CVF V20 CLIMATE VULNERABLE FORUM VULNERABLE TWENTY GROUP

BHUTAN RESOURCE MOBILIZATION PLAN

PRELIMINARY REPORT

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BHUTAN FINANCE MINISTER'S FOREWORD ON BRMP

Lyonpo Lekey Dorji, Finance Minister, Royal Government of Bhutan

Bhutan stands at a pivotal moment in its development journey. As one of the world's first carbon-negative countries and a global leader in environmental stewardship, we have demonstrated that economic progress can be achieved in tandem with protecting the planet. We have long been guided by the principle of Gross National Happiness (GNH), striving for growth that values human well-being and ecological balance. True to this ethos, we remain committed to preserving at least 60% of our land under forest cover, a constitutional mandate we uphold even as we aspire to achieve high-income status by 2034.

Bhutan's recent graduation from Least Developed Country status in December 2023 is a proud achievement that comes with new responsibilities. This transition compels us to mobilize and leverage catalytic financing more efficiently through country-led and value-driven partnerships that create greater prosperity for our people today, while safeguarding the opportunities for future generations. In doing so, we move towards a model of resilient, inclusive, and sustainable development, fueled also by our own innovation and resources. The Bhutan Resource Mobilization Plan (BRMP) is our answer to this call. It harnesses the potential of Bhutan's natural endowments, opportunities in climate-smart infrastructure and green industries, and aligns public and private financing and investments with our high-income GNH aspirations.

The BRMP is a strategic roadmap to finance Bhutan's leap towards a high-income, climate-resilient economy grounded in GNH. Rooted in the 13th Five-Year Plan and our constitutional mandate for environmental conservation, this plan channels resources toward our sustainable development goals. It also serves as the financial arm of Bhutan's 21st-century Economic Roadmap, translating our ambitious vision into concrete investment pathways. Through the BRMP, we will seek to invest in priority sectors, from renewable energy and climate-smart agriculture to ecotourism and digital innovation, to create jobs and opportunities for our youth, all while safeguarding our natural heritage.

The BRMP represents a bold commitment to pursue the most ambitious outcomes: our analyses show

that in the long run, the 13th 5-Year Plan plus Climate Prosperity strategy (CPP) trajectory can drive higher growth and deeper poverty reduction than business-as-usual, all while preserving Bhutan's carbon-negative status. From expanding hydropower and solar energy to strengthening climate-resilient infrastructure, each component of the CPP is designed to secure sustained prosperity for our people and protection for our planet.

Acknowledging that this vision will require significant partnership, We call upon our friends in the international community, international financial institutions, development partners, technology innovators, and private sector investors to join us in bringing the BRMP to life. The plan outlines multiple avenues for collaboration, including scaled-up climate finance from multilateral funds and development banks, access to technology, and financially attractive innovative mechanisms to attract private investment. By aligning your support with Bhutan's strategy, you will be investing in a nation that has consistently harmonized economic prosperity with environmental stewardship.

In launching the BRMP, we affirm our country's commitment to charting a development path that is both ambitious and responsible. I am confident that, with BRMP as our investment guide and the support of our international partners, we will achieve our vision of a vibrant, carbon-neutral, and high-income GNH society.

I want to thank the CVF-V20 Secretariat for their invaluable support, commitment, and partnership in developing this plan.

Let us together forge a new model of prosperity, one that inspires the world by showing that sustainability and progress can march hand in hand.

I EXECUTIVE SUMMARY

Photo credit: Tiger's Nest Monastery in Paro, Bhutan | Usman bloch | Freepik

The Bhutan Resource Mobilization Plan (BRMP) is a strategic framework to finance the country's transition to a high-income, climate-resilient Gross National Happiness (GNH) economy. Rooted in the priorities of the 13th Five-Year Plan (2024–2029) and Bhutan's constitutional mandate for environmental conservation, the BRMP seeks to align public and private resources towards Bhutan's sustainable development goals. It also serves as a financing arm of Bhutan's 21st Century Economic Roadmap, translating the Roadmap's 10X vision into concrete investment pathways.

At the core of the BRMP is Bhutan's Climate Prosperity Plan (CPP), an ambitious strategic framework designed to guide the country towards a low-emissions, high-resilience development pathway. Leveraging Bhutan's substantial renewable energy potential, the BRMP focuses on climate-proofing the economy and ensuring sustainable growth. This approach operationalises the Bhutan 21st Century Roadmap's priority sectors, hydropower, agriculture, tourism, digital economy, and green services, ensuring that climate-proofing is embedded in the national growth trajectory.

The Green Economy Model (GEM) underpinning Bhutan's Climate Prosperity Plan (CPP) is aligned with the Sustainable Development Goals (SDGs), recognizing that climate action cannot be decoupled from broader development ambitions. The CPP integrates climate resilience and low-carbon pathways in a manner that simultaneously advances multiple SDGs, including those focused on poverty alleviation, health, education, gender equity, clean energy, economic growth, sustainable infrastructure, reduced inequality, responsible consumption, and biodiversity protection. By structuring interventions to maximize co-benefits and synergies across these goals, the GEM CPP framework ensures that investments not only drive climate outcomes but also deliver inclusive, sustainable prosperity for Bhutanese society. This holistic approach enhances Bhutan's capacity to meet its constitutional commitment to environmental stewardship while accelerating progress toward the 2030 Agenda.

Utilizing rigorous system dynamics modelling, BRMP evaluates three distinct scenarios: Business-as-Usual (BAU), Nationally Determined Contributions (NDC), and Climate Prosperity. Comparative analysis demonstrates that the Climate Prosperity scenario delivers the most ambitious and transformative outcomes, combining the highest GDP growth rates, deepest poverty reduction, and lowest emissions intensity, all while preserving Bhutan's carbon-negative status.

Under the 13th FYP + CPP scenario, Bhutan's GDP is projected to be 15% higher than under the Business-as-Usual (BAU) scenario by 2050, and 12.5% higher than under the 13th Five-Year Plan (FYP) alone, with an average annual growth rate of 7.4% over the 2025–2050 period. The CPP also accelerates Bhutan's income transition, enabling the country to attain high-income status by 2034 - five years earlier than projected under BAU.

In terms of household well-being, real disposable income per capita rises sharply under the 13th FYP to $4,490 by 2050, and increases further with the CPP to $5,035 per person, nearly doubling the level observed in the BAU scenario.

Poverty reduction is similarly accelerated. Under BAU, the number of people living below the national poverty line is projected to decline to 39,783 by 2050. With the implementation of the 13th FYP, this figure drops further to 27,737. The CPP scenario achieves the most ambitious outcome, reducing the

number to 25,455 people, representing approximately 3% of the total population.

The BRMP outlines five strategic aims to guide investment and resource mobilization:

- Maximize Hydro Energy Potential and Establish Regional Leadership
- Enhance Climate Resilience in Agriculture and Food Security
- Build and grow a sustainable Green Economy (Jobs, Youth, Green tourism & Industrialization)
- Strengthen and ensure Climate Resilient Infrastructure (Roads, Bridges, Power plants, Smart Grids, Water Management)
- Optimise Natural Assets and Leverage Carbon Sinks

The financing strategy blends domestic fiscal reforms with targeted engagement across multilateral, bilateral, and private-sector channels. It emphasizes:

- Strengthened domestic resource mobilization, including tax and non-tax revenues aligned with GNH principles and the issuance of thematic bonds;
- Enhanced access to international climate finance, including the Green Climate Fund, Global Shield, and development banks;
- Catalytic instruments to mobilize private-sector capital, such as guarantees, results-based financing, and de-risking facilities.

These instruments directly operationalise the enablers of the 21st Century Roadmap as well as Bhutan's 13th Five Year Plan by expanding Bhutan's financial ecosystem, enhancing market access, attracting FDI, facilitating private sector development and leveraging innovative capital markets to fund the climate resilient transformation that will enhance the wellbeing of all Bhutanese.

Ultimately, the BRMP provides a clear, actionable roadmap for achieving Bhutan's long-term development objectives. It demonstrates how climate action, economic resilience, and social well-being can be pursued jointly through strategic investments and coordinated financing. The plan reflects Bhutan's enduring commitment to harmonizing prosperity with environmental stewardship.

II
BACKGROUND

Photo credit: Aerial view of Wangdue Phodrang, Bhutan, September 2024 | Phuntsho Wangdi | Pexels

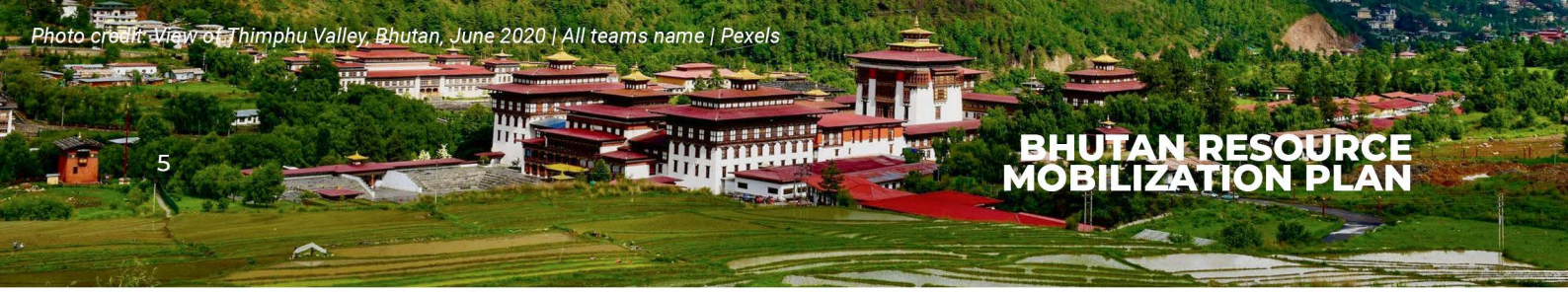
Photo credit: View of Thimphu Valley, Bhutan, June 2020 | All teams name | Pexels

The Kingdom of Bhutan, a landlocked country with an area of 38,394 Km2 in the heart of the Himalayas, is one of the world's only three carbon-negative countries. It is one of the lungs of the world. Bhutan is a global leader in environmental conservation and sustainability. Secluded from the rest of the world until recent decades, it has firmly rooted itself in its culture and ideas.

