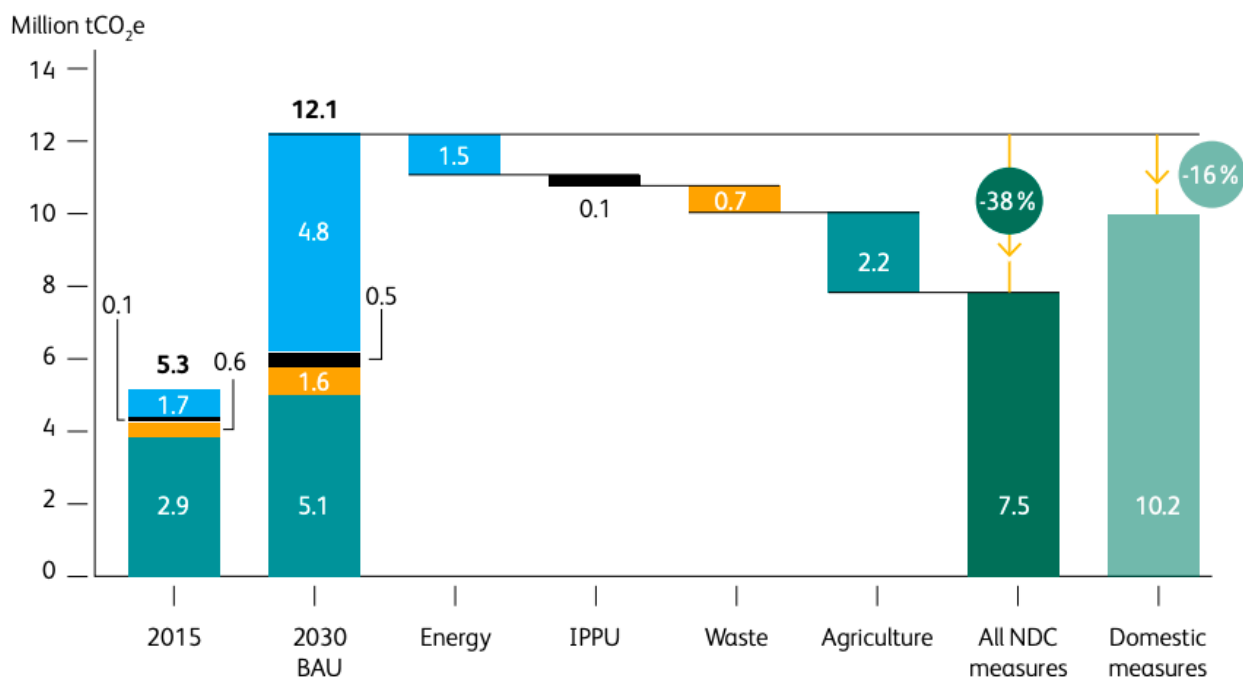


Figure 8: Rwanda's NDC commitments by sector, to reduce GHG emissions from 2030 BAU levels² (source: Republic of Rwanda, 2020)

CLIMATE CHANGE VULNERABILITY AND RISK FOR RWANDA

Climate change poses a threat to all sectors of the Rwandan economy, and efforts towards preparedness are necessary in every sector. However, the nature of some sectors (their raw materials or inputs, their systems and processes, and their outputs or contributions) is such that certain sectors are substantially more at-risk to climate change than others. **In Rwanda, the sectors that are most vulnerable, and therefore must place a considerable emphasis on building adaptive capacity, are WASH and waste, agriculture, and natural resources management** (land and water resources, including forestry). Urban settlements and energy also require adaptation. In relative terms, transport, and industries and mining have less of an imperative in the near future to focus heavily on adaptation.

WASH and Waste

Water is the principal channel through which climate change impacts are manifested. This makes water access and supply the most vulnerable of Rwanda's sectors, with significant implications for water services and sanitation. Climate change is expected to create greater variability in water availability, including through shifts

² Colours represent sector contributions for Energy (blue); IPPU (black); Waste (yellow) and AFOLU (teal). Dark green represents all NDC measures, while light green represents domestic measures.

in seasonality and distribution of rainfall. With rising temperatures and increased evapotranspiration, this is also expected to lead to greater aridity in dry areas. At the same time, warmer temperatures are likely to increase demand for water (for consumption and cooling) as well as exacerbate public health challenges if effective solid waste cannot be effectively managed. This coupled with demographic and economic factors (rising population and economic growth) can lead to operational challenges for cities and settlements relating to WASH and Waste (The World Bank, n.d.).

Climate change adaptation is a pressing need for Rwanda's water sector supply and sanitation, to assure security of supply and adequate services despite climate variability and extreme weather. Ensuing public health issues can remain under control through effective waste management and the provision of improved sanitation facilities will be essential.

Agriculture

Climate change is a threat-multiplier to agriculture, enhancing risks already felt from climate variability, particularly through changes in the availability of water (a fundamental input in a country reliant on rain-fed agriculture) and through temperature shifts that affect crop growing patterns (crop growth cycles are influenced by temperature, and productivity of some crops drops after a certain temperature threshold is breached) (The World Bank, n.d.). Rwanda is already starting to experience more extremes, with the dry regions in the east and south becoming more arid (and projected to see more droughts), and wet regions in the north and west becoming more humid and moist (and projected to see more floods and landslides) (PSTA 4, Republic of Rwanda, 2018).

A number of assessments suggest that climate impacts in Rwanda such as higher temperatures, increased dryness (in some regions), and higher evapotranspiration, may alter the extent of areas suitable for agriculture and the length of growing seasons, affecting crop yields (e.g., for tea, coffee, maize, beans, wheat, fruit, and groundnuts) as well as hunger and nutrition (PSTA 4, USAID, 2019). Furthermore, there is a higher risk of soil erosion due to more extreme rainfall events in certain regions. In addition, climate change may alter the occurrence and distribution of pests that harm or damage crops and livestock, such as the berry borer beetle and rift valley fever (USAID, 2012).

The agriculture and food security sector in Rwanda is one of the most vulnerable components of Rwanda's economy, given its susceptibility to climate change impacts. Adaptation is of utmost importance.

Natural Resources (Land, Forestry and Water Resources Management)

Rwanda's land is a factor in the country's climate change vulnerability. Its topography makes it particularly prone to flash floods and landslides. As climate change projections suggest more frequent and more intense heavy rainfall events, the risk of such disasters is expected to rise. Rwanda needs to build resilience to such expected impacts by ensuring that its landscapes remain stable when confronted by climatic shocks and stresses. Sustainable landscape management needs to be prioritised to manage flood and landslide risk

through ecosystem-based approaches (biophysical interventions), as well as improved technical capacity for flood forecasting (information systems and climate services), physical structures (infrastructure), and community-based approaches. In Rwanda, firewood is the main source of energy for an estimated 98% of rural households. Such heavy reliance on fuelwood for domestic cooking and heating contributes to both slope destabilization and soil erosion in many areas. Hence increasing the efforts to provide reliable access to more sustainable, low-carbon fuels is imperative (The World Bank, 2019; Rwanda Water Resources Board, 2019).

Climate change also makes Rwanda vulnerable through impacts on biodiversity and ecosystems. Temperature changes shift distributions of native species (such as the giant senecio trees), and expand the range of invasive species such as the water hyacinth. Amphibians in Rwanda's Albertine Rift region, such as Fischer's African Caecilian and the Western Rift Puddle Frog, have been identified as vulnerable to climate change. Species sensitive to climate change include the Kivu clawed frog, and the Rwenzori side-striped chameleon, amongst others (IUCN, 2013). In addition to biodiversity protection and genetic preservation, biosafety is also a priority for Rwanda.

Rwanda already experiences high rates of soil erosion that is depleting topsoil in forests and riparian corridors, with the mountainous Gishwati ecosystem (which contains high numbers of threatened reptiles and amphibians) particularly vulnerable. Rising temperatures also threaten plants and wildlife through increased physiological stress and disruption of pollination and predator–prey relationships. An estimated 107 mammal, 199 bird, 31 fish, 34 amphibian, and 79 plant species in the Albertine Rift region are highly vulnerable due to thermal sensitivity and/or changes in habitat suitability induced by climate change. Among the animals affected are the hippo, African wild dog, western rift puddle frog, grey-crowned crane, and the critically endangered mountain gorilla. These threats to biodiversity are likely to decrease tourism, a key source of foreign earnings and economic diversification (USAID, 2019; Rwanda Water Resources Board, 2019).

Climate change is expected to create greater variability in water availability, including through shifts in seasonality and distribution of rainfall. With rising temperatures and increased evapotranspiration, this is also expected to lead to greater aridity in dry areas (USAID, 2012).

The changing hydrological cycle also has implications for groundwater availability, indirectly through extreme weather events; increases in rainfall can lead to rapid runoff and flooding, which reduces groundwater recharge because too much rain at one time exceeds soil absorption capacity. Heavy rainfall also increases siltation of rivers, lakes (USAID, 2019; Rwanda Water Resources Board, 2019).

Rwanda's land is vulnerable to climate change from the increased risk of natural hazards (floods, droughts, landslides), particularly as land use changes cause slope destabilization and soil erosion. Loss of biodiversity may impact nature-based tourism.

Urbanisation and Settlements

Climate change poses a threat to cities and human settlements in Rwanda in a number of ways. Temperature rise may affect population health in the form of heat stress and heat exhaustion (or, in severe forms, heat

strokes), given that the urban heat island effect exacerbates rising temperatures significantly in built-up areas. Rising temperatures also increase demand for cooling and water usage, leading to pressure on essential services. Most acutely, urban settings are at risk from extreme weather occurrences such as intense rainfall events, due to changes in drainage patterns in built areas. Kigali, for instance, has suffered highly damaging floods annually for the last several years, compounded by issues of waterlogging. Given the density of many of Rwanda's cities and its hilly, uneven topography, extreme rain events also bring an elevated risk of landslides (Republic of Rwanda, 2018).

Cities and urban infrastructure in Rwanda are vulnerable to both chronic and acute climate change impacts. Disaster risk reduction and disaster management, as well as urban drainage and storm water management are pressing adaptation needs.

Energy

The energy sector in Rwanda is vulnerable to climate change impacts in two principal ways. One, given the large share of hydropower in the country's electricity mix, increased variability in rainfall (including more frequent drought conditions in eastern and southern Rwanda) poses a risk to the reliability and availability of hydropower. Alongside this an increase in rainfall intensity which leads to landslides and sedimentation of water bodies affects key infrastructure. Two, even for thermal power facilities, there may be increased requirements for cooling systems, due to an anticipated rise in average ambient temperature due to climate change. Beyond these two factors, other potential challenges to the power sector from climate change include an increase in demand for residential and commercial cooling (in response to higher temperatures), which creates pressure on power supply, and extreme weather events, which could damage power sector assets or temporarily disrupt fuel supply chains due to localized disasters such as floods and landslides (The World Bank, n.d.).

While Rwanda's current NDC does not include adaptation actions related to the energy sector, it may be prudent for the sector to assess its vulnerability more robustly to climate change related trends in power consumption, as well as disruption from extreme weather events.

Transport

The transport sector faces several of the risks faced by the urban sector and the industry sector in terms of infrastructure damage, loss, and depreciation. Higher temperatures are known to cause tarmacs at airports to melt, and temperature variability (extreme highs and lows) are known to cause roads to buckle and crack (IPCC, 2014; Ministry of Infrastructure, 2021). Moreover, transport systems and networks can face disruption from extreme weather events such as floods or landslides, causing supply chain interruptions (IPCC, 2014). In the context of adaptation, transport systems such as roads and bridges have an important role to play in strengthening resilience; if designed and constructed with adequate roadside drainage and higher permeability, they can alleviate some of the risk of flooding in certain areas (IPCC, 2014; Ministry of Infrastructure, 2021).

Transport infrastructure is vulnerable to damage from climatic hazards, and can also play a more proactive role in enhancing a region's resilience through more climate-responsive design.

Industries and Mining

No major climate change study or instrument in Rwanda (including the 2015 baseline climate change vulnerability index or the 2020 NDC, or even independent climate change risk and vulnerability studies such as USAID's 2019 climate change risk profile or SIDA's 2019 environment and climate change analysis, or the Government of Netherlands' 2018 climate change risk profile for Rwanda) has examined the vulnerability of the industry, manufacturing, and mining sector to climate change. This is because the sector is typically focused on as a target for mitigation. However, climate change impacts do have implications for the sector, and decision-makers and planners in the sector would be well-advised to interrogate the need for adaptation action. Chief amongst these concerns is supply-chain disruptions to key industries and manufacturing units due to climate change, both as a result of rapid-onset events (extreme weather disasters such as floods and landslides) and slow-onset events (droughts and shifts in agricultural growing regions). Acute climate hazards can also pose a risk of physical damage and depreciation to capital assets. Given the key role of agro-based industries in Rwanda, and the vulnerability of crops and livestock to climate change, disruptions to the value-chains of agribusiness ought to receive attention.

Industry is not regarded as a highly climate-vulnerable sector. However, disruptions to supply chains and damage to physical assets are a reason for the sector to examine adaptation options as needed.

GREEN GROWTH AND CLIMATE RESILIENT PATHWAYS

Understanding the climate change implications for key economic sectors is one of the bases from which development trajectories can be planned. baseline development pathway, reflecting existing low carbon mitigation, green economy and climate adaptation commitments is already very ambitious in comparison with other developing countries and thus the minimum or 'low' scenario is already aspirational. Formulating alternative green growth and climate resilient scenarios therefore requires greater levels of ambition about achievement of carbon neutrality by 2050, the transition to niche green industry and knowledge-based services, the nature of urban settlements to minimise their ecological footprint and ensure resilience, the levels of protection of ecological resources, and the degree of decoupling of the economy and its dependence on primary natural resources. In response, three distinct scenarios of the future trajectory have been distilled, considering the specific context of Rwanda as a small, densely populated, mountainous country that has ambitious aspirations to be developed within the next thirty years:

- **Scenario One: Foundational Ambition.** This scenario is characterised by seeing through Rwanda's adoption of the already ambitious green growth, and carbon mitigation commitments in the Vision 2050 and related sector strategies that reflects a balanced mix between agricultural, industrial, and service economic development, with a focus on ensuring climate robustness in all infrastructure and long-lived investment, with a focus on climate disaster management.

Box 1: Rwanda's Existing Commitments

Rwanda embarked on a determined two-decade period to make strides in reducing poverty, increasing incomes, improving living standards, strengthening good governance, promoting home grown solutions, establishing rule of law, maintaining stability, promoting gender equality and women empowerment, and establishing peace and security in the country.

Now, Rwanda has articulated the Vision 2050 to serve to transform its economy and modernize the lives of all Rwandans. Rwanda has also committed to several international treaties which, at a minimum, position the country to embark on an ambitious green growth and climate resilient development pathway.

- **Scenario Two: Green Industrialisation.** In this scenario Rwanda would increase their green growth aspiration by building upon scenario one through the additional adoption of more aggressive low-carbon and niche green industrial development with more stringent conditions for green urban and economic development, built on comparative advantages in primary agricultural and mineral resources to drive trade and inclusive balanced green economic growth to achieve carbon neutrality by 2050.

Box 2: Country Case Example - Israel

From 1930s to 1970s, there was light industries that absorbed unskilled labour e.g. textiles, woodworking, metalworking, agro-processing etc. With the increase in skilled immigrants in the 1980s, the country moved to heavy and technical industries such as machinery and equipment (e.g. for aviation, commerce etc.), processing diamonds and the establishment of transnational companies in the computer, information and technology industry (e.g. Intel, Microsoft, IBM etc.).

In 2020, one in five Israelis was employed by industry, while the other four were employed in the services sector (Statistica, 2020). This demonstrates the power of an aspirational economic shift to green industrialisation and a sustainable services sector. The average GDP growth per annum was 5% between 1996 and 2020 (Economics, 2020). The annual spending on R & D (a % of GDP) has been consistently twice the average OECD of 2-2.5% spending in the past 20 years (OECD, 2020). While maintaining lower than 10 tonnes per capital of GHG emissions annually (always lower than the OECD by at least 0.5%) between 2000 and 2017. Its exports of \$56 billion are 30% of GDP and they are mostly technologies (OECD, 2019; OECD, 2020). Therefore, the country capitalized on its human capital and heavily invested on R & D to support the upskilling of the workforce across economy, establishing a largely resource-decoupled output.

Rwanda can draw lessons from Israel's experience on how to become a knowledge economy as envisioned in Vision 2050. The process implement this in three generations of development (each spanning 10 years). The first generation (2021 to 2030) will shift the economy and much of the jobs from labour-intensive agriculture light industry (including agro-processing). During the same period, the country will invest on building its human capital, particularly in TVETs. The second generation (2031 to 2040) reorientates the economy to heavy green industry, while investing more on R&D and human capital, especially advanced degrees in Science, Technology, Engineering and Mathematics. This will enable the third generation (2041 to 2050) to build a strong services sector with leading green technologies. Thus, making Rwanda a knowledge economy by 2050.

- **Scenario Three: Green Transformation.** This scenario represents the most ambitious and aspirational pathway which Rwanda could aspire toward, and requires a fundamental shift in how the Rwandan economy is developed. This scenario layers' additional actions and higher green growth and climate resilience ambitions onto scenario one and two by transforming towards a strongly natural resource decoupled knowledge-based services economy serving the regional and continental markets with a focus on urban smart low-carbon technologies, shifting to niche high-value agricultural and industrial activities (with carbon neutrality by 2050).

Box 3: Country Case Example - Singapore

In 1960, Singapore industrialised (light and labour-intensive industry) without a strong natural capital or agricultural sector (World Bank, 2019). While in the 1970s, it focused on human capital development and creating a services sector. This resulted in full employment by then. The country used loans from multilateral institutions to capitalise the Development Bank of Singapore. The development was skills and technology intensive. It exported its technology. In the 1980s, industry was almost contributing a third of the economy

(29%) (Country Studies, 2018). The country repaid its World Bank loan in this decade. While moving from light industry to specialised electronics and computers industry, it shifted from a copyright and "intellectual property" violator to an enforcer with a series of IP laws. By the close of the decade, it was the world's greatest producer of disk drives and disk drive parts.

The average growth rate in Singapore from 1965 to 1990 was 9.2% and 7.7% thereafter (World Bank, 2019). In 2018, its economy was anchored by industry and the services sector (financial services and ICT). While the state provides strong human capital development and financial backing to its citizens. Singapore is the international benchmark for the green, knowledge-based economy that support smart digitised cities and aspirational natural resource reuse and efficiency. Rwanda can prioritise similar niche green industrial investments to position itself as a green technology hub in Africa.

While Rwanda has established ambitious green growth and climate resilience goals, the cases above show that there are opportunities to learn from countries who have managed to exceed expectations and drive increasingly aspirational and sustainable growth trajectories. Importantly, the countries outlined above that have followed these trajectories from low income starting points have typically diverged in their pathway as national income and wealth has increased. Thus, the first five to ten years may be quite similar for these trajectories, ensuring the building blocks for long term economic development are in place, with critical considerations being not to foreclose opportunities to diverge later. It is in this context that the scenarios can be seen as sequenced, allowing the revised GGCRS to focus on those interventions that will provide an adequate platform for the preferred trajectory, which may be refined as conditions evolve beyond 2030 (both in response to the global economic outlook and climate uncertainties).

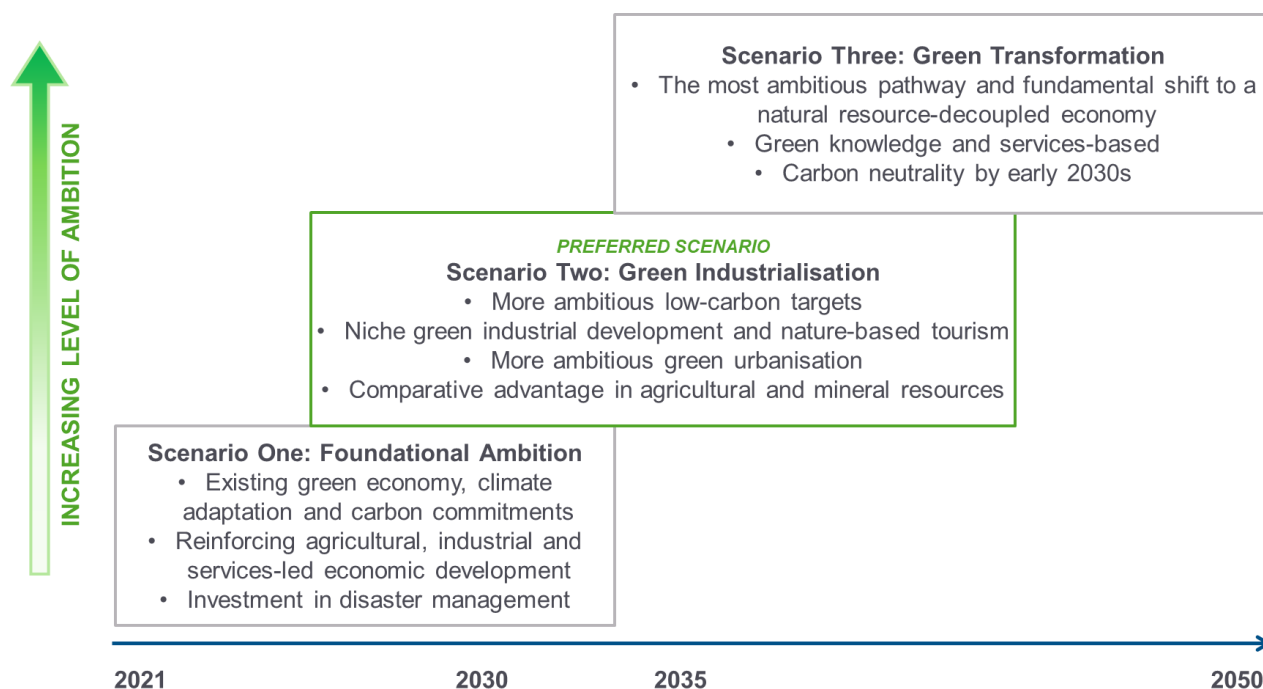


Figure 9: Pathways to Green Growth and Resilience

Indicative levels of aspiration are presented in the figure above, highlighting key thresholds that may be achieved during each trajectory. At present, the preferred trajectory for Rwanda is the **Scenario Two** due to its **pragmatic aspiration and reinforcement of the Vision 2050**. While Scenario One is already aspirational for a country at Rwanda's current level of development, there are additional interventions that would put Rwanda on a more environmentally sustainable, resilient and low carbon pathway. While Scenario Three may reflect a desired future towards 2050, it requires a strong economic and capability platform that needs to be built over the next decade through the preferred scenario. The Revised GGCRS seeks to be relevant for assisting Rwanda in developing sustainably towards Vision 2050 to enable future transformation and decoupling the economy from resource use and shift to modern, green knowledge-based services.

The GGCRS will support competitiveness toward Vision 2050 through niche green industrial development, modern and inclusive green urbanisation and inclusive green economy skills development that enhances the country's human capital for green growth. Following the preferred scenario in the GGCRS will also leverage Rwanda's existing comparative advantage in agricultural and mineral resources, but ensuring a shift to more sophisticated, sustainable and integrated value chains, with improved beneficiation for inclusive growth. The preferred scenario is also founded upon intersectoral collaboration and cross-cutting enablers (see chapter 5) ensuring a capable and unified state to drive GGCRS implementation for the country. The preferred scenario enables Rwanda to attract and sustain high private investment through the development of competitive and viable green industry development. The preferred scenario places a strong focus on value addition and resilience in resource-based sectors (agriculture and forestry) such that investment in these sectors will deliver both attractive and sustainable returns. This focus builds a competitive rural economy alongside the preferred scenario's focus on urban innovation. Green and SMART urbanisation in the preferred scenario will not only enhance the investment image of Rwanda's cities, but ensure that they can attract and absorb the jobseekers benefitting from green skills development and education. Therefore, Scenario Two reinforces the targets of Vision 2050 by ensuring that they are achieved in a green and climate resilient approach.

In following Scenario Two, Rwanda will begin in the short term along the current, more traditional economic development pathway but evolves with earlier and more ambitious implementation of low carbon aspirations and climate resilient development. Scenario Two makes targeted investments toward greater empowerment of people through the development of the secondary economy and greater robustness of infrastructure and livelihoods to the impacts of climate change. This is achieved by building a more balanced primary and secondary economic output (i.e. building on the processing and beneficiation of natural resources in addition to maintain the resource base for raw materials) through a green industrial and agricultural transition. In 2050 agriculture in Rwanda will be market-led and high-tech, driven by a few professional farmers with large farms on irrigable lands. Farms will be mechanized and use high-tech inputs in higher volumes

Scenario Two pursues a more ambitious carbon target, aiming to achieve carbon neutrality several years prior to the 2050 commitment. This is achieved through the adoption of best practice in green industry and urban systems, as well as targeted efforts to offset carbon emissions by investment in rural natural capital and

renewables. Scenario Two also sees a larger investment in rural economic transition and green efficiency to enable sustainable resource use, transformed green agriculture and sustainable forest harvesting (which will remain a part of the economy for domestic use and some trade). However, over time this scenario will pivot to enhancing and preserving its natural capital to focus on disaster risk management that increasing the climate resilience of people, systems, and infrastructure.

Ultimately, any of the scenarios considered for the revised GGCRS position the strategy to meet the Vision 2050. Despite distinct levels of ambition that will inform the pace and nature of green growth achievements, common objectives and outcomes of development processes include:

1. Building an ***inclusive green economy*** in which environmentally sustainable economic opportunities are available to all Rwandan citizens and sectors;
2. Prioritising ***low carbon and mitigation-focused*** improvements and interventions in key infrastructure and technological developments; and
3. Ensuring ***climate resilience and adaptive capacity*** is built in the short term, to protect the country's people and their livelihood to future risks.

These outcomes and the objectives detailed in the following section can be seen as the key building blocks to guide implementation and investment decisions toward achieving Vision 2050. They summarise the intended outcomes of the Programmes of Action at a high level as key goals for the implementation of the GGCRS.

3. Vision and Objectives

The Vision 2050 and vision for the GGCRS is for **Rwanda to be a developed, climate-resilient, and low carbon economy by 2050**. In achieving this vision there are three Strategic Objectives:

To achieve Energy Security and Low Carbon Energy Supply that supports the development of Green Industry and Services and avoids deforestation

To achieve Sustainable Land Use and Water Resource Management that results in Food Security, appropriate Urban Development and preservation of Biodiversity and Ecosystem Services

To ensure Social Protection, Improved Health and Disaster Risk Reduction that reduces vulnerability to climate change impacts.

Together these refer to the elements upon which the Vision 2050 are built, namely the infrastructure and systems that enable low-carbon growth and sustainable resource use, the natural capital and associated spatial development that ensure sustainable development, and the human capital and inclusion that build resilience of the Rwandan people. Vision 2050 envisages Rwanda as a developed food secure country, with a strong services sector, low unemployment and low levels of poverty. It is a country where agriculture and industry have a minimal negative impact on the environment, operating in a sustainable way, and enabling Rwanda to be self-sufficient regarding basic necessities. By 2050, development will be achieved with low carbon domestic energy resources and practices, reducing Rwanda's contribution climate change while allowing it to be independent of imported oil for power generation. Finally, Rwanda will have the robust local and regional knowledge to be able to respond to changes in the climate, in a position to support other African countries as a regional services hub.

The contribution of the GGCRS to achieving Vision 2050 is guided by the Theory of Change and Strategic Framework depicted in Figure 10. Cross-cutting enabling pillars (See Section 5) facilitate the implementation of several Programmes of Action arranged in four broad Thematic Programme Areas. These thematic areas in turn respond to the core objectives and Vision 2050.

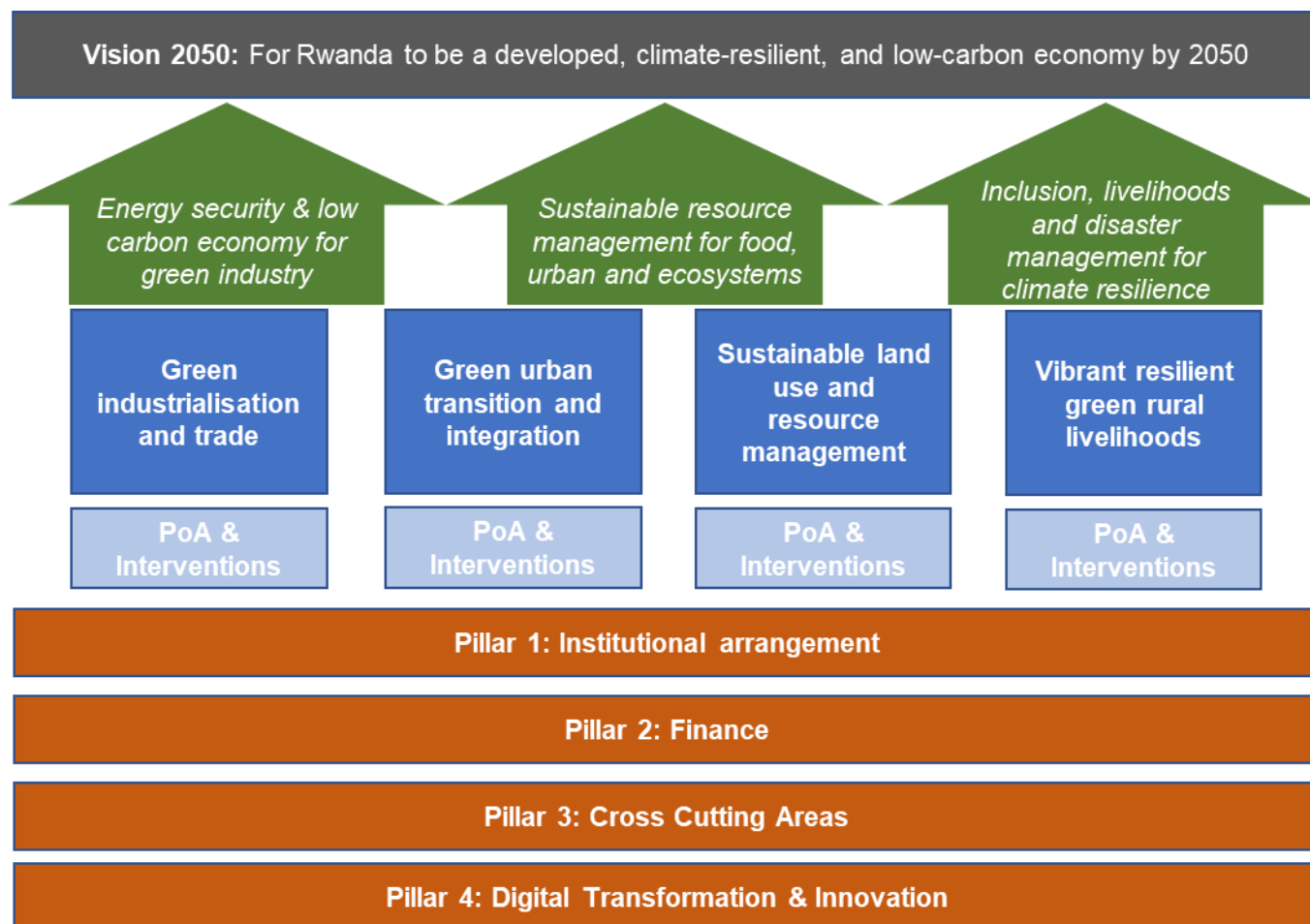


Figure 10: Strategic Framework for Rwanda's Green Growth and Climate Resilience Strategy

GUIDING PRINCIPLES

The Strategy is guided by a number of principles, already given in Vision 2050, National Strategy for Transformation I (NST I) and the National Environment and Climate Change Policy (2019). They ensure that no actions are taken that conflict with decisions already made by the people of Rwanda regarding their future prosperity and environmental sustainability. They are:

Economic Growth and Poverty Reduction

The future decisions and investments that will be guided by the GGCRS will seek to enhance economic growth and poverty reduction, with a clear focus on the green economy and low-carbon development. A key component of Rwanda's resilient economic future is the **efficiency, productivity, prosperity** that its economy can deliver. As such the GGCRS is designed so as to enable the simultaneous prioritisation of economic development and sustainability in climate responsive Programmes of Action and to ensure that green growth and climate resilience interventions generate economic value and benefits for Rwanda and its citizens.