One of its core concepts is Gross National Happiness (GNH), introduced by the Fourth Monarch, King Jigme Singye Wangchuck. This approach focuses on maintaining a balance among happiness, prosperity, and security. With an estimated population of 777,224 by 2024, Bhutan is dedicated to preserving at least 60% of its land as forest while aiming for a High-Income GNH Economy by 2034, as detailed in the 13th Five-Year Plan (2024-2029). Bhutan has been implementing several such five-year plans since the 1970s. Currently, Bhutan has a total of 69.71% of forest cover.[1]

Hydropower is the single largest contributor to the Bhutanese economy, with the power export totalling 45 percent of the annual revenue of the Royal Government of Bhutan (RGoB),with agriculture, which employs 51% of the labour force, contributing only 14.5% of total GDP. However, the Kingdom of Bhutan continues to face growing challenges from climate change, which impacts water resources, agricultural output, energy exports, and biodiversity protection.

The country's youth (41% of the total population is under the age of 24) are seeking high-paying jobs, but Bhutan's $2.5 billion economy is struggling to create them to entice educated youth to stay in the country. The leadership places a lot of focus on the youth so that they can maintain their Bhutanese cultural identity and at the same time, be ready to join the modern workforce. This mindset is reflected in the queen's quote, "Our students must be locally rooted and globally competitive."

In addition to its own environmental policies, Bhutan's recent graduation from Least Developed Country (LDC) status in December 2023 necessitates a shift in focus from aid dependence to self-sustained development, further driving the need for climate-smart infrastructure and industries. Bhutan's resource mobilization plan proposes to harness the potential of Bhutan's natural endowments and mobilize resources that align with its high-income GNH goals, promoting sustainable economic development, prosperity, and resilience.

BHUTAN: A CARBON SINK FOR THE WORLD

According to the National Forest Inventory, Bhutan's forests store 523 million tonnes of carbon in biomass carbon and soil organic carbon (SOC). The biomass and soil organic carbon in forest land constitute about 341 million tonnes and 1822 million tonnes of total carbon stock respectively.[2]

[1] FMID, 2023, National Forest Inventory Volume I: State of Forest Report
[2] FMID, 2023, National Forest Inventory Volume II: State of Forest Carbon Report

LAND USE AND LAND COVER CLASS	AREA (KM^2)	% OF LAND COVER
Forests	26414.32	69%
Sandy Bank	48.49	0.13%
Shrub	1576.4	4.11%
Snow and Glaciers	1852.95	4.83%
Rocky outcrops	1736.18	4.52%
Alpine Scrub	3411.81	8.89%
Agriculture Land	1137.92	2.9%
Meadows	1685.34	4.39%
Water bodies	233.54	0.61%
Moraines	164.12	0.43%
Built up	96.83	0.25%
Landslides	26.42	0.07%
Non-built up	9.68	0.03%
Total	3,839,400 km	
Total Forest Area	2,676,545.42	
Carbon sequestration per annum	11.45 million tCO_2	
Total emission per annum	1.7 million tCO_2 without LULUCF	
Net emission	9.7 million tCO_2	

The 2017 Biodiversity Statistics of Bhutan records 11,248 species from all the biodiversity groups found in Bhutan; namely 5,114 species under the Kingdom Animalia, 5,369 species under the Kingdom Plantae, 690 species of fungus, 55 species under the Kingdom Chromista, 18 species of Eubacteria, and two species of protozoa under the Kingdom Protista.

III
THE PROPOSED BHUTAN RESOURCE MOBILIZATION PLAN

Photo credit: Statue of Buddha Dordhenma at Kuensel Phodrang in Thimphu, Bhutan, June 2019 | aaron burns | Unsplash

The proposed Bhutan Resource Mobilization Plan (BRMP) is a comprehensive strategy for sustainable development that spans both short and long-term goals, focusing initially on support for resource mobilization, and implementation of a robust climate finance and investment strategy.

This approach is designed to support the government's current initiatives while setting the stage for future climate resilience and prosperity. Aligned with Bhutan's 13th Five-Year Plan, the BRMP emphasizes renewable energy generation, particularly hydropower as the backbone of the nation's economy. Besides strengthening the hydropower sector, the plan also prioritizes 10X Economy, rural development, social protection, health and technology progress aiming to have balanced and inclusive growth effects across various sectors, such as green tourism, green industrialization, sustainable agriculture and mining. These key focus areas align with the Bhutan 21st Century Roadmap, emphasising tourism as a high-value sector, shifting agriculture toward high-value exports, expanding green industries and digital services, and exploring critical resources and sustainable mining.

This ambitious initiative sets a target to invest over 200% of Bhutan’s current GDP in infrastructure and development, with the overarching goal of achieving climate prosperity and positioning Bhutan as a high-income nation by 2034. It is shaped by the country’s vision, including innovative projects such as Sustainable Cities of the Future (Mindfulness city). This aligns with the 21st Century Roadmap’s ambition to attain developed-economy status by 2034 and deliver tenfold GDP growth by 2050. Supporting this vision, the Bhutan Resource Mobilization Plan will play a crucial role in advancing Bhutan's Sustainable Development Goals, while ensuring the country remains committed to climate prosperity in the long term.

Photo credit: Neighborhood in Thimphu, Bhutan, August 2020 | Pema Gyamtsho | Unsplash

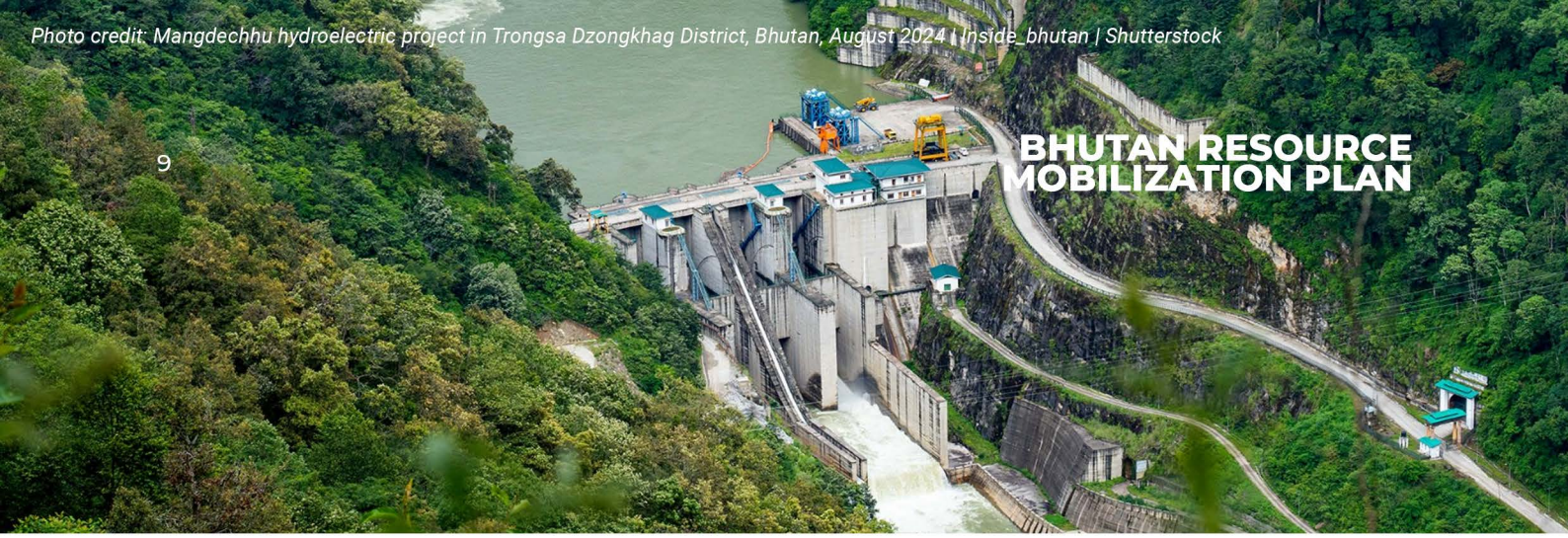

Photo credit: Mangdechhu hydroelectric project in Trongsa Dzongkhag District, Bhutan, August 2024 | Inside_bhutan | Shutterstock

A. STRATEGIC AIMS

1. MAXIMIZE ENERGY POTENTIAL AND ESTABLISH REGIONAL LEADERSHIP

TARGET HIGHLIGHTS:

- Increase Bhutan's Hydropower Capacity by 10X.
- Diversify Renewable Energy resources by maximizing Solar & Wind.
- Install 500 MW of solar and maximize wind capacity by 2035.
- Bhutan becomes a 100% Energy Exporter with Zero Energy Imports.
- Establish a knowledge-based and innovation-driven economy, with 20–25% of GDP coming from knowledge industries and tech sectors by 2050.
- Contribute to grid connection partnerships in South Asia to facilitate power exports.

Bhutan's commitment to leveraging its vast renewable energy resources forms the cornerstone of the BRMP. Being one of the world's carbon-negative countries, Bhutan is uniquely positioned to play a transformative role in regional energy leadership and foster a sustainable energy future while contributing to economic growth and climate resilience.

Bhutan envisions completing ongoing hydropower projects to add over 7 GW of capacity by 2035, expanding transmission and distribution networks, and reducing sedimentation in existing dams through advanced technology, all while complementing hydropower with the installation of 500 MW of solar capacity by 2035 to ensure energy security during dry seasons and periods of reduced hydropower generation. Bhutan intends to promote decentralised solar projects to electrify remote areas and enhance rural development.

The Bhutan Resource Mobilization Plan (BRMP) also recognises the importance of a robust and interconnected grid for energy security and regional collaboration and is pursuing regional grid partnerships as well as prioritizing investments in smart grid technology, energy storage solutions, and building local expertise in renewable energy technologies alongside the development of a Regional Energy Wheeling Program.

2. ENHANCE CLIMATE RESILIENCE IN AGRICULTURE AND FOOD SECURITY

TARGET HIGHLIGHTS:

- Build a climate-resilient seed centre for Bhutan by 2027
- 100% Insurance coverage for all small farms across Bhutan by 2030
- Increase Agriculture sector contribution to Bhutan's GDP by 100% by 2030*
- Increase food security and 100% self sufficiency on Rice, Vegetable and Milk by 2035
- Plant one million fruit trees nationwide by 2029 to climate-proof rural livelihoods
- Pivot to High-Value, Organic and Export-oriented sector by 2050

Agriculture is a cornerstone of Bhutan's economy and society, employing a significant portion of the population and contributing notably to the nation's GDP. As of 2025, approximately 44% of Bhutan's workforce was engaged in agriculture, and the sector contributed 14.67% to the country's GDP. It remains a key driver of rural development and a cornerstone of Bhutan's efforts toward self-reliance. However, the sector faces increasing challenges due to climate change, including unpredictable weather patterns, water scarcity, and soil degradation.

The Plan intends to ensure that every Bhutanese citizen has access to a stable and reliable food supply by bolstering local agricultural production and decreasing reliance on imports. This vision is grounded in adopting climate-smart farming techniques, increasing agricultural productivity, and strengthening food distribution networks to address climate-related challenges.