Inclusion and People Focus

Green Growth and Resilience building is about people, and as such, the GGCRS is ultimately **people centric**. Inclusion is critical to empowering people to have resources, access, skills, and capacity to benefit from green growth and thereby to build their own resilience to future uncertainties. The Programmes of Action integrate strategic interventions which **build welfare, and ensure wellness** of all citizens in Rwanda's growing population. Mechanisms to ensure equality and equity is built both **inter- and intra-generationally** for women, children and vulnerable groups are integrated into the Programmes of Action either through targeted interventions, or through the cross-sectoral reach of the enabling pillars for the GGCRS.

Sustainability of the Environment and Natural Resources

A green and resilient economic future is not only about building new infrastructure or physical capital, but also about the **conservation of natural capital** through the protection and enhancement of ecosystems as part of the broader social and economic landscape. Green Growth and Climate Resilience places the sustainability of the environment and natural resources at the forefront of economic innovation for Rwanda. This is implemented through maintaining a **dual focus on mitigation and adaptation**; ensuring **strategic environmental and social assessment** informs all development; and by taking an **ecosystem approach** to the conservation, enhancement, and beneficiation of ecosystems and natural resources.

Existing economic development and activities should also be modernised to ensure effective uptake of the **Precautionary Principle**, the **Polluter Pays Principle** and **Extended Producer Responsibility (EPR)**. Through these efforts the GGCRS aims to guide the country on continual sustainability innovations such as the promotion of **Circular Economy** and **industrial symbiosis**.

Good Regional and Global Integration

Building **connectivity** along the rural-urban continuum is critical in densely populated countries like Rwanda. Key considerations about how grey infrastructure is built and how ecosystems are conserved will be important to ensure resilience for rural, peri-urban, and urban communities alike. Interactions between people, the economy and ecosystems need to be considered spatially, where land-use distribution and processes fundamentally underpin a green economy.

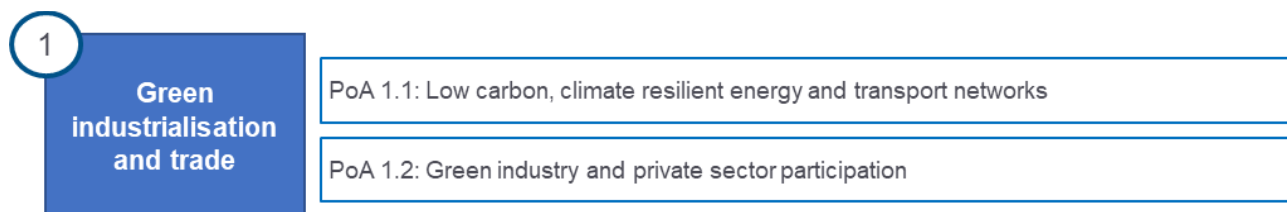
Connectivity can also be considered in terms of knowledge and information flows. The GGCRS seeks to maintain the momentum built around the updated NDCs in terms of information sharing and awareness raising toward upholding the **principle of cooperation** in the implementation of the Programmes of Action.

4. Programmes of Action

In order to implement the vision and strategic objectives outlined above, **Programmes of Action** (PoAs) have been designed to address the most important areas of work required to achieve Green Growth and Climate Resilience. These Programmes of Action have been conceptualised to meet the level of ambition and aspiration defined in Scenario Two (Green Industrialisation) Rwanda's preferred pathway to achieve a balance and aspirational greening and resilience building across its economic sectors. The Programmes of Action are structured in four **Thematic Programme Areas** which deliver strategic intent toward the GGCRS objectives. The Programmes of Action cover a balanced focus between mitigation, adaptation and green growth. In as much as the GGCRS will guide ambitious low-carbon development and economic growth, it will also enable targeted action to build climate resilience and adaptive capacity of Rwanda's people. The revised GGCRS streamlines the required activities into eight programmes for ease of implementation, tracking and monitoring. The Programmes of Action predominantly detail short-medium term strategic interventions that will be implemented over the next 5 – 10 years. However it is important to consider and ensure effective long-term impact and continuity of the strategic interventions beyond this period toward 2050. Long term considerations are summarised at the end of each Thematic Programme Area. *A narrative description of the Programmes of Action and their aspiration are outline below. Policy orientation and actions are distilled per sector in Appendix A: Green Growth Costing & Ministry Responsibilities.*

1. GREEN INDUSTRIALISATION AND TRADE

Resource-efficient infrastructure and physical capital to drive green industrial and trade growth, powered by low-carbon and climate-resilient energy and transport systems.



Thematic Programme Area 1: Green Industrialisation and Trade consolidates programmes of action that focus on energy and infrastructure systems that promote green industry and increasing connectivity for regional and global trade. Rwanda's pathway to becoming an upper-middle-income economy by 2035 and high-income country by 2050 hinges on its ability to enhance competitiveness at macro and micro levels to accelerate growth in economic activity, expansion in revenues, and increase in foreign exchange receipts. This is expected to come, in great measure, from the structural transition towards a more competitive manufacturing sector, developing future and innovative industries and become a regional and even global trade and logistic hub. This is also likely to be driven, in part, by continued growth in Rwanda's minerals and extractives, textile, construction and agro processing sectors where Rwanda has built a comparative advantage. Such a transition must necessarily be underpinned by extensive climate resilient infrastructure

development to support green industry and trade, providing both the vast low carbon energy requirements and connectivity required for raw materials or inputs to support transformation into processed and value-added outputs, and the movement of goods and people to markets.

Rwanda is cognizant, however, that such industrial and trade growth should not come at the expense of the natural capital base that underpins it. In a world that is increasingly moving towards a circular economy paradigm and prioritizing the need to operate within the planet's carrying capacity, Rwanda is aiming to be more competitive while ensuring that its industrial and trade growth is resource-efficient, and also ensure that concomitant energy and transport infrastructure is 'green' and environmentally sound.

For this approach to succeed, it is imperative for the private sector to own and drive this vision of green, low-carbon, climate-resilient industrialisation and trade, given the increasingly dominant role that private companies are expected to play in this green transformation journey. Rwandan continues to demonstrate its attractiveness as an East African investment opportunity. Building off this vantage point, will reinforce private enterprise as an influential partner to the government in developing a green economy in a profitable way.. Rwanda will also learn from successful green industrialisation happening in different parts of the world e.g. Norway, drawing inspiration and direction from those countries' green economic transition over the last few decades:

Box 4: Country Case Example – Norway

While initially starting off with light industry (textiles) in previous decades, after independence from Sweden in 1905, Norway industrialised to take on more value-added goods in intermediate industry (agro-processing etc) and heavy industry (machinery and equipment) for the growing its hydropower capacity. During this, labour was mostly absorbed by intermediate industry (Economic History Association, 2010). After the second world war, Norway had more centralised economic planning and social programmes to ensure inclusive growth. This allowed the country to increase its human capacity, adopt technologically advanced methods and strengthen its institutions.

When industrialisation was beginning to unravel, there was the discovery of oil in the beginning of the 1970s. With private companies driving this process, while respecting 50% state ownership (Norway's Ministry of Petroleum and Energy, 2020). The state-owned entity, Statoil was formed in 1972. In the 1980s, the centralised planning was abandoned but the social programmes and public good consideration in economic policy were kept. With market forces being slowly considered, interest rates were still set and kept lower than market rates (Economic History Association, 2010). This allowed the creation of a services sector along this boom. In the 1990s, Norway developed its telecommunications industry meet domestic needs and export ICT goods (World Data, 2020).

With expanding electricity power generation from renewable sources, the country managed to not only meet its domestic demands but it exported the energy (Planete Energies, 2015). In the 1990s, two state-owned entities were formed one to control power generation and the other power transmission. By the middle of the

decade, it was now partnering with Sweden in terms of power market, this expanded to inclusion of all Nordic countries. By the 2000s, the power grid was connected underwater to the Dutch's. In the 2000s, state owned entities were listed and some sold stake to private sector to increase competitiveness (Norway's Ministry of Petroleum and Energy, 2020). The Norwegian sovereign fund committed and began to invest in green projects in the 2010s and in 2015 ceased funding any coal-based projects (Planete Energies, 2015).

Rwanda can build on similar fundamentals to Norway which will ensure that the vision of the GGCRS is implemented by 2050. In particular, investment in education and ensuring training and skills development in relevant green economy areas must be prioritised. Furthermore, at least 60% of the electricity generated in Rwanda today is from renewable sources (RURA, 2020) and the aim is to maintain this until 2050. It can be pursued alongside Rwanda's investment in renewable energies (such as hydropower) and increasing electricity capacity to meet domestic demand and export to neighbouring countries. This building of human capital will ensure a smooth transition between second and third generation, while also opening up Rwanda to leading the region when it comes to green energy technologies and exporting electricity to its neighbours much like Norway.

In the long term, Rwanda will position itself at the forefront of green technology and industry such as nanotechnology, biotechnology, block chain technology, robotics, and artificial intelligence. Alongside creating highly skilled and specialized jobs in advanced green technologies, The Rwanda Vision 2050 advises to consider job creation in high value-added products and services, resulting from the specialised extension services in agriculture, knowledge-based services in IT and finance, aviation, and light manufacturing (Republic of Rwanda, 2020). As the Vision 2050 envisions, Rwanda could become an exporter of knowledge and technology services: fin-tech, edu-tech, energy-tech, agri-tech, big-data management, pharmaceutical tech, biotech, cyber-tech etc. (Republic of Rwanda, 2020). Inclusive, modern, and effective energy and transport systems investment would be complimented by investments Rwanda has sought already in public transit, green transportation, and e-mobility programmes with pursuing ambitious low-carbon energy infrastructure and aspiring to be 100% renewable Therefore, the Vision 2050 urges that key developments in green technology and digitalisation of service systems will be important considerations for implementing these measures to ensure efficiency, and maintaining an affordable cost services in Rwanda's cities (Republic of Rwanda, 2020).

Under this thematic programme area, there are two Programmes of Action (PoAs) that are designed to support green and climate-compatible growth in Rwanda:

- **PoA 1.1: Low-carbon, climate-resilient energy and transport networks**
- **PoA 1.2: Green industry with private-sector stewardship**

Each of these Programmes of Action comprises of several Strategic Interventions (SIs). The SIs serve as specific priorities for designing and directing investment in green industrialisation and trade.

PoA 1.1 Low-carbon, climate-resilient energy and transport networks

SI 1.1.1 Increasing renewable energy in the generation mix, including with private sector investment

Rwanda will advocate the rollout of renewable energy in Africa, and use the opportunity to capitalise on innovations in the deployment of renewable energy. This renewable energy acceleration will be driven by private companies working in the energy sector. While half of Rwanda's energy production is already based on renewables, the government's desire to attract investment and grow the sector is part of a concerted move to sustainably provide clean energy, and ensure technological transfers of renewable power generation that could potentially assist the country bypass old technologies in its effort to transform itself into a highly skilled service-sector oriented market.

Over the next 30 years, Rwanda will grow the share of renewable energy including hydro wind, solar, and geothermal as more significant contributors to its long-term generation mix. These also have high potential to drive green job creation and economic development.

Looking ahead, Rwanda will take measures to link into a regional renewable energy grid in the long-term, and will explore opportunities to tap into power from a range of diverse sources. Rwanda is currently a member of the Eastern Africa Power Pool and Pool Energetique De L'Afrique Centrale, with interconnection of African Power Pools under the African Union, already has numerous regional projects under development and in the pipeline. Rwanda is also already interconnected with the East African Community. Rwanda will leverage these interconnections and expand them. In the medium-to-long term, Rwanda will explore the possibility of linking into a future renewable regional grid.

Sector	Lead Ministry	Implementing Entity	Focus Area
Energy	MININFRA	REG, EPD	Mitigation ✓
			Adaptation
			Green Growth

SI 1.1.2 Increasing access to reliable low-carbon energy to boost urbanisation and mobility

The provision of consistent and low carbon energy supply to key sectors is essential to achieve Rwanda's economic growth ambitions. The generation, transmission and distribution strategies for major economic sectors will thus be carefully planned, leveraging on opportunities within each sector to transition to low-carbon options as soon as possible. Two of the sectors where energy demand will grow the most, and therefore needs to be met to the greatest extent by reliable, low-carbon energy, are the urbanization and transportation.

This intervention focuses on providing the energy options and infrastructure to facilitate the transition to low-carbon and sustainable modalities within these two sectors. This will include prioritising the extension of the renewable energy grid and infrastructure networks to Kigali, satellite and secondary cities and key transport nodes, as well as increasing access to electric mobility and low carbon fuel sources for sustainable urban development and transport .. Improving the availability of low carbon energy and infrastructure to cities and

transport is essential to enabling specific sectoral transitions to sustainable urbanisation and mobility in Rwanda.

Sector	Lead Ministry	Implementing Entity	Focus Area
Energy	MININFRA	REG,EPD, RTDA	Mitigation ✓
			Adaptation
			Green Growth ✓

SI 1.1.3 Expanding sustainable initiatives and climate resilience in regional transport networks, freight, and logistics

To achieve the vision of becoming a regional trade & logistic hub, and increasing domestic and cross-border economic activity, Rwanda will reduce freight and logistics costs while increasing the efficacy of such transport networks. Bearing in mind the objectives and vision of this strategy, these networks will be built and expanded in a climate resilient and sustainably manner. Implementing sustainable initiatives within freight and logistics networks (such as efficient routing protocols) will decrease the negative impact of various value-chains on the natural environment and result in overall avoidance of transport-related GHG emissions. These freight and logistics networks within which sustainability measures will be integrated include the proposed railway transportation system in Rwanda, as well as air transport for freight and logistics.

At the same time, sustainable initiatives within such networks will also increase the robustness of such infrastructure to future climate change (such as flooding impacts), and will in turn be designed and planned in a manner that allows them to become fundamental tools for population resilience to climate change.

Sector	Lead Ministry	Implementing Agency	Focus Area
Transport	MININFRA	RTDA, RCAA, MINICOM, RDB/PEZ	Mitigation ✓
			Adaptation ✓
			Green Growth

SI 1.1.4 Promoting integrated, multimodal transport systems with modern information and knowledge management capacity

A recurring feature across developed economies is the presence of reliable, integrated, multi-modal transport systems. Improving access to goods and trade for both imports and exports is imperative to achieve both economic and green growth. Rwanda will develop such integrated, multi-modal transport systems, not only to facilitate the movement of people (predominantly through public transit), but also as an impetus to regional, cross-border trade. Key low-carbon components of this intervention will include developing rail transportation networks for both passenger and freight usage, ensuring connectivity and integration with existing modes of public transport in terms of the passenger network, as well as coherent and integrated linkages to freight transport, and (ii) developing inland waterways transport, including the development of ports on Lake Kivu. These components will enhance both supply chain efficiency, and the carbon intensity of the regional freight network

As Rwanda develops and rolls out such an integrated multi-modal transport network, it has an opportunity to use advanced, cutting-edge information and communication technology (ICT) tools that vastly improve the reliability and efficiency of transport fleets. Guided by Rwanda's ICT Hub Strategy and the SMART Rwanda Master Plan, this includes the introduction of smart cards and contactless payments on public transport vehicles, geo-location-based apps that provide real-time information on arrivals and departures, and other digital fleet management technologies. Multi-modal transportation systems enhanced with information and knowledge management technologies will have a significant impact in terms of climate change mitigation, through fuel efficiency, and fuel-switching, Smart systems could also play a key role in adaptation, ensuring preparedness and responsiveness in the face climate impacts and disasters.

Sector	Lead Ministry	Implementing Agency	Focus Area
Transport	MININFRA	RTDA, RISA, PSF	Mitigation ✓
			Adaptation
			Green Growth ✓

SI 1.1.5 Assuring universal access to energy through reliable grid connectivity

Rwanda aims to ensure universal access to electricity by 2024, with roughly half of such access from on-grid connectivity and half from off-grid sources. The intent is to provide both urban and rural dwellers with access to reliable and cost-effective electricity. Achieving this will require significant development in the generation, transmission and distribution capacity of the country.

Beyond more renewable energy generation (noted in SI 1.1.1) realizing this goal will require substantial scale-up in the transmission of energy to the grid and the ability to dispatch that electricity to end-users and consumers. Inadequate transmission and distribution networks lead to constant congestion and curtailment issues, which affect the economic viability of projects. Private investors would be reluctant to build power plants if electricity from their projects will be curtailed due to congestion. Rwanda will therefore match on-grid generation capacity with transmission and distribution capacity, and leverage off new technologies to utilise smart and intelligent systems, optimising for energy management and efficiency.

The country is making rapid strides with the proposed Rwanda Universal Energy Access Program (RUEAP), that will cover four components of energy access: 1) investment in grid connections for households, commercial and industrial consumers, and public institutions, 2) improving grid reliability and efficiency, 3) advancing off-grid energy and clean cooking, and 4) providing technical assistance, capacity building and implementation support.

The increased provision of electricity to all, in addition to its social benefits, will also support key industries, catalysing green, economic growth. Beyond 2024, Rwanda will focus on energy security.

Sector	Lead Ministry	Implementing Agency	Focus Area
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Energy	MININFRA	REG	Mitigation
			Adaptation
			Green Growth ✓

PoA 1.2 Green Industry and Private Sector Participation

SI 1.2.1 Greening SEZs and industrial parks

Rwanda is actively developing SEZs and provincial industrial parks in different parts of the country as per the National land use and development masterplan. These industrial sites are being designed and developed as models for integrating green infrastructure, including energy efficient technologies, wastewater re-use and recycling, solid waste management systems, air quality management systems and design, and low carbon and energy efficient building design as stipulated in Rwanda green building minimum compliance guidelines. Circular economy principles will be embedded within the operations of the SEZs. Achieving this objective in the SEZs and provincial industrial parks will require awareness raising, capacity building, facilitating joint efforts with the private sector to turn industrial parks into eco-industrial parks, and will also require effective systems to be put in place to monitor and report the environmental performance of such SEZs and industrial parks, to ensure that the green mechanisms on-site produce the outcomes desired. The design and layout of industrial parks will be environmentally sensitive, using nature-based solutions and ecosystem management to reduce and/or recycle waste, improve adaptive capacity, and minimise resource inputs through efficient processes and clean cooling as per National cooling strategy. The SEZs and Industrial parks will serve as industrial symbiosis examples to promote resource efficiency throughout Rwanda's economy.

Sector	Lead Ministry	Implementing Entity	Focus Area
Industry	MINECOFIN	NIRDA, RDB, ACEs, REMA	Mitigation ✓
			Adaptation
			Green Growth ✓

SI 1.2.2 Increasing finance for green technologies in industries to raise productivity

One of the major impediments to the adoption and scale-up of green technologies in the industries and manufacturing sector is the lack of finance for such investments. Rwanda has recognized the need for suitable financing mechanisms and facilities to acquire, transfer and adequately supply green technologies. Initial steps to facilitate access to finance have been taken, such as the proposal in the draft Industry Development Policy to introduce climate mitigation financial incentives. Incentives could inspire industries to seek supply from many sources. Other funding opportunities could include finance from the Export Growth Facility, grants or loans from FONERWA, and funding from the National Council of Science and Technology to support applied research innovation projects on cleaner production systems.

It is crucial that private finance be tapped and secured to finance green technologies in industry, especially those that increase productivity and resource-efficiency. Rwanda will explore options to raise levels of such private finance through innovative financial instruments.

Sector	Lead Ministry	Implementing Agency	Focus Area
Industry	MINECOFIN, FONERWA	NIRDA, RDB	Mitigation
			Adaptation
			Green Growth ✓

SI 1.2.3 Strengthening institutional capacity in the industrial sector,

Rwanda will enhance capacity within the industrial sector to pursue the objectives and activities of the GGCRS. Technical and operational capacity to integrate climate change and green growth elements into the industrial sector have been a challenge in the past. In response, this SI will target (i) capacity building for the relevant ministry, affiliated institutions, staff and key stakeholders on green growth and climate resilience concepts; regulatory frameworks; (ii) continuous strengthening and evolution of appropriate policies, strategies, guidelines, laws, and regulatory frameworks on green and environmentally responsible industry; (iii) development and implementation of a monitoring and enforcement mechanism for efficiency and cleaner production measures in the industry (linked to the joint sector review process); and (iv) building the financial capacity of institutions responsible for greening and resource-efficiency in industry.

The institutions that will be the focus of this capacity building include the National Industrial Research and Development Agency (NIRDA) and the Rwanda Standards Board (RSB). In particular, capacity enhancement will be focused on Rwanda's Cleaner Production and Climate innovation Centre (CPCIC), which has been proposed a source for technical support to industries to promote cutting-edge, modern access to green technologies and business services for enhanced productivity, for circular economy initiatives (including industrial symbiosis and recycling), climate resilience measures within industry, and to boost overall competitiveness and environmental compliance in Rwanda.

The objective of CPCIC is to ensure that all technology, processes and service choices made by the industrial private sector and the public sector embrace best practices in terms of climate change resilience and cleaner/efficient production. The CPCIC will also guide national policies and strategies on industries, oriented towards climate change resilience, the circular economy, and clean/efficient use of resources. For the industrial sector to internalise and translate the objectives of the GGCRS into practice, the role of the CPCIC will be crucial. Thus, its organisational set-up and capacity will be a priority.

Sector	Lead Ministry	Implementing Agency	Focus Area
Industry	MINECOFIN, MINICOM	NIRDA, RSB, CPCIC	Mitigation
			Adaptation
			Green Growth ✓

SI 1.2.4 Greening the Mining Sector to ensure sustainability and responsiveness to the Green Economy

Climate, green growth, and environmental considerations are being integrated in the mining industry's operations and must be part of this sub-sector's transformation. This will be built into the overall structural economic transformation that mining in Rwanda needs to undergo. Local efforts to improve value addition will ensure that revenues are sufficient to divert surplus funds towards environment protection. The GGCRS seeks to help local industry to add meaningful value that enhances their ability to raise sufficient capital to scale-up or technologically improve operations. If the mining industry is to become sustainable, the current government policy of industry consolidation, industry modernisation and value addition will have to be achieved. This offers an opportunity to embed green technology, social and environmental safeguards, and improved sustainability within the modernisation and consolidation efforts in the mining sector.

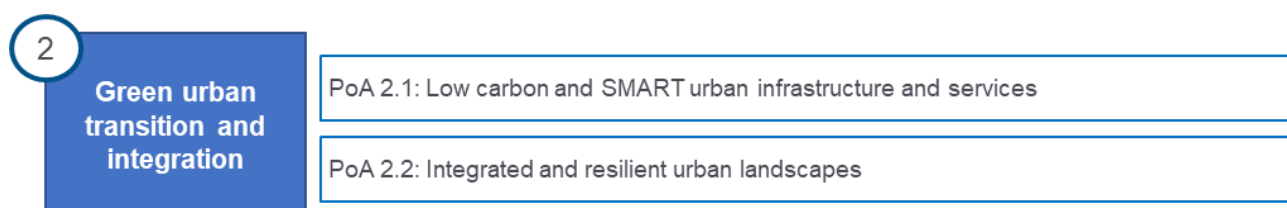
Rwanda will ensure that its mining industry adopts adequate, responsible, and forward-looking measures that support green growth and climate resilience. Such measures would include, for instance: (i) applying for a water use permit (this is already a requirement for some water users, and would be extended to all mining entities); (ii) storing, recycling and reusing water as a way to conserve it and also to reduce water pumping costs; (iii) Containing water on site to prevent such water eroding land and silting rivers; and (iv) Carrying out water harvesting from the mine site and processing site buildings; (v) avoiding deforestation. Activities may also include (1) improved mining techniques (2) Developing policies to rehabilitate abandoned mining sites, including holding responsible parties liable and incentivizing investment in reprocessing waste (3) Developing a coordinated approach to improving environmental performance in the mining sector, drawing on international conventions and agreements as valuable conduits for standards, coordination and information, (4) Internalization of the cost of environmental externalities associated with mining operations, (5) Implementing innovative finance mechanisms/instruments, such as PES, to upscale restoration country wide in the mining sector, (6) Develop, monitor the implementation of long-term mine closure plans to ensure risks such as subsidence, mine waste and mine fines storage stability, acid drainage is adequately addressed, and (7) Attracting investors who demonstrate the use of best international practices and green technologies to the betterment and modernization of the responsible mining sector development.

Through the adoption of green and efficient technologies – and Resource Efficient and Cleaner Production (RECP) procedures – as part of the mining sector's development, small-scale mines will be better placed to undertake value-addition. Greening measures include the use of renewable energy and energy efficiency, as well as circular economy approaches for water re-use and recycling. These will be accompanied by increased management training to ensure implementation and monitoring capacity, and low carbon technologies.

Sector	Lead Ministry	Implementing Agency	Focus Area
Mining	MINICOM, RMB	RMB, RMA	Mitigation ✓
			Adaptation
			Green Growth

2. GREEN URBAN TRANSITION AND INTEGRATION

Sustainable and smart development of well-serviced cities, towns, and settlements, to maximize the socio-economic benefits of agglomeration while ensuring urban landscape resilience and quality of life.



Thematic Programme Area 2: Green Urban Transition and integration consolidates programmes of action that support the agglomeration of people into cities, towns, and rural settlements, linking them to green economic opportunities and climate resilient services.

Rwanda has been steadfast in its commitment to urbanisation. By 2050, Rwanda aims to have an urbanisation rate of 70%, and envisions over half the country's population living in urban areas by 2035. To achieve this significant leap from the current (2020) levels of urbanisation of less than 20%, Rwanda will be undertaking the mammoth task of building vast amounts of urban infrastructure in cities, towns, and even rural settlements. Such infrastructure – including housing stock, water and sanitation services, power systems, and transportation networks – must be capable of absorbing and catering to successive waves of Rwandans who will relocate from the hinterland to settlements in pursuit of opportunities and to help fuel the country's economic engine as it transforms into a services-driven knowledge economy.

Rwanda's ambitious plan to reshape the country's urban profile is an opportunity to integrate sustainability, green growth, low-carbon development, and climate resilience into the urban agenda. Given the current baseline and the extent of growth to come, there is also an opportunity to leapfrog and build cities that are not merely adequate for contemporary times, but to adopt forward-thinking and cutting-edge technologies to build 'cities of the future.' A crucial element of this will be to ensure that Rwandan urban settlements do not repeat the mistakes of many developing nations, such as sacrificing urban forests and greenery, depleting urban biodiversity, and losing ecosystem-based services that can support a rich and balanced quality of life. Rwanda's approach to urban development should enable built landscapes and advanced ICT systems to be in sync with natural resources and nature-based livelihoods.

Rwanda may consider South Korea as a useful example to learn from their particular urban transition and innovative pathway toward green, smart and digitally transformed cities:

Box 5: Country Case Example - South Korea

One of the first countries to adopt green growth as a national strategy, South Korea is leading with green cities. At Songdo, residents use public transport fuel by renewable energies or share taxis, energy loss and pollution are reduced, with grey water being recycled (World Bank, 2012). The city has solar panels almost everywhere and parks and natural spaces.

In the 1960s cities began sprawling and new ones like Ulsan were created by the government. (Kang, 2014) With modernisation and industrialisation accompanying the urbanisation, the government invested heavily in human capital and strengthening institutions and governance. In the 1970s, the greenbelt (greenery) was created around Seoul to ensure better air quality and water supply. In the 1990s, the city adopted the U-city concept to ensure that internet access was increased. This was strengthened in the 2000s to ensure that services could be readily accessed anywhere using ICT. The u-city concept ensures smart and green cities.

Rwanda has already laid the foundations to follow a similar urbanisation process to South Korea. By ensuring compliance with the green building system, prioritising urban greenspace and resilience to climate impact through green liveable cities, Rwanda's cities can become and remain vibrant and healthy agglomerations of human and technological capital to drive the country's green agenda.

In the long term, Rwanda will seek to pioneer the adoption of smart metering to ensure efficient utility operations to support a green urbanisation transition. A fundamental component of the development of this technology must be using it toward developing human capital. Rwanda will seek to achieve its ambitions around universal access to financial services, with 100% financial inclusion as well as universal broadband access by 2030 (Republic of Rwanda, 2020). The delivery of these services is also supported by assuring safe, affordable, and decent housing for all (Republic of Rwanda, 2020). Ensuring technological transfers of renewable power generation could potentially assist the country “leap-frog” old technologies in its effort to transform itself into a highly skilled service-sector oriented market. While exportable, service-oriented jobs centred on the knowledge economy are critical for Rwanda's green-growth future, the country will ensure inclusivity more actively in the job market by skilling new internal migrants and poorer residents with better quality jobs in city greening and nature-based solutions as one option

Under this thematic programme area, there are two Programmes of Action (PoAs) that are designed to support an integrated and green urban transition in Rwanda:

- **PoA 2.1: Low-carbon and SMART urban infrastructure and services**
- **PoA 2.2: Integrated and resilient urban landscapes**

Each of these Programmes of Action comprises of several Strategic Interventions (SIs). The SIs serve as specific priorities for designing and directing investment in integrated and green urban development.

PoA 2.1 Low-carbon and SMART urban infrastructure and services

SI 2.1.1 Implementing Rwanda's Green Building Minimum Compliance System

One of the most important ways in which Rwanda has supported the attainment of the green growth agenda is through green building standards for large commercial buildings, buildings used for public administration, cultural buildings, education buildings, and health facilities. Stipulations in the Rwanda Building Code (RBC) – under which green building standards are included – ensure compliance of new buildings to internationally recognized environmentally sustainable building standards. These contain a greater emphasis on efficient resource use, improved ventilation, and the use of locally manufactured building materials. These interventions are expected to reduce future greenhouse gas emissions, as all new large commercial buildings will be required to comply with the RBC. Importantly these standards can also guide retrofitting older buildings and capitalise on the low hanging fruits in existing public buildings to reduce energy consumption, promote water efficiency and sustainable waste management in existing buildings. When this action is implemented at a country-wide scale the way existing buildings are operated in Rwanda can be transformed. This action also has potential to create green jobs, raise interest for new green technologies.

The existence of the code is the first major step in this direction, but concerted effort will be needed to ensure consistent, effective, and rigorous implementation. Rwanda will therefore invest in systems to ensure adoption and compliance because the regulation of businesses and developers must be equalled by demonstration of leadership in the RBC's application for public buildings. Green buildings also have improved adaptive capacity to temperature increases and disasters.

Sector	Lead Ministry	Implementing Agency	Focus Area
Urbanisation	MININFRA, MINALOC, MoE	RLMUA, LODA, RHA	Mitigation ✓
			Adaptation
			Green Growth

SI 2.1.2 Providing for high quality, affordable housing that is green and climate resilient and leverages urban density

Rwanda's emphasis on high density settlements and mixed-land uses in urban policy has also been manifested in revised master plans. These master plans, which have been implemented in Kigali as well as secondary cities, include land-use plans and other sectoral plans that reflect cities' commitments to densification, mixed-land use and, more broadly, reduced carbon emissions. To avoid the inefficiency in land use, there is a need to strategically provide serviced land start from urban pocket lands for infill and implement Planned City Extension programmes.

Additionally, the Government of Rwanda will be introducing a number of schemes to ensure that affordable housing is within reach of the majority of the population. This will include the operationalisation of the new affordable housing fund created in the BRD to enable investors to borrow money at discounted rates if they construct affordable dwellings, and a new mortgage finance facility which will allow potential homeowners to

obtain mortgages at subsidized rates. Focus should also be placed on research and promotion of green and local construction materials.

Such efforts to provide for high-quality and affordable housing, and to translate master-plans into on-the-ground development that maximizes the benefits of mixed-use dense settlements will continue to be scaled up using the Made in Rwanda construction value chain. High quality and densified housing settlements also constitute a low-carbon development intervention that reduces the requirements for energy for transport and services. The housing that will be developed must itself be resource efficient and climate resilient to improve future residents' adaptive capacity to climate impacts. While the GGCRS cannot dictate housing policy, it should prioritise densification and climate resilience in housing, and continue to seek innovative finance solutions that assist the overcoming of affordability issues.

Sector	Lead Ministry	Implementing Agency	Focus Area
Urbanisation	MININFRA, MINALOC	RHA, LODA	Mitigation ✓
			Adaptation ✓
			Green Growth

SI 2.1.3 Creating and preserving rewarding and tradeable off-farm jobs

Service sector jobs are a major path to green growth through the development of a service and knowledge economy, as opposed to one built on extractive industries. Official statistics indicate that employment in off-farm jobs has steadily increased nationally since 2017, although it is unclear whether these jobs are in highly productive sectors. To promote increased creation and preservation of productive, service-sector jobs, the Rwanda Development Board has issued a new National Skills Development Employment Promotion strategy 2019-2024 with the aim of developing skills, increasing productivity and generating employment in off-farm job sectors. It will be important to ensure that this new effort to accelerate job growth also consciously creates green jobs, i.e. jobs with meaningful remuneration in environmental sectors such as clean energy, environmental services, sustainable industry, eco-tourism, and natural resource management etc. An expansion in such livelihoods and income-generation opportunities will contribute both to socio-economic resilience, as well as higher value placed on environmental conservation and management. Furthermore, the expansion of the skills for these livelihoods is critical for the transition to a knowledge-based economy that is anchored in the green industrialisation and technological transition of the urban fabric. FONERWA is developing innovative instruments that include incubators, accelerators and green guarantees as well as the Rwanda Green Investment Facility in partnership with Development Bank of Rwanda which may also stimulate such employment creation.

Sector	Lead Ministry	Implementing Agency	Focus Area
Urbanisation	MINECOFIN, MIFOTRA, MINALOC	LODA, FONERWA	Mitigation
			Adaptation ✓
			Green Growth ✓

SI 2.1.4 Accelerating the transition to green public and passenger transit

Improving public transport services is imperative for climate change mitigation, as well as to support population resilience (through greater and more reliable mobility). The Final Transport Sector Policy and Strategy for the National Strategy for Transformation (NST1) envisions a number of projects that will facilitate more robust public transit in Rwanda. These include: (i) implementation of Dedicated Bus Lanes (Ms); (ii) bus priorities at designated intersections; (iii) demand and supply management approaches; (iv) application of route franchising approaches; and (v) formalisation and integration of infrastructure, schedules, fares and systems.

As Rwanda's cities grow, there will be a growing need for public transport systems to not only provide the required mobility for the growing population but also to provide an alternative to the private vehicle. Without such reliable public transit systems, greenhouse gas emissions are likely to increase exponentially alongside private vehicle usage. Conventional air pollutants will also increase with unabated growth in private passenger motor vehicles. Rwanda will prioritize public transport in cities to ensure urban growth remains consistent with the objectives of green, low-carbon, and climate-resilient growth.

Rwanda will seek investments in public transit and green transportation as it weans itself off dependence on petroleum products, both to contribute to climate change mitigation and to improve air quality. This will include implementation of a Bus Rapid transit in the city of Kigali and the support of the uptake of electric vehicles and e-mobility more broadly. In addition, secondary cities in Rwanda will continue to promote the use of electric buses and passenger vehicles, while also piloting the use of electric motorbikes, through public private partnerships. In particular, the recent growth of e-mobility presents an opportunity for Rwanda to leapfrog regional, or continental counterparts in the deployment of electric vehicles, with focus on electric motorcycles and the public transport system.

Given the country's hilly terrain, Rwanda – and Kigali city in particular – will also explore the possibility of using cable cars. This is a technology that has been deployed in other parts of the developed world and is gaining traction given the potential for low carbon emissions – many cable cars are fuelled by solar panels – and opportunities to move transport away from buses and other motorized vehicles, which has the added benefit of easing traffic and congestion in urban centres.

Sector	Lead Ministry	Implementing Agency	Focus Area
Transport	MININFRA	RTDA	Mitigation ✓
			Adaptation
			Green Growth

SI 2.1.5 Adoption of Smart approaches for municipal service management in Green Cities to achieve resource efficiency at the City Level

Rwanda's Vision 2050, the Smart City Rwanda Master Plan, and the urban sector's strategic plans all envision the emergence of 'smart cities' across the country. Rwanda's intends for its smart cities to use data-led management and planning, efficient community-based infrastructure and services, and localized and shared

innovation to support the creation of compact, connected, socially inclusive and resilient cities. Rwanda will take advantage of digitisation of land use to inform Master Planning and implementation as well as increasing efficiencies in providing basic amenities.

For this vision to be realized, there is a pressing need for investment in research, development and piloting of smart water supply and sanitation approaches, amongst a range of necessary smart systems. To this end, Rwanda will pursue a twofold approach: (i) identifying cost effective, energy efficient, and environmentally sound water treatment processes for differing domestic and industry uses in urban environments; and (ii) improving water demand management in urban contexts – focused both on supporting administrators in more efficient planning, management, billing and empowering households through water efficiency and cost saving measures. Illustrative measures that will be implemented include Smart water supply networks; smart water metering; optimization of the integrated WASH Management Information System (MIS); an urban underground connected ‘internet of things’ (IoT) network for wastewater monitoring; and technology-based filtering of harvested rainwater, amongst other smart, digital, ICT based options. Rwanda has a significant opportunity to be an African leader in these technologies as an important green growth economic export.

Rwanda has already adopted several city-level initiatives that use smart technology, such as the use of solar street lighting across Kigali, and is also exploring options for smart technology use for wastewater treatment and sustainable solid waste management. There are major opportunities to implement circular economy innovations, recycling, waste to energy and efficient, labour intensive separation processes to effectively manage municipal solid waste. Pilot projects have already demonstrated a marked improvement in resource-efficiency, and reduction of environmental impacts. The government aims to scale up such pilot initiatives, which would entail a range of interventions in water, electricity and solid waste management to ensure the efficient delivery of critical urban services. Although electricity is always provided using pay-as-you-go meters installed in each dwelling, other technological innovations that allow water to be treated on-site or solid waste to be efficiently managed, or recycled and used for other purposes are options that Rwanda can explore. Additionally, the use of security cameras and other automated detection systems are critical for ensuring the long-term peace and stability of the country.

Rwanda will pursue the expanded use of smart city technologies across all public spaces in urban settlements, to enhance urban resilience, improve efficiency of resource use, mitigate climate change, and ensure the safety and security of city residents.

Sector	Lead Ministry	Implementing Agency	Focus Area
Urbanisation & Settlements, WASH, Waste, Wastewater	MININFRA, MINALOC	RTDA, LODA, WASAC	Mitigation ✓
			Adaptation ✓
			Green Growth ✓

PoA 2.2 Integrated and resilient urban landscapes

SI 2.2.1 Agglomeration, Densification, Mixed Use and Multifunctional Urban Spaces

Recognising the primacy of Kigali as the national growth engine and acknowledging the need for viable opportunities and sustainable development of secondary cities, Rwanda will manage urbanisation as a system of cities (Roadmap for Green Secondary Cities, 2015; RUDP II, 2020). Part of this urban management must be the strategic design of city layouts to encourage agglomeration and densification, and enable mixed use and multi-functionality of urban spaces. Acknowledging that cities and environment are interconnected, a comprehensive approach is needed for managing risks across the natural and built environment. Such an approach responds to the connectivity between land, water and waste in cities, and aims to demonstrate the complementarity and integration of grey infrastructure and nature-based solutions (or green infrastructure) that can be replicated across the country. Precinct planning and mixed-use zoning will be essential to integrating and transitioning urban landscapes to green liveable and multi-functional spaces.

Sector	Lead Ministry	Implementing Agency	Focus Area
Urbanisation & Settlements	MINALOC, MoE	LODA, REMA	Mitigation
			Adaptation ✓
			Green Growth ✓

SI 2.2.2 Greening urban landscapes and layout through green spaces and urban agriculture

Rwanda has increasingly affirmed the importance of open and green spaces to ensure sustainable urbanism. For instance, Rwanda's NDC (2020) discusses the importance of open and green spaces in both Kigali and secondary cities as a way of increasing the country's surface area of carbon sinks. In secondary cities specifically, the National Roadmap for Secondary cities explicitly stipulates that required green space areas must meet World Health Organisations (WHO) standards, while highlighting the benefits of green areas in controlling flooding, heat island effects and greenhouse gas emissions.

Rwanda will prioritize the development of green urban spaces and urban green infrastructure (such as wetlands), including through urban agriculture (urban farms, community gardens etc.), to contribute to climate change mitigation, and to elevate urban residents' quality of life through access to green recreational areas, and contribute to improving adaptive capacity.

Sector	Lead Ministry	Implementing Agency	Focus Area
Forestry and Land Use	MoE, MINALOC	REMA, LODA	Mitigation ✓
			Adaptation ✓
			Green Growth ✓

SI 2.2.3 Improving disaster resilience through integrated urban stormwater and drainage management

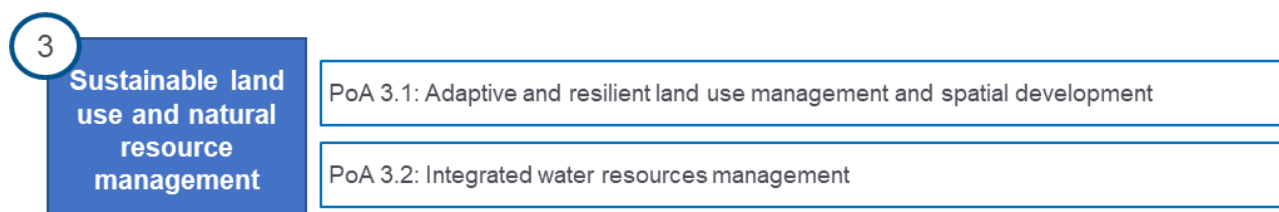
As a key factor affecting human and natural capital in urban settings, and a conditional measure in Rwanda's NDC (2020), improved stormwater management requires targeted investment. The 2020 - 2050 National Land-Use and Development Master Plan (NLUDMP) stipulates that stormwater management approaches should consider the use and retention of urban wetlands as collection points and filters for stormwater from the urban areas, based on the fact that wetlands are part of the "green infrastructure" of healthy catchments and provide a multitude of ecosystem services especially in urban areas (through the preservation of open and green spaces, urban agriculture interventions, etc.).

Such integrated storm water drainage and management and nature-based solutions, also highlighted in Rwanda's Strategic Plan for Climate Resilience (SPCR), will comprise both soft and hard elements: (i) strengthening of the regulatory enabling environment; and (ii) infrastructure development, i.e. building of urban stormwater and drainage infrastructure, as captured in Management Plans. This must be guided by building codes that ensure integration of local drainage infrastructure into broader urban land use plans. Construction practices of on-site storm water management should be promoted and enforced. The private sector will have to be a key role player in supporting improved stormwater management, with the primary responsibility for financing and building a major portion of local drainage infrastructure inside privately owned premises.

Sector	Lead Ministry	Implementing Agency	Focus Area
Water Resources	MININFRA	RWB, RTDA, LODA, REMA	Mitigation
			Adaptation ✓
			Green Growth

3. SUSTAINABLE LAND USE AND NATURAL RESOURCE MANAGEMENT

Strategic spatial planning tools and intelligent information and knowledge management systems to inform and implement effective land use and natural resource management, for resilient landscapes and communities



Thematic Programme Area 3: Sustainable Land Use and Natural Resource Management consolidates programmes of action that drive appropriate spatial development of land use considering natural resources availability and constraints, and disaster risk reduction.

Rwanda's natural capital is the foundation on which its ambitious economic growth will be built. As the country pursues unprecedented levels of economic growth, it must not deplete this valuable capital or damage it beyond repair. Maintaining the health and performance of natural systems will not only ensure the continued provision of ecosystem services, but it will also allow Rwanda a wider range of choices for its economic model in coming decades, including the possibility of positioning itself as a nature-based, ecologically-responsible economy that operates sustainably with minimal impacts on larger planetary systems.

Moreover, sound management of natural resources such as land and water is crucial for landscape restoration, safety and stability, to allow for the physical security of communities from natural disasters brought on by soil erosion or flash flooding, and exacerbated by climate change impacts on the hydrological cycle. Sustainable land use and resource management will require not only robust strategy and planning instruments, but it will also require reliable, real-time, actionable data and information that supports sound decisions. Rwanda has an opportunity to put in place sophisticated ICT and GIS capabilities to advance land use planning and management, in an integrated manner that allows for information-sharing and enables a more complete spatial understanding of land use change and its impacts.

Bhutan is an international example of a country who has taken great strides with prioritising their natural and cultural capital to support a vibrant green economy. Rwanda may consider insights from Bhutan's pathway to sustainable land use and natural resource management.

Box 6: Country Case Example - Bhutan

Bhutan has high end tourism sector. Part of the attraction to the country is the conserved forests. That is, eco-tourism that is based on natural capital (scenery of the mountains and forests). This is also coupled with the country's cultural heritage (history and monarchy) and green transformation driven by renewable energies

(such as hydro power), non-carbon economy (making use of electric cars). There is also a constitutional mandate to uphold and preserve its natural capital.

The government in Bhutan took an active role in encouraging targeted tourism to the country with the signing of legislation in 1971 and there were 287 tourists the following year (Tourism Council of Bhutan, 2019). The main offering was the rich culture and history of the country with the scenery that was well preserved. This was the cornerstone in the development of an eco-tourism sector. The Bhutan Tourism Corporation managed the sector (Chen-Ray, 2020). In the 1990s, the country adopted the concept of Gross National Happiness (GNH) which enabled it to continue marketing itself as high-end leisurely destination that is environmentally-friendly (Tourism Council of Bhutan, 2019). That meant there was a constitutional mandate to maintain 60% forest cover. It was also in this decade that tourism began being privatised (Tourism Council of Bhutan, 2019). In the 2000s, volume tourism began taking hold of the sector.

In 2010, there were efforts to get the tourism sector which was regressing back on track. As part of this in 2018, the government with donors came up with the Bhutan for Life, a fund with \$43 million from the donors and \$75 million (to be contributed over 14 years) from the government for protected areas where eco-tourism and organic farming. At least 51% of the country's land is now protected area (WWF, 2020) and 70% of the country is forest cover (IRENA, 2019). By the 2019 there about 1,300 registered tourism companies (Chen-Ray, 2020). The tourism sector was the second biggest sector only after the hydropower in terms of revenue. In 2019, its electricity came from renewable sources: on-grid hydropower of 2092 GWh, Off-grid hydropower of 0.8 GWh and Off-grid solar of 0.2 GWh (IRENA, 2019). It also exported electricity to India.

Rwanda like Bhutan already has ambitions for aspirational natural capital development. For instance, there is already 30.4% forest - which is above the 2024 target of 30% (Rwanda Forestry Authority, 2019). There is also the legislative and policy framework (national forestry policy, forestry sector strategy, the forest investment program, FONERWA among others) that must be implemented to support this development trajectory. Rwanda also has a strong cultural heritage (as seen in Kigali Genocide Memorial, also Rwandan Arts and Culture, and King's Palace). The country already has established strong green transformation with renewable energies (such as hydro power) dominating power generation. It also has strong ambitions of a non-carbon economy such as the use of electric cars. These are strong building blocks that must be maintained to ensure Rwanda's success on this development path.

In the long term, Rwanda will seek to establish itself as a green based knowledge economy which has become decoupled from natural resources. In the short term this requires fundamental shifts in the approach to resource-based sectors, pivoting to focusing on diversified and higher-value product outputs whilst moving to increasing preservation of raw materials and the natural resource base. Building Rwanda's circular economic processes to actively enhance the natural resource base will be central to this programme area. This shift should be accompanied by extensive land, water and natural resource management programmes that improve the resilience of Rwanda's economy to shocks to the natural capital base. These include progressive approaches to ensuring enhanced biodiversity, the prioritisation of water towers, reforestation of degraded lands,

creation vegetation buffer zones along riverbanks and grass buffer strips in farmlands, and upstream watershed protection measures.

Under this thematic programme area, there are two Programmes of Action (PoAs) that are designed to support sustainable land use and natural resource management, both in terms of planning, and physical management of landscapes and resources:

- **PoA 3.1: Adaptive and resilient land use management and spatial development**
- **PoA 3.2: Integrated water resources management**

Each of these Programmes of Action comprises of several Strategic Interventions (SIs). The SIs serve as specific priorities for designing and directing investment in land use and natural resource management.

PoA 3.1 Adaptive and resilient land use management and spatial development

SI 3.1.1 Ensuring integrated planning and monitoring for sustainable land management

Effective implementation of Rwanda's National Land Use Development Master Plan (NLUDMP) requires adopting an integrated approach to planning and compliance monitoring, to ensure sustainable land management and land use. A fully functional Land Administration Information System (LAIS) that is regularly updated and improved will be key to ensuring easy access of information on all land parcels in the country. Moreover, Rwanda's Building Permitting Management Information System (BPMIS) too must be upgraded to be interoperable with other systems, enabling the remote inspection of field developments; it must integrate with that LAIS' spatial component, the Rwanda Revenue Authority, the National Identification Agency, and utilise land-use spatial data, and satellite imageries. The NLUDMP proposes a real-time monitoring using spatial data and Land Use Monitoring system, linked automatically to updated high-resolution ortho-imageries, an upgraded LAIS, as well as BPMIS. All these systems need to be fully operational and interoperable in order to contribute to an integrated environment capable of providing all necessary data for real-time analysis and monitoring and ensuring compliance across sectors and districts.

Moreover, there is need for land management tools and applications to be availed to support a strong community outreach program and mindset change on land use in Rwanda. All levels of the Rwandan community from central and local leadership to households and individual citizens will need to have access to tools and approaches to land use management to ensure integrated efforts. Rwanda will thus organise annual land use and planning forums annually for all stakeholders to discuss land use, planning, and implementation issues, and take collective decisions. This will develop the capacity, ownership and accountability of sectors and local government in land use development and management. Furthermore, the NLUDMP should be a live instrument and therefore its implementation and periodic updates must include the monitoring of feedback from sub-national planning procedures and lessons learned from the field along the way including relying on best practices such as District level land week sessions. Minor amendments to the NLUDMP should be approved periodically by authorized organs.

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MoE, MINAGRI, MINALOC, MININFRA	RDB, RAB, RLMUA, RFA, RWB	Mitigation
			Adaptation ✓
			Green Growth

SI 3.1.2 Developing sustainable sectoral land use strategies and national spatial data infrastructure (NSDI) including an information management and sharing policy

Uncontrolled or poor sectoral land use planning and management has detrimental effects on the ecological infrastructure that supports Rwanda's economy. The development of a strong spatial data management system for sustainable sectoral land use is key to harmonized, sustainable use of the scarce land resources.

Robust sector land use strategies based on a strong and updated National Spatial Data Infrastructure (NSDI) will minimise land resource degradation and misuses such as turning farmlands into settlements. The preparation of District Land Use Master Plans and Sectoral land use development strategies at all levels need to be prepared in a bid to implement the NLUDMP.

Several institutions in the country that have GIS professionals have created spatial data and spatial outputs. However, these spatial data and outputs are stored on private computers where they cannot be easily accessed by the public, and are isolated from other spatial data-sets. A comprehensive NSDI will include establishing a national framework for access to and sharing of spatial data, regulating and coordinating how spatial data could be collected, stored, and shared.

This combination of sustainable sectoral land use strategies and a reliable, integrated NSDI will help generate more information on sectoral land use and development, as well as accurate data on exposure to climate vulnerability of households and infrastructures in high-risk areas, supporting resilience efforts.

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MoE, MINAGRI, MINALOC, MININFRA	RDB, RAB, RLMUA, RFA, RWB	Mitigation
			Adaptation ✓
			Green Growth

SI 3.1.3 Deploying GIS and ICT innovation throughout government, districts, and implementing agencies for Land Use Management

Land Use Planning and Sustainable Land Management demands integrated analysis of various datasets including land use, zoning, administrative boundaries, roads, population and health, environment, soils and geology, hydrology, and elevation. By harnessing GIS and ICT technologies, Rwanda will enable national government and district offices to avoid uncontrolled development, increased energy demand and emissions, inefficient transport systems, overburdened water and sanitation systems, environmental degradation and loss of biodiversity, food insecurity, health impacts and reduced livelihoods. In order to foster professionals with the skill sets required to understand and respond to these demands, Rwanda will build a GIS user community, and a District Planning Capacity program. Planning partnerships will be established between national and district

government offices to ensure a common service delivery framework. Such technology diffusion will build on the National ICT Plan (NICI III) and advance Government to Government (G2G), Government to Business (G2B), and Business to Business (B2B) ICT components of a knowledge-based economy

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MINICT, MoE, MINAGRI, MINALOC, MININFRA	RDB, RAB, RLMUA, RFA, RWB	Mitigation
			Adaptation ✓
			Green Growth

SI 3.1.4 Developing an inclusive and automated land administration to regulate and guide land tenure security

It is critical to automate all processes in land administration services to ensure efficiency in processing land administration issues, particularly at local levels in Rwanda. Collecting information automatically from other digital systems (such as changes to a registered landowner's civil status) will shorten processing time of requests and be more transparent. Automation will also accompany digitized processes that will allow for paperless systems of land registration. These will rely on electronic signatures, facilitating more administrative ease and reducing transaction costs. Digitized processes and solutions also increase the reliability and authenticity of all information in the land administration information system, and thereby support security of land tenure. Increased reliability will decrease the number of conflicts and counteract the informal market and unplanned land use development.

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MoE, MINAGRI, MINALOC, MININFRA	RDB, RAB, RLMUA, RFA, RWB	Mitigation
			Adaptation ✓
			Green Growth

SI 3.1.5 Maintain up-to-date risk assessment and vulnerability mapping for effective early warning systems

Rwanda will continue to conduct risk assessments and vulnerability mapping to develop effective disaster management systems. This will include health impact assessments for water-related infrastructure projects such as dams and irrigation where disease may spread. Timely risk assessment is crucial to disaster prevention as it enables disaster preparedness planning and mitigation activities, such as the protection of fragile ecological zones including steep slopes and flood prone areas like wetlands. Vulnerability mapping will build planning capacity and allow for rapid response and resource allocation based on sector activity and geographical prioritization of risk and vulnerability

Inter-sectoral coordination and collaboration will be supported by a systems data maintenance and inter-sectoral coordination programme. The National Disaster Management Executive Committee made of MoE, MINEMA, MINAGRI, MININFRA, MINALOC, and MoD has been established by the Office of the Prime Minister to coordinate issues related to disaster management, flood management, soil protection and water management. The National Steering Committee will be led by the Ministry of Environment (MoE).

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MoE, MINAGRI, MINALOC, MININFRA	RDB, RAB, RLMUA, RFA, RWB	Mitigation
			Adaptation ✓
			Green Growth

PoA 3.2 Integrated water resources management

SI 3.2.1 Building climate resilient water infrastructure for storage, supply, efficiency

To strengthen Rwanda's resilience against climate change, and to keep pace with the water demands of a growing population and expanding economy, Rwanda needs greater water security. This can come through a combination of large-scale water storage infrastructure (dams and reservoirs), small-scale water infrastructure, water harvesting and reuse. The principal uses of such water storage infrastructure would be for hydropower, irrigation, as well as for industrial water supply.

This will be a combination of predominantly "hard" interventions, i.e. physical infrastructure, including: (i) large-scale storage dams and reservoirs that support improved river runoff regulation and groundwater recharge; (ii) improved road runoff management and drainage, diversion of runoff from roads into channels/canals and then distributed into ditches/basins or farmland; (iii) the greening of grey infrastructure such as ridging, erosion and runoff control methods located in drainage lines or near culvert outlets, which are put in place to prevent or reduce sedimentation and erosion of the landscape; (iv) swales to reduce erosion from rainfall on steep slopes (these are long, shallow depression in the ground designed to collect or redirect water).

Interventions on water storage development need to be completed by other actions to support demand management and water use efficiency, as well as pollution and water quality management to complement Rwanda's high targets under the vision 2050 for water dependent sectors.

Sector	Lead Ministry	Implementing Agency	Focus Area
Water Resources	MININFRA, MINAGRI, MoE and RWB	RWB, WASAC	Mitigation
			Adaptation ✓
			Green Growth

SI 3.2.2 Developing catchment restoration and water security for all

In Rwanda, land is the most important resource in agricultural production, and limited availability of productive land is a major constraint to economic growth. Poor land use planning and management have detrimental effects on ecological infrastructure that supports Rwanda's economy, i.e. the water resources in catchments. Water resources degradation is intimately linked to land degradation and influenced by various catchment management and land use factors. Thus, addressing the biophysical consequences of poor catchment land use planning and management, by establishing and reviewing comprehensive land use guidelines, is a key priority to ensure sustainable water resources for Rwanda.

Rwanda intends to reduce catchment degradation through soil erosion control and water conservation activities and appropriate land use practices. Development of catchment restoration and soil control

strategies will minimise the effects of deforestation, wetlands being filled or drained, and farmland being turned to settlements, which could impact surface runoff and pollution. It will also minimise storm water management issues such as flooding and facilitate the integrated sustainable management of wetlands that require communities to not only manage the wetlands through land use planning but also the surrounding catchments that sustain and impact the wetlands. Wetlands make up 10% of the national territory and catchment strategies must apply a strong focus to their enhancement. The protection of water towers and key water source areas within catchments will also be a major feature of catchment restoration

Soil erosion and sedimentation is one of the biggest problems facing communities in Rwanda, due to the serious environmental, economic and social consequences, including loss of productive land, siltation of reservoirs, reduction of water quality for human use and impacts on aquatic ecosystems. Although there are many different parties involved in providing soil conservation and management advice, it is recommended that consensus be built, and a consistent message be sent to all. Implementing erosion and runoff control structures or measures, located in drainage lines or near culvert outlets, which are put in place to prevent or reduce sedimentation and erosion of the landscape caused by intensive rainfall and direct runoff will be critical for Rwanda's water resource management.

Rwanda has already developed four catchment plans for level one catchments. Five other level one catchments still require comprehensive catchment plans. Such plans would be crucial drivers of both green growth as well as climate resilience. The integrated nature of catchment management would enhance livelihoods by creating jobs, strengthen land preservation, reduce soil erosion, diminish natural hazards (such as floods and landslides), and preserve Rwanda's hydrologic systems. Integrated approaches to catchment land and water management are essential for maximizing the economic and environmental benefits of development activities in Rwanda. Such strategies are characterised as "soft" interventions but would likely translate – during implementation – into several hard, physical infrastructure investments (including GIS and ICT systems for spatial mapping and planning tools, contour ridging, rotational resting of grazelands, riparian buffer zones etc.).

Sector	Lead Ministry	Implementing Agency	Focus Area
Water Resources	MININFRA, MINAGRI, MoE and RWB	RWB, REMA, Meteo Rwanda	Mitigation
			Adaptation ✓
			Green Growth

SI 3.2.3 Strengthening disaster management and response

The frequency and severity of disasters, particularly caused by floods, landslides and droughts, have significantly increased over the last two decades and have increasingly caused human casualties as well as economic and environmental losses. For example, flood hazards have worsened with recent population growth and land scarcity which have pushed settlements and other human activities in flood-prone areas. To build resilience and adaptive capacity against climate change, Rwanda must minimise the likelihood and impacts of hazards on communities. Sound risk management will be key to Rwanda responding in a prepared manner to climate change and hazard event exposure.

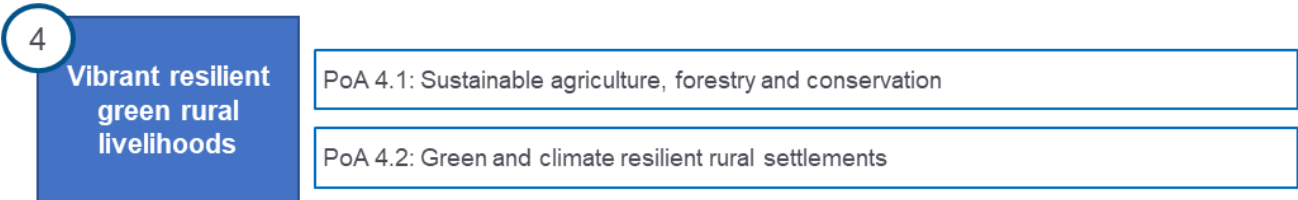
Although disaster risk reduction is primarily relevant to all hazard types mostly concerned with the present, it is increasingly forward-looking. The goal would be to anticipate, plan for, and apply an integrated management approach to floods, landslides and droughts to reduce their negative social, economic and environmental impact. This includes the development of a flood and drought response protocol which comprises a structured set of inter-connected institutional and partnership roles, focus areas, and mechanisms to prepare for, respond to and recover from a disaster. The components of the response protocol would include, at a minimum: (i) formalised institutional roles and partnership collaborations; (ii) a flood/drought/fire preparedness plan that is understood by both institutional actors and communities in flood/drought/fire prone zones; and (iii) Implementation of flood control plans through establishment and maintenance of flood management infrastructure (e.g. berms or dikes that help reduce flood waters affecting communities).

Given the linkages between floods, droughts, fires and ecological infrastructure, part of the integrated approach to disaster management will be to find synergies with catchment management plans. Catchment restoration can build in important activities that support flood and drought prevention, through the secure maintenance of natural capital. An integrated approach would also involve components that support job-creation and generate livelihoods. Integrating gender in early warning systems will also be key, as women play a pivotal role in emergency preparedness and responses as well as in disaster risk reduction, provided they are empowered to do so.

Sector	Lead Ministry	Implementing Agency	Focus Area
Water Resources	MINEMA, RWB and MoE	RMA, RWB, and RISA	Mitigation
			Adaptation ✓
			Green Growth

4. VIBRANT RESILIENT GREEN RURAL LIVELIHOODS

Resilient economic activities and support systems in Rwanda’s rural areas, to ensure sustainable growth opportunities and a high quality of life, with judiciously managed natural resources.



Thematic Programme Area 4: Vibrant, Resilient, Green Rural Livelihoods consolidates programmes of action that build green opportunities in the rural economy, and climate resilience through off-grid services specifically targeted to rural inhabitants.

Rwanda aspires to be a predominantly urban nation by 2050, with the majority (70%) of its citizens living in cities. However, a third of the country (30% of the population) will still be living in rural areas, and need to be afforded a life that is at par with fellow citizens.

Rwanda is committed to helping rural communities thrive, by ensuring adequate access to and reliable delivery of services related to water, energy, and waste. This must be done through prudent and sustainable use and management of natural resources and of land.

Crucially, rural Rwanda will still remain the source of raw materials and primary inputs that feed into the country's economic machinery, which makes it imperative to preserve and sustain the systems that generate such raw materials. Rwanda's agricultural lands will remain essential to the nation's food security and nutrition, enabling the labour force to be healthy and productive. Agriculture will also continue being a key contributor to economic growth, through higher yields and productivity achieved through biotechnology, efficient infrastructure support, and enhanced access to markets.

South Korea has built a diversified and resilient rural economy and Rwanda may learn from this country's particular green growth pathway and innovations:

Box 7: Country Case Example - South Korea

With the assistance of aid, South Korea developed its rural economy. In the 1950s the sector was intended to ensure national food security and it employed 80% of the labour force (Park, 2013). The government provided assistance to village projects using the Community Development Program (CDP). In the 1960s these projects began being driven by the state. While the forces of urbanisations and industrialisation decreased the rural population (from 50% to 34%) and reduced the GDP contribution of the agricultural sector (from 28% to 9%) respectively in the 1970s, the government created ten villages and provided all rural residents (villages) building materials and inputs. With national government responsible for policy development, local government responsible for monitoring and evaluating and villages managing themselves through committees, villages that yielded results were rewarded. This was the decade agriculture was mechanised.

In the 1980s, the government continued to provide support to villages and provided all rural counties with \$4 million. The government also strengthened its support to the fisheries industry. In the latter half of the 1980s economic liberation began, with market forces determining resource allocation. In the 1990s, institutions to support the sector were created. The standard of living had rapid increased, with many houses and transport infrastructure in the rural areas. In the close of the decade the country became a service-dominated and knowledge-based economy. It now prioritised conservation of nature for Green Rural Village tourism and to restore some of the unintended consequences of rural development. By the late 2000s, urban people visited rural places for leisurely activities.

Rwanda may also draw key insights from South Korea to enhance the development of its rural economy. Firstly, Rwanda has the aim of improving agricultural production to be more productive and less labour intensive through value addition, sustainable intensification and beneficiation. Secondly, the government will

also support the populace with social protection. Currently, 8.06% of the population receive social protection and this will rise to 30% by 2035 and 50% by 2050. These are key policy actions to underpin the resilience of Rwanda's rural economy.

In the long term, economic prosperity and a regionally and globally competitive rural economy, will support continuous improvements to productivity and create decent jobs for its citizens through both economic and human capital investments (Vision 2050). Rwanda's investment in rural livelihoods and education through TVET will enable the urban aggregation required over time. That is, skills development, self-sufficiency and capacity building for a resilient transition. These skills and capacities will underpin the rural transition to developing diversified and intensified sustainable agriculture, a high-value agro-forestry industry, reaching aspirational natural resource enhancement and management. The decoupling of the Rwandan economy from resource dependence by 2050, requires targeted support to the rural economy which is presently highly dependent on the natural resource base.