Central to this initiative is the creation of a seed centre designed to withstand the impacts of climate change. This centre will play a vital role in developing, conserving, and distributing crop varieties that are resilient to shifting environmental conditions. It will serve as a cornerstone of innovation, providing essential resources and expertise to farmers, enabling them to sustain yields and safeguard their livelihoods despite adverse climatic events.

Recognising the significant risks faced by small-scale farmers, the Plan emphasises comprehensive insurance coverage. This initiative is crafted to shield farmers from financial hardship caused by climate-induced hazards such as drought, floods, and landslides. By providing this safety net, the plan seeks to foster stability and encourage ongoing investment in sustainable agricultural practices.

These efforts collectively aim to create a sustainable and climate-resilient agricultural framework, ensuring the protection of livelihoods and securing Bhutan's long-term food sovereignty and economic resilience in the face of climate uncertainties.

Photo credit: Agriculture field in Bhutan, October 2023 | Tenzin Wangchuk | Unsplash

3. BUILD AND GROW A SUSTAINABLE GREEN ECONOMY (JOBS, YOUTH, GREEN TOURISM)

TARGET HIGHLIGHTS:

- Create 97.5% quality jobs by 2027.[3]
- Attract at least 300,000 tourists annually from diverse sources, ensure 5 Green Hotels in Bhutan with 100% renewable electricity and 80,000 tourism sector jobs by 2050.
- Increase green jobs to 16.7 thousand in 2030.
- Ensure that 100% of Bhutanese products for export are Carbon Border Adjustment Mechanism (CBAM) compliant by 2045.
- Increase private sector's share of contribution to GDP to 60% by 2029.

At the heart of BRMP lies an unwavering commitment to developing a sustainable green economy that fuels the nation's progress. This strategy reflects Bhutan's resolve to balance economic prosperity, environmental stewardship, and social inclusivity – principles deeply rooted in the country's guiding philosophy of Gross National Happiness (GNH).

Goal 3 outlines a roadmap to transform Bhutan into a global model of sustainable development. By 2027, the plan aims to create 97.5% quality jobs, unlocking new avenues of opportunity for the country's vibrant youth population. 41% of Bhutan's population is under 24[4]. It is important to note that the youth unemployment rate currently stands at 17.7% as of Q4 2024. This is a critical statistic that highlights the job challenge the BRMP needs to address.

This focus on employment generation is complemented by a target to increase green jobs to 16.7 thousand by 2030, further diversifying Bhutan's economic base.

Bhutan's thriving tourism sector is poised to play a pivotal role in this green economic transition. The CPP complements the 13th 5 year objective of attracting at least 300,000 tourists annually from diverse sources. Building on the country's unique "high-value, low-impact" tourism model that emphasizes environmental and cultural preservation, tourists will continue to be required to pay a daily fee that supports sustainable development initiatives, ensuring that the benefits of the Tourism industry are equitably distributed and reinvested in the local communities.

The Bhutan CPP will ensure that 100% of Bhutanese export products are Carbon Border Adjustment Mechanism (CBAM) compliant by 2045. This move not only future-proofs the country's export economy but also solidifies its reputation as a champion of green trade and environmental stewardship.

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[3] For the purposes of this plan, quality jobs align with the concept of "decent work" as outlined in the Sustainable Development Goals (SDG 8). "Decent work sums up the aspirations of people in their working lives. It involves opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize, and participate in the decisions that affect their lives." (Source: ILOSTAT, 'Measuring Job Quality: Difficult but Necessary')

[4] https://www.pmo.gov.bt/wp-content/uploads/2019/09/Bhutan-21st-Century-Economic-Roadmap_-Final-Version_26th-May.pdf

4. STRENGTHEN AND ENSURE CLIMATE RESILIENT INFRASTRUCTURE (ROADS, BRIDGES, POWER PLANTS, SMART GRIDS, WATER MANAGEMENT)

TARGET HIGHLIGHTS:

- 100% of All new construction of Roads, bridges, schools and hospitals is climate proof.
- 100% of public transportation is electrified.
- 75% of new road vehicles are electric or hybrid.
- 50% of existing built structures are equipped with insulation and high-efficiency HVAC.
- 75% of new buildings equipped with insulation and high-efficiency HVAC.
- Ensure Electric Battery stations across Bhutan next to Petrol stations.
- Ensure 100% of Water for consumption is safe to drink.
- Community-based rainwater harvesting increased by 75% in 2030.
- Establish New Green Industries and Technology hubs by 2030.

Bhutan's Climate Prosperity Plan (CPP) places a strategic emphasis on strengthening and ensuring climate-resilient infrastructure, as outlined in Goal 4. However, the country's pursuit of this critical objective is compounded by several infrastructural challenges, as highlighted in Bhutan's 13th Five-Year Plan (FYP).

One of the key barriers is the lack of critical infrastructure and disaster preparedness capacities. Bhutan's mountainous terrain, remoteness, and landlocked status have led to high transportation costs, further exacerbating the challenges of infrastructure development. Exports are also constrained by infrastructure limitations, including a lack of market information, port and airport facilities, telecommunications, and reliable inland transport.

These challenges however, translate into investment opportunities as highlighted by the 13th FYP, which outlines a comprehensive strategy to enhance Bhutan's connectivity and productivity. Investments will be made to consolidate and improve roads, bridges, airports, and railway links along the southern belt, primarily to enhance logistics and trade. The government also plans to establish and operationalize dry ports at strategic locations, further streamlining the country's export capabilities.

Recognizing the importance of reliable and affordable energy, the Bhutan CPP emphasizes the harnessing of non-hydropower renewable energy sources, such as wind and solar power, to complement the country's hydropower-centric energy mix. This diversification will not only reduce fossil fuel consumption but also improve the accessibility, reliability, and affordability of energy for Bhutan's citizens and businesses.

In alignment with the 13th FYP, the CPP will prioritize the development of climate-resilient water infrastructure based on comprehensive assessments of climate risks and vulnerabilities, establish a knowledge bank on water resources management, explore natural and built water storage solutions, as well as the implementation of nature-based approaches for watershed conservation and restoration.

5. OPTIMISE NATURAL ASSETS AND LEVERAGE CARBON SINKS

TARGET HIGHLIGHTS:

- Maintain Bhutan's forest cover above 70% of the country's total land area as a carbon sink.
- Embed sustainability and environmental stewardship at the center of development, committing to maintain carbon neutrality through 2050 and beyond (PM).
- Maximize carbon offsets through carbon trading mechanisms (Article 6.2 / 6.4).
- Protect and Restore 60% of critical biodiversity ecosystems by 2030, generating innovative biodiversity credits through comprehensive ecosystem rehabilitation.
- At least 5% of nationally listed threatened species are downlisted by 2030.

Bhutan's commitment to optimising its natural assets and leveraging carbon sinks is a pivotal role in mobilising resources to build adaptive capacity in its critical growth sectors while mitigating the physical effects of climate change under further warming scenarios. This approach also unlocks expanded opportunities in global carbon markets and emerging instruments such as biodiversity credits, providing Bhutan with new revenue streams for climate resilience and economic diversification.

As the world's first carbon-negative country, Bhutan will leverage its extensive forest cover. Constituting over 69.7% of its land area, Bhutan's forests offer a unique opportunity to generate economic and climate co-benefits through the monetisation of carbon sinks. (Estimated 523 million tons of carbon stored in forests).

Bhutan's hydropower exports also represent significant potential for carbon market revenues, approximately 5 million tonnes of CO_2. This potential is further enhanced by Bhutan's expanding renewable energy portfolio, including planned solar installations targeting 500 MW capacity by 2035 under the National Renewable Energy Strategy. The activation of Article 6.4 establishes a framework for international carbon markets that allows Bhutan to generate and trade verified carbon credits from its high-value forests, reforestation, and ecosystem-based solutions.

Beyond carbon, Bhutan's rich biodiversity and protected areas offer an opportunity to generate biodiversity credits, a financial mechanism that rewards the preservation and restoration of ecosystems. By quantifying the biodiversity benefits of forest conservation, Bhutan can attract investments from entities seeking to offset biodiversity loss and align with global frameworks.

The biodiversity credit mechanism is currently being developed or designed to incentivize and finance conservation efforts by quantifying the positive impact of actions that protect, restore, or enhance ecosystems and species. Similar to carbon credits, these tradable units are aimed to attract investment toward nature-positive outcomes. However, persistent challenges remain in standardization, credible verification, and ensuring equitable benefits for local communities, including the establishment of common and transparent metrics and monitoring protocols. Therefore, it is essential to revisit or develop clear strategic interventions to address these issues effectively.

Photo credit: Hills of Paro, Bhutan, October 2025 | Rama Krushna Behera | Unsplash

These carbon and biodiversity trading revenues will be strategically reinvested into sustainable forest management initiatives, forest restoration, forest monitoring, biodiversity conservation efforts, disaster risk reduction efforts, including early warning systems for floods and glacial lake outburst floods and rural development programmes, creating a sustainable cycle that benefits both the environment and local communities.

B. MANDATE AND STRATEGIC ROLE OF THE BHUTAN CLIMATE FUND

This strategic aim can only be delivered in collaboration with the Bhutan Climate Fund (BCF), which is a dedicated national mechanism to mobilize and manage climate finance for the country's low-carbon development. The BCF is an innovative financing vehicle designed to channel carbon finance into high-integrity climate projects in Bhutan, acting as a one-stop intermediary for carbon credit transactions. By aggregating financial resources and carbon credits, the Fund creates a structured, transparent carbon market that sustains Bhutan's environmental commitments while promoting economic resilience amid declining traditional aid. Launched with an initial capitalization target of USD 25 million, the BCF aims to attract public and private investors and position Bhutan as a model for climate finance innovation.

The mandate of the Bhutan Climate Fund is to aggregate and monetize Bhutan's carbon credits under international carbon market mechanisms, and to deploy the resulting revenues for national climate and development priorities. The BCF's establishment coincides with Bhutan's fulfilment of Article 6 readiness requirements under the Paris Agreement, including the adoption of Carbon Market Rules (2023) and the launch of a National Carbon Registry in 2023 to transparently record and track credits. By delivering climate finance through market-based transactions, the BCF allows Bhutan to monetize its natural assets (forests, renewable energy) responsibly, generating revenue for sustainable development without incurring debt. This aligns with Bhutan's development philosophy of Gross National Happiness, which seeks a balance between economic prosperity and environmental conservation. Through the Fund's activities, Bhutan optimizes its natural endowments for financial gain while safeguarding its carbon-negative status, demonstrating climate leadership and self-reliance in the post-LDC era.