Under this thematic programme area, there are two Programmes of Action (PoAs) that are designed to support vibrant and resilient green rural livelihoods:

- **PoA 4.1: Sustainable forestry, agroforestry, and ecotourism**
- **PoA 4.2: Green and climate resilient rural settlements**

Each of these Programmes of Action comprises of several Strategic Interventions (SIs). The SIs serve as specific priorities for designing and directing investment in rural economic resilience and sustainability.

PoA 4.1 Sustainable agriculture, forestry and conservation

SI 4.1.1 Enhancing agro-ecology, crop variety development, and promoting climate-resilient cultivars and animal breeds, for local and export markets

Availability, accessibility, and optimal use of climate tolerant/resilient seeds enhances crop yields and supports greater food security, balanced nutrition, improves the value of the product in the market, and contributes to economic growth. It is therefore essential that seed development be given the important role it deserves, to drive the structural transformation of the agriculture sector. Further, to cope with the effects of climate change and variability, Rwandan agriculture will need to focus on promoting high quality plant varieties and animal breeds. Ensuring that appropriate genetic resources with relevant traits for climate change adaptation and mitigation are available and accessible is important for coping with climate change, through the regulated introduction of superior planting material including transgenic materials. This will enable the shift toward a modern, climate resilient agriculture sector.

The Rwandan seed sector is dominated by the use of farmer-saved seed with low yield potential which may be vulnerable to the effects of climate change and variability. Increasing smallholder access to good quality seeds is recommended for addressing yield gaps and increasing output, as most farmers would otherwise resort to using farmer-saved seed with low yield potential, resulting in low agricultural productivity.

Germplasm collection, bio-engineering and proper conservation needs to get more attention in order to continue improving the genetic potential and diversity of local varieties to render efficient breeding programs. Likewise, certain livestock breeds are more suited to drought conditions, increased productivity and resistance to pests and diseases. Consideration of improved livestock breeding programs including enforcement of sanitary standards would help drive the sector forward. Strategies will focus on supporting investment in research, release and adoption of high performing varieties, and animal breeds and practices, fishery and aquaculture that are adapted to the observed and forecasted/future impact of climate change. These will include drought tolerant crop/ varieties, animal breeds and fish seeds, and early maturation varieties; improved forage management practices; pest resistant or tolerant varieties etc. A conservation strategy that safeguards the diversity of genetic resources is crucial for maintaining and enhancing the resilience of agricultural production.

The private sector must play a more active role in improving crop varieties and animal breeds, including those with climate-resilient traits. Policy reforms are required to shift the role of governmental seed regulatory system from direct supervision of seed production toward technical and policy support for cost effective varietal development of a wide range of seeds, driven by the private seed industry. There is also a strong opportunity to improve access to micro-finance and risk sharing which can be driven by the private sector and agribusiness support.

Lastly, Rwanda has already been making progress towards catering to more specialized markets. This includes more sustainable production (to cater to markets seeking sustainable or organic products). It also includes moving towards higher quality / specialty coffee and tea, which command much higher prices outside the bulk commodity markets. However, this higher value market is very sensitive to the quality of the tea and coffee, and these cash crops are themselves highly sensitive to climate. Thus, Rwanda will prioritize building the resilience of these high-value export crops through use of climate resilient varieties, and climate-smart agricultural practices. At the same time, the country must create more adaptability in its agricultural sector by diversifying exports, especially by promoting other export crops that are climate resilient.

Sector	Lead Ministry	Implementing Agency	Focus Area
Agriculture	MINAGRI, MINICOM, MoE	RAB, NAEB, and NIRDA	Mitigation
			Adaptation ✓
			Green Growth ✓

SI 4.1.2 Improved on-farm water and energy management including development of more efficient irrigation and farming systems

Rwanda's agriculture is highly rainfall-dependent. As a result, crop and livestock production is vulnerable to water-related stress, and water scarcity leads to significant productive losses. Beyond insufficient rainfall, rainfall at the wrong time of plant development is also a challenge (for coffee, for instance). Ultimately, irrigation will only deliver its full potential if combined with proper soil management techniques and quality seeds and planting material. On-farm water management can alleviate these risks. Moving forward, Rwanda will renew

efforts to capacitate farmers to implement improved on-farm water management and soil water retention within the context of both integrated water resources management (IWRM) and landscape approaches. Landscape planning and IWRM will help maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems, a priority under Vision 2050.

Providing access to water and reliable, low-carbon energy to farmers will be critical in the face of a changing climate, and will require more effective and efficient ways to capture water in both downhill marshland systems and hilltop crop production. This can be accomplished through a combination of measures such as: (i) increasing the capacity of on-farm water harvesting and storage; (ii) groundwater development; (iii) expanding and modernizing irrigation infrastructures; (iv) enhancing soil moisture retention capacity; (v) drainage and flood management, (vi) energy efficient and solar pumping, and (vii) improved delivery methods such as enclosed canals.

Sector	Lead Ministry	Implementing Agency	Focus Area
Agriculture	MINAGRI	RAB, and NAEB	Mitigation
			Adaptation ✓
			Green Growth ✓

SI 4.1.3 Value addition through diversification and manufacturing with expansion of local and export market access

In order to meet its own market demand, Rwanda will expand local markets by improving farm to market access and logistical support to farmers, alongside serviceable road and transport networks, cold-chain storage, developing decentralised village-based agricultural processing centres that incorporate low-carbon sources of energy, such as biogas-digesters and solar driers, and decentralised compost plants. This will form a conduit for agricultural-based trade based on less food miles for regionally and internationally imported food products. Strengthening local markets will also build economic resilience in rural areas that is less dependent on linear commodity flows of raw goods leaving rural areas unprocessed and without added value.

To create additional export opportunities, Rwanda will develop niche export crops under organic and fair-trade branding, such as organic and fair-trade tea, coffee and horticulture. Such initiatives, including 'Greening the Tea' initiative will increase adaptive capacity while reducing greenhouse gas emissions (mitigation) by addressing not only crop production, but also processing technologies that are currently energy and bio-mass intensive. Developing adaptation capacity in the export crop sector will also increase resilience to future temperature changes which are already impacting on coffee production in Kenya.

Rwanda will add value to food stuffs through the processing of agricultural products to supply the market demand of a growing population with an increasingly wider demand for processed food items, much of which is currently imported from regional and international suppliers. By 2050, higher value locally produced niche products will be found in all urban supermarkets, restaurants and hotels. Food products will be widely

certified to ensure their safety and hygiene consistently, as well as their Fair Trade and Sustainably-Sourced qualities to ensure access to premium markets.

Processing agricultural products also reduces post-harvest loss due to insufficient storage or cold-chain facilities, particularly with high value and perishable fruits and vegetable crops. Expansion of manufactured products will best be achieved through the development of decentralised village-based agriculture processing centres using a range of appropriate technologies that incorporate low-carbon sources of energy, such as biogas-digesters and solar driers. Rwanda will also develop Pesticide control and create pesticide residue check system for high value/ diversified export commodities.

Sector	Lead Ministry	Implementing Agency	Focus Area
Agriculture	MINAGRI	RAB, and NAEB	Mitigation
			Adaptation ✓
			Green Growth ✓

SI 4.1.4 Developing agroforestry and soil management for sustainable agriculture and fruit production

Agroforestry systems can address both land degradation and poverty issues by improving soil fertility, reducing soil erosion, strengthening food security, sequestering carbon, improving resilience to climate change. Multipurpose tree species, with emphasis on nitrogen fixing, fodder and fruit production, and both indigenous and exotic species will be raised in the nursery and distributed to farmers in different agro-ecological zones.

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MoE, MINAGRI, MINALOC	RAB, REMA, RFA, RWB, LODA	Mitigation ✓
			Adaptation ✓
			Green Growth ✓

SI 4.1.5 Rehabilitation of degraded forest resources (reforestation and afforestation) and improvement of forest management.

The national forestry inventory of 2015 reported that most forest plantations are understocked. There is a clear need to maximize the productivity of degraded forest plantations, which also presents an opportunity to increase biomass supply without converting additional land. Efforts should therefore be directed towards improving the productivity of existing degraded forest plantations.

For public forests, Rwanda will allocate forest concessions to private companies or enter co-management agreements. For private forests, Rwanda will create private forest management units (PFMUs) managed by cooperatives or Forest Owner Associations (FOAs). Additionally, Rwanda will promote public private partnerships to sustainably manage all public forest plantations, through multi-year contracts with forest operators who will plant and maintain young plantations until they reach commercial size.

Rwanda will increase the use of quality germplasm, planting trees at the right time (in the rainy season), in the most appropriate sites (designated areas), and improving post-planting care (maintenance operations). Priority will be accorded to replanting harvested areas and planting new available forest areas, such as on steep slopes, buffer zones, around water bodies, wetlands, protected areas, alongside roads, and in the settlements as stipulated under environmental laws and the National Land Use Development Master Plan (NLUDMP).

Mixed-species planting with both slow and fast-growing species will be promoted to maximize both mitigation and adaptation potential, and to increase biodiversity. In particular, production and dissemination of indigenous species and planting materials will be encouraged to reduce the dominance of Eucalyptus and other exotic species in planted forests and shift the sector focus to species diversity that increases productivity.

Rwanda will also focus on the development, implementation and monitoring of sustainable District Forest Management Plans (DFMPs). This will be re-enforced through the use of the newly developed Forest Monitoring and Evaluation System equipped with tablet GPS field data recording tools. Public and private forest ownership structures will be organised into Forest Management Units sustainably managed through their approved simplified forest management plans integrating the best climate adapted silviculture practices. The sustainable management of road, river and lake side protective tree plantation through participatory Local Community Vigilance Committee will also be scaled up.

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MoE, MINALOC	RFA, RWB, LODA	Mitigation
			Adaptation ✓
			Green Growth ✓

SI 4.1.6 Promoting conservation, community-based ecotourism, and enforcement of PES

In terms of conservation, the NST1 has identified tourism industry as a priority sector to help transform the nation to reach the objective of becoming a middle-income economy (GoR 2017). Rwanda commits to develop the hospitality industry and build the capacity of the private sector to provide high levels of service delivery to boost Rwanda's service sector performance and productivity in general and its tourism sector in particular. Projections indicate Tourism revenues doubling from USD404m in 2016 to USD800m in 2024. The plan that has already been initiated through low impact and high value gorilla product suggests growth and transition to world-class tourism destination (GoR 2017). Thus, tourism will increasingly serve as a source of foreign exchange earnings with income-multiplier effects to contribute to national sustainable economic development.

Rwanda has a host of prime ecotourism destinations such as the Volcanoes National Park, Nyungwe National Park, and Akagera National Park, and the forthcoming Gishwati-Mukura National Park. These can be further developed. There is also considerable potential to grow ecotourism in other locations across the country.

The National Land Use Development Master Plan (NLUDMP) also recommends the development of ecotourism parks in wetland areas, for conservation, educational and recreational purposes. In addition to attracting tourism revenues, the enhancement and sustainable development of tourism and recreational activities in wetlands will be an impetus for their conservation.

The major threats to protected areas in Rwanda, which are ecotourism assets, include population pressure, unsustainable resource use, and endemic poverty around protected areas. Despite strong enforcement of protections, these conditions continue to pose a challenge for long-term sustainability and viability of ecotourism destinations. These economic and financial factors can be remedied through equitable benefit-sharing of tourism revenues with local communities, and strategic distribution and use of such revenues. Additionally, there is need for more awareness, capacity building, and enhanced participation of local communities in other forms of tourism such as cultural services. Small businesses can also be provided guidance and support to develop in the areas adjacent to parks, to both support and benefit from ecotourism, and complement sustainable park management.

Payments for Ecosystems Services (PES) will also be strengthened and expanded building on the completion of Rwanda Natural Capital Accounts. PES schemes will broaden participation, through the engagement of community conservation wardens, women's and youth groups at the cell level, and other key community groups. The inclusion of PES targets within District Performance Contracts could also drive the success of PES schemes. Beyond ecotourism, PES schemes will also focus on carbon sequestration (in conjunction with REDD+), catchment management, and biodiversity protection.

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry	MoE, MINALOC, MINAGRI	RFA, RWB, LODA, RAB, REMA, RDB	Mitigation ✓
			Adaptation ✓
			Green Growth ✓

PoA 4.2 Green and Climate Resilient Rural Settlements

SI 4.2.1 Building decentralised water packaging plants and water treatment solutions

Rwanda is committed to increasing investment in the construction, extension and rehabilitation of water supply systems in Kigali and secondary cities.

While such centralised water treatment solutions are appropriate for large cities, Rwanda also recognizes the need to assess and develop appropriate water treatment facilities for settlements outside of the secondary cities, i.e. urbanising peri-urban and rural areas, where traditional water treatment plants may not be viable in the short to medium term. In these instances, containerised Water Package Plants may be effective and economical water treatment option. These have low maintenance requirements and low operating costs, and are thus better suited to remote areas where conventional infrastructure is not appropriate.

Such water packaging plants support localised self-sufficiency by utilising solar energy to power their systems. Their modular, mobile nature means that they can be relocated to areas most in need (and in times of crisis). Moreover, they support growth of the small, medium and micro-enterprises (SMMEs) that design, finance, build and operate, them.

Sector	Lead Ministry	Implementing Agency	Focus Area
WASH	MININFRA	WASAC	Mitigation

			Adaptation ✓
			Green Growth

SI 4.2.2 Ensuring availability of reliable bus services through route franchising

Rwanda's transport sector strategic plan under the National Strategy on Transformation affirms the need to provide adequate and reliable public transport in rural areas. While some forms of public transit infrastructure will not be economically or technically viable in rural areas due to scale issues and lower passenger numbers and density, bus systems must be the backbone of rural transportation. Rwanda will prioritize the availability of bus services in rural areas by adopting a route franchising approach.

Sector	Lead Ministry	Implementing Agency	Focus Area
Transport	MININFRA	RTDA	Mitigation ✓
			Adaptation ✓
			Green Growth

SI 4.2.3 Assuring universal access to electricity through off-grid solutions

Rwanda's goal of ensuring universal access to electricity by 2024 is predicated on half of such access coming in the form of off-grid sources. Off-grid solutions will be particularly important to reduce energy poverty and equip rural dwellers with reliable and cost-effective electricity. Under this rural energy-focused intervention, Rwanda will halve the number of households that use biomass for energy by 2024.

Rwanda's Rural Electrification Strategy affirms the government's commitment to developing the off-grid sub-sector. The proposed Rwanda Universal Energy Access Programme (RUEAP) also emphasizes advancing off-grid energy and clean cooking. Off-grid solutions to be explored and expanded further include standalone solar systems, as well as isolated mini-grids, based on location, income levels and usage patterns. Innovations in electricity-generating technologies that are suited to rural regions (such as waste-to-energy and solar PV), as well as innovative finance mechanisms will continue to receive attention.

The reduction of dependence of biomass will also be supported by providing access to alternative clean cooking technologies, such as: more efficient cookstoves including pellet-based models, (linked to the Sustainable Development Goal targets); replacing charcoal with biomass briquettes; access to cost-effective electricity from both on- and off-grid sources; as well as the use of lower-cost Liquid Petroleum Gas (LPG) and biogas as a fuel source (through increased use of on-farm anaerobic digestion of manure to produce bioenergy in bio-digestors) instead of solid fuels. These measures will reduce negative health externalities associated with solid fuel combustion, and will contribute to climate change mitigation by reducing the combustion of firewood and fossil fuels.

Rwanda will also explore the expanded use of ethanol for cooking and transportation fuel. Ethanol can be produced from organic material, thereby being a renewable resource. Enabling regulations and R&D are needed to promote ethanol, as is investment. Ethanol production must be done with environmental safeguards in place, to manage the amount of land used. The use of cleaner, lower-carbon fuels is not only being safer

(for humans and the environment) but also will save households – women in particular -- time for wood collection and cooking. Making such fuels more affordable will automatically increase their penetration rate, and thus efforts to reduce costs must be a priority. Rwanda intends to reduce resource wastage from wood conversion, both by increasing efficiency of the conversion process and improving the value of wood products to make them more profitable (creating a natural incentive to reduce wastage). Efficiency of the conversion process can be improved through a more optimal charcoal value chain; increased use of wood pellets with highly efficient gasifier stoves; the use of improved stoves; and increased salvage and reuse of timber and service wood products.

Sector	Lead Ministry	Implementing Agency	Focus Area
Energy, Land Use and Forestry	MININFRA / MoE	REG, RFA, RWB	Mitigation ✓
			Adaptation
			Green Growth

SI 4.2.4 Model Green Rural Villages for sustainable livelihoods and social protection

Integrating the above services and livelihoods focused interventions into a settlement planning level intervention, Rwanda will design and roll out Model Green Rural Villages to support spatial connectivity and resilience to Rwanda's rural residents. Model villages are typically home to 200-500 people and can cover five to 10 hectares of land (one hectare is roughly the size of a 400-meter racetrack). The development of Model Villages to house Rwanda's rural population will ensure homes, infrastructure and social support are available to support sustainable livelihoods, climate resilience, and connectivity of rural residents to the broader rural economy. Importantly, the rollout of model villages must be planned in conjunction with the NLUDMP implementation and other land management processes to ensure that any resettlement efforts do not place small-holder farmers too far from their land. As green settlements are established, attention to the accessibility of village level sustainable livelihoods, rural jobs and beneficiation will be critical. Services in Model Green Rural Villages will ensure modern and innovative approaches to areas such as waste management where waste is recognised as a resource for alternative livelihoods and supportive of healthy settlements.

Sector	Lead Ministry	Implementing Agency	Focus Area
Land Use and Forestry, Settlements	MINECOFIN/MININFRA / MINALOC/ MoE	RHA, RLMUA, LODA/Districts	Mitigation ✓
			Adaptation
			Green Growth

5. Enabling Pillars

Enabling Pillars are pre-requisite and cross-cutting arrangements of resources and capabilities, which are necessary for the Programmes of Action to be implemented effectively. The objective of the pillars is to provide a foundation for current and future actions and will continuously be improved and reviewed. The four enabling pillars are Institutional Arrangements; Finance; Capability, Inclusion and Training; and the Digital Transformation and Innovation. The pillars align strongly to the NST-1 pillars as follows:

- The Institutional Pillar aligns to the NST-1's pillar for **Transformational Governance**
- The Finance Pillar aligns to the NST-1's pillar for **Economic Transformation**
- The Capabilities, Inclusion and Training Pillar aligns to the NST-1's pillars for both **Social and Economic Transformation**
- The Digital Transformation and Innovation Pillar also aligns to the NST-1's pillar for **Economic Transformation**.

PILLAR ONE: INSTITUTIONAL ARRANGEMENTS

Rwanda's institutional arrangement for the GGCRS must be responsive and capable to ensure effective flow of information, knowledge, and mobilisation and allocation of climate finance. Rwanda has a robust national planning process coordinated by the Ministry of Finance and Economic Planning (MINECOFIN) through sector working groups (SWGs) that monitor implementation of sector priorities. The SWGs hold semi-annual meetings and workshops for progress reporting through Joint Sector Review consultative sessions. Building upon existing structures and SWGs in a sector-wide approach through the National Strategy for Transformation (I) platform, , the GGCRS seeks to leverage institutional coordination efficiencies for implementation.

Intersectoral Coordination and Multi-level Governance

While the original GGCRS proposed the establishment of new institutional structures (namely the Technical Coordinating Committee and the Centre for Climate Knowledge for Development), set up a practical forum of focal persons that would follow up implementation of mandated POAs of their respective sectors. The Ministry of Environment also initiated the half-yearly High-Level Dialogue composed of sector leaders, development partners and civil society in which the focal persons would report for the monitoring and evaluation and further guidance for implementation. While this structure has worked for its purpose of bringing responsible authorities and stakeholder groups together to discuss, develop and validate policy and strategies, it is not appropriate as a regular inter-ministerial coordinating committee.

GGCRS coordination will use the robust national planning process overseen by the Ministry of Finance and Economic Planning (MINECOFIN) through sector working groups (SWGs) that monitor implementation of sector priorities through Joint Sector Reviews (JSRs). The SWGs hold semi-annual meetings and workshops to monitor and evaluate performance through Joint Sector Review consultative

sessions. The SWGs and Joint Development Action Forums (Districts) structures and processes facilitate sector-wide approach in support of the medium-term strategies, National Strategy for Transformation platform for the 2018 – 2024. The same proposed arrangements support the updated Nationally Determined Contributions (NDCs). The Green Growth and Climate Resilience Strategy (GGCRS) currently under revision will leverage institutional efficiencies for implementation including streamlining both public and private finance flows to priority GGCRS strategic interventions.

The well-established mechanism of integration of environment and climate change issues as crosscutting areas will guide sector and District coordination in implementation of GGCRS. In this regard, strategic interventions will be implemented in a way that delivers high-level objectives in a way that is cognizant of the pathway and essential institutional coordination arrangements that continually enhance linkages to the programs of action and the thematic areas of the GGCRS. Therefore, the Sector Strategic Plan (SSP) forms a common framework for contributing results towards strategic interventions.

The SSP will also be used to lay out a comprehensive strategy involving one or more institutions within the sector, for delivering on these results, together with costs for the strategy and a sector specific monitoring framework. The Ministry in charge of Planning shall issue detailed guidelines to sectors on the formulation of sector strategies. The process of formulating medium term and long-term strategies shall be participatory – involving all sector institutions and non-state sector stakeholders. Furthermore, coordination will be essential to identify guidelines (mainstreaming tools in national planning as part of the Budget Call Circular and Budget statement) checklists, and assessments appropriate to monitor specific environment and climate change indicators and targets to achieve Sector Strategic Plans (SSPs) and District Development Strategies (DDSs) and therefore NST 1 objectives.

The Environment and Natural Resources Sector working group (ENR SWG) will play a technical leadership role in the implementation of GGCRS and will establish mechanisms for coordination and information sharing across the various stakeholders. These include development partners, representatives from civil society organizations, the private sector, and government agencies active in Environment and Natural Resources (ENR) Sector. Members of the ENR SWG therefore include: The Lead Ministry, the Lead Donor, Prime Minister's Office, the Ministry of Finance and Economic Planning (MINECOFIN), a Representative from each Ministry, a Representative from each Province and Kigali City, Development Partners, Civil Society Organizations and Private sector institutions.

Regular means of coordination will be strengthened including the SWG and Thematic Working Groups (TWGs), bringing together Central and Local government institutions, development partners, the private sector and civil society appropriately identified and engaged in the ENR sector and affiliate institution themes. This is particularly crucial for the Joint Sector Review as it provides an opportunity to engage in policy dialogue and to ensure ownership, accountability and transparency of National Medium Term Development Strategy implementation and monitoring process.

The Permanent Secretary (PS) forum, a structural level in the national planning arrangements will serve as the highest level of decision making in support to GGCRS implementation. The PS forum will periodically determine and guide additional platforms (High level policy dialogue/Economic cluster/ PM guided inter-ministerial dialogue/ Development Partners Coordination Group (DPCG)) of engagement for strategic and/or policy decisions and orientation. The GGCRS coordination modalities will therefore follow the national planning and results monitoring frameworks and evaluation carried out under the SWGs and JSRs(NDC and or SDGs primarily follow the same framework).

Table 2 Multi-level Governance Structure for the GGCRS

Level of intervention/ Line Ministry	Roles and Responsibilities	Lead Agency	Key stakeholders
	<ul style="list-style-type: none"> 		
Permanent Secretaries Forum	<ul style="list-style-type: none"> Monitor the implementation of NST1 (GGCRS); propose measures to fast track its implementation. Technical coordination and propose measures to fast track implementation of NST1 (GGCRS). 	Permanent Secretary in Prime Minister's office	Permanent Secretaries for all Ministries
	<ul style="list-style-type: none"> 		
Sector Working Groups (SWG) Thematic Working Groups (TWG) & Joint Sector Reviews	<ul style="list-style-type: none"> Follow up implementation of sectoral plans and investments through Joint Sector Reviews. Provide a forum for dialogue, ownership and accountability of the development agenda by all stakeholders at sector level Build synergies in policy formulation, implementation and enhance regular reviews on GGCRS. Conduct joint sector reviews (Forward and Backward reviews) Monitor progress of the Sector Strategic Plan (SSPs) relying on the GGCRS sector working papers as a guide on how the key GGCRS interventions have been implemented by sectors. 	Sector level Planning and monitoring of GGCRS sector priority integration and implementation.	All sector stakeholders (Ministries relevant to sectors, DPs, private sector and Civil Society Organizations)
Joint Action Development Forum (JADF)	<ul style="list-style-type: none"> At the district level, JADF brings together all stakeholders contributing to the delivery of the NST1 (GGCRS) implemented through District Development Strategies. Participate in the elaboration and monitoring of GGCRS interventions and targets and their inclusion into imihigo Promote cooperation between the public sec sector, private sector and civil society to deliver on NST1/GGCRS at district level 	Local level Planning and monitoring of GGCRS priority implementation.	All District stakeholders (District, DPs, private sector and Civil Society Organizations)

Climate Data and Projections

The Ministry of Environment (MoE) chairs the Environment and Natural Resources SWG (ENR SWG) that has the responsibility to monitor and evaluate the implementation of the NDCs through regular stakeholder consultative engagement. Under the MoE are agencies that regularly organize Thematic Working Group (TWG) sessions in the context of the national planning process that supports implementation including monitoring, evaluation and progress reporting on sub-sector priorities. Rwanda Environment Management Authority (REMA) has the overall responsibility for, and chairs, the Environment and Climate Change Thematic Working Group (E&CC TWG) that has technical oversight over implementation of climate change priorities.

Building on the momentum established through the latest NDC submission and the extended Monitoring, Reporting and Verification (MRV) development processes, it is recommended that the E&CC TWG forum on behalf of the ENR SWG, as the ideal platform for guiding the analytical framework, reporting on the updating and implementing both national mitigation, and adaptation priorities, host the technical working committee to coordinate all national institutions that implement sector specific mitigation, adaptation, and green growth interventions. This coordination includes supporting capacity building, knowledge and technology transfer especially in terms of climate data and knowledge for green growth development.

It is recommended that REMA as the Chair of the E&CC TWG appoint a core team to the technical working committee that includes (among others) the Rwanda Meteorological Agency, MINEMA, MINAGRI, MININFRA, MINICOM, MoH and MINALOC as well as the Centre of Excellence in Biodiversity and Natural Resource Management (CoEB), College of Science and technology (CST) under the University of Rwanda (UR) to take on the function of improving robust climate data and projections, and translating the information into sector-specific knowledge and policy options for decision makers. It is also recommended that an inter-sectoral “Climate Data and Projections” committee is constituted and chaired by RMA to manage Climate Data and Projections that will be used beyond the E&CC TWG.

Private Sector and Civil Society

A focus needs to be placed on strengthening FONERWA’s institutional and regulatory arrangements to fast-track domestic resources mobilization by catalysing additional green finance flows to the country. Rwandan communities, private sector and NGOs can also contribute significantly to green growth and climate resilience related activities through public-private partnerships. Engaging these actors will draw on existing protocols and structures established through the updated NDC process, namely with support of broad sector and District based stakeholders through the SWG and the Joint Action Development Forum (JADF), an opportunity for engagement of NGOs private sector and development partners to provide inputs.

The mutually supportive roles of MINECOFIN and FONERWA as the key institutions in catalysing Climate Finance for implementation of the GGCRS needs to be streamlined and strengthened and efforts are already underway through the Monitoring, Reporting and Verification (MRV) framework under the updated NDC. Through internalisation of the GGCRS provisions, actions must be taken to build on and enhance FONERWA’s

current comparative advantage with guidance and support from MINECOFIN to accelerate mobilization of resources to meet Rwanda's climate finance/action ambition. These include:

1. Produce a detailed financing strategy that clearly outlines financing of the revised NDC implementation plan and guidance for accelerating national access to scalable climate finance.
2. FONERWA as a national climate finance coordinator working closely with MINECOFIN must communicate a coordinated and coherent plan for national climate resources mobilization setting in place a multi-sectorial/cross sectorial project pipeline generated through collaboration with national and sub-national actors.
3. Streamline and boost domestic human and financial resources flows including technical support to the RGIF in collaboration with BRD to catalyse access to private sector, which is crucial for NDC resources mobilization to fill the unconditional resources gap.
4. Work directly with MINECOFIN to monitor resource flows to green and climate action through among other areas using the MRV in support of implementation of the updated NDC.

Priorities

Success in the institutional enabling pillar would be characterised by strategic alignment at multiple levels of government and consistent, effective engagement with civil society and the private sector across all industries. Clarity in mandates, responsive governance, and continued improvement to capacity development and knowledge sharing are essential to the outcome of the institutional priorities over the next five years. The priorities of the Institutional Pillar are summarised in the table below.

Table 3 Priorities for the Institutional Enabling Pillar

Priority	Relevant Programmes of Action	Ministries and Agencies
Integrate GGCRS planning, implementation, monitoring and evaluation into existing inter-ministerial coordination structures (Economic Cluster) as well as SWGs and TWGs for climate data and projections for development	All	MoE, MINECOFIN, MINALOC, REMA, RWB, RFA, RLUMA, RMS
Engage the Private Sector (industry and developers) through PPPs and bi-lateral agreements, using centres of excellence and planned hubs and innovation centres	1.1; 1.2; 2.1; 3.1; 4.2	MINECOFIN, RDB
Use the GGCRS to facilitate Local Adaptation Plans of Action and Locally Appropriate Mitigation Actions to take up the level of ambition set for the updated NDCs and chosen GGCRS development pathway and mainstream into District Development Strategies	2.1; 3.1; 3.2; 4.1; 4.2	MINALOC

PILLAR TWO: FINANCE

Rwanda's Green Fund (FONERWA)

A National Fund for Climate and the Environment (FONERWA) has been established and is the centrepiece in managing climate funds that flow into Rwanda. The thematic investment priority areas include biomass replacement, green cities, sustainable transport, waste, water, renewable energy, and climate smart agriculture. FONERWA's current levels of seed capitalization by the Government of Rwanda and development partners as well as leveraged external finance and co-financing for supported projects stand at USD170.5 million disbursed into 44 public and private projects (FONERWA, 2019).

A key area of focus to support the implementation of the revised GGCRS will be increasing both the percentage of disbursements to private sector implemented projects, and increasing the contributions from the private sector to the Fund. FONERWA has indicated an intention to increase the level of involvement of the private sector within the NST-1 implementation period. Part of this intention has been mapping alternative funding sources for Green Growth and Climate Resilience efforts support by FONERWA (Figure 11). It is crucial that private finance be tapped and secured to finance green technologies in industry, especially those that increase productivity and resource-efficiency. Rwanda will explore options to raise levels of such private finance through innovative financial instruments. Furthermore, through opportunities around the recent establishment of the Rwanda Green Investment Facility in partnership with the Development Bank of Rwanda (BRD) additional instruments include incubators, accelerators and green guarantees. The GGCRS recommends expediting the accreditation of BRD by the GCF to further expand opportunities for long term private sector climate financing. It is recommended that these funder engagements are pursued as a key pillar of the GGCRS implementation.

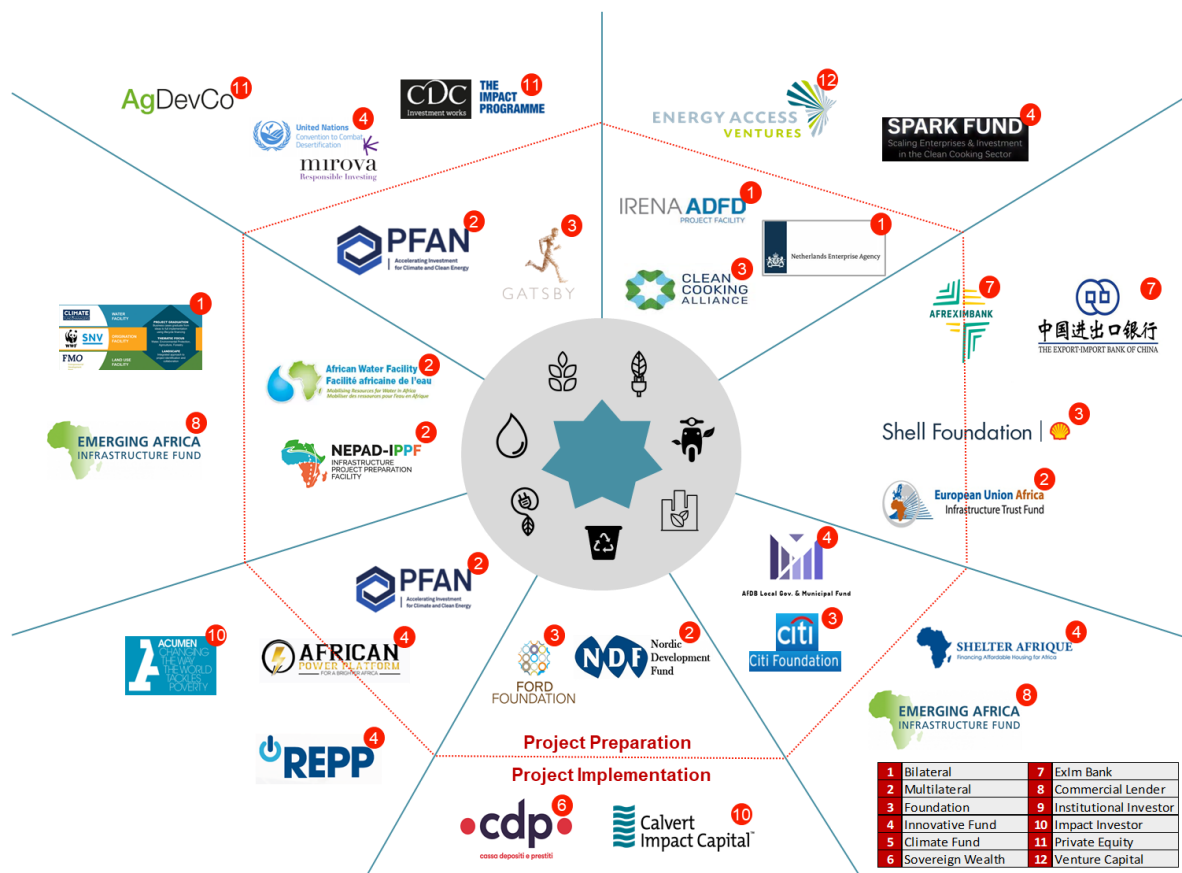


Figure 11: Recommended funders (partners and/or investors) for FONERWA to engage

Partnerships for Funding and Funding for Partnerships

The MoE received Green Climate Fund (GCF) accreditation in 2015, and have mobilised an estimated USD159 million climate funds from the GCF and co-financing institutions. Rwanda also recently became a member of the NDC Partnership, a global initiative to help countries achieve their national climate commitments and ensure financial and technical assistance is delivered as efficiently as possible. The Rwanda government should leverage the NDC Partnership and its achievements through the GCF to access additional international climate finance, continuing to seek opportunities with the funds listed in Table 5, and take note of current priorities in Table 4. Though significant, the international climate funding flowing into Rwanda will not be sufficient to finance the revised GGCRS in full. Thus, it will be crucial for the government to secure domestic sources of revenue and leverage private capital for low carbon and adaptation activities. The extent to which key Rwandan ministries and FONERWA can forge partnerships with bi- and multi-lateral partners, the private sector and innovative finance providers will be a determining factor for the successful implementation of the revised GGCRS.

The government of Rwanda has also made significant progress in establishing sector-focused funds to stimulate entrepreneurship, SMME development and other private sector involvement in key green economy sectors and climate resilience building activities (such as the National Research and Innovation Fund,

Agricultural Development Fund etc.). These fund opportunities are essential to encourage greater private sector and civil society participation in public development efforts, as well as to stimulate innovation from these actors toward advancing the GGCRS.

Two further focus areas for increasing access to funding and effective spending will be improving the viability and bankability of projects prepared, as well as increasing the contributions Rwanda can offer through domestic revenue generation. The GGCRS must be used to support Environmental (and Climate Change) Fiscal Reform (EFR) to support operationalization of the Environment/Climate change budget statement. In addition, a range of domestic funding sources could be relevant within Rwanda. If legislation can explicitly earmark these for FONERWA and establish the necessary institutional and regulatory arrangements these could supplement domestic resources. These include **environment-related user fees** (e.g. National Park and conservation area entry fees), and tourism levies; **international payments** (such as debt-for-nature swaps); **environmental taxes** (carbon footprint off-setting fees, fossil fuel levies, mining and drilling fees, timber and logging fees); and a portion of other major and non-environmental taxes could be ear-marked for FONERWA in the national interest of mainstreaming green growth and climate resilience. These mechanisms would require strengthening coordination between MINECFIN and FONERWA on the one hand and RDB and FONERWA on the other hand to leverage opportunities for scaling up public and private climate finance to among other things mobilize NDC resources for climate action.

Private Sector and Civil Society

The role of FONERWA as the key institution in catalysing Climate Finance for implementation of the GGCRS needs to be strengthened. The Rwanda Green Investment Facility (RGIF) under FONERWA will serve as an emerging platform to catalyse climate finance flows to private sector actors and increase their participation in GGCRS implementation. Specific actions and mechanisms to improve the effectiveness of this catalysation include:

- (i) Support set up and operationalize the RGIF through partnership between FONERWA (technical support to green finance and Rwanda Development Bank (BRD) as a private finance support agency to ensure (i) mainstreaming climate action into the financial sector in Rwanda
- (ii) Unlocking private sector to drive more resources toward the investments necessary to achieve the goals of the NDC,
- (iii) Building and continuously improving partnerships, skills and expertise to support green and climate financing in Rwanda through technical/financial support and knowledge enhancements; and broaden and diversify financial instruments as well as measures to address current barriers to accelerating access to green and climate finance.

Key barriers that will need to be overcome include (i) lack of affordable financing, (ii) high cost of capital, (iii) high perceived project risk, (iv) limited credit enhancement products and facilitate enhanced customer

knowledge base through RGIF as a one-stop-centre for green/climate finance through among others incubation/acceleration and green guarantee.

In the implementation of the GGCRS, a mechanism to establish measures for roll out of Community Adaptation Facility (CAF) must be developed to catalyse community access to finance for climate action. This must build on achievements to date, for example the GCF financed project in Gicumbi executed by FONERWA to continue to strengthen the relationship between FONERWA and GCF. Over the GGCRS implementation timeframe, there will be a need to support evolution and nationwide scale up of CAF building on current pilot initiatives to (i) improve approaches, tools, and actors necessary to reduce climate risk in grant/credit portfolios to communities, and (ii) scale up climate-smart practices to smallholders across multiple geographies. The tools and approaches promoted and supported under the CAF include Climate-smart grant/credit products and processes designed to promote climate-smart management practices among small holder farmers including agriculture and land management scoring tools to determine eligibility for payment and ensure compliance with climate-smart management practices and grant/loan requirements under the scheme.

Mechanisms must also be put in place to set up, grow and diversify local banks and microfinance institutions, value chain companies e.g. input suppliers, producer associations, traders, processors, and NGOs and technical assistance providers to enhance partnerships to crowd in finance and enhance incentives, access to finance as well as uptake of finance by aggregated groups of smallholders such as cooperatives and other farmer producer groups

Priorities

Success in the Finance Pillar will be characterised by a diversified funding pool, for which innovative and efficient mechanisms are consistently pursued. Rwanda will have a pipeline of well-developed, bankable projects, effective funder engagement strategies, productive partnerships with a range of investor and donors, and support bi- and multi-lateral arrangements that contribute to an enabling financial environment for GGCRS implementation. The priorities for the Finance Pillar are outlined in the table below. Together these priorities could be seen as elements of a GGCRS Finance Mobilisation Strategy, as implied in the Implementation Roadmap.

Table 4 Priorities for the Finance Pillar

Priority	Relevant Programmes of Action	Ministries and Agencies
Strengthening coordination between MINECOFIN and FONERWA on the one hand and RDB and FONERWA on the other hand to leverage opportunities for scaling up public and private climate finance to among other things mobilize NDC resources for climate action.	All	MINECOFIN, MININFRA; RDB, RWB, REG

Increase capacity to developing bankable projects to continue to attract finance from the Green Climate Fund, the Adaptation Fund and other climate funds accessible to Rwanda	2.2; 3.1; 3.2; 4.1; 4.2	MoE
Investigate and employ environmental fiscal reforms, a feed-in tariff, a green investment index, and public financing mechanisms to encourage green consumerism and investment to increase domestic revenue generation for GGCRS implementation	1.1; 2.1; 2.2; 4.1; 4.2	MINECOFIN, MININFRA; WASAC, RWB; REG
Encourage conservation and the support of private investment in nature through finalising Rwanda's Natural Capital Accounts and other key supportive frameworks such and Biodiversity financing (BIOFIN) for effective Payments for Ecosystem Services (PES), Nature-based Solutions, and other innovative financial mechanisms	2.2; 3.1; 3.2; 4.1	MINECOFIN, MoE, REMA

Table 5: International Climate Funds accessible to Rwanda's key Green Growth and Climate Resilience Sectors

	Agriculture	Built Environment	Disaster Risk Reduction	Climate	Energy	Forestry	Industry	Land Management	Mining	Transport	Water
Adaptation Fund											
AfDB Congo Basin Forest Fund											
AfDB Sustainable Energy Fund for Africa											
Africa Enterprise Challenge Fund											
Clean Technology Fund											
Climate Finance Innovation Facility											
ClimDev-Africa Special Fund											
DEG - Deutsche Investitions											
EIB Post-2012 Carbon Credit Fund											
EIB-KfW Carbon Programme II											
Global Climate Change Alliance											
Global Energy Efficiency and Renewable Energy Fund											
Global Environment Facility											
Global Facility for Disaster Risk Reduction and Recovery											
Green Climate Fund											
Hatoyama Initiative (Japan)											
International Climate Initiative (Germany)											
International Climate Finance (UK)											
International Development Association											
KfW Development & Climate Finance											
Least Developed Country Fund											
Nordic Climate Facility											
Private Infrastructure Development Group											
Public-Private Infrastructure Advisory Facility											
Seed Capital Assistance Facility											
Special Climate Change Fund											
UNDP Green Commodities Facility											
UNDP/MDG Carbon Facility											
UNEP Renewable Energy Enterprise Development											
World Bank Carbon Facility											
World Bank Catastrophe Risk Management Facility											
World Bank Forest Carbon Partnership Facility											

PILLAR THREE: CROSS CUTTING AREAS

As identified in the NST-1, Rwanda's constrained human resource capacity is arguably the greatest challenge facing green growth and climate resilient development. Many of the programmes of action required to implement the GGCRS are knowledge intensive and require new skills across sectors and management levels. Actions to build capacity must harness existing efforts as much as possible, in order to promote efficiency of investment in current resources. Critically, existing opportunities and frameworks must be extended to ensure their accessibility to women and girls. The components of the Capacity, Inclusion and Training Pillar here are well aligned to those stated as fundamental to Vision 2050. As such the cross-cutting priorities here can be implemented through those defined in Vision 2050 and need not be seen as additional.

Basic education and green skills

REMA developed and launched school curricula in collaboration with the Ministry of Education. The courses have been fully mainstreamed in the school education systems. REMA also initiated the Green Schools programme which it has mainstreamed into the extra curricula activities of school systems. The Rwanda Workforce Development Agency (WDA) also proposed a Technical and Vocational Education and Training (TVET) qualifications framework which would facilitate the development of required skills levels in areas such as renewable energy, agroforestry and irrigation. This has translated in the WDA and Ministry of Education having accredited qualifications in renewable energy technologies including methane gas, micro-hydro power plants, solar and biogas as well as irrigation and drainage technologies. Some of these qualifications are currently offered by some TVET institutions including the Integrated Polytechnic Regional Colleges of Tumba and Musanze. Capacity enhancement will be focused on Rwanda's Cleaner Production and Climate innovation Centre (CPCIC), which has been proposed as a source for technical support to industries to promote cutting-edge, modern access to green technologies and business services for enhanced productivity, for circular economy initiatives, climate resilience measures within industry, and to boost overall competitiveness and environmental compliance in Rwanda.

Although several green growth and climate resilience education and skills training programmes have been mainstreamed in schools and TVET institutions, monitoring and evaluation must be strengthened, especially for the continued skills development in green technologies against the economic growth requirements. It is recommended that REMA, in association with industry leaders stipulate a programme of actions specifying green technology skills requirements which includes targets to monitor progress within the framework of GGCRS implementation.

Inclusive and Innovative Job Creation

Through the establishment of innovation centres, centres of excellence, and district hubs for ICT, coordination, community forums and skills development, the access to new green growth skills and knowledge must be matched by appropriate job creation at all skills levels. The stimulation of industrial and technological development for the green and knowledge economy will generate exportable, service-oriented jobs for medium

to high-skilled job seekers. Rwanda must actively ensure inclusivity by (1) adopting labour intensive development and management methods wherever possible, and (2) skilling new internal migrants and poorer residents with better quality jobs.

Research and Development

In the long term, Rwanda will increase its research and development (R&D) capacity by forming links between government, industry and relevant higher learning and research institutions in Rwanda (University of Rwanda (UR), Rwanda Polytechnics (RP), etc.) and abroad. Such links will enable effective research in line with the Strategy and support innovation and locally appropriate solutions. The E&CC TWG will play a key role in this area. Other research centres may be set up to support the growing demand for research and policy development, and universities should continue to set up courses to cover all the professions required to maintain a climate resilient low carbon economy. This will support the aspiration of Vision 2050 in creating a knowledge-based economy.

Priorities

Successfully implemented cross cutting areas will be characterised by broad-based skills development and green economy education, innovative approaches to service delivery and development that promote labour intensive and inclusive methods, the stimulation of private sector and SMME driven exportable jobs in the service and knowledge economy. This needs to be built on and strengthen the relevant training and education initiatives adopted to achieve Vision2050. The priorities for the cross-cutting areas over the next five years are summarised in the table below.

Table 6 Priorities for the Capabilities, inclusion, and training pillar

Priority	Relevant Programmes of Action	Ministries and Agencies
Continue to expand school curricula, tertiary education, technical and vocational training and farmer field schools to build the skills base for climate resilience and low carbon development	All	MINEDUC, UR, RP, WDA
Develop capacity within national and sub-national government through exchange programmes, university partnerships, training focal points, professional development and pilot villages	All	MINEDUC, UR, RP, WDA
Improve knowledge management and public awareness through an online Climate Portal, creative radio programming, short training courses, demonstrations of best practice in communities and community exchange visits	3.1; 3.2; 4.1; 4.2	MoE; RMS; REMA
Ensure adequate education and training is provided for women and girls, and vulnerable groups	All	MINEDUC, UR, RP, WDA
Match skills development with job creation across sectors and skills levels	ALL	MINECOFIN, UR, RP, WDA

PILLAR FOUR: DIGITAL TRANSFORMATION AND INNOVATION

In moving towards a modern, knowledge-based economy, Rwanda must determine and navigate a Digital Transformation to ensure that data, information, science and technology, and smart digital systems are integral and efficient features of the Green Growth and Climate Resilient development pathway. Data-driven, SMART, and innovative technological and digital systems can be applied across all sectors implementing GGCRS interventions. Key responsible stakeholders for the digital transformation are UR-CST, PSF, National Industrial Research and Development Agency (NIRDA), Rwanda Agriculture and Animal Resources Development Board (RAB).

Data Innovation

Building on the MRV systems established for the updated NDCs, as well as the achievements with vulnerability mapping, Rwanda is well placed to integrate climate information necessary for future monitoring, climate trend detection, vulnerability mapping, management of climate variability, early warning and disaster management. Linking this information to spatial planning systems and SMART services will be essential for GGCRS planning and implementation.

In 2019, RLMUA initiated the development of the National Spatial Data Infrastructure (NSDI) in Rwanda. This ensures that all data collected conforms to a set of minimum standards and allows for the inter-changeability of data between users. It will be even more important to have across-the-board standards for all data. Digitization of available geospatial data that identifies and locates all national infrastructure assets could be pursued to create insights for proper infrastructure planning and developing tailored services and technologies on top of such data. Technologies include online digital tools and supervisory control and data acquisition systems that will allow for remote monitoring, data generation and information sharing to monitor the functionality (quality and quantity) of key urban and rural settlement services. Such data and management systems are primarily useful for monitoring of water and energy networks but could also be used for sewerage and solid waste management. The above SMART networks should go hand-in-hand with a transition to more transparent, IT-based billing applications for households in urban centres.

Technology Innovation

Rwanda is pivoting to establish itself as an ICT Hub of Africa, driving ICT-led development and management, especially in the implementation of the GGCRS. The application of, and investment in technology, innovation and infrastructure is vital for development. Rwanda has the opportunity to leapfrog old technologies and destructive development pathways, and build a green economy, resilient to a changing climate. Resource efficiency and cleaner production in industries through green technologies and operations remain a national priority whose stipulated actions are well aligned to NDCs and SDGs that requires continuous long-term action. Steady progress in the adoption of green technologies and practices is evident in Rwanda and actions are therefore recommended to continue.

Priorities

A successful Digital Transformation will be characterised by reliable, real-time, and integrated data and information systems that support responsive development and management planning for economic development and climate resilience. Technological innovations will enable Rwanda to leapfrog in both rural and urban economic applications. There is a depth in the ICT skills base to respond to new opportunities for employment in data collection and management, system operation and maintenance, and the development of impactful applications of the back of robust ICT infrastructure. The priorities for the digital transformation Pillar over the next five years are summarised in the table below.

Table 7 Priorities for the Digital Transformation

Priority	Relevant Programmes of Action	Ministries and Agencies
Continue to identify, record and maintain fundamental integrated data sets according to international standards, particularly for energy, water, climate impacts, and key services	All	MINICT, NIRDA REMA, RLMUA, RMA, UR
Identify and implement applicable technologies through technology transfer to drive efficiency of resource consumption and creation of SMART services, particularly in energy and water	1.1; 2.1; 3.1; 4.1; 4.2	MINICT, MINALOC, NIRDA REMA, RLMUA, RMA, UR
Develop a robust forecast of future resource demands and vulnerabilities which are stress tested for future shocks, with applicable warning indicators	1.1; 2.2; 3.1; 3.2; 4.1; 4.2	MoE, REMA, RMS
Link GGCRS monitoring, reporting and evaluation systems to existing MRV systems for the updated NDCs improve planning and provide the evidence base to receive climate finance	All	MoE, MINECOFIN
Maintain links to regional and international centres of excellence to benefit from the latest research and innovation on climate resilience and low carbon development	All	MoE, RMS

6. Roadmap to Implementation

The Implementation Roadmap that follows is structured according to the Thematic Programme Areas and Programmes of Action. Sectors are guided to Appendix A: Green Growth Costing & Ministry Responsibilities for sector policy actions resulting from the implementation roadmap

The Roadmap to Implementation is the product of the final phase of the GGCRS revision process in which both short- and long-term implementation planning were analysed for synergies and appropriate phasing was determined. The roadmap outlines the major short-term priorities, as well as long term vision and ambitions that link back to the core objectives of the Revised GGCRS. The roadmap was built by identifying implementable actions for each Strategic Intervention, defining lead ministries and implementing agencies, and identifying financing requirements and approaches. Importantly, the roadmap identifies key interdependencies for implementation that guide considerations for alignment, coordination, and integration in the realisation of the GGCRS activities. The roadmap also contextualises the Enabling Pillars for each Programme of Action to demonstrate how the pillars can be applied across the nine sectors and many areas of focus for the GGCRS.

This phase also entailed a comprehensive costing exercise in which high-level costs for implementable actions for the period 2021 – 2025; 2026 – 2030; 2031 – 2035; and 2036 – 2050 were estimated. To guide the costing of the roadmap the team developed an excel-based database of ongoing and prospective actions that are (i) included in the budget or in current medium-term expenditure frameworks of key planning documents (including those linked to Vision 2050, NST-1, and the NDC), and (ii) supplemental actions with specific and credible sources of potential interventions in Rwanda – in particular from sector strategy papers, identified investment needs and opportunities (for example from RDB and FONERWA), (iii) third-party assessments of green growth and climate resilient investment needs in Rwanda, for example in the programs of partners such as the AfDB and the World Bank, or published by reputable research organisations such as the IGC, (iv) expert opinion and analysis of relevant examples of international programs, for example to estimate the potential investment in zero-waste SEZs or in embedded renewable energy generation.

Costs were then scaled and phased over the four key time periods and attributed to sectors and relevant ministries based on the nature of the actions. Care was taken to identify overlaps and synergies to ensure integrated implementation, and importantly, avoid double-counting wherever possible. Costs were also categorised according to capital or operational expenditure, and distributed appropriately between what would be provided by the public sector, and what might feasibly be leveraged by from the private sector.

While the next 5 to 10 years have a clear and specific set of actions to deliver on the commitments made in this GGCRS, the costing and implementation plan from 2030 to 2050 should be interpreted as very much a conservative lower bound. It includes (i) an estimate of ongoing operating expenditure related to investments up to 2030, (ii) some specific actions that will need to be continued and/or scaled up post-2030, and (iii) high-level estimates particularly of the private sector investment opportunity for which resources will need to be

mobilised. However, it does not attempt to “cost” actions which are as yet unidentified, and it is clear both the climate, Rwanda’s economy, and global value chains and technologies will have evolved greatly over the next 10 years. It will therefore be important to continue to revisit this GGCRS to ensure its continued relevance – and to build out from this current strategy with new actions and strategic interventions.

The Revised GGCRS costing is provided at a strategic high-level, and should be used as an indicative guide for sector budgeting and planning processes. The Strategic Interventions that have been costed highlight the investment need for the Revised GGCRS over its full implementation lifetime to 2050. The level of spending required is significant, but realistic when considering Rwanda’s growth ambitions and its key milestones in the journey to achieving high-income status.

On average, the investment required to implement the Revised GGCRS will reach US\$ 2 billion annually, of which approximately US\$ 700 million will come from government budgets and spending.

The following figures highlight the proportion of GGCRS spending in relation to (a) annual public expenditure, and (b) as a share of annual GDP, respectively.

The first chart shows the share of public expenditure required to deliver the investments identified in the GGCRS, as a share of annual public budgets. This is included to provide a clear indication of the extent of the commitment required from the public purse to invest in green growth and climate resilience - much of which is for major infrastructure.

The second chart shows the overall investment requirement (public and private) as a share of GDP. This is provided as a benchmark for the amount of capital that will need to be mobilised either through public sources, international investment, or domestic private sector investment.

In both cases the shares are declining over time. This is because (1) the GGCRS costing and implementation includes only spending needs identifiable today, which by the period 2035-2050 becomes less clear. The later periods should be periodically evaluated and updated. (2) even under a "conservative planning" assumption, as Rwanda follows its Vision 2050 to transition to an upper-middle-income country by 2035 and a high-income country by 2050, both GDP and the share of GDP raised for public finance will increase.

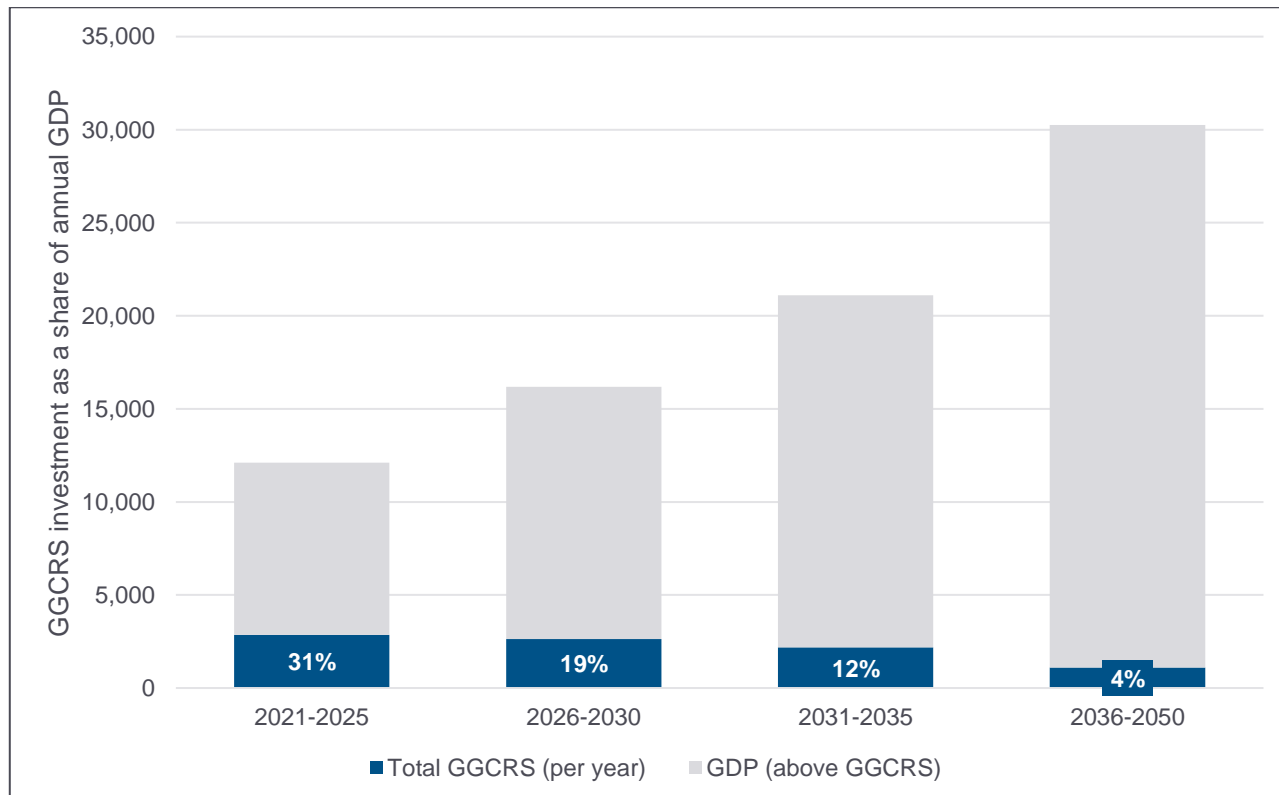
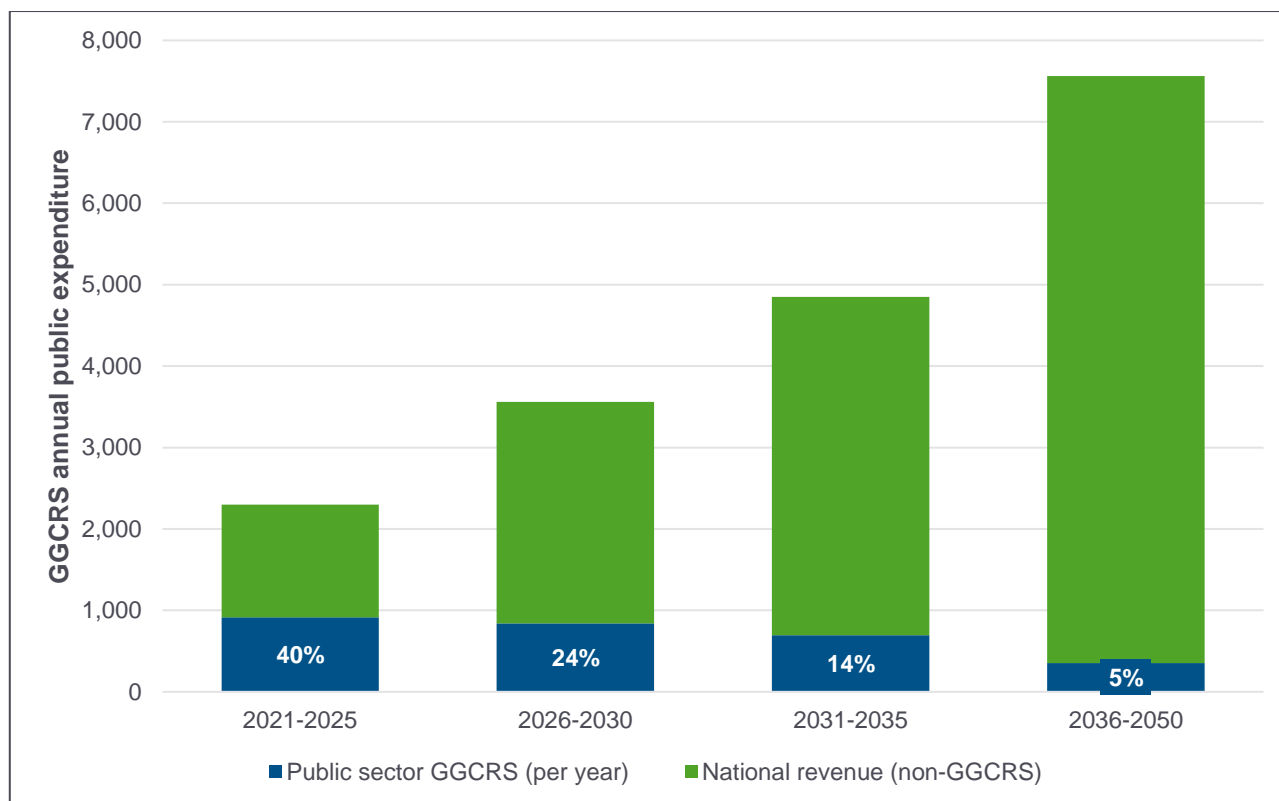


Figure 12 GGCRS Spending against other national benchmarks (a) as a share of annual public revenue (b) as a share of annual GDP

GREEN INDUSTRIALISATION AND TRADE

1.1 LOW-CARBON, CLIMATE-RESILIENT ENERGY AND TRANSPORT NETWORKS

Short-medium term priorities (2020 – 2030)

In the next 5 to 10 years the priority is to increase electricity generating capacity and increase connections to the main grid. Small and medium scale hydro-electric plants will be delivered to ensure as electricity generation increases to power households and industries it does so exploiting green technologies as much as possible. The share of households connected to the main grid will progressively increase once the universal access target (of which 52% connected to the grid) is reached in 2024, and a major priority to build on this progress will focus on generating green energy to power productive economic sectors.

Policies and hard infrastructure to facilitate a transition to widespread adoption of electric vehicles will also be prioritised. In the next decade this will focus largely on public sector programs to deploy the physical infrastructure needed to charge electric vehicles and “de-risk” private investment through proof of concept. New technologies such as e-motorbikes and electric buses will be scaled up in the coming decade, while increasingly strict energy efficiency standards for ICE private cars will be implemented. As Rwanda aims to become a regional transport hub, low-carbon transport such as railways will be prioritised, while aviation and roads will be developed resilient to climate change. A multi-modal transport system for both freight and passenger transport will centre around a low-carbon spine of railways and airports, with efficient links to road transport to reach throughout the country. Investment in resilience of transport networks will be a priority to protect against the risk of localised flooding and landslides.

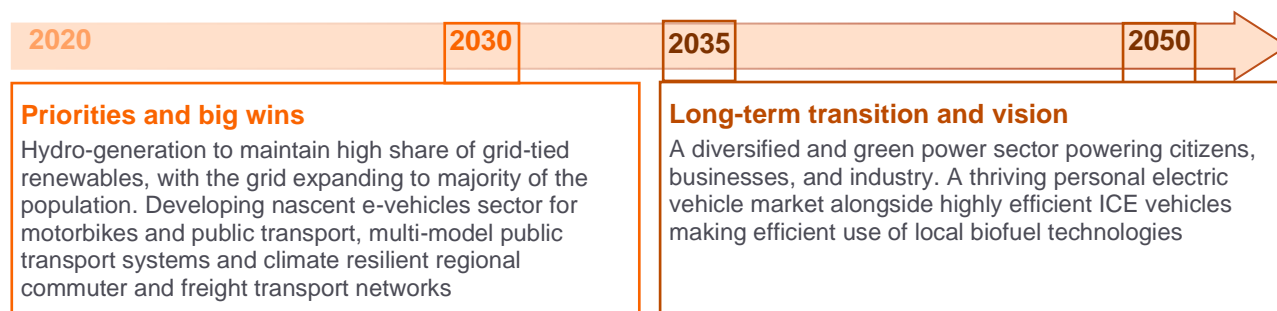
Long term ambitions (2030 – 2050)

The longer-term ambition will be to have a resilient, diverse, and green energy sector that underpins a carbon-neutral economy. This will include developing non-hydro based renewable energies, to ensure an electricity generating system that is resilient to future changes in rainfall patterns and water flow. This will include putting in place policies and regulations to encourage embedded renewable energy generation for households, businesses and major industries, and exploring cost-effective utility scale solar, wind, and geothermal technologies.

In the transport sector, an increase in the share of electric vehicles will be targeted, alongside fuel-efficiency measures and biofuels. Post-2030, measures to encourage private electrical vehicle adoption will be phased in, while all new ICE vehicles will need to meet high efficiency standards, while sustainable local biofuel technologies will also be explored.

Financing and unlocking implementation

A significant portion of the required funding in the next decade will come from the public sector, to develop key policies and hard infrastructure to catalyse private sector investment and economic activity in the long-term.