C. KEY CHALLENGES

Bhutan faces an array of climate-related challenges, including slow-onset disasters, and the potential for an increase frequency of extreme events, such as floods, landslides, and glacial lake outburst floods, which impact habitats, the country's ecosystems and the economy. The economic burden of these climate-induced events is significant, affecting infrastructure, agriculture, and livelihoods, particularly in rural areas. To address these challenges, Bhutan's CPP integrates robust strategies that reduce vulnerabilities, enhance resilience, and build a sustainable foundation for long-term economic security.

The Plan outlines key projects across prioritized sectors that aim to achieve climate security and advance climate prosperity in Bhutan. These ambitious projects are in line with Bhutan's goal to become a High-Income GNH by 2034 and beyond.

D. STRATEGIC VISION

With a vision to become a high-income, climate-resilient nation by 2034, Bhutan aims to safeguard its unique environment from climate-induced risks, enhance socio-economic resilience, and leverage its natural resources for sustainable development. Bhutan's strategic approach positions climate resilience and economic development as fundamentally interconnected objectives. Rooted in the belief that climate resilience and economic prosperity are mutually reinforcing goals, the CPP, rather than treating climate adaptation as a constraint, transforms environmental challenges into catalysts for innovation and growth. The CPP framework is focused on accelerating economic prosperity and poverty reduction while enhancing climate resilience, guided by Gross National Happiness principles, the 13th Five-Year Plan and the Bhutan 21st Century Roadmap. This framework supports a portfolio of high-impact projects designed to meet climate commitments while driving climate resilient and sustainable growth across priority sectors.

IV
CLIMATE PROSPERITY PROJECTS

Photo credit: Punatsangchhu-II Hydroelectric Project | Punatsangchhu-II Hydroelectric Project Authority

A. COMPREHENSIVE ENERGY EXPORT PROGRAM

Unlocking 100% of Bhutan's Hydropower Capacity: This includes a comprehensive energy export program designed to leverage Bhutan's abundant hydropower resources to strengthen the nation's economy, contribute to regional energy stability, and mitigate global carbon emissions.

KEY COMPONENTS:

1. MAXIMIZING HYDROPOWER GENERATION

- Complete ongoing large-scale hydropower projects:

HYDRO POWER PROJECTS AND SPECIFICATIONS		
PROJECT NAME	**CAPACITY**	**ESTIMATED PROJECT COST (USD)**
Punatsangchhu-I	1,200 MW	1.2B
Punatsangchhu-II	1,020 MW	2B
Nyera Amari	404 MW	320M
Kholongchu	600 MW	500M
Dorjilung	1,125 MW	1.25B
Bunakha	180 MW	200M
Wangchhu	900 MW	800M
Khomachhu	363 MW	380M
Dangchhu	170 MW	50-100M
Chamkharchhu-I	770 MW	900M
Kuri-Gongri	2,800 MW	2.5-3B
Total	**9,532 MW**	**10.65B**

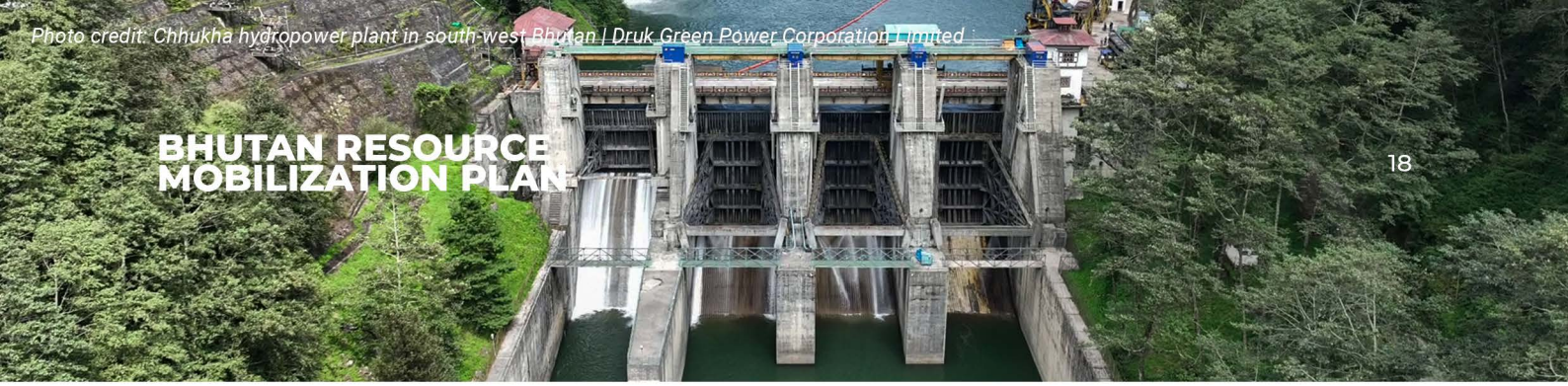

Photo credit: Chhukha hydropower plant in south-west Bhutan | Druk Green Power Corporation Limited

- Develop smaller, decentralized hydropower projects to provide electricity to remote areas while adding exportable capacity. Priority will also be given to the following small hydropower projects in various phases:

PHASE I	PHASE II	PHASE III
Suchhu - 18 MW	Jomori - 90 MW	Dagachhu - 70 MW
Yung Chu - 32 MW	Gamri-I - 54 MW	Parochhu - 33 MW
Burgangchhu - 54 MW	Bindu-I & II - 26 MW	
	Begana - 25 MW	

2. REGIONAL ENERGY EXPORT AGREEMENTS

- Strengthen and expand partnerships with neighbouring countries, particularly India and Bangladesh, to ensure reliable energy trade agreements[5].
- Negotiate long-term power purchase agreements (PPAs) that provide stable revenue streams and enhance regional energy security.

3. GRID MODERNIZATION AND INTERCONNECTIVITY

- Upgrade Bhutan's national grid with smart grid technology, for a total of 1.703km[6], to manage energy flows efficiently and integrate variable renewable energy sources.
- Build regional transmission networks to export surplus electricity during peak production and ensure an uninterrupted domestic supply during dry seasons.

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[5] India's peak power demand is expected to reach approximately 366 gigawatts (GW) by 2030, up from the current 243 GW. (https://energy.economictimes.indiatimes.com/news/power/indias-power-demand-projected-to-reach-366-gw-by-2030-capacity-expansion-to-900-gw-targeted/106971394?utm_source).
IEEFA's assessment shows that Bangladesh's demand may rise to 25,834 megawatts (MW) in 2030 (https://ieefa.org/articles/bangladesh-power-development-board-can-save-us12-billion-annually-through-key-electricity?utm_source).

[6] https://openjicareport.jica.go.jp/pdf/12326856_02.pdf

4. INNOVATIVE FINANCING AND PARTNERSHIPS

- Leverage green financing, such as green bonds and climate funds, to attract investments for grid expansion and hydropower development.
- Partner with multilateral development banks and private sector investors to de-risk projects and accelerate implementation.

5. ADDRESSING ENVIRONMENTAL AND SOCIAL CONCERNS

- Implement sedimentation management systems in dams to improve the efficiency and lifespan of hydropower facilities.
- Ensure that energy export projects align with Bhutan's environmental and social sustainability goals, minimizing impacts on ecosystems and local communities.

6. DIVERSIFYING RENEWABLE ENERGY

- Complement hydropower with solar and wind energy installations, ensuring a diversified energy portfolio to mitigate risks associated with changing water availability.

Photo credit: Mangdechhu hydropower plant in Trongsa, Central Bhutan / Punatsangchhu-II Hydroelectric Project Authority

Photo credit: Road beside a river in Bhutan, October 2025 | Anil Sharma | Pexels

B. CLIMATE RESILIENT INFRASTRUCTURE INITIATIVE

Climate-proofing infrastructure, including roads, bridges, and public facilities, will protect Bhutan's assets from extreme weather events and strengthen national resilience. This initiative includes investments in climate-adaptive construction techniques to ensure durability and sustainability.

KEY COMPONENTS:

1. TRANSPORT AND CONNECTIVITY

- Prioritizing high-risk and economically significant routes.
- Climate-adaptive transport infrastructure development across critical corridors.
- Reinforced road networks and bridges utilizing advanced engineering solutions.
- Strategic expansion of transport networks to remote communities, enhancing market access and service delivery.
- Comprehensive charging infrastructure to support electric mobility.
- Climate adaptive transport hub that includes multi-modal facilities[7] with renewable energy integration, facilitating tourism development, regional connectivity and ensuring safe and reliable movement across the country despite Bhutan's unique geographic and climatic challenges.

2. PUBLIC INFRASTRUCTURE RESILIENCE

- Weather-resistant public facilities incorporating disaster-resilient design.
- Integration of renewable energy systems and resource-efficient solutions.
- Enhanced thermal efficiency, water conservation systems, and structural reinforcement.

[7] Multi-modal facilities are integrated transportation hubs that connect and coordinate multiple modes of transport, such as road, rail, and air, within a single infrastructure or network. These facilities are designed to facilitate seamless transitions between different transportation systems, improve logistics efficiency, and reduce costs and travel times for passengers and goods.

3. NATURAL INFRASTRUCTURE INTEGRATION

- Strategic deployment of natural defense mechanisms for ecosystem preservation.
- Key elements:
  - Wetland conservation for flood mitigation
  - Bioengineering for slope stabilization
  - Watershed protection around critical infrastructure
  - Natural drainage system enhancement

4. URBAN RESILIENCE FRAMEWORK

- Enhance drainage infrastructure by developing advanced urban water management systems to withstand extreme weather events.
- Integrated rainwater harvesting infrastructure to ensure water security.

Photo credit: Thimphu River in Bhutan, December 2021 | Ugyen Tenzin | Unsplash


Photo credit: Wangdicholding Palace, Bhutan, November 2020 | bradford zak | Unsplash

C. WATER SAFETY AND SECURITY

Bhutan's CPP emphasizes a National Water Safety and Security Program, ensuring sustainable water resources for all communities. This includes climate-resilient water management practices, rainwater harvesting, and enhanced flood protection to safeguard public health and ecosystems.

KEY COMPONENTS:

1. SUSTAINABLE WATER SUPPLY SYSTEMS

- Develop and modernize water supply systems to ensure safe and reliable access to drinking water in urban and rural areas.
- Reduce water loss through leakage control, maintenance, and smart water grid systems to optimize usage.
- Monitor and regulate groundwater extraction to prevent overuse and ensure aquifer recharge.