Financing Requirements by 2050



Public sector funding need estimated at US\$ 7,593 million



Mobilise US\$ 6,279 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Increasing RE generation in the generating mix	✓			Share of renewables in total electricity supply (%)	1,241
Low carbon energy to key sectors	✓		✓	Percentage of EVs over total vehicles, by type (motorbike, car, bus)	1,114
Sustainable and climate resilience transport networks, freight and logistics		✓		Travel times on international and national roads, including delays at ports, weighbridges, police checks and border posts (frequency: biannual; unit of measure: hours)	5,617
Integrated multimodal transport systems	✓	✓		Reduced length (km) of roads vulnerable to landslide, by type (national paved national unpaved district road)	4,469
Universal Access to Electricity - on-grid solutions	✓		✓	Number of households connected to the grid	1,432

Interdependencies in implementation

- Access to green energy is a key driver for Programmes of Action 2.1 and 2.2
- Links to off-grid energy access and powering rural economy in Programme of Action 4.2

Enabling Pillars

Institutional arrangements Energy sector working group key driver, delivery of energy sector strategic policy, national transport policy, etc.	Finance Significant public sector finance needed. Strong role for FONERWA and international climate finance
Capability, Inclusion and Training Workforce will need to be trained with specific qualifications for RE installation and maintenance, driving inclusive and high-skill jobs	Digital Transformation and Innovation Use of GIS and sophisticated energy usage data should drive a data driven approach to demand side management for a resource efficient energy sector

1.2 GREEN INDUSTRY AND PRIVATE SECTOR PARTICIPATION

Short-medium term priorities (2020 – 2030)

Rwanda will continue to develop its SEZs and industrial parks to develop light industry and service sector agglomerations. This will involve increasing incentives for green growth for example aiming for “zero waste”, switching to lower-impact materials, and using onsite renewable energy generation for agro-processing and manufacturing to serve the local market and exports to neighbouring counties.

A supporting policy and regulatory environment will support a shift from agriculture and primary production to developing integrated value chains for agro-processing and manufacturing, initially inward-oriented and over time exploring high-value export potential. This will build on activities described in PoA 2.1 to increasingly raise minimum energy performance standards in industry and to increase standards on both imported machinery and local manufacturing. The manufacturing and industrial sectors will be innovative and nimble to respond to opportunities as they arise, with continued investment and capacity building to strengthen the mandate, technical and financial capacity of the Cleaner Production and Climate innovation Centre.

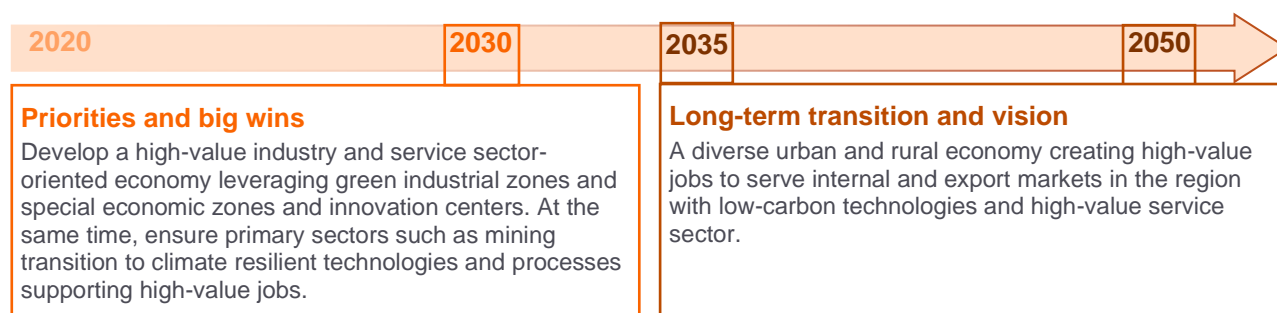
Finally, while the above measures describe a transition to a diversified green and climate resilient economy, the mining sector will continue to be important and will be professionalised including adopting clean onsite energy generation, and implementing best practice climate compatible mining.

Long term ambitions (2030 – 2050)

In the longer term, innovation centres will foster high-tech service sector agglomerations providing high-skill jobs adapted to a fast-evolving world-economy and resilient to physical and transition climate change risks. This will include building a regional leading financial services sector and exploring sophisticated financial instruments (including labelled bonds), while creating an ecosystem for a cutting-edge knowledge economy, initially building data analytics capabilities to support key industries and over time investing in skills for advanced technologies such as blockchain, artificial intelligence etc.

Financing and unlocking implementation

The majority of finance for green industries will be mobilised from domestic and international investors, with policy, regulatory, and some financial incentives from public funding. In particular, through PPPs to provide enabling public sector investment in key industrial parks and to encourage location of high-value businesses to innovation and agglomeration sites. While the need for public funding is limited to around US\$ 46 million in the next 5 to 10 years, this should be aiming to form partnerships with private sector operators to mobilise up to US\$ 10 billion in investment over the coming decades.



Financing Requirements by 2050



Public sector funding need estimated at US\$ 562 million



Mobilise US\$ 10,197 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Green SEZs and Industrial Parks	✓		✓	Emission intensity per output (tonnes/USD million value added)	365
Increase finance for green technologies in industries to raise productivity			✓	Cumulative volume of financial resources [USD millions] mobilized for climate and environmental purposes in industry and technology	10,305
Strengthen industrial sector capacity including of the Cleaner Production and Climate Innovation Centre			✓	Students enrolled in TVET as proportion of total students in Basic Education (%)	24
Greening the Mining Sector to ensure sustainability and responsiveness to the Green Economy	✓	✓	✓	Percentage of companies deploying climate compatible mining	64

Interdependencies in implementation

- Driven by access to clean and reliable energy and transport networks (Programme of Action 1.1)
- Providing quality urban and rural jobs (Programmes of Action 2.1 and 4.1)

Enabling Pillars

Institutional arrangements RDB and SEZAR to form bilateral agreements and PPPs with industry and developers. Innovation centres such as CPCIP to support businesses and skills development	Finance Public finance to connect and provide access to infrastructure. PPPs and bilateral developer agreements to mobilize private sector investment
Capability, Inclusion and Training Education sector needs to prepare for the jobs of the future and enable shift to service-oriented economy	Digital Transformation and Innovation Initially focus on developing application of data to support finance, industry, and logistics, while developing long-term capabilities in knowledge economy

GREEN URBAN TRANSITION AND INTEGRATION

2.1 LOW CARBON AND SMART URBAN INFRASTRUCTURE AND SERVICES

Short-medium term priorities (2020 – 2030)

Ensuring that the growing urban population has access to affordable housing will require supporting measures to lower the costs of building affordable houses. Then public-private-partnerships will need to be structured to deliver quality buildings, accessible to lower-income households. Master plans for Kigali and secondary cities will be updated and delivered to ensure harmonised, integrated implementation of housing investments.

Urban transport infrastructure will centre around creating a reliable public transport system in Kigali and secondary cities with a mix of interventions like hard costs to expand and upgrade bus fleets, introducing dedicated bus lanes and in the case of Kigali in the first instance, a bus-rapid transit network and cable car system. These infrastructure investments will be supported by soft measures such as route franchising, real-time digital control room and improved traffic management systems. Non-motorised transport will be integrated alongside modern motorised public transport to deliver resilient and healthy cities and citizens.

Access to high-skill jobs will be fostered through investments in world-class infrastructure, and as part of an integrated plan for economic and industrial industry development. Existing training and upskilling programs will be supported, and bilateral agreements with world-class universities will continue to be facilitated and extended. Flagship projects like Kigali innovation city will be a key driver and proof of concept to attract and retain a qualified, green labour force.

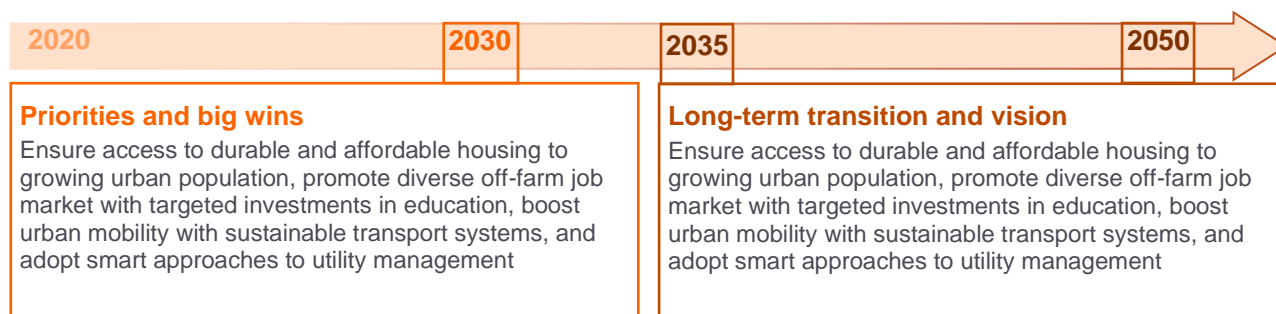
Integrated municipal services and utility management will focus on ensuring reliable water, electricity, and waste management. The most urgent priorities include investing in efficient waste management practices and continuing support develop e-waste recycling; promoting solar water heater installation in buildings; and creating a Kigali smart city control centre that collects data on utilities and on transport.

Long term ambitions (2030 – 2050)

In the long term, the ambition is to integrate green and affordable housing, efficient and renewable energy, reliable, environmentally friendly public transport, and smart waste and water management in a holistic way. This will require data-driven management and planning for utilities, reliable infrastructure and services, and localized and shared innovation. This will be achieved by upscaling projects like the Green City Kigali pilot to secondary cities. Increased mobility will support increasing EV infrastructure, extended BRT and cable car systems to secondary cities, and the establishment of a Mass Rapid Transit (MRT) system in Kigali.

Financing and unlocking implementation

Key public sector regulations, policies, and finance is expected to mobilise substantial private sector investment and partnerships. Enabling policies, skill development, and hard infrastructure investments will allow for gradual phasing out of major subsidies in the long term, especially in the housing and public transport sector. In the short term, import tax breaks and regulations could encourage adoption of new technologies in construction, while time-limited subsidies may be needed to ensure quality green housing is affordable for all.



Financing Requirements by 2050



Public sector funding need estimated at US\$ 5,391 million



Mobilise US\$ 12,196 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Rwanda Green Building Minimum Compliance System	✓			Number and % of new Category 4 and 5 buildings that comply with the Green Building Minimum Compliance system (i.e. those covered by the regulation: commercial buildings, health and education facilities, public administrative buildings and social/cultural ones)	2,292
High quality, affordable housing and dense cities	✓	✓		Decreasing percentage of urban population living in informal settlements	12,950
High quality, tradeable off-farm jobs		✓	✓	% of skilled people (qualified and experienced) with critical and rare skills in the high priority sectors	306
Transition to green public transit	✓			CO2 Emissions intensity per passenger-km for public transit	1,841
Smart approaches for municipal service management	✓	✓	✓	Public services rendered online (%)	197

Interdependencies in implementation

- Reliable access to green energy and an integrated transport network, in Programme of Action 1.1, are needed
- Successful growth of off-farm jobs is strictly linked to thriving green industry, in Programme of Action 1.2

Enabling Pillars

Institutional arrangements Affordable housing plan, Green Building Minimum Compliance, National skills development strategy, City master plans, transport sector plans	Finance Public spending main component but key to expand access to household finance and to target PPPs in core housing and transport sector
Capability, Inclusion and Training Education and specific training needed to ensure that right skills are developed for off-farm and in particular green jobs	Digital Transformation and Innovation Data-led management pivotal to promote efficient public transport networks and to achieve smart integrated planning for municipal services

2.2 INTEGRATED AND RESILIENT URBAN LANDSCAPES

Short-medium term priorities (2020 – 2030)

In the next decade, Rwanda will urbanise rapidly and the short-term priority is to ensure this trend is powered by citizen- and business-oriented cities resilient to the threats of climate change. Delivering on Kigali's green development plan while supporting urban planning and channelling investment to the six secondary cities is the priority. The actions outlined below are complementary to the substantial investment in housing, transport, high-skill jobs and integrated municipal services described in PoA 2.1.

Climate resilient structure starts with the design and installation of Sustainable Drainage Systems in key urban areas across Rwanda's main cities and towns, including swales, bioretention areas, retention ponds, and buffer strips. This will unlock open streets and cycle paths along nature routes. Moreover, we will prioritise reducing the vulnerability of the road network and other infrastructure to landslides, developing environmental and engineering guidelines for all new projects, and investing to strengthen the existing system. Finally, as Rwanda's economy transitions to a higher share of industry and service-sector, targeted actions will make sure the workforce is resilient to rising temperatures as well. These include investment in smart building design and spreading of cooling technologies (costed in PoA 2.1 above).

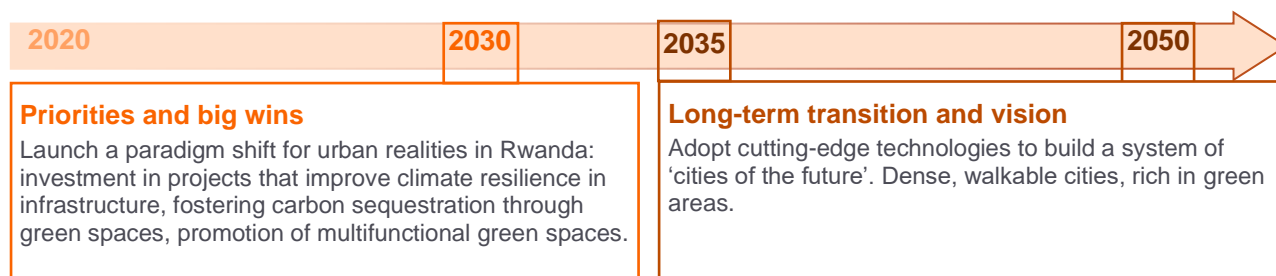
Rollout of city master plans will deliver functional and liveable cities, promoting higher density in urban settings and increased availability of multifunctional spaces. In practice, this means expanding access to green recreational areas, piloting the development of urban community gardens and urban farms in some areas, and supporting other initiatives to ensure carbon sequestration like green roofs. Having the same goal, the completion of Green City Kigali will serve as a model for other sustainable neighbourhoods. A National Centre of Excellence for Green Urbanisation will be established to enhance research, capacity and knowledge generation; existing community outreach and awareness programs for residents will be reinforced.

Long term ambitions (2030 – 2050)

The ambition in the long term is to consolidate successful pilot projects on green urban areas, urban horticulture, multifunctional spaces, and resilient infrastructure into wider implementation plans. Lessons learnt from the Green City Kigali project will be capitalized, replicating the project in other districts and cities.

Financing and unlocking implementation

Flagship projects currently benefitting from public and private funding will catalyse international funds for their scaling up and will hence become self-sustaining. Setting up enabling guidelines and regulations, and ensuring their compliance, will allow for the productive implementation of plans in the market. Promoting community participation and knowledge sharing on the sustainable growth of neighbourhoods and cities will make strategies more powerful and project implementation more effective.



Financing Requirements by 2050



Public sector funding need estimated at US\$486 million



Mobilise US\$1,621 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Agglomeration, Densification, Mixed User and Multifunctional Urban Spaces		✓	✓	Percentage of urban households living in a smart green city/district	1,700
Greening Cities through Green Space and Agriculture	✓	✓	✓	Average share of the built-up area of cities that is open and green space for public use for all (SDG)	7
Integrated Urban Stormwater and Drainage Management		✓		Percentage of urban population in areas covered by master plans with storm water considerations	400

Interdependencies in implementation

- Low-carbon public transport, grid electrification, and affordable housing (Programmes of Action 1.1 and 2.1) are prerequisites for densification
- Efficient land management and spatial planning (Programmes of Action 3.1) are needed for urban development
- Stormwater management should happen in concert with increasing the climate resilience of roads, costed in Programmes of Action 1.1

Enabling Pillars

<p>Institutional arrangements</p> <p>Cooperation of national agencies (MINALOC, MININFRA and MoE) with city councils. Rollout of master plans for Kigali and six secondary cities.</p>	<p>Finance</p> <p>Mostly public investment for resilience of infrastructure; catalyse private sector and household investment for greening the urban layout and multifunctional spaces.</p>
<p>Capability, Inclusion and Training</p> <p>Establishment of Centre of Excellence for Green Urbanisation; community outreach programs like Urban October initiative</p>	<p>Digital Transformation and Innovation</p> <p>Use of GIS data for monitoring green space development and the successful delivery of densification according to city master plans</p>

SUSTAINABLE LAND USE AND NATURAL RESOURCE MANAGEMENT

3.1 ADAPTIVE AND RESILIENT LAND USE MANAGEMENT AND SPATIAL PLANNING

Short-medium term priorities (2020 – 2030)

In the next 5 - 10 years a strong focus must be placed on operationalising an integrated GIS data and information system to create a unified framework of spatial planning, land administration, and vulnerability mapping tools. The National Spatial Data Infrastructure must be put in place to support the development of sophisticated ICT and GIS capabilities that will enable Rwanda to advance land use planning and management, in an integrated manner that allows for information-sharing and enables a more complete spatial understanding of land use change and its impacts.

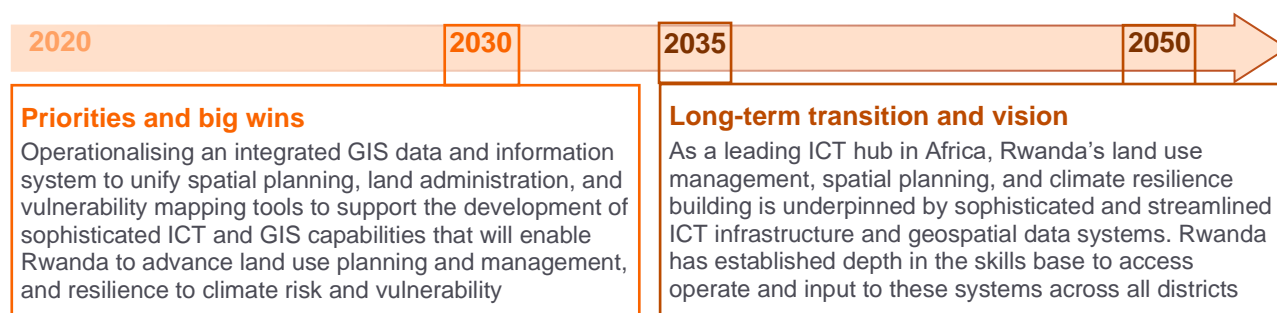
This will facilitate the NLUDMP implementation processes as well as support the interoperability between existing systems and repositories. Importantly, the use of these state-of-the-art GIS-based tools and information must also be targeted to building climate resilience. This will be done through the active maintenance of updated risk and vulnerability mapping which is interlinked with advances in understanding of climate projections and impacts

Long term ambitions (2030 – 2050)

In the long term, Rwanda's ICT Sector will be a cornerstone of Economic transformation, Social transformation, and transformational Governance as it operates as the "Leading ICT Hub in Africa." This will have a fundamental impact on land and natural resource management as Rwanda transitions to decouple its economic growth from reliance on resource-based and extractive industries. Reliable, real-time, responsive ICT infrastructure and systems will be a strong base for inclusive planning and resilience building to enable interventions and management programmes to reach vulnerable populations and areas, and assist with the distribution of livelihood building inputs, disaster response, and natural resource management.

Financing and unlocking implementation

The government of Rwanda will need to overcome delays and lack of implementation of sustainable land use management and spatial planning infrastructure and systems such as the NSDI and its inter-operability with other systems. This could be done by capitalising on the momentum around building the resilience of the economy and the adaptive capacity of Rwandan people and businesses. The bulk of this Programme of Action would be financed by public budget (\$ 295 million by 2050) with inputs from the private sector to support access to cutting edge technology, skills transfer and data sharing.



Financing Requirements by 2050



Public sector funding need estimated at US\$ 331 million



Mobilise US\$ 6 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Integrated planning and monitoring for sustainable land management		✓		NLUDMP that includes comprehensive measures and procedures for sustainable land use practices	92
Development of sustainable sectoral land use strategies and National Spatial Data Infrastructure (NSDI) including information management and sharing policy.		✓		Percentage of operational integrated geospatial information framework integrated with environmental and socio-economic statistics	117
GIS/ICT Innovation throughout Government, Districts and Implementing Agencies		✓		GIS systems and ICT tools in use at all levels of government	11
Development of an inclusive and automated land administration to regulate and provide guidance for land tenure security.		✓		Percentage of registered state land optimally used	38
Risk Assessment and Vulnerability Mapping (including integrated early warning system)		✓		Percentage of occurred extreme weather events for which advance warning was provided at least 30 minutes in advance	80

Interdependencies in implementation

- Implementation of Programme of Action 3.2 relies on the planning and management support that an effective ICT and GIS tools base will provide.
- The green technology and SMART services processes established through Programme of Action 2.1 will complement and build on the achievements in this Programme of Action.

Enabling Pillars

Institutional arrangements Leading ministries (MoE, MINAGRI, MINALOC, MINIFRA) will ensure agencies (RDB, RAB, RLMUA, RFA, RWB) are capacitated to reach district and community level for multi-level skills development and implementation	Finance Scale up finance for ICT entrepreneurship and expand access to National Research and Innovation Fund to encourage Rwandan SMMEs to pursue ICT-based solutions for climate resilience.
Capability, Inclusion and Training To ensure integrated implementation the distribution of GIS Hubs and training centers must facilitate improving data literacy and access to geospatial ICT skills development to ensure depth in this critical skills base.	Digital Transformation and Innovation ICT led adaptive capacity building will require innovations in remote sensing, satellite monitoring and imagery, and responsive data management and sharing

3.2 INTEGRATED WATER RESOURCES MANAGEMENT

Short-medium term priorities (2020 – 2030)

In the next 5 – 10 years Rwanda will design and implement the necessary interventions to support the maintenance and enhancement of its natural capital. This will support rural livelihoods, larger resource-based sectors, as well as the security and productivity of strategic natural resources such as water and land resources. Importantly, the short-term focus on natural and water resources management should also facilitate the transition from extractive processes and the export of raw materials to resource preservation through value adding product development and green efficiency.

Initially the focus of land and natural resource management must be on vulnerable and climate impact prone areas and populations to build the adaptive capacity of rural economic activities and communities.

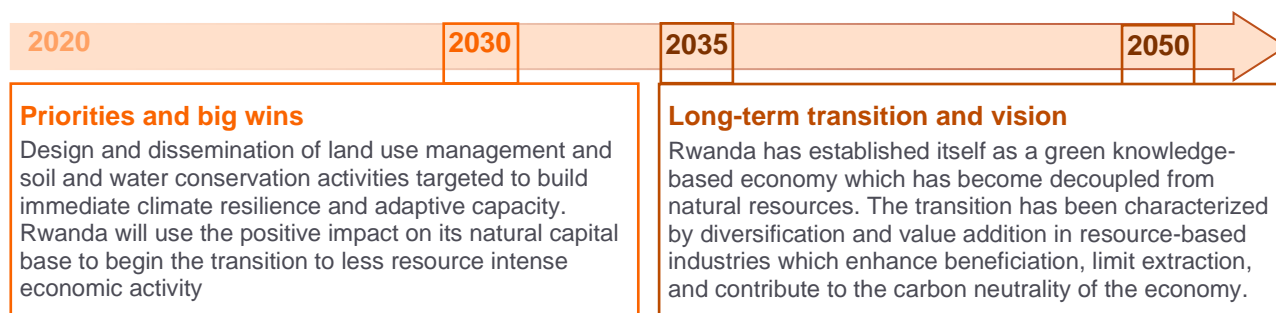
Long term ambitions (2030 – 2050)

Rwanda will seek to establish itself as a green knowledge-based economy which has become decoupled from natural resources. This shift should be accompanied by extensive land, water and natural resource management programmes that improve the resilience of Rwanda's economy to shocks to the natural capital base. These include progressive approaches to ensuring enhanced biodiversity, the prioritisation of water towers, reforestation of degraded lands, creation vegetation buffer zones along riverbanks and grass buffer strips in farmlands, and upstream watershed protection measures. Water storage and multi-functional infrastructure should be a key focus especially noting that it will underpin irrigation, sustainable urbanization while also reducing risk of flood disaster.

Financing and unlocking implementation

Effective partnerships will need to be built to disseminate and align stakeholders from communities through to government and private sector in order to achieve multi-level integrated implementation of sustainable land and water resources management. Financing needs to 2030 are considerable (US\$ 1,920 million) if the country seeks to implement measures at national scale, leaving no one behind. However, the avoided costs of destructive climate impacts and climate vulnerability, alongside the economic benefits of agricultural productivity gains, job creation, and livelihoods security will justify the outlay to build a resilient economy.

Rwanda has the opportunity to access an ever-growing pot of climate-related finance, as well as structure context-specific innovative finance products and mechanisms that enhance natural capital. These include debt-for-nature swaps, blended finance facilities, endowment vehicles, and payments-for-ecosystem-services.



Financing Requirements by 2050



Public sector funding need estimated at US\$ 1,392 million



Mobilise US\$ 1,100 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Climate Resilient Water Infrastructure for Storage and Supply		✓		% of water storage and supply infrastructure fortified with climate resilience improvements	280
Completion of Remaining Level 1 Catchment Plans and implementation of catchment restoration and soil erosion control strategies		✓		Percentage of water bodies with ambient water quality	2,172
Strengthened Disaster Management and Response		✓		Number of effective city contingency plans developed	40

Interdependencies in implementation

- Land use management and soil and water conservation activities must be planned and implemented with information from Programme of Action 3.1
- Largescale management of land and natural resources underpins sector specific successes in the rural economy for Programmes of Action 4.1 and 4.2

Enabling Pillars

Institutional arrangements Multi-level implementation will be facilitated through REMA and the RDB predominantly through the broadscale upskilling and behaviour changing of farmers, pastoralists across districts	Finance Agricultural development fund, access to finance for smallholders (SACCOs, MFIs), PES, climate finance and catalyzing private investment through impact investing, blended vehicles
Capability, Inclusion and Training Annual land and catchment management forums must facilitate continued engagement, skills development, and responsiveness to resilience-building needs. GIS Hubs and community forums will ensure effective information dissemination and inclusive planning	Digital Transformation and Innovation Ensuring implementation is carried out with support from geospatial ICT innovations, and in turn feeds back into GIS knowledge systems is essential for dissemination, logistics, reliability and building state of the art scientific evidence base for nature-based solutions.

VIBRANT RESILIENT GREEN RURAL LIVELIHOODS

4.1 SUSTAINABLE AGRICULTURE, FORESTRY AND CONSERVATION

Short-medium term priorities (2020 – 2030)

The immediate priority is to ensure food security in the context of rapid urbanisation, population growth, and climate change which increases pressure on scarce land resources. Climate smart crops and improved livestock husbandry will be implemented, including increased use of mechanisation, efficient and clean irrigation and on-farm water management. Investment is needed in climate-smart varieties of key crops, multi-cropping and continuous crop rotation to diversify livelihoods and manage soil quality, in improved use of organic fertilisers to boost yields while also managing soil erosion and improving soil fertility. Finally, insurance markets for climate and disease related incidents will be developed to protect farmers and communities against remaining climate risks that they are not well able to manage.

The structure of the agriculture sector will evolve as population grows and with increasing pressure on land for other purposes (including housing) and individual smallholder plots transitioning to consolidated rural settlements. Agricultural land will be assessed based on criteria including soil quality, water availability, nutrients, potential yield and crop-diversity. Agricultural value chains will be developed to support development of processed goods for high-quality domestic and international exports, with improved cold-storage, logistics and post-harvest manufacturing infrastructure to access markets and reduce post-harvest losses.

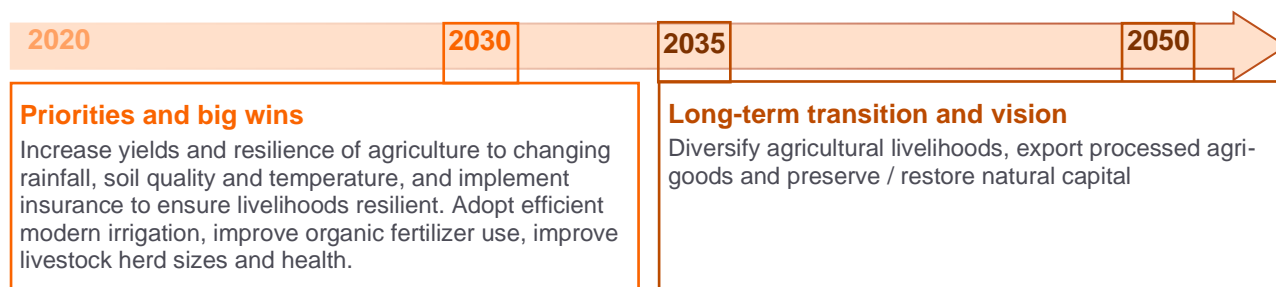
Improved forest management and natural resources will be underpinned by continued development and application of natural capital accounts, incentivising private sector stewardship of natural resources, including promoting reforestation and afforestation of designated areas. This includes supporting a growing eco-tourism industry, rollout of PES, of community-based adaptation agreements, and revenue-sharing mechanisms for agro-forestry, conservation and restoration activities.

Long term ambitions (2030 – 2050)

Much of the priorities for sustainable agriculture, forestry and conservation need to be implemented in the next decade to ensure Rwanda's growth is sustainable and supported by a rich and resilient natural environment. Natural resources will need to be preserved and support diversified livelihoods.

Financing and unlocking implementation

At an institutional and policy level, operationalising the recently finalised National Agriculture Policy (2018) and the Land Use and Development Master Plan (2020) are the immediate priorities. A key enabling pillar for the realisation of this PoA is the increasing use of GIS data to support land use prioritisation and management. The majority of finance must come from the private sector, with public policy and small windows of catalytic public funding used to create the right incentives for bankable investments in resilient agricultural practices, forestry and land use. Rwanda will continue to need to mobilise resources from innovative financing instruments including exploring the use of labelled bonds ("green", "sustainability", "transition") and implementation of payment for ecosystem services, biodiversity, accessing carbon finance etc.



Financing Requirements by 2050



Public sector funding need estimated at US\$ 594 million



Mobilise US\$ 4,874 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Enhance agro-ecology, crop variety, climate-resilient cultivars and animal breeds, local and export markets		✓	✓	Climate resilient crop varieties: (i) number of varieties developed and (ii) percentage of farmers adopting them	1,089
Improved on-farm water and energy management incl. efficient irrigation and farming systems	✓	✓	✓	Number of hectares under irrigation within IWRM (Integrated Water Resources Management) framework	2,955
Diversification and manufacturing with expansion of local and export market access		✓	✓	Capacity of storage constructed in MT (million metric tonne)	470
Developing agroforestry and soil management for sustainable agriculture and fruit production	✓	✓	✓	Average tree density (tree/ha) in crop and agroforestry lands	734
Rehabilitation of degraded forest resources and improvement of forest management.	✓	✓		Number of ha restored and set under approved management plan	150
Promoting conservation, community-based ecotourism, and enforcement of PES	✓	✓	✓	Tourism revenue generated by ecotourism parks sites per year	72

Interdependencies in implementation

- Supported by Programme of Action 4.2 especially sustainable biomass usage and access to sustainable cooking practices
- Underpinned by sustainable land use and data (Programme of Action 3.1) and disaster management and response (Programme of Action 3.2)

Enabling Pillars

Institutional arrangements National Agricultural Policy (2018), National Land-Use and Development Master Plan 2020-2050 (2020), community-based adaptation, revenue sharing	Finance Agricultural development fund, PES, access to finance for smallholders (SACCOs, MFIs), catalyzing private investment in bankable and sustainable projects
Capability, Inclusion and Training High-skill public sector extension services and trained livestock and crop experts. Empowering women in agriculture and diversification beyond primary production	Digital Transformation and Innovation Digital applications to disseminate information to farmers, underpin agri-insurance, high-res GIS data on soil quality and typology, efficiency in logistics planning

4.2 GREEN AND CLIMATE RESILIENT RURAL SETTLEMENTS

Short-medium term priorities (2020 – 2030)

In the next five to ten years, targeting urbanisation increase will go hand in hand with ensuring that rural settlements thrive, guaranteeing universal access to basic services, improving regional transport connections, and gradually transitioning to cleaner energy for everyday tasks like cooking.

Universal access will be achieved by 2024 through a quick scale up in deployment of installation of mini grids and quality solar home systems in line the Ministerial Guidelines (2019). Households will gain access to modern energy cooking services (i.e. improved cooking stoves) and to alternative fuels (e.g. LPG, electricity, ethanol, pellet instead of biomass). Other essential services to be rolled out in the next ten years include decentralised solutions to ensure that remote areas are reached and served – in particular, for water treatment and sanitation.