2. RAINWATER HARVESTING SYSTEMS

- Community rainwater harvesting systems to expand rainwater collection in rural and urban areas, reducing reliance on conventional water sources.
- Develop storage solutions at the domestic and communal level to capture and utilize rainwater for agricultural, industrial, and domestic purposes.

3. ENHANCE FLOOD PROTECTION

- Strengthen glacial lake monitoring and implement measures to reduce the risk of potential outbursts, such as controlled lake drainage systems.
- Construct levees, embankments, and reservoirs to manage and control floodwaters, particularly in vulnerable areas.
- Improve drainage infrastructure in urban areas to handle extreme rainfall events.

4. WATERSHED CONSERVATION AND RESTORATION

- Maintain and restore critical ecosystems like forests, wetlands, and riparian zones that naturally regulate water flows while incorporating ecosystem-based management approaches such as constructed wetlands and buffer zones.

D. DZONGKHAG-BASED CLIMATE RISK FINANCING AND AGRICULTURE INSURANCE PROGRAM

Bhutan's Dzongkhag-Based Climate Risk Financing and Agriculture Insurance Program establishes a comprehensive risk management framework for the agricultural sector. The agricultural sector in Bhutan employs 51 percent of the working population and contributes 15.9 percent to the national GDP (Food and Agriculture Organization [FAO], 2024).

The program leverages Dzongkhags (district administrative centers) to protect smallholder farmers against climate-induced risks like floods, droughts, and landslides. Through integrated public-private partnerships and innovative financing mechanisms, it will enhance farmers' adaptive capacity, promote climate-smart agricultural practices, and strengthen rural economic resilience while contributing to national food security.

The V20/G7 Global Shield Against Climate Risks offers a valuable complement to Bhutan's Dzongkhag-Based Climate Risk Financing and Agriculture Insurance Program. By introducing pre-arranged and trigger-based financing instruments across other vulnerable sectors, the Global Shield enhances Bhutan's capacity to adapt to climate shocks and minimize loss and damage. Through mechanisms such as parametric insurance, the Global Shield ensures the timely disbursement of funds when specific climate thresholds—like drought, floods, or landslides—are exceeded. By aligning with broader climate resilience initiatives for support, including the Loss and Damage Fund, Bhutan will be positioning itself to respond swiftly to climate-related disasters, protect vulnerable populations, and sustain economic stability.

Photo credit: A house in the middle of a paddy field in Paro, Bhutan, October 2023 | Tenzin Wangchuk | Unsplash

KEY COMPONENTS:

1. COMPREHENSIVE CLIMATE RISK ASSESSMENT

- Conduct localized assessments of climate risks at the Dzong level to identify vulnerabilities in the agricultural sector.
- Develop climate risk maps and data platforms to guide decision-making and prioritize areas for intervention.

2. AFFORDABLE AND ACCESSIBLE AGRICULTURAL INSURANCE

- Design crop and livestock insurance products tailored to the specific needs and risks of Bhutanese farmers.
- Offer subsidized premiums for smallholder farmers, ensuring affordability and wide coverage.
- Implement index-based insurance schemes linked to weather or yield data to streamline claim processes.

3. CLIMATE-RESILIENT AGRICULTURE INVESTMENTS

- Incentivize farmers to adopt climate-smart agricultural practices such as drought-resistant crops, water-efficient irrigation, and soil conservation techniques.
- Provide grants or loans for purchasing climate-resilient seeds, tools, and technologies.

4. PUBLIC-PRIVATE PARTNERSHIPS (PPPS)

- Collaborate with private insurers and financial institutions to develop innovative risk-sharing mechanisms.
- Establish reinsurance arrangements to manage large-scale climate risks.

5. COMMUNITY ENGAGEMENT AND CAPACITY BUILDING

- Train farmers and local officials in risk management and the use of agricultural insurance products.
- Promote awareness campaigns on the benefits of insurance and climate-resilient farming practices.

6. DZONGKHAG-LEVEL IMPLEMENTATION FRAMEWORK

- Utilize the Dzongkhag administrative structure to implement and monitor the program at a local level.
- Establish district-level Climate Risk Financing Committees to oversee operations and ensure inclusivity.

7. INTEGRATION WITH NATIONAL FINANCING STRATEGIES

- Align the program with Bhutan's broader sustainable financing frameworks, including the Climate Fund and Green Bonds initiatives.
- Seek international grants and concessional financing to support program implementation.

Photo credit: Farmers walking on a field in Bhutan, October 2023 | Tenzin Wangchuk | Unsplash

E. FOREST CONSERVATION INITIATIVE

Bhutan's exceptional forest coverage, currently at 69.7% and constitutionally mandated to remain above 60%, presents a unique case in global carbon finance. As a carbon-negative country that annually sequesters 13.2 million tons of CO2 equivalent while emitting only 1.7 million tons (excluding LULUCF), Bhutan has faced challenges in accessing traditional carbon markets due to additionality requirements. However, opportunities exist through the activation of Article 6.4 of the Paris agreement, which is a UN-governed international carbon crediting mechanism, innovative financing mechanisms that recognise and monetise the country's comprehensive ecosystem services, including biodiversity conservation, watershed protection, and enhanced forest management practices. Success in developing new carbon finance frameworks and biodiversity credits will depend on Bhutan's ability to demonstrate value beyond carbon sequestration, establish robust monitoring systems, and create benefit-sharing mechanisms that support both conservation goals and community livelihoods while maintaining its strong cultural and constitutional commitment to forest preservation.

KEY COMPONENTS:

1. SUSTAINABLE FOREST MANAGEMENT

- Enhance periodic forest resources inventory, strengthen sustainable forest management and implement improved forest management practices.
- Encourage and implement participatory forest management to promote sustainable forest management.
- Enhance forest monitoring systems using satellite technology to provide real-time data on forest health and illegal activities.
- Strengthen forest policies to mitigate risks from forest fires, pests, and climate-induced changes in forest ecosystems.

2. BIODIVERSITY PROTECTION

- Strengthen and enhance the management of network of protected areas to ensure critical habitats for endangered species are preserved
- Develop partnerships with international organizations to support biodiversity research and conservation.

Photo credit: Khamsum Yulley Namgyel Temple nestled amid a pine forest in Punakha, Bhutan, October 2025 | PENDEN Wangchuk | Unsplash

3. COMMUNITY ENGAGEMENT AND LIVELIHOOD SUPPORT

- Empower local communities by integrating eco-tourism, agroforestry, and non-timber forest products (NTFP) into their livelihoods (forest-based livelihood enhancement programs with equitable benefit sharing mechanisms).
- Provide capacity-building programs focused on climate-resilient agricultural practices and forest resource management.
- Sustainable forest product value chains.

4. CARBON SEQUESTRATION AND MARKET INTEGRATION

- Develop forest-based carbon projects to leverage international carbon markets.
- Measure and certify carbon sequestration to generate additional financing for conservation.

F. CLIMATE PROSPEROUS PROGRAMS

KEYSTONE PROJECTS:

1. Electrification, Financing and Expansion of Transportation Networks
2. Accessing Carbon Markets utilizing Bhutan Climate Fund Projects
3. Green Entrepreneurship Jobs & Export Program
4. Green Tourism Initiative
5. Climate Resilient Agriculture & Seed Program
6. Cities of the Future → Exporting Bhutanese Culture/Spirituality
7. Regional Energy Wheeling Program
8. Fiscal Space Reengineering: Yearly Debt For Climate Swap
9. Maximizing Bhutan Solar Potential
10. Accelerating EVs Adoption Program

V
COUNTRY PLATFORM FOR THE IMPLEMENTATION OF BRMP

- Photo credit: People working in the agricultural field at Paro, Bhutan, October 2012 | deba.way | Shutterstock

To ensure effective implementation of Bhutan's Resource Mobilization Plan, the Royal Government of Bhutan will leverage existing multisectoral arrangements (post thorough consultations); and where necessary establish a Country Platform as the national coordination and delivery mechanism.

A. RECOMMENDED MANDATE OF THE COUNTRY PLATFORM (TO BE FURTHER REFINED POST CONSULTATIONS)

- Led by the Ministry of Finance, the approved multisectoral coordination and delivery mechanism will Coordinate project pipeline development across all priority sectors to ensure alignment with national strategies and readiness for investment.
- Lead resource mobilization and financial structuring, including the design and issuance of thematic bonds, guarantees, and blended finance instruments.
- Facilitate investor engagement and strategic partnerships, connecting bankable projects with domestic and international financing sources.
- Support policy reform to strengthen Bhutan's investment climate, expand fiscal space, and ensure enabling conditions for private sector participation.
- Oversee the design and roll-out of innovative financial instruments, while deepening Bhutan's domestic capital markets to unlock long-term financing.
- Facilitate private sector engagement by creating incentives and partnerships to scale green investments, including investor forums.
- Enhance regional and international cooperation through trade, natural asset management and strengthening access to climate funds, bilateral agreements, and multilateral partnerships.
- Ensure monitoring, accountability, and transparent reporting to both national stakeholders and international partners, building trust and sustaining momentum.
- Mobilize philanthropic capital to catalyze cross-ministry collaboration, leverage project preparation resources for feasibility studies, and attract viability gap financing and risk-sharing mechanisms. These functions will ensure that Bhutan can crowd in private capital at scale while maintaining coherence with its Gross National Happiness development philosophy.

This approved delivery mechanism, post consultations with relevant agencies will ensure that the implementation of the CPP scenario is broad-based, inclusive, and resilient by establishing an integrated national mechanism that embraces a whole-of-government and whole-of-society approach. By actively involving civil society, academia, and private sector stakeholders alongside ministries and regulators, the platform enhances legitimacy, strengthens transparency, and optimizes Bhutan's capacity to attract and mobilize climate finance for sustainable prosperity.

B. MODELING GUIDELINES AND FINDINGS

SCENARIOS AND TIMEFRAMES

The CPP strategy is a development framework that has the objective of supporting a faster transition towards a low-carbon and climate-resilient development model through policy making, programs and investments. The pertinence of the CPP is here simulated and tested through GEM which has been augmented with new indicators relevant to the strategy.

GEM is structured into four components:

1. The creation of low carbon development pathways that maximize economic and social development;
2. The identification of the most viable resilient investments that strengthen the economy and society by ensuring their ability to withstand climate shocks;
3. The assessment of the most relevant mechanisms for risk transferring;
4. The production of a Cost Benefit Analysis (CBA).

The CPP strategy's impact is simulated through four scenarios:

1. The Business as Usual (BAU) scenario
2. The Nationally Determined Contribution (NDC scenario)
3. 13th 5 years Plan (FYP) scenario
4. 13th 5 years Plan + The Climate Prosperity Plan (CPP) scenario

THE BAU SCENARIO CONSTITUTES THE BASELINE SCENARIO

The Business-as-Usual (BAU) scenario assumes that no additional adaptation or mitigation measures are implemented beyond those already approved under existing frameworks, such as the 12th Five-Year Plan (FYP), previous FYPs, and the Nationally Determined Contributions (NDCs). In essence, it represents a scenario of inaction, where current trends persist and future developments unfold in line with historical patterns.