Improving the availability of bus services in rural areas with route franchising measures, together with the construction and rehabilitation of rural roads, is imperative to the growth and connectivity of both people and goods. Its success is tightly linked to plans for expanding the paved road network and the expansion of local and export agricultural markets, which are costed in Programmes of Action 1.1 and 4.1.

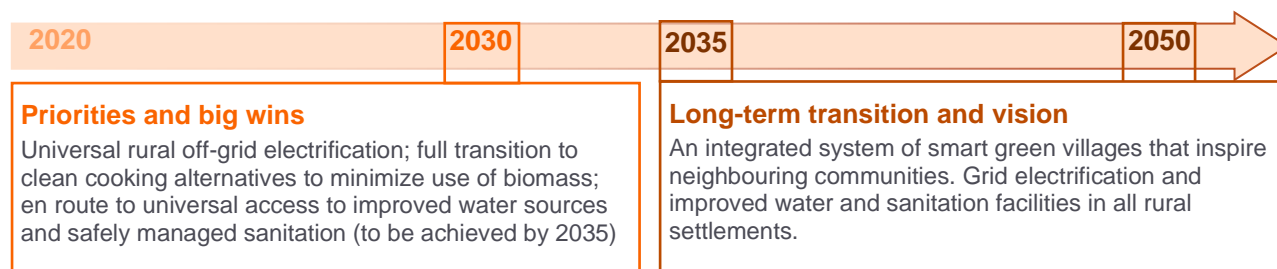
Investments in model green villages will be scaled up, aiming to implement over 400 (one in each sector of the country). This integrated approach will support realisation of environmentally sustainable, socially inclusive and economically stable communities, with lessons learned replicated nationwide.

Long term ambitions (2030 – 2050)

The ambition for Rwandan rural settlements in 2050 envisions that all households will have availability of improved water sources in dwellings/yard (i.e. access to safely managed drinking water services). Once universal access to energy is achieved, the focus will shift to improving reliability and quality of access including expanding grid electrification and “stacking” energy access technologies to expand options for high-quality renewable energy in everyday life. Green villages will be scaled up, gradually incorporating the ‘smart’ component in them, and serving as model to other communities. Longer term plans also include the gradual phasing out of ICE buses in favour of electric vehicles.

Financing and unlocking implementation

Reaching ambitious targets by 2024 will require coordination across a range of stakeholders. Households will have a major role in the implementation – especially in accessing clean energy technologies. Public funding and policies will support these goals by facilitating private sector investment, encouraging access to consumer finance, and promoting broad community engagement and behavioural change. While most of the investment will be mobilized from the private sector, targeted public funding will ensure lower income households are not left behind and have access to basic goods, services, and economic opportunities. Large-scale public investment will be needed in rural transport networks and water treatment infrastructure.



Financing Requirements by 2050



Public sector funding need estimated at US\$ 1,228 million



Mobilise US\$ 1,175 million in private sector investment

Strategic interventions summary

Strategic intervention	Mitigation	Adaptation	Green growth	Key indicator	Total cost until 2050 (US\$ millions)
Decentralised Water Treatment Solutions		✓		Number of households having access to improved water sources and sanitation services	320
Bus services in rural areas	✓	✓		Percentage of population conveying with public transportation (total urban rural)	248
Off-grid electricity and efficient wood conversion	✓			Number of households with off-grid access to electricity	1,761
Model villages and effective spatial planning	✓			Number of smart green villages	74

Interdependencies in implementation

- Links to grid extension and renewable energy, as defined in Programme of Action 1.1.
- Effective spatial planning depends on good land management, put in place according to Programme of Action 3.2
- Functioning bus services serve industry and urban development as well (Programmes of Action 1.1 and 2.1)

Enabling Pillars

<p>Institutional arrangements</p> <p>MININFRA and MoE main role; leading agencies for implementation are WASAC, RTD, REG, and RFA, RWB.</p>	<p>Finance</p> <p>Supporting solutions to the affordability challenge with pay-as-you-go approaches (e.g. clean energy appliances), and targeted investments for infrastructure</p>
<p>Capability, Inclusion and Training</p> <p>Awareness campaigns and community engagement will be pivotal to power behavioural changes for households, especially for WASH, energy, and transport.</p>	<p>Digital Transformation and Innovation</p> <p>Larger role of ICT in the long term, in particular for managing household expenditures related to utilities. Important for smart green villages, focus after 2030.</p>

7. Implementation Planning and Results Framework

The GGCRS provides a coherent framework and costed set of interventions and actions that sector departments and entities must take forward. It is envisaged that each sector develops its sector plan for implementation building on the sector interventions outlined in Appendix A, including the timing and annual budget that should be allocated for implementation. These budget requirements would be an important part of the annual Government of Rwanda budgeting process driven by MINICOFIN, and may be captured in a GGCRS specific financing mobilisation strategy to be driven by MINICOFIN and FONERWA. Ongoing regular coordination and monitoring of implementation would occur as outlined in the Pillar 1: Institutional Arrangements, against the Results Framework described below.

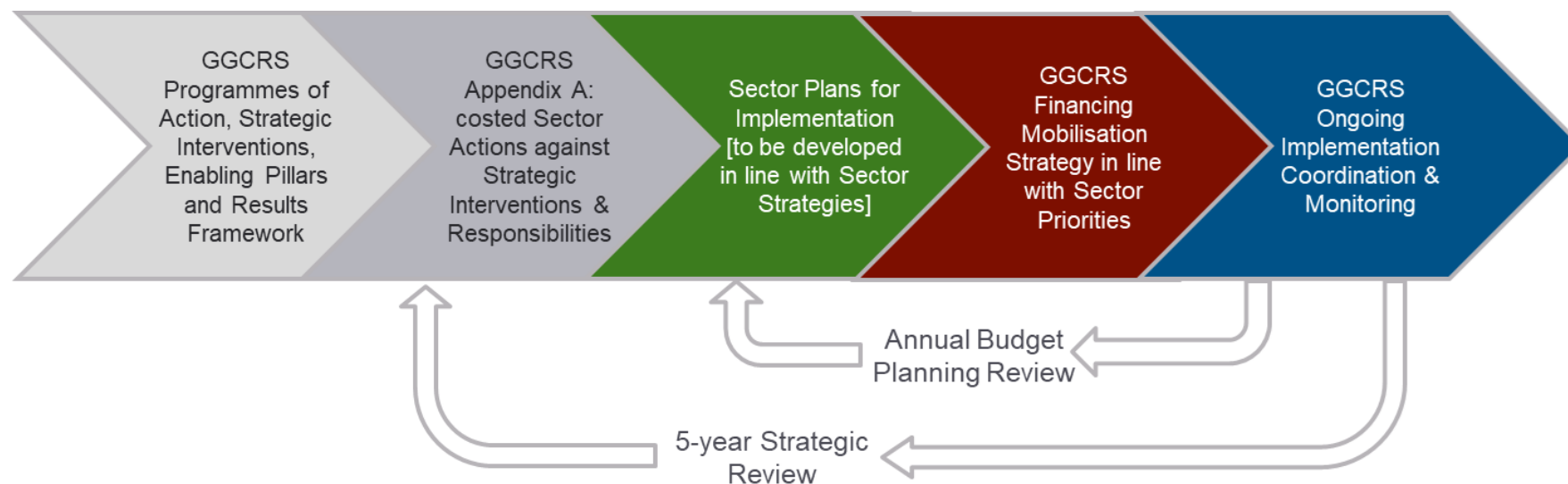


Figure 13: GGCRS Implementation Planning Mechanism

Importantly, annual evaluation and adaptation of these sector plans would occur as part of government review and budgeting, while 5-yearly evaluation of progress with the GGCRS should guide the prioritisation and costing of interventions and actions within the Programmes of Action, reflecting implementation progress and evolving conditions in driving Rwanda towards the Vision 2050.

The roadmap concludes with a Results Framework built with primary and secondary indicators that are **Specific, Measurable, Action-oriented, Relevant** and **Time-bound** to ensure the implementation of the GGCRS can be effectively monitored, reported on, and verified. The indicators are drawn primarily

from the updated NDC MRV Framework, Vision 2050, various national strategies, and the Sector Strategic Plans. Where Strategic Interventions are additional to the existing range of Green Growth and Climate Resilience Activities already found in key planning documents, indicators were drawn from credible studies by development partners and finance institutions including the African Development Bank (AfDB). The following GGCRS Results Framework is structured to guide the implementation of the strategy, and is closely aligned with other key planning documents to integrate and streamline implementation, monitoring, reporting and verification.

SUMMARY DASHBOARD

A summary dashboard of indicators has been compiled to enable senior management across Rwanda's ministries to track the implementation of the GGCRS. These indicators align to the foundational visions and targets of the Vision 2050, and assist to enhance the green growth, and climate resilience focus of Rwanda's future economic development.

GGCRS Programme of Action	Indicator (aligned with Vision 2050)	Baseline	Near-Term Target (2025, 2030)	Long-Term Target (2035, 2050)
1.1 Low-carbon, climate resilient energy and transport networks	Increasing share of renewable energy in power generation mix	53.78% (June 2020)	At least 60%	At least 60%
1.2 Green industry and private sector participation	Industry sector's value-added contribution to GDP, ensuring increasing proportion of industrial activity is related to GGCRS priority sectors	18% (2019)	24%	33%
2.1 Low carbon and SMART urban infrastructure and services	Percentage of urban households living in a smart green city/district accessing sustainable and modern municipal services.	Urban population: 18.4% (2016/17) of which 10% living in green city/district	Urban population: 52.69% of which 25% living in green city/district	Urban population: 70% of which 50% living in green city/district
2.2 Integrated and resilient urban landscapes	Proportion of urban area that has been formalised/enhanced based on green principles (in line with the national Roadmap for Green Secondary City Development and Green City Kigali)	City of Kigali had 30% public green space in 2018	10 square metres green space per capita in urban areas	15 square metres green space per capita in urban areas
3.1 Adaptive and resilient land use management and spatial planning	Percentage of districts adhering to and implementing the NLUDEMP	NLUDEMP first published in 2020.	100% of district Land Use Plans (LUP) harmonized with NLUDEMP by 2025	100% of district Land Use Plans (LUP) harmonized with NLUDEMP
3.2 Integrated water resources management	Percentage completion and implementation of catchment management plans to ensure coherent and climate resilient infrastructure development integrated with catchment conservation	44% 4 of 9 completed (2021)	100%	100%
4.1 Sustainable agriculture, forestry and conservation	Maintain advantageous land use allocation as per NLUDEMP for highest value-add against natural resource conservation to support optimum value chain development. Ensure sustainable intensification through monitoring agricultural value added per worker.	Percentage Coverage Agric. & Forestry: 42% Conservation: 47%	Percentage Coverage Agric. & Forestry: 44% Conservation: 43%	Percentage Coverage Agric. & Forestry: 47% Conservation: 38%
		Agriculture value-add per worker: US\$ 587 (2019)	Agriculture value-add per worker: US\$ 4,696	Agriculture value-add per worker: US\$ 14,088
4.2 Green and climate resilient rural settlements	Increasing % rural population living in integrated, planned, green, clustered settlements	68% (2019)	80%	100%

Macro-economic Indicators	Indicator (aligned with Vision 2050)	Baseline	Near-Term Target (2025, 2030)	Long-Term Target (2035, 2050)
GDP	GDP per capita	USD 818 (2019)	USD 4,036	USD 12,476
Labour & Education	Percentage of student's enrolment in TVET as proportion of total students (in Basic Education), with green economy-focused training options increasing compared to baseline	33.1% (2019)	60%	60%
Private Investment	Private investment as a % of GDP	15.7% of GDP in 2019	21.4% of GDP	25% of GDP
Public Investment	Public investment as a percentage of GDP (government investment in infrastructure increases with rising GDP over time)	10.4% of GDP (2019)	11% of GDP	10.2% of GDP
Multidimensional Poverty index	Proportion of population facing multidimensional poverty	29% EICV 5 (2016/17)	15% (in line SDG 1)	5%

The summary dashboard provides **thirteen summary indicators** for each of the 8 programmes of action, as well as 5 macro-economic indicators for integrated assessment of Rwanda's economic growth path toward high-income status under the Vision 2050. The intention of the summary dashboard is to enable monitoring of GGCRS implementation across the full strategy. The full results framework that follows provides sector-level detail for monitoring implementation of the strategic interventions that comprise the GGCRS and its programmes of action.

FULL RESULTS FRAMEWORK

Strategic intervention	Main indicator	Target	Second indicator	Target	Proposed ministry for data collection	Proposed data source
1.1.1 Increasing renewable energy in the generation mix (including incentivising private sector investment)	Share of renewables in total electricity supply (%)	Target: At least 60% by 2035, maintained at min 60% in 2050 (Baseline: 53.8% in 2020)	Non-hydro power share of renewable energy in total electricity supply	Increasing with time to ensure resilient and diverse supply	MININFRA	REG
1.1.2 Low carbon energy to key sectors - Urbanisation and Transport	Percentage of EVs over total vehicles, by type (motorbike, car, bus)	Partial target: electric motorbikes being 2.3% by 2024 and 33% by 2030	Average fuel economy for newly registered vehicles (litres of fuel consumed per 100 km)	Decreasing compared to baseline	MININFRA	RTDA, REG
1.1.3 Sustainable initiatives and climate resilience in the management of regional transport networks, freight and logistics	Travel times on international and national roads, including delays at ports, weighbridges, police checks and border posts (frequency: biannual; unit of measure: hours)	Decreasing compared to baseline	Volume of passengers and freight: Available air/water/ rail/road passenger seats; Tonnes of freight	Increase compared to baseline	MININFRA	RTDA

Strategic intervention	Main indicator	Target	Second indicator	Target	Proposed ministry for data collection	Proposed data source
1.1.4 Promote integrated multimodal transport system (including Developing efficient knowledge, information and operational systems)	Reduced length (km) of roads vulnerable to landslide, by type (national paved national unpaved district road)	Target: not available in NDC yet (Baseline in 2015: 979 km, of which 165 km for national paved roads, 210 km for national unpaved roads and 604 km for district roads)	Length (km) of airstrips, roads, ports, rehabilitated/upgraded by category	Partial target: - Length of paved national road improved: 369km by 2024 (up from 0 in 2018); Length of national roads upgraded to paved standards (km) 753.2km in 2024 and 246.3km by 2030 (up from 666.8km in 2018)	MININFRA	RTDA
1.1.5 Universal Access to Electricity - on-grid solutions	Number of households connected to the grid	52% of households by 2024; 65% of households from 2050	Number of planned and unplanned power outages (in terms of incidents and also hours p.a.)	Decreasing compared to baseline	MININFRA	REG
1.2.1 Greening the SEZs and industrial parks - services to consolidated industries	Emission intensity per output (tonnes/USD million value added)	Decreasing compared to baseline			MINICOM	RRA, REMA
1.2.2 Promoting Green Technologies in industries, to increase productivity and access to green finance	Cumulative volume of financial resources [USD millions] mobilized for climate and environmental purposes in industry and technology	Increasing compared to baseline	Industry sector's Value Added contribution to GDP (%)	24% by 2035 and 33% by 2050 (Baseline 19% in 2019)	MINECOFIN, MoE	FONERWA, REMA
1.2.3 Capacity building of the industry sector and strengthening the mandate, technical, and financial capacity of Cleaner Production and Climate Innovation Centre	Students enrolled in TVET as proportion of total students in Basic Education (%)	60% by 2035, maintained at 60% in 2050 (up from 33.6% in 2020)	Proportion of graduates in STEM (Science, Technology, engineering and Mathematics) related programmes (%)	Target 44.3% in 2035 and 50% in 2050 (Baseline: in 2020 36.9%, of which 42.6% male and 29.9% female)	MINECOFIN, MINICOM, MINEDUC	NIRDA, RDB
1.2.4 Greening the Mining Sector to ensure sustainability and responsiveness to the Green Economy.	Percentage of companies deploying climate compatible mining	Target: All (100%) mines comply water use efficiency by 2025 and 2030 (in 2018, 100% of active mines complied)			MINICOM, MoE	RMB

Strategic intervention	Main indicator	Target	Second indicator	Target	Proposed ministry for data collection	Proposed data source
2.1.1 Rwanda Green Building Minimum Compliance System	Number and percentage of new Category 4 and 5 buildings that comply with the Green building minimum compliance system (i.e. those covered by the regulation: commercial buildings, health and education facilities, public administrative buildings and social/cultural ones)	Target: 100% of buildings	Percentage of total buildings that comply with the green building minimum compliance system (including those for which compliance is voluntary, like residential buildings and old ones)	Increasing compared to baseline	MININFRA, MoE	RHA, Rwanda Green Building Organization (RWGBO)
2.1.2 High Quality, affordable housing and dense cities	Decreasing percentage of urban population living in informal settlements	Target 47% by 2025 and 35% by 2030 (down from 62.6% in 2016)			MININFRA, MoE	RHA
2.1.3 High Quality, Tradeable Off-farm Jobs	Percentage of skilled people (qualified and experienced) with critical and rare skills in the high priority sectors	33% by 2024 (17% in 2019)	Percentage of working population employed in off-farm jobs	Baseline: 73% of population was working in agriculture in 2014	MIFOTRA (Ministry of public service and labour), MINEDUC, MINICT, MININFRA	RDB, PSF (private sector federation), Rwanda Polytechnic, & WDA (workforce development authority); NISRA
2.1.4 Transition to Green Public Transit	CO2 Emissions intensity per passenger-km for public transit	Decreasing compared to baseline	Number and percentage of urban population living within 0.5 – 1 km to a serviced public transport stage	Increasing compared to baseline	MININFRA	RTDA, RURA
2.1.5 Adoption of Smart approaches for municipal service management in Green Cities to achieve resource efficiency at the City Level	Public services rendered online (%)	Target 100% by 2035, maintained at 100% by 2050 (it is 40% in 2020)	Number of districts where WASH Management Information System has been developed and operationalised	Target: all districts	MININFRA	WASAC, REG, EDCL
2.2.1 Agglomeration, Densification, Mixed Use and Multifunctional Urban Spaces	Percentage of urban households living in a smart green city/district	Increasing compared to baseline	Number of households living in a smart green city/district	Increasing compared to baseline	MININFRA, MoE	RHA, LODA
2.2.2 Greening the City Layout through Green Space and Agriculture	Average share of the built-up area of cities that is open and green space for public use for all (SDG)	Have a sustained (with qualitative maintenance) of 30% urban green and public space (CoK had 30% public space in 2018)	Green sqm per capita in urban areas	Target: 15 sqm per person	MININFRA, MINALOC	LODA, RLMUA

Strategic intervention	Main indicator	Target	Second indicator	Target	Proposed ministry for data collection	Proposed data source
2.2.3 Integrated / Improved Urban Stormwater and Drainage Management	Percentage of urban population in areas covered by master plans with storm water considerations	Target: 90% by 2025 (up from 20% in in 2016)	(Decreasing) number of flooding incidents of flooding and associated cost of damages	Decreasing compared to baseline	MININFRA	RWB
3.1.1 Integrated planning and monitoring for sustainable land management	Implementation of NLUDMP that includes comprehensive measures and procedures for sustainable land use practices	100% of Land Use Plans (LUP) harmonized with NLUDMP by 2025	% of compliance of LUDP to the NLUDMP	To develop a land use monitoring index by 2025	MoE	RLMUA
3.1.2 Development of sustainable sectoral land use strategies and National Spatial Data Infrastructure (NSDI) including information management and sharing policy.	Percentage of operational integrated geospatial information framework integrated with environmental and socio-economic statistics	To develop updated and accurate geospatial data and tools to guide every planning in the country by 2030	Accurate data on exposure to climate vulnerability on HHs and infrastructure in high-risk areas reported	To have an operational and integrated National Spatial Data Infrastructure (NSDI) by 2030	MoE	RLMUA
3.1.3 GIS/ICT Innovation throughout Government, Districts and Implementing Agencies	GIS systems and ICT tools in use at all levels of government	Key GIS Systems (NSDI) and ICT tools in active use by officials at all levels of government by 2025			MINICT	NIRDA
3.1.4 Development of an inclusive and automated land administration to regulate and provide guidance for land tenure security.	Percentage of registered state land optimally used	To ensure the security of tenure and access to land for the rational use of land by 2025	Model linking land use/administration in place	To update the land registration data/ information by 2025	MoE	RLMUA
3.1.5 Risk Assessment and Vulnerability Mapping (including integrated early warning system)	Percentage of occurred extreme weather events for which advance warning was provided at least 30 minutes in advance	95% occurred extreme weather events are warned in lead time by 2025 and 2030	Population covered by DRR programs	Community-based DRR with developed farming techniques, first aid training, public awareness for disease prevention, and relocation of 10,209 households from high-risk zones by 2030	MINEMA	RMA
3.2.1 Climate Resilient Water Infrastructure for Storage and Supply	Percentage of water storage and supply infrastructure fortified with climate resilience improvements	100% of storage and supply infrastructure with climate resilience improvements by 2030	Water storage per capita (m³ per capita)	10 m³ per capita storage by 2025 12 m³ per capita storage by 2030	MININFRA	RWB

Strategic intervention	Main indicator	Target	Second indicator	Target	Proposed ministry for data collection	Proposed data source
3.2.2 Completion of Remaining Level 1 Catchment Plans and implementation of catchment restoration and soil erosion control strategies	Percentage of water bodies with ambient water quality	45% of water bodies with ambient water quality by 2025	Area of Land under erosion control measures and used optimally	The target is to reach 142,500 Ha of land with radical terraces; 1,007,624 Ha of progressive terraces by 2025; Biological soil conservation practices of 150,000 ha by 2025	MoE, MINAGRI	RWB, RAB
3.2.3 Strengthened Disaster Management and Response	Number of effective city contingency plans developed	Review contingency plans and develop districts disaster management plans by 2025	Population covered by Disaster risk reduction (DRR) programs	Detailed National risk and vulnerability atlas developed by 2025	MINEMA	MINEMA
4.1.1 Enhance agro-ecology, crop varietal development, promoting cultivars and animal breed adapted to the impacts of climate change, and enhancing the resilience of export crops	Climate resilient crop varieties: (i) number of varieties developed and (ii) percentage of farmers adopting them	Target (i): release 100 climate resilient varieties by 2025 and 200 by 2030 (Baseline: 40 in 2019) Target (ii): 50% of farmers using improved seed varieties by 2025 and 90% by 2050 (11.8% in 2019)	Ha of crops under insurance	Target by 2025: 37,462 Ha of crops insured by 2025. Including: Maize (16,244 Ha), Rice (10,322 Ha), Banana (928 Ha), Cassava (975 Ha), Beans (278 Ha), Irish potato (2785 Ha), Soybeans (278 Ha), French beans (975 Ha), Chili (500 Ha), Tea (4177 Ha). Target by 2030: 102,284 Ha insured crops. Baseline crop insured by 2019: maize 247.61 Ha, and rice 1,588 Ha	MINAGRI	RAB
4.1.2 Improved on-farm water and energy management incl. development of more efficient irrigation and farming systems,	Number of hectares under irrigation within IWRM (Integrated Water Resources Management) framework	Target: 102,284 Ha to be irrigated by 2025, 200,000 Ha by 2030 (baseline: 48,508 ha in 2016, i.e. 7.5% of potential land)	Number of ha where NDC - compliant improved farming systems are used: Terraced land (ha) + Crop rotation (ha)+ Banana and coffee multi-crop production (ha)	Partial target for terracing by 2025: 142,500 Ha of land with radical terraces and 1,007,624 Ha of progressive terraces (up from 103,918 ha of radical terraces and 913,884 ha of progressive terraces in 2017)	MINAGRI	RAB
4.1.3 Value addition through diversification and manufacturing with expansion of local and export market access	Capacity of storage constructed in MT (million metric tonne)	Target 1,200,000 MT capacity in agro processing facilities in 2030 (baseline: 400,000 in 2018)	Manufacturing share of total exports	8% by 2024 (from 6% in 2020)	MINAGRI, MINICOM	RAB, NAEB (National Agricultural Export Board)

Strategic intervention	Main indicator	Target	Second indicator	Target	Proposed ministry for data collection	Proposed data source
4.1.4 Development of agroforestry and soil management (i.e. control soil erosion and improved soil fertility) for sustainable agriculture	Average tree density (tree/ha) in crop and agroforestry lands	Baseline 25, target 2030: 40, target 2050: 100	Alternative: Land ha where biological soil conservation is implemented	Biological soil conservation practices of 150,000 ha by 2025	MINAGRI	RAB, NAEB, RLUMA
4.1.5 Rehabilitation of degraded forest resources (reforestation and afforestation) and improvement of forest management.	Number of ha restored and set under approved management plan	Target: baseline: 17.000 ha, 2030: 80.000 ha, 2050: 200.000 ha	Km2 and % of land surface covered by forest	Target 30.6% in 2024 (up from 19.8% in 2019). Target 7,483km2 in 2035 and 7,725 km2 in 2050 (baseline: 7,242 km2 in 2020)	MINAGRI	RFA, RWB, RAB, REMA, RFA, RLUMA
4.1.6 Promotion of conservation that builds value for community-based ecotourism through encouragement of Payments for Ecosystem Services (PES)	Tourism revenue generated by ecotourism parks sites per year	Target: double tourism revenues to USD 800 million by 2024 (up from USD 374 million in 2016)	Cumulative volume of financial resources [USD] available for PES	Increasing compared to baseline	MINICOM; MINALOC	RDB
4.2.1 Decentralised Water Treatment Solution – Water Package Plants, and sustainable sanitation solutions	Number of households having access to improved water sources	100% by 2035 (up from 87.4% in 2017)	# Households having access to safely managed sanitation services	100% by 2035 (up from 86.2% in 2016)	MININFRA	WASAC
4.2.2 Ensuring availability of bus services in rural areas under a route franchising approach	Percentage of population conveying with public transportation (total urban rural)	Increasing compared to baseline. Patrial target exists, for total population only: 24% by 2035 and 40% by 2050 (up from 17% in 2020)			MININFRA	RTDA
4.2.3 Universal Access to Electricity - Off-grid solutions including promotion of efficient wood conversion and sustainable biomass energy	Number of households with off-grid access to electricity	48% by 2024	Number of households using an efficient stove	Target: 42% of the total population using efficient cookstoves by 2024 (66% in 2020)	MININFRA	REG

Strategic intervention	Main indicator	Target	Second indicator	Target	Proposed ministry for data collection	Proposed data source
4.2.4 Model villages and building resilience (land use management and social protection) spatial planning for settlements and livelihoods	Number of smart green villages	416 villages by 2024 (from 44 in 2018)	Increasing % rural population living in integrated, planned, green, clustered settlements	80% of rural households settled in integrated, planned, green rural settlements by 2025 (up from 68% in 2019)	MININFRA, MoE	LODA

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APPENDIX A Green Growth Costing & Ministry Responsibilities

AGRICULTURE

Sector Vision

Rwanda intends to become a nation that enjoys food security, nutritional health and sustainable agricultural growth from a productive, green and market-led agricultural sector. The mission is to ensure food and nutrition security, modern agribusiness technologies professionalizing farmers in terms of production, commercialisation of the outputs and the creation of a competitive agriculture sector.

Vision 2050 envisages Rwanda as a developed country, with a strong services sector, low unemployment and low levels of poverty. It is a country where agriculture and industry have a minimal negative impact on the environment, operating in a sustainable way, and enabling Rwanda to be self-sufficient regarding basic necessities. By 2050, development will be achieved with low carbon domestic energy resources and practices, reducing Rwanda's contribution to climate change while allowing it to be independent of imported oil for power generation. Finally, Rwanda will have the robust local and regional knowledge to be able to respond and adapt to changes in the climate and the resulting impacts, supporting other African countries as a regional services hub to do the same.

It is expected that agricultural exports will increase and the productivity of the sector will rise, thanks to the development of more efficient irrigation and farming systems, improved soil erosion control and soil fertility, promotion of climate resilient crops and animal breeds, and investment in postharvest and value addition facilities and technologies. Increased use of digital tools for disease monitoring and prevention, surveillance, and control, will play an important role to raise the sector's productivity, together with the use of data and ICT to reduce inefficiencies in the entire value chain.

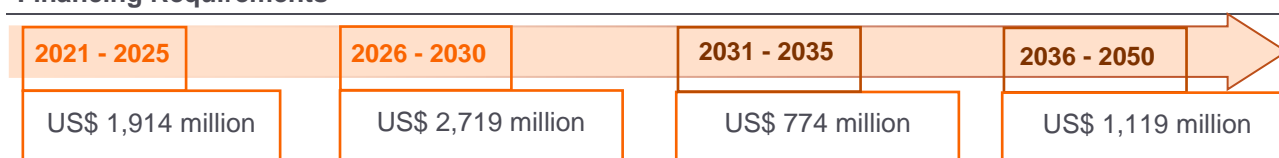
Ministry Responsibilities

The leading role in the sector will be taken by MINAGRI, which will guide the implementation of the plan with RAB and NAEB. Actions related to export crops will be undertaken in collaboration with MINICOM and NIRDA, and, crucially, ensuring a sustainable use of land and effective spatial development will require cooperation with RFA, RWB and RMLUA. Finally, engagement with MINICT will promote the shift to a knowledge-based economy, and the involvement of REG will be important for improved energy management in farming.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
Finalise Urban Agriculture Development Plan and Urban Agriculture Extension Manual	2.2.2 Greening the City Layout through Green Space and Agriculture	-	-
Strengthen crop management through digital practices (disease monitoring and prevention, diagnostic, surveillance and control)	3.1.2 Development of National Spatial Data Infrastructure (NSDI)	6	-
Soil and water conservation: terracing and conservation tillage	3.2.2 Development / Completion of remaining Level 1 Catchment Plans including catchment restoration and soil erosion control strategies	1,124	-
Develop climate resilient crops and promote climate resilient livestock	4.1.1 Enhance agro-ecology, crop varietal development, promoting cultivars and animal breed adapted to the impacts of climate change, and enhancing the resilience of export crops	772	-
Insurance for farmers		309	-
On-farm soil and water conservation: crop rotation and multi-cropping	4.1.2 Improved on-farm water and energy management	408	-
Improve on-farm irrigation infrastructure, including solar pumping		2,547	-
Research and development for crop diversification	4.1.3 Value addition through diversification and manufacturing with expansion of local and export market access	56	-
Investment in agro-processing and post-harvest manufacturing facilities and technology, also using ICT to reduce losses en-route to market		412	-
Development of Agroforestry and Sustainable Agriculture (control soil erosion and improved soil fertility)	4.1.4 Development of agroforestry and soil management (i.e. control soil erosion and improved soil fertility) for sustainable agriculture	342	-
Improved fertiliser use and aerobic composting		392	-

Financing Requirements



Public sector investment estimated at US\$ 909 m



Mobilise US\$ 5,616 m in additional private sector investment



Total Annual Operations & Maintenance: US\$ 0 – actions will need to be reviewed over long-term, no specific OPEX associated

Coordination and Implementation

Lead Ministry

- MINAGRI
- MINICOM
- MINICT

Implementing Agency

- RAB
- NAEB
- NIRDA
- RMLUA
- RFA
- RWB

Intersectoral Coordination

- Integrated water resource management, as per Programme of Action 3.2, are crucial
- Closely linked to functional rural settlements, described in Programme of Action 2.2
- Interdependencies with Programme of Action 3.1, on sustainable use of land and effective spatial development.

ENERGY

Sector Vision

The energy sector is a key enabling sector to catalyse economic growth, enshrined in Priority Area 4 of the NST to “*reduce the cost of doing business and facilitate trade by implementing key projects.*” (Republic of Rwanda & MINECOFIN, 2017).

Rwanda will achieve universal access to electricity through expansion of the grid under the Energy Access Roll-out Program (EARP), with 52% of households connected to the grid by 2024, while off-grid solutions will reach 48% of the population over the same period (Energy Sector Strategic Plan). All healthcare facilities will have access to electricity by 2024, and the GoR also aims to ensure all productive users have access to electricity.