THE NATIONALLY DETERMINED CONTRIBUTION (NDC) SCENARIO

The scenario is where climate change mitigation and adaptation ambitions for reducing sectoral emissions are implemented as outlined in the official NDC document.

13TH 5-YEAR PLAN (FYP)

This scenario follows the guidelines and the objectives of the national development strategy, where economic growth, social progress, enhanced security and transformed governance are the main pillars and hydropower mega projects are the main drivers of this strategy.

13TH 5-YEAR PLAN + THE CLIMATE PROSPERITY PLAN (CPP)

This scenario shows the pathway where the country leverages the maximum potential of its domestic renewable energy resources and fully climate-proofs its economy. The assumptions for mitigation and adaptation considered in the CPP scenario are added on top of the existing national strategies. Moreover, in the model the FYP is considered only until the 2034, (implementation of two full five-year plans cycles) then the CPP takes over as an autonomous development plan.

C. CPP MITIGATION AND ADAPTATION AMBITION

INTERVENTION	UNIT	2030	2040	2050
CLIMATE CHANGE MITIGATION				
Sustainable agriculture				
Adoption rate	%	-	100%	100%
Land based interventions				
Reforestation (cumulative)	Ha	2,000	6,958	16,958
Energy sector interventions				
Additional EE growth	%/Year	-	2%	4%
Average electrification of energy demand	Average %	-	60%	100%
Power generation				
Share of electricity generated from renewables	%	100%	100%	100%
CLIMATE CHANGE ADAPTATION				
Sustainable agriculture				
Share of land protected by net shading	%	-	100%	100%
Share of land using resilient practices	%	-	10%	10%

Share of land covered by drip irrigation	%	-	100%	100%
Flood protection for agriculture				
Share of cropland equipped with drainage	%	-	100%	100%
Livestock				
Nature and technology-based heat protection	Average %	-	50%	50%
Labor productivity				
Additional buildings with air conditioning	%	-	100%	100%
Buildings with retrofit insulation	%	-	100%	100%
Livable cities (green spaces)	%	-	100%	100%
Flood protection for infrastructure				
Share of buildings with flood protection	%	-	100%	100%
Industry and services capital with flood protection	%	-	100%	100%
Power generation				
Wind protection for all types of generators	%	-	100%	100%
Flood protection for all types of generators	%	-	100%	100%

Photo credit: View of Thimphu valley, Bhutan, April 2020 | Pema Gyamtsho | Unsplash

VI DETAILED MACRO-ECONOMIC ANALYSIS

Photo credit: People at Tashichho Dzong, Thimphu, Bhutan, October 2025 | Pierre Jean Durieu | Shutterstock

A. MACRO-ECONOMIC OUTCOMES

The Bhutan Climate Prosperity Plan (CPP) is expected to deliver significant improvements across a broad spectrum of crucial socio-economic and environmental indicators compared to the business-as-usual (BAU) scenario. These improvements include stronger economic performance, enhanced social well-being, improved public health, and enriched biodiversity. By advancing the CPP, the country is anticipated to accelerate progress toward achieving all relevant Sustainable Development Goals (SDGs), facilitating earlier and more efficient attainment of these objectives.

B. GEM PILLARS

The Green Economy Model (GEM) offers an integrated representation of socio-economic and environmental dynamics, and the natural capital that supports them, at country level (Bassi, 2015; Pallaske, Bassi, Garrido, & Guzzetti, 2023). To ensure that the CPP analysis is comprehensive and accounts for several climate risks, includes relevant investment options, and produces a wide range of avoided costs and added benefits generated by climate action, several changes and additions have been made to GEM. These can be grouped into four categories: (i) the integration of detailed climate data, (ii) the estimation of a more extended list of climate change damage and assumptions for reconstruction, (iii) the integration of a variety of co-benefits of climate action, and (iv) the addition of several policy options for climate resilience.

GEM is designed to inform policy making towards sustainable development. It allows forecasting and assessing the outcomes of various policies and investments in relation to medium- and long-term national development targets. By offering a systemic approach, GEM forecasts the outcomes of action and inaction across sectors, actors, dimensions of development and over time. Further, GEM enables the formulation of policies and investment packages that result in a more inclusive, robust, and resilient outlook for the country. At the same time, by means of co-creation, GEM supports the creation of a better understanding of the co-benefits associated with sustainable policies and investments, including on climate action, under different climate scenarios.

Figure 1 presents the generalized underlying structure of GEM. Figure 2 presents instead a sub-system diagram of the model. The former shows how four key capitals (built, social, human and natural) are interconnected, and how they contribute to shaping future trends across social, economic and environmental indicators. Specifically, feedback loops can be identified that are reinforcing (R), in all areas pertaining to economic growth and social development. These are driven by investments and knowledge creation, and enabled by the availability of natural capital, which, if not properly managed, can constrain economic growth (hence the balancing loops -(B)- identified in the diagram). Policies can be implemented to promote sustainable consumption and production, decoupling economic growth from resource use (also through education and behavioral change), to mitigate the exploitation of

natural capital and generate a stronger and more resilient green growth.

GEM has been applied to more than 50 countries and was designed to include all key sectors that are relevant for future development, for instance, in the context of low carbon development (HMIT, 2021; BAPPENAS, 2021) and green recovery packages (UNEP, 2020). These include, among others: population, food demand and supply, land use and land cover, economic activity (via the use of national accounts), employment, access to health care, education, energy demand and supply, air emissions, water pollution, and climate trends. The model also provides an economic valuation for several externalities, including GHG emissions (social cost of carbon), air pollution, wastewater, waste, traffic-related impacts (e.g. accidents, noise), the opportunity cost of water (from savings in the agriculture sector) and biodiversity.

In the context of the Climate Prosperity Plan (CPP) project, GEM has been equipped with several additional climate impacts, and with more than 20 additional climate resilience options, now coupled with an equal amount of transition investments. This allows to create a complete economic and financial assessment of climate action (built on physical indicators, and summarized in a Cost Benefit Analysis) for both transition and climate resilience.

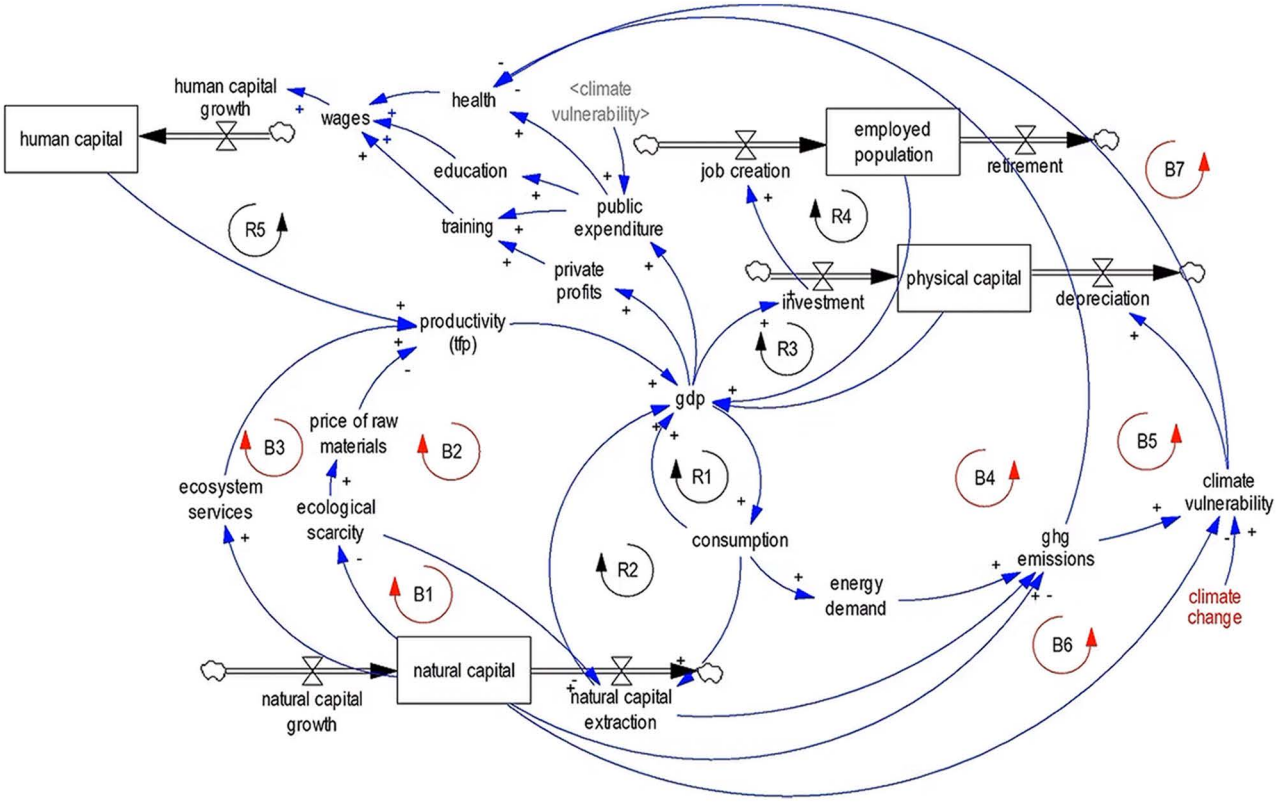


Figure 1. Overview of GEM, built on (Bassi, 2015)

GEM is built using the System Dynamics (SD) methodology, serving primarily as a knowledge integrator.

SD is a form of computer simulation modelling designed to facilitate a comprehensive approach to development planning in the medium to long term (Meadows, 1980; Randers, 1980; Richardson & Pugh, 1981; Forrester, 2002). SD operates by simulating differential equations with "what if" scenarios, explicitly represents stocks and flows (critical to estimate climate change impacts on infrastructure, and how such impacts accumulate over time to affect economic productivity, among other indicators), can integrate optimization and econometrics and support model coupling (e.g. in conjunction with spatially explicit models, sectoral models for energy and the economy).

The purpose of using SD for the development and application of GEM is not to make precise predictions of the future, nor to optimize performance; rather, GEM applications are used to inform policy formulation, forecasting policy outcomes (both desirable and undesirable) and leading to the creation of a resilient and well-balanced strategy (Roberts, Andersen, Deal, Garet, & Shaffer, 1983; Probst & Bassi, 2014). Such an approach is consistent with the thinking framework of policymakers, who weigh sets of outcomes on the basis of political, technical and institutional preferences in choosing from among policy packages.