Key sectors of focus for access to green and reliable energy include mining, manufacturing, ICT and commercial premises. Quality of electricity will be improved by continuing investments in network upgrading and strengthening as well as investing in loss reduction and energy efficiency projects. Priority will be given to productive use connections such as industrial zones, market centres and other socio-economic facilities such as schools and health centres. (Republic of Rwanda & MINECOFIN, 2017)

For grid-connected electricity generation, installed capacity to will increase by 400 MW by 2025 and by 800 MW by 2040 (Rwanda Energy Group, 2019), largely through increased hydro and methane plants, while solar, peat (initially increasing) and thermal (initially decreasing) will remain the same over time. Natural gas and hydro pumped storage (PS) will be introduced from 2030. The Vision 2050 commits to increasing the contribution of renewable energy sources in the generation mix from a baseline of 54% in June 2020 to at least 60% in 2030 (and 2050) and to reduce tariffs, losses to close to 5% (from 22.5% in 2016/17) and power outages (in terms of incidents and also hours p.a.) (Republic of Rwanda, 2020).

The energy sector plan will need to be dynamic and evolve to reflect changes in Rwanda’s economy and as industries grow.

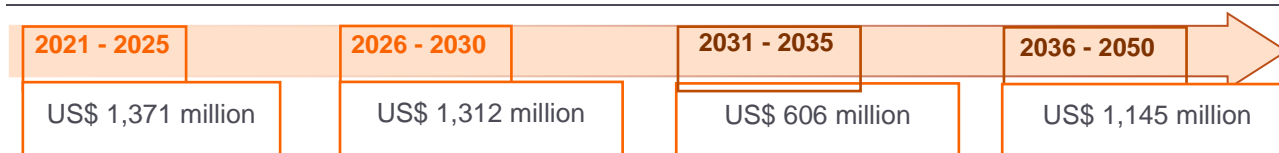
Ministry Responsibilities

Implementation of energy sector actions will be led by MININFRA, coordinating through sector and technical working groups with key implementing agencies REG, EDCL, RURA, EPD and others. Strong coordination will be needed with MoE and MINAGRI to ensure that sustainable access to energy and use of biomass is delivered. all public services delivery is planned accordingly with water resources management. MINIMCOM must also be engaged to ensure that the detailed locational demands for energy from industry are met through clean and reliable supplies.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
On-grid renewable generation – small to large scale hydro by 2030	1.1.1 Increasing renewable energy in the generation mix	328	9.8
Diversified, embedded and utility scale non-hydro renewables in longer term, and regional electricity integration		913	47.0
Expand grid connections to households and productive users	1.1.5 Universal Access to Electricity - on-grid solutions	1,432	7.6
Expand solar home systems and mini-grids for access to off-grid technologies, improving capacity over time	4..2.3 Universal Access to Electricity - Off-grid solutions	675	3.9
Scale up access to improved cookstoves, alternative cooking technologies, and improved cooking fuels		831	-
Expand use of biogas digesters for rural households		254	-

Financing Requirements



Public sector funding need estimated at US\$ 1,713 m



Mobilise US\$ 2,721 m in additional private sector investment



Total annual operational expenditure associated with investment: US\$ 68.4 m

Coordination and Implementation

Lead Ministry

- MININFRA
- MoE
- MINICOM
- MINAGRI

Implementing Agency

- REG, EDCL
- EPD
- RURA
- RTDA
- RFA
- RWB

Intersectoral Coordination

- Low carbon energy to key sectors will be driven by MININFRA and REG, in coordination with MINICOM to meet industry priorities in PoA 1.1 and PoA 1.2
- Integration of grid and off-grid energy will require coordination through the energy access technical working group
- Promotion of sustainable biomass will need to be coordinated with MINAGRI and MoE.

FORESTRY AND LAND USE

Sector Vision

Rwanda's vision for the forestry and land use sector is for the sector to contribute more to economic growth, through revenue generation and job creation, particularly through greater productivity. This would entail greater private sector participation, and more value-addition to forest-based products. At the same time, the vision includes preservation of the country's natural capital, through more sustainable forest management and landscape management, integrated land use planning, and strengthened resilience of Rwanda's landscapes. This would enable Rwanda's forests to support greater biodiversity and eco-tourism, and reduce human and property loss from floods, landslides, erosion, and siltation. Building on commitments under the NST-1, the updated NDCs, and the NLUDMP (2020-2050), the forestry sector must aspire to sustainable, integrated and innovative forestry management to position Rwanda as productive, biodiverse, and ecologically advanced. This will ensure that the Forestry sector develops in an internationally competitive manner whilst protecting and enhancing Rwanda's natural capital base.

In the long term, Rwanda's Forestry and Land Use sector will be instrumental as the country establishes itself as a green knowledge-based economy which has become decoupled from natural resources through fundamental shifts in the approach to resource-based sectors. Rwanda's land management innovations will be driven by extensive land, water and natural resource management programmes that improve the resilience of Rwanda's economy to shocks to the natural capital base, and reliable, real-time, responsive ICT infrastructure and systems. In turn these will open up new opportunities in high-value forestry and agriculture product development, and eco-tourism and conservation-based livelihood diversification.

Ministry Responsibilities

Sustainable Land Use and Forestry management will require increased coordination among key resource-based sectors and their associated ministries. MoE, MINAGRI, MINICOM will need to ensure cross sectoral linkages to drive the sustainable sourcing of raw materials (mineral, forest wood and non-wood materials) for low-carbon and resource efficient industrial processing. Resource management needs to be underpinned by accurate and comprehensive data so that awareness of the health of the natural capital base can be maintained. In this regard, MINICT is an essential stakeholder for inter-ministerial coordination.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
Integrated approach to planning and monitoring for sustainable land management (implementation on the NLUDMP and ensuring compliance)	3.1.1 Integrated planning and monitoring for sustainable land management	80	0.4
Prepare sectoral land use strategies and District Land Use Master Plans and sensitize stakeholders with annual land use forums and community training	3.1.2 Development of sustainable sectoral land use strategies and National Spatial Data Infrastructure (NSDI) including information management and sharing policy.	72	-
Develop a harmonized and integrated spatial data management system for sustainable land use management and ensure interoperability with all systems		55	0.13
Implement the Rwanda Data Revolution Strategy supported by national research programmes to generate spatial data and assist with digitisation of all land use management information	3.1.3 GIS/ICT Innovation throughout Government, Districts and Implementing Agencies	36	0.2
Development of GIS hubs at district level, with requisite ICT infrastructure to offer GIS trainings at district level, with a focus on climate resilience and vulnerability, disaster management, and sustainable land use		7	1.65
Establish an Integrated Early Warning System	3.1.5 Risk Assessment and Vulnerability Mapping (including integrated early warning system)	15	-
Improvement of forest management and rehabilitation of degraded forest resources with improved germplasm and post-planting operations	4.1.5 Rehabilitation of degraded forest resources (reforestation and afforestation) and improvement of forest management.	150	-
Institutional design, structuring, establishment, and operationalisation of Forest Owners Associations and Private Forest Management Units (part of NLUMDP implementation)		-	-
Development of more comprehensive, spatially informed, data-rich disaster preparedness and response plans in all districts through continued vulnerability mapping and monitoring, ICT tools and an integrated knowledge system	3.2.3 Strengthened Disaster Management and Response, and 3.1.5 Risk Assessment and Vulnerability Mapping (including integrated early warning system)	85	-
Complete Rwanda Natural Capital Accounts and Promote Payments for Ecosystem Services and Protection	4.1.6 Promotion of conservation that builds value for community-based ecotourism through encouragement of Payments for Ecosystem Services (PES)	20	-
Scale up Eco-tourism and continue Tourism Revenue Sharing		52	0.5

Financing Requirements



Public sector investment estimated at US\$ 374 m



Mobilise US\$ 153 m in additional private sector investment



Total annual operational expenditure associated with investment: US\$ 3 m

Coordination and Implementation

Lead Ministry

- MoE
- MINICT
- MINAGRI
- MINICOM

Implementing Agency

- REMA
- RLUMA
- RWB
- RFA
- RMA
- RDB

Intersectoral Coordination

- The green technology and SMART services processes established through Programme of Action 2.1 will complement and build on the achievements in this Programme of Action.

INDUSTRY

Sector Vision

Industry is an essential sector to drive Rwanda to its goal of being a developed, climate-resilient, low-carbon economy by 2050. One of the three key strategic objectives of Vision 2050 is “Achieving energy security and a low carbon energy supply that supports the development of Green Industry and services and avoids deforestation”. The industry sector, while increasingly achieving high production rates, needs to adapt to green processes too. Vision 2050 addresses this in the program of action of ‘Green industry and private sector development’. This is captured as one of the interventions under NDC too, being ‘Green industry and private sector investment’.

The continued development of SEZs, industrial parks, and innovation centres underpins the NST objective of ‘promoting industrial development, export promotion and expansion of trade related infrastructure’, balanced with ‘sustainably building the competitiveness of local industries through Made in Rwanda initiative, exploiting natural resources and protecting the environment’. The industry sector presents both one of the biggest opportunities and largest risks to green growth and climate resilience, needing to balance progressive planning and industrial growth, while ensuring secure development that is appropriately shielded from aggravated natural disasters, and contributes to resilient livelihoods and green job creation.

Energy efficiency represents both a key priority to ensure energy intensity and emissions per unit of production are minimised, and also an investment opportunity in efficient commercial and industrial processes. Key actions include: (1) energy efficiency in agro-processing and a range of energy efficiency measures focused on reducing firewood and electricity consumption in the coffee and tea sector, (2) efficient brick kilns and energy efficiency in the brick manufacturing industry, and (3) energy efficient cement production, use of waste heat recovery (WHR) and increased use of rice husks as fuel within clinker production.

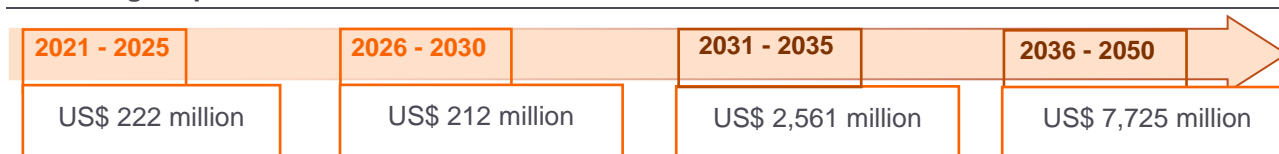
Ministry Responsibilities

MINICOM is the lead ministry to deliver on the priority actions for the industry sector. However, to support this growth access to sustainable energy, water and waste will be highly important, and will require careful planning and coordination with other sectors including MININFRA, MoE, and MINAGRI. The main implementing entities to deliver on the industry actions include RDB, NIRDA, REG, and RAB.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
Energy efficient cement production and energy efficiency brick kilns		46	-
Fluorinated gases substitution	1.2.1 Greening the SEZs and industrial parks - services to consolidated industries	43	-
Roll out SEZs and industrial parks with green and low-waste design		300	-
Kigali Innovation City		300	-
Foster investment in innovation centres and green industry	1.2.2 Promoting Green Technologies in industries	10,000	-
National cooling strategy		5	-
Capacity building of the industry sector and strengthening the mandate, technical, and financial capacity of Cleaner Production and Climate Innovation Centre	1.2.3 Capacity building of the industry sector and strengthening the mandate, technical, and financial capacity of Cleaner Production and Climate Innovation Centre	12	-
Hub for entrepreneurship and innovation		12	-
Establish an Entrepreneurial support organization (ESO) association		-	-
Energy efficiency in agro-processing	4.1.3 Value addition through diversification and manufacturing with expansion of local and export markets	2	-

Financing Requirements



Public sector investment estimated at US\$ 566 million



Mobilise US\$ 10,154 in additional private sector investment



Total annual operational expenditure associated with investment: \$0* assuming investments self-finance after initial set up costs

Coordination and Implementation

Lead Ministry

- MINICOM
- MININFRA
- MoE
- MINAGRI

Implementing Agency

- RDB
- REG
- NIRDA
- RAB

Intersectoral Coordination

- Coordination with MININFRA to ensure industry actions are supported by access to sustainable water, energy and transport infrastructure
- Ensure industry actions are balanced with environmental objectives and rural objectives with MoE and MINAGRI

MINING

Sector Vision

Climate compatible mining will remain a key sector in Rwanda's economy, delivering both mitigation benefits in the form of reduced GHG emissions, and ensuring resilience to climate change. This is enshrined in the Vision 2050's action program of "Climate Compatible Mining", and in the NDC actions relating to climate compatible mining.

In broad terms, the climate compatible mining priorities are to improve energy efficiency; increase replace on-site fossil-fuel energy generation with renewable power, improve water and wastewater management; and capacity building and awareness raising of both the importance of and commercial opportunities represented by green and climate resilient mining.

Consolidation of mines and "greening" mining operations are currently being piloted in the industry driven by RMB, and included in the draft mining policy. The vision for the sector is to ensure mining activities continue to be both technically and economically viable while ensuring protection of the environment, green growth and climate resilience.

The need for 'responsible' development and 'efficiency' clearly states the current national growth pathway of the mining sector. Of the four planned outputs of the mining sub-sector in the ENR SSP, the fourth directly speaks to environment management aiming to increase the number of mines complying with environmental and modernized practices. Other actions include supporting the development of environmental practitioners and introduction of cleaner production and resource efficiency (CPRE).

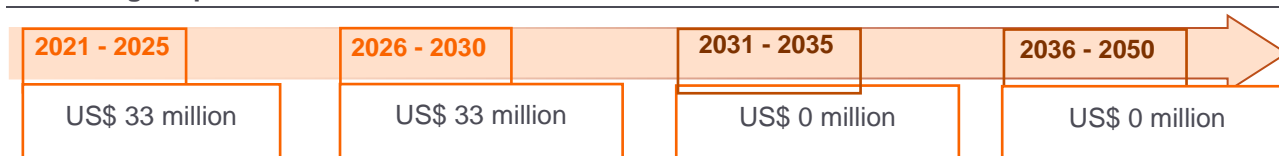
Ministry Responsibilities

MINECOFIN is the lead implementing ministry for the mining sector, with activities implemented by RMB. This will feature continued close engagement with the private sector to attract investment for exploitation, value addition and consolidation of artisanal and small-scale miners. Alongside coordinating on replacement of embedded diesel generation with renewable energy generation, MININFRA will also need to be engaged to ensure on-site energy generation is reliable, and can connect with grid-based electricity generation where appropriate. MININFRA and MoE will also need to be engaged in ensuring water and waste-water resources are well managed in the mining sector.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
Implement climate compatible mining practices including energy efficiency and sustainable practices	1.2.4 Greening the Mining Sector to ensure sustainability and responsiveness to the Green Economy.	59	-
Phase out diesel generation in mining		5	-
Waste-water treatment plants / technology in mines		-	-
Policy and regulatory frameworks as well as on-site measures to control Acid Mine Drainage		-	-

Financing Requirements



Public sector investment estimated at US\$ 0



Mobilise US\$ 64 m in additional private sector investment



Total annual operational expenditure associated with investment: \$0* - investments expected to improve efficiency and reduce running costs

Coordination and Implementation

Lead Ministry

- MINECOFIN
- MINAGRI
- MINICOM
- MININFRA
- MoE

Implementing Agency

- RMB

Intersectoral Coordination

- MINECOFIN and RMB as main actors to drive implementation
- Coordination with MININFRA for interconnection to clean and reliable grid energy supply
- Coordination with MININFRA and MoE to monitor and ensure environmental quality – including water and wastewater, around mining sites.

TRANSPORT

Sector Vision

The ability to connect both people and goods is imperative to enhance any developing economy. While Rwanda's transport sector is expanding, infrastructure and logistics need further strengthening to lower transport costs and allow trade in goods to be more competitive and tourism to grow, as well as ensuring future sustainability and green growth. Improvements in transport infrastructure, operations and availability are a key promoter of growth, developing greater mobility, accessibility, and connectivity within society.

Considering the longer term, while the transport sector does not contribute the majority of Rwanda's emissions, its share in contribution of such is on the rise due to factors such as population growth, urbanisation, and the increase in car dependency of the population. Without intervention the continuous increase in the population and subsequent rise in transport traffic will likely transform into growth of GHG emissions, hindering the achievements of the country's 2050 Vision.

The overall vision for the transport sector is to gain a modern transport infrastructure that promotes free movement of goods and passengers by being efficient, safe, reliable and seamless integrated at both national and regional levels. Moving forward, the provision of reliable and cost-effective transport systems will enable the population's needs to be met, allowing cities to grow in a sustainable way and rural settlements to stay connected and thrive, with further initiatives for green growth to be considered throughout the strategy implementation.

Ministry Responsibilities

MININFRA will take the lead in coordinating and providing strategic direction to RTDA, which will be the implementing agency in charge of operationalising the transport sector plan. The support of RDB will be important to attract private capital, an important driver in the sector, while the engagement of MINECOFIN, MINALOCA and NIRDA will ensure that the integration of the local, national and regional transport system is coordinated with Rwanda's trade policy in an optimal way. Promotion of e-mobility will be achieved thanks to collaboration with REG, while MINICT and RISA will help creating a data-led, efficient transport network. Active engagement with civil society and the private sector will be pivotal to ensure that a successful transition to green means of transport takes place.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
E-mobility in cities	1.1.2 Low carbon energy to key sectors	1,090	9
Development of aviation sector		2,917	26
Construction of railway network	1.1.3 Sustainable initiatives and climate resilience in the management of regional transport networks, freight and logistics	1,668	33.4
Waterways, and other regional infrastructure like border posts		1,031	4
Road network: expansion, maintenance, improved climate resilience and increased road safety	1.1.4 Promote integrated multimodal transport system	4,405	88
Real-time digital control room or "command centre" for major transport networks		64	2.5
Large public transport infrastructure in cities: cable car system, BRT, and metro rail system		1,628	87
Incentivising non-motorised transport in cities	2.1.4 Transition to Green Public Transit	6	0.1
Formalisation and integration of schedules, fares & systems		7	-
Route franchising approaches	4.2.2 Ensuring availability of bus services in rural areas under a route franchising approach	248	-

Financing Requirements



Public sector funding need estimated at US\$ 7,623 m



Mobilise US\$ 5,442 m in private sector investment



Total annual operational expenditure associated with investment: US\$ 258 m

Coordination and Implementation

Lead Ministry

<ul style="list-style-type: none"> • MININFRA • MINALOC • MINECOFIN • MINICT
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Implementing Agency

<ul style="list-style-type: none"> • RTDA • NIRDA • RDB • REG • RISA • REMA

Intersectoral Coordination

<ul style="list-style-type: none"> • Depends on an effective urban stormwater and drainage management, achieved in Strategic Intervention 2.2.3 • Will facilitate the expansion of local and export market access, in Strategic Intervention 4.1.3 • Will help promoting green industry and private sector participation in Programme of Action 1.2.

URBANISATION AND HUMAN SETTLEMENTS

Sector Vision

Rwanda looks to develop cities that are green, sustainable, resource efficient, and sustain a diverse and inclusive green economy that offers high quality employment by 2050. Since the long-term goal is to have 70% of the population living in urban areas by 2050, it will be crucial that cities are placed on a sustainable path of green and resilient growth.

Rwandan cities are expected to set an example in terms of well-planned, efficient, and mixed-land use while also showcasing the best in SMART systems and innovative green building technologies. At the same time, cities need to be prepared to absorb people in decent employment and living conditions. Inclusive growth is thus a key consideration, with a focus on upgrading and improving living conditions for those living in informal settlements and high-risk zones, and investment in affordable and resilient infrastructure and basic services.

Rwanda's sustainable urbanization agenda therefore includes a number of ambitious goals, centred around an efficient use of land, improving living conditions for the most vulnerable segments of the population, energy efficient construction and green buildings, and widespread availability of high-quality jobs that a knowledge-based economy.

Ministry Responsibilities

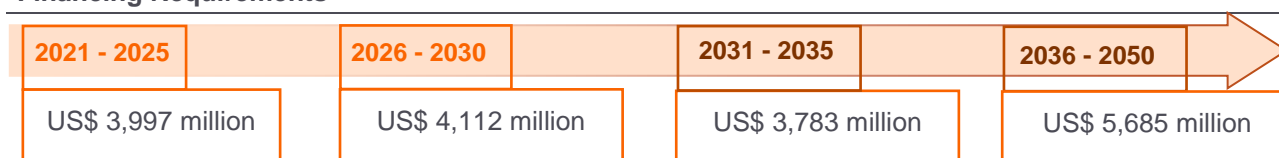
MININFRA, MINALOC and MoE have the main role to play in achieving green urbanisation in the next decades, guiding the implementation plan of the relevant agencies: RHA for housing policy and settlement upgrading, LODA for mobilising funds, and for community outreach programs, REMA to ensure that all relevant policies are consistent with Rwanda's environmental goals.

Coordination with other ministries and agencies will be crucial. The successful operationalisation of city master plans will require close collaboration with RLMUA, while RTDA will ensure the development of an efficient public transport network. Synergies with MINEDUC and MIFOTRA will enable an effective rollout of the skill development strategy, and MINICT, RISA and WASAC will drive the establishment of integrated and smart municipal service management in Kigali and secondary cities.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
Green building minimum compliance system: solar water heater programme and efficient lighting in public buildings	2.1.1 Rwanda Green Building Minimum Compliance System	349	
Potential for private investment in EDGE-standard buildings		1,943	
Implementation of affordable housing plan, including informal settlement upgrading and expanding access to housing finance	2.1.2 High Quality, affordable housing and dense cities	12,950	
Development of specialised skills	2.1.3 High-quality, tradeable off-farm jobs	306	
Increasing public transport efficiency and reliability: Dedicated bus lanes and route franchising	2.1.4 Transition to green public transit	200	4
Smart City Control Centre (Smart C3 project) and solar street lighting	2.1.5 Adoption of Smart approaches for municipal service management in Green Cities to achieve resource efficiency at the City Level	49	
Upscale Green City Kigali	2.2.1 Agglomeration, Densification, Mixed Use and Multifunctional Urban Spaces	1,700	
Community outreach, awareness programs and other initiatives to promote multifunctional urban spaces		-	
Pilot urban community gardens and green roofs in Kigali and secondary cities	2.2.2 Greening the City Layout through Green Space and Agriculture	7	
Policy revision: inclusion of more green infrastructure and nature-based solutions in urban plans		-	
Scale up model green villages (administration and planning)	4.2.4 Model villages and building resilience (land use management and social protection) spatial planning for settlements and livelihoods	75	

Financing Requirements



Public sector investment estimated at US\$ 4,623 m



Mobilise US\$ 11,174 m in additional private sector investment



Total annual operational expenditure associated with investment: US\$ 4* m, assuming most investments do not trigger an O&M commitment

Coordination and Implementation

Lead Ministry

- MININFRA
- MINALOC
- MoE
- MINICT
- MIFOTRA
- MINEDUC

Implementing Agency

- RHA
- LODA
- REMA
- RISA
- WASAC
- RLMUA
- RTDA

Intersectoral Coordination

- High-skill job development is connected to green industry, in Programme of Action 1.2
- Requires smart spatial development and integrated water resources management, to be achieved in Programmes of Action 3.1 and 3.2
- Links to the development of a reliable multimodal transport system, as outlined in Strategic Interventions 1.1.3 and 1.1.4

WASH AND WASTE

Sector Vision

WASH

The government's primary policy objective for the WASH sector is to progressively achieve safely managed water and sanitation services for the socioeconomic development of all Rwandans through the provision of improved, extended and sustained water supply as well as increased access to sanitation services. However, as of 2018, "safely managed" water supply service levels sat at just 13% and basic sanitation at 66% - indicating that there is much to be done over the next decade to meet the country's SDG and NDC targets (MININFRA, 2018) (NISR, 2018). ***If Rwanda is to achieve these targets and its ambitious growth trajectory over the next thirty years (i.e. an industrialized, high income country with above 10% average annual growth), it will be critical to re-imagine the WASH sector's approach to managing water quality and quantity in the midst of a changing climate and evolving economic demands.*** This requires the adoption of a systemwide view that is informed by a clearer understanding of how the country's water resources are changing and the implications that this will have on water systems. Being adaptive and able to manage a changing resource is going to be key to supporting the resilience of Rwanda's WASH sector. With this comes a pressing need for investment in technologies and systems that drive efficiency in terms of energy consumed, chemicals used, resources use, and effective supply and demand management.

Solid Waste

Solid waste is not waste; it is an untapped opportunity. Rwanda's mix and flow of solid waste³ materials is an indicator of how people, businesses and industry collectively use valuable resources. Rwanda's waste sector is poised to evolve and grow dramatically over the next three decades. Waste is a key sector in realising Rwanda's green growth and climate resilience ambitions; but how will Rwanda respond to the present-day threat of solid waste, which is restricting livelihoods, constraining economic growth, and damaging ecosystems? ***The vision is for government to lead a national mindset change – to identify solid waste as an important resource, not a problem; a resource that will enable valuable green growth opportunities and mitigate the harmful effects of climate change.***

Ministry Responsibilities

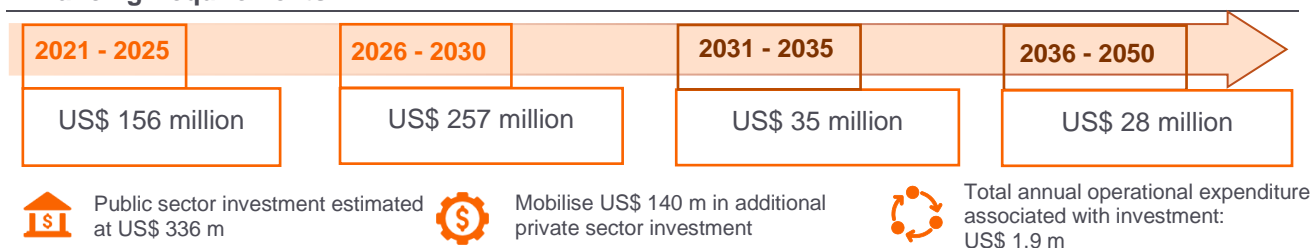
MININFRA, MINALOC and MINECOFIN will need to coordinate and provide leadership and strategic direction to the implementing agencies of WASAC, RWB, LODA, RURA, RHA who will liaise and carry out the main sector actions outlined in the table below. There will also need to be engagement with REMA to ensure WASH and Waste interventions are carried out in environmentally acceptable ways with cognisance of natural resource management and sustainability efforts.

³ Solid waste constitutes solid and semi-solid waste that is generated from residential, commercial and industrial areas, and includes agricultural waste, electronic waste, industrial waste, radioactive waste, health-care waste, and dried sewage sludge.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
Smart Water Metres for household demand management		25	0.1
Sustainable e-waste recycling		17	0.1
Development and operationalisation of WASH-MIS Management information systems		5	0.2
Institutionalisation of WASH Sector Master Plans at national, city and district Levels	2.1.5 Adoption of Smart approaches for municipal service management in Green Cities to achieve resource efficiency at the City Level	-	-
Complete and implement Integrated Waste Management Policy and Strategy, and National waste legislation re-design including tariff setting and economic incentives		5	-
Alternative waste treatment analysis and implementation		25	-
Operational Priorities and Landfill Management practices for Sanitary Landfills		72	-
Resilient Faecal Sludge Management	4.1.1 Decentralised Water Treatment Solution – Water Package Plants, and sustainable sanitation solutions	8	0.5
Decentralised and in some cases package Waste-water treatment plants (WWTP)		150	0.5 ⁴
Decentralised sanitation solutions	4.2.1 Decentralised Water Treatment Solution – Water Package Plants, and sustainable sanitation solutions	160	0.5
Community engagement on hygiene education and awareness		10	-

Financing Requirements



Coordination and Implementation

Lead Ministry	Implementing Agency	Intersectoral Coordination
<ul style="list-style-type: none"> MININFRA MINALOC MINECOFIN 	<ul style="list-style-type: none"> WASAC LODA RTDA RHA RURA 	<ul style="list-style-type: none"> Links to grid and network extension and as defined in Programme of Action 1.1. Will need to work effectively with densification efforts in Programme of Action 2.1.2 Relies on effective spatial planning and ICT support to be developed through Programmes of Action 3.1 and 3.2

⁴ Dependent on number of plants installed

WATER RESOURCES

Sector Vision

Rwanda's water resources sector objective is to ensure sufficient and equitable access to water resources for long-term economic growth and to reduce flooding impacts (Rwanda Water Resources Board, 2019). To achieve this objective, the country needs to take an integrated approach to water resource management and planning. As a central part to sustainable development, human dignity and inclusivity, and economic growth, the cross-cutting linkages between the water and the other sectors will be a priority. The management of water within the energy, agriculture, urban, and industrial sectors will require cross-sectoral, coordinated decision making and policies to avoid competition for the natural resource.

The government's aim to increase equitable access to water and ensure integrated water resource management has several key components to address to support the water sector's resilience. There is a need to address the funding gap to increase the level of service and reducing the cost of service-provision as a result of depleting water resources. Increasing institutional responsibility and capacity in areas of planning, project management and operation and maintenance; and monitoring systems. Rwanda's vision should focus on sustainable water resource management that results in food security, appropriate urban development, and preservation of biodiversity and ecosystem services.

The catchment management plans (for the years 2018 – 2024) have been developed within the scope of other strategic plans and outline near-term (pre-2030) vision-statements and objectives. The visions for the catchments focus on them being well-managed, community prosperity, and environmental stewardship which draws on social and economic benefits. Effectively managing land, water and other natural resources have been recognised as central objectives for sustainable development and improved livelihoods in Rwanda.

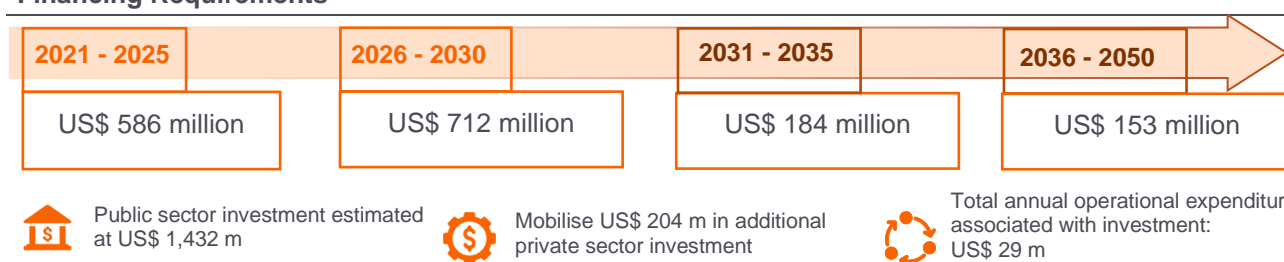
Ministry Responsibilities

Integrated Water Resources Management requires MoE and MININFRA to lead multi-level governance efforts between the implementing agencies of REMA, RWB, RMA, RDB and others. This structure should engage strongly with ministries working in Urbanisation and Settlements as well as services (RHA, RURA) to ensure that all public services delivery is planned accordingly with water resources management. Water Resources is also a key sector to support climate resilience, public health, and sustainable intensification of agriculture and forestry. Government leaders and implementers must also ensure effective engagement of civil society and the private sector for integrated water resources management. This is critical to support leveraging additional financial and non-financial resources for implementation and ensuring widespread behaviour change around water and land resources management.

Sector Actions

Main Sector Actions (relevant actions for each sector across all Programmes of Action)	Strategic Intervention	Total cost until 2050 (US\$ millions)	
		Investment	Annual O&M
Integrated / Improved Urban Stormwater and Drainage Management	2.2.3 Integrated / Improved Urban Stormwater and Drainage Management	400	2
Climate Resilient Water Infrastructure planning and implementation for Storage and Supply	3.2.1 Climate Resilient Water Infrastructure for Storage and Supply	253	15
Integrated water resource planning and management through mapping and automated hydrological network		27	0.3
Develop a National Water Security through water conservation practices, wetlands restoration, water storage and efficient water use	3.2.2 Development / Completion of Remaining Level 1 Catchment Plans including catchment restoration and soil erosion control strategies	164	3.3
Design and implement sustainable land management practices (soil erosion control; landscape management; radical terracing and biological soil and water conservation)		346	7
Develop and implement a catchment management plan for all Level 1 catchments		380	-

Financing Requirements



Coordination and Implementation

Lead Ministry	Implementing Agency	Intersectoral Coordination
<ul style="list-style-type: none"> MININFRA MoE MINALOC MINEMA 	<ul style="list-style-type: none"> RWB RTDA LODA RMA REMA 	<ul style="list-style-type: none"> Land use management and soil and water conservation activities must be planned and implemented with information systems and data from Programme of Action 3.1, coordinating with the RMA Largescale management of land and natural resources underpins sector specific successes in the rural economy for Programmes of Action 4.1 and 4.2 and must be implemented in conjunction with MINAGRI, RHA, and RURA