All GEM applications include four key capitals (physical, human, social and natural) as interconnected via the explicit representation of feedback loops (reinforcing or balancing)[8]. Policies can be implemented to strengthen growth (reinforcing loops, e.g. investments in physical capital accumulate capital stock, which, other things equal, increases output potential, production, aggregate demand, including investment, further increasing, capital and output); or curb change (e.g. by strengthening balancing loops). In the context of climate action, we generally find that transition investments directly stimulate new growth, while investments in climate resilience reduce costs and free up resources, thereby enabling new growth indirectly.

Among the many feedback relationships represented by GEM, there are two that are worth highlighting, considering how central they are for explaining the connectedness of climate, environmental and socio-economic outcomes, which is, in turn, central for the design of robust development policies. The first one refers to impacts on what mainstream models refer to Total Factor Productivity (TFP). TFP in the model is impacted by technology, infrastructure (e.g. the road network and access to electricity), energy productivity (i.e. considering the cost of energy as a ratio of GDP), air pollution, weather (e.g. temperature) and extreme weather events. As a result, investments in energy efficiency and renewable energy, to cite two examples both reduce energy consumption and spending (possibly resulting in higher GDP), and reduce air pollution (also possibly resulting in higher GDP, but via a different channel). The second one refers to a feedback loop that governs linkages between climate, environment (including policies) and the socio economy. This feedback loop considers the availability of natural resources, and impacts of land cover change on ecosystem service provisioning, which goes on to affect economic activity, as well as access to natural resources. These dynamics are represented via the use of feedback loops in the model, resulting in circular relations that may highlight the simultaneous emergence of short term benefits and medium term challenges, or vice versa, depending on the scenarios simulated.

[8] In a reinforcing loop, a change in one direction is compounded by more change. Under a reinforcing loop, policies or shocks that move a variable in one direction transmit through the system in a way that leads to further increases in such variable over time. For example, money in a savings account generates interest, which increases the balance in the savings account and earns more interest. Balancing loops, in contrast, counter change in one direction with change in the opposite direction.

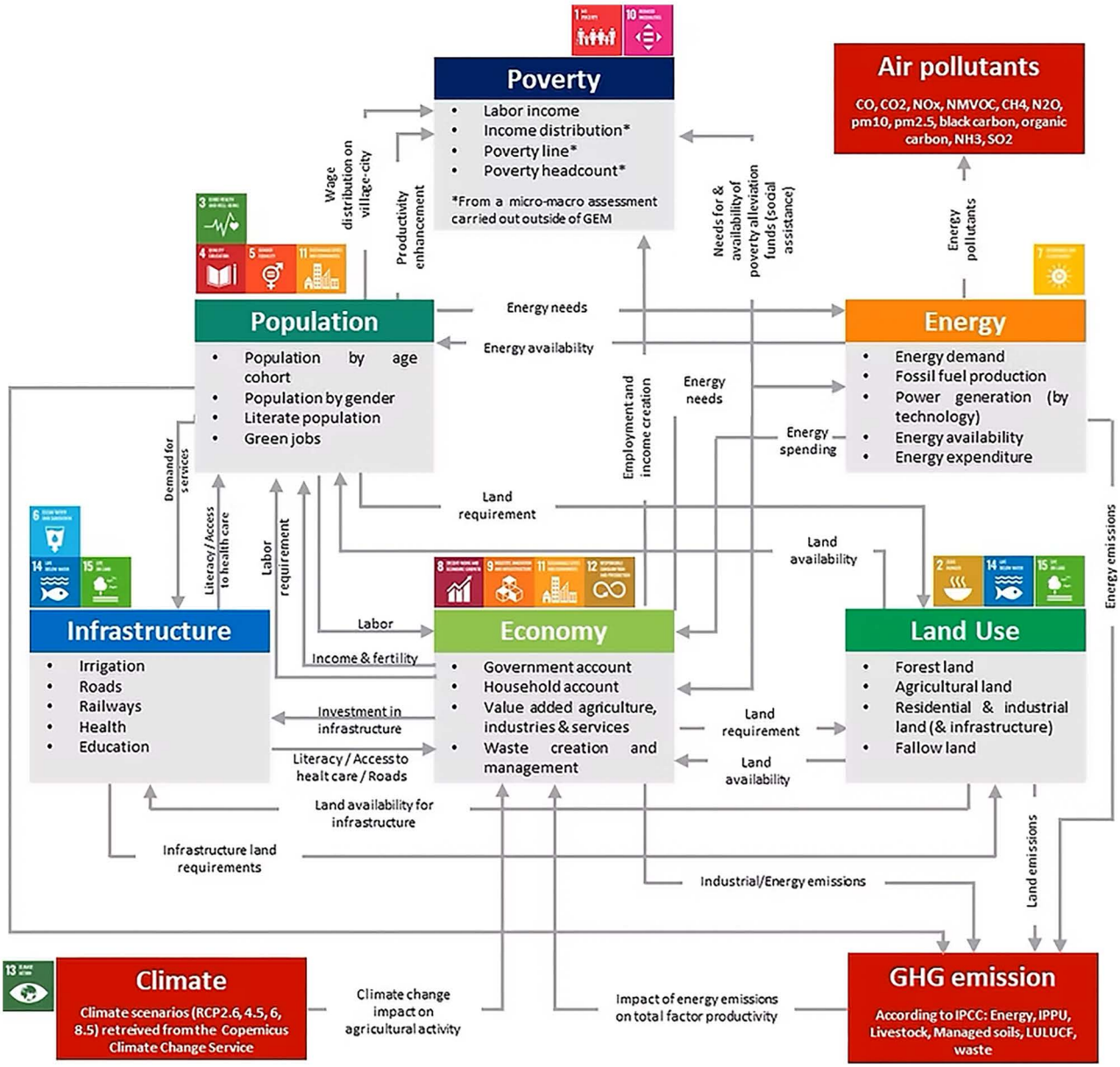


Figure 2. Sub-system diagram presenting the key sectoral components of GEM

Photo credit: Wangdue Phodrang, Bhutan, September 2024 | Phuntsho Wangdi | Pexels

C. ANALYSIS PERSPECTIVE

The results of the analysis show that the CPP scenario offers a strong synergy between investments, economic growth, social empowerment and environmental preservation, as follows:

- The CPP is a competitive economic development strategy. It achieves a Benefit to Cost Ratio (BCR) of 1.70 by 2050.
    - The Climate Prosperity Plan (CPP) stands out as a competitive economic development strategy at the national level, it offers a unique approach to address the pressing issue of climate change. It recognizes that climate action and economic prosperity are not mutually exclusive but can, in fact, be mutually reinforcing.
- The Bhutan CPP stimulates economic growth (GDP 12.3% higher than the 13th 5-year plan by 2050) and job creation (0.3% higher than 13th 5-year plan by 2050) both by reducing costs of climate change (resilience) and by increasing productivity (transition).
    - The CPP generates economic growth and job opportunities through a dual strategy. On one hand, it mitigates the economic burdens associated with adapting to climate change, reducing the costs incurred due to climate-related disasters. On the other hand, it enhances economic productivity by accelerating the transition to a green economy.
- The CPP, due to high ambitions for climate resilience, creates a strong synergy with transition investments.
    - The CPP distinguishes itself by setting ambitious targets for climate resilience, which creates a robust synergy with transition investments.
- Investment levels are the highest for the CPP scenario (close to 240% of GDP by 2030).
    - The Climate Prosperity Plan envisions significant investments, making it a comprehensive and proactive strategy to address climate change. By earmarking substantial funds, the CPP ensures that it has the financial resources to make a significant impact.
- The CPP investments are economically viable (with USD 3,200 millions of net benefits between 2023 and 2050).
    - The investments outlined in the CPP are not just ambitious but economically and financially viable as well. The CPP stands as a credible and practical approach to climate prosperity, both from an investment and development point of view.
- Funding options are available; a balance between public and private sources should be sought.

- The Climate Prosperity Plan identifies available funding options for its implementation. While public funding plays a critical role, the CPP also advocates for a balanced approach that leverages private sector investments.

D. ECONOMIC

The economic section outlines the macroeconomic outcomes of the CPP scenario simulation, with a focus on key indicators such as Bhutan's GDP growth and disposable income. It also examines the projected income graduation year and analyzes poverty levels. Additionally, the section evaluates the contribution of insurance in driving value-added growth, particularly its impact on real GDP expansion.

1. GDP GROWTH

Real GDP, or total Gross Domestic Product adjusted for inflation, is presented in constant prices. The calculation is based on the GEM model, calibrated in line with data from the World Bank and International Monetary Fund (IMF). The GDP deflator, used to convert nominal GDP into real terms, is benchmarked against the World Bank Data Portal (2021) and adjusted using the Bhutan National Bureau of Statistics database. The real GDP growth rate reflects the annual percentage change in real GDP, offering a key measure of the economy's expansion while adjusting for inflationary effects.

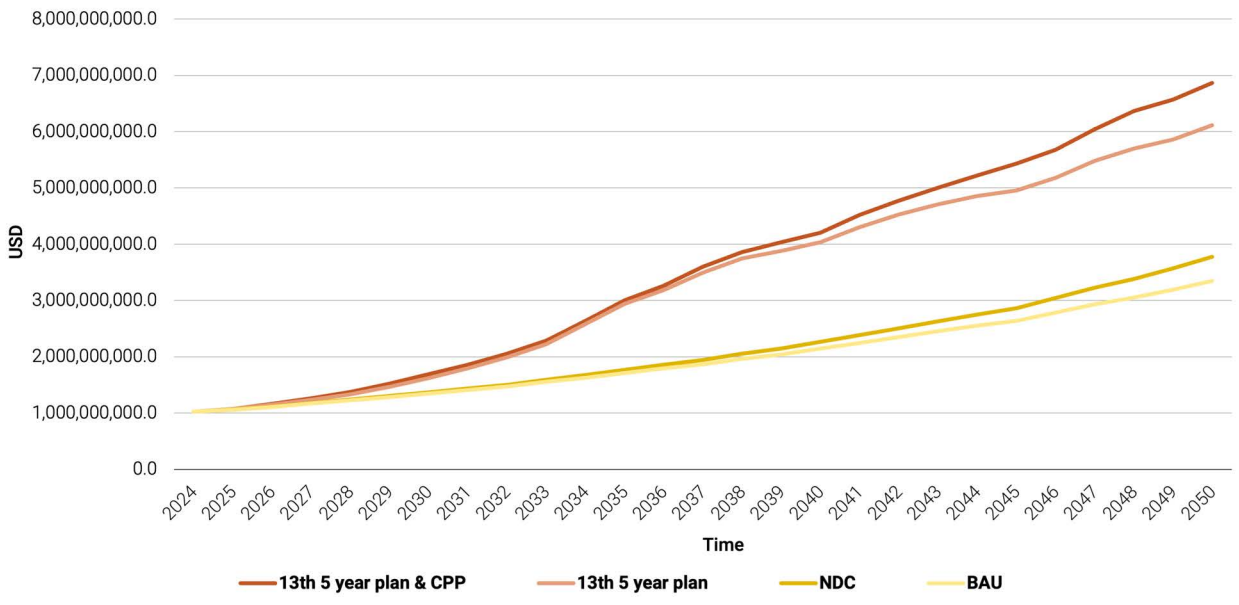


Figure 3. Total real GDP, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

Under the Business as Usual (BAU) scenario, Bhutan's economy is projected to grow at a steady average rate of 4.7% annually between 2025 and 2050. Real GDP is expected to increase from $903 million in 2025 to $3.35 billion by 2050. This growth trajectory reflects the continuation of development policies from previous decades, leading Bhutan to graduate to upper-middle-income status by 2026 and achieve high-income status by 2039, marking one of the nation's history's most significant developmental achievements. The NDC scenario follows a similar growth path to the BAU, with no major deviations until the 2040s.

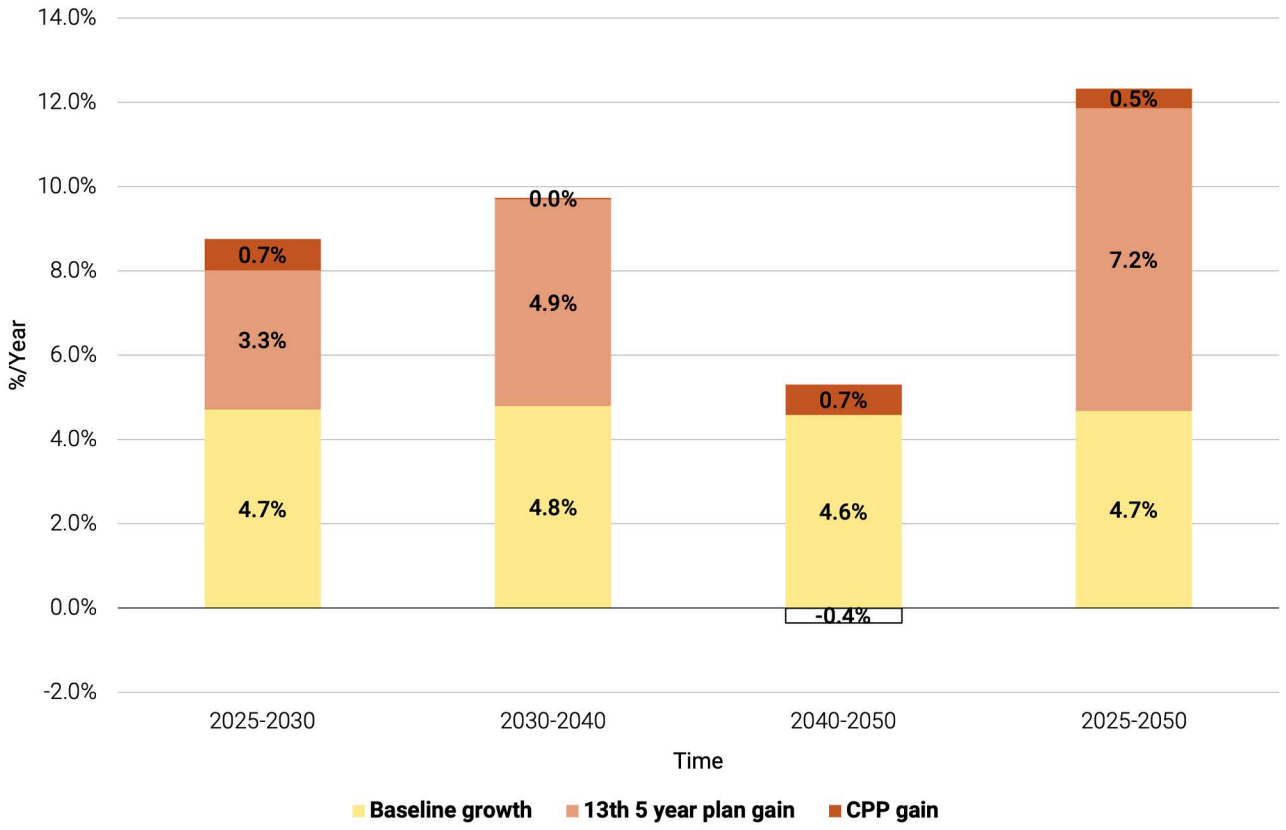


Figure 4. Average real GDP growth rate, Baseline growth, 13th FYP gain, and CPP gain

Conversely, under the 13th Five-Year Plan (FYP), Bhutan's growth is projected to accelerate, achieving an additional 3.3% annual growth compared to BAU between 2025 and 2030. This results in an impressive average growth rate of 9.7% annually up to 2040, primarily driven by large-scale hydropower projects. The rapid economic expansion enables Bhutan to achieve high-income status earlier, by 2034, although growth tapers off in the subsequent decade. By 2050, real GDP is expected to reach $6.13 billion.

In the CPP scenario, growth mirrors the trends of the 13th FYP up to 2034 but adds further momentum thereafter, with an additional 0.5% annual growth in the final decade. This results in nearly $800 million more in real GDP compared to the 13th 5 year plan scenario, representing a substantial 12.52% increase overall.

REAL GDP GROWTH RATE COMPARISON WITHIN EACH SCENARIO					
AVERAGE REAL GDP GROWTH	UNIT	2025 - 2030	2030 - 2040	2040 - 2050	2025 - 2050
13th 5 year plan + CPP	%/Year	8.8%	9.7%	5.0%	7.7%
13th 5 year plan	%/Year	8.0%	9.7%	4.2%	7.2%
BAU	%/Year	4.7%	4.8%	4.6%	4.7%
13th 5 year plan + CPP vs BAU	%/Year	86.0%	103.3%	8.1%	63.7%

2. INCOME LEVEL CHANGE

INCOME LEVEL GRADUATION YEARS				
INCOME LEVEL	YEAR OF GRADUATION (BAU)	YEAR OF GRADUATION (NDC)	YEAR OF GRADUATION (13TH 5-YEAR PLAN)	YEAR OF GRADUATION (CPP)
High Income	2039	2039	2034	2034
Upper Middle Income	2026	2026	2025	2025

3. POVERTY LEVELS AND DISPOSABLE INCOME

Disposable income and poverty level are other relevant variables falling under the economic section and are used to evaluate living standard in inversely proportional manners. The Real disposable income per capita is a measure of the purchasing power of an individual, taking into account the effect of inflation. It is calculated by subtracting taxes and other mandatory payments from a household's disposable income, and then adjusting for inflation. The poverty level is an economic threshold used to define the minimum income or resources necessary for individuals or households to meet their basic needs, such as food, shelter, clothing, and essential services. There are several thresholds that define different levels of poverty (World Bank International level of extreme poverty is $2.15) the Bhutan national poverty level is currently set at $ 26.40 per month.

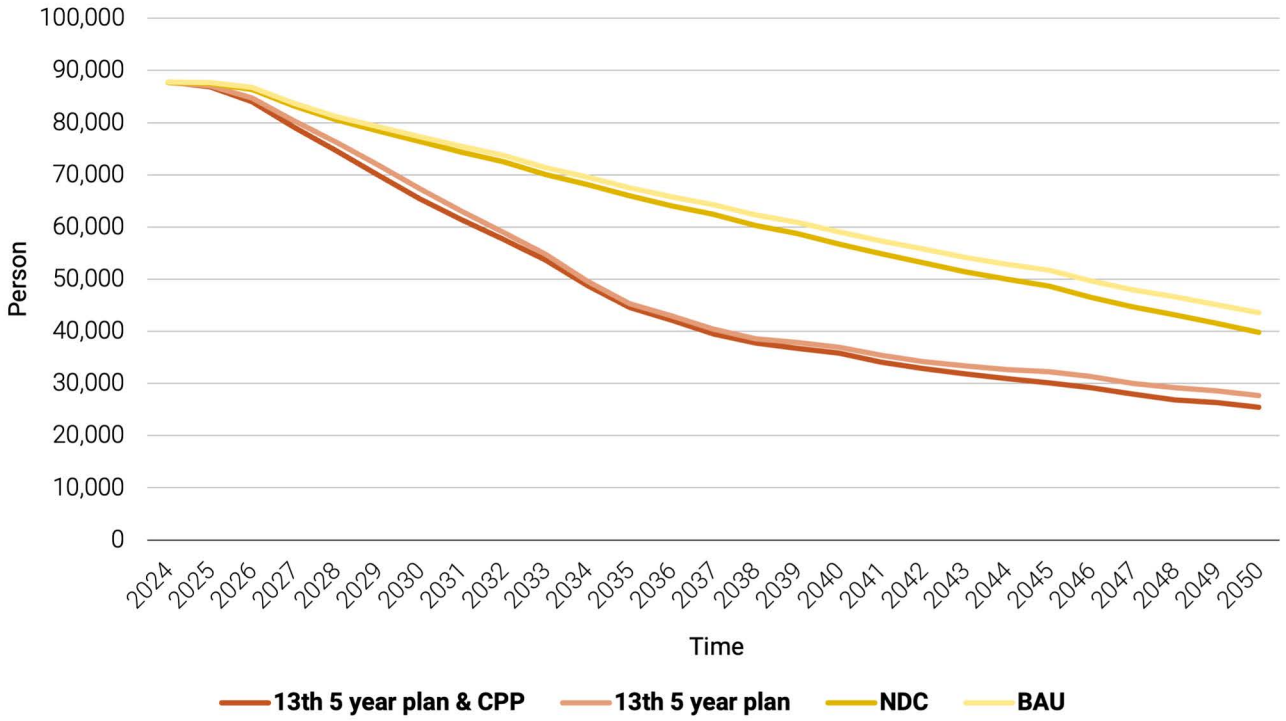


Figure 5. Population below poverty line, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

In the BAU, the total number of people living below the poverty line decreases from 95,697 (12%) in 2025 to 43,533 in 2050 (5%). In the NDC scenario, the total population below the poverty line is reduced to 39,783 people by 2050. With the implementation of the 13th 5 year plan, this is further decreased to 27,737 and experiencing an additional decline in the CPP scenario arriving to 25,455 people around the 3 percent share of total population.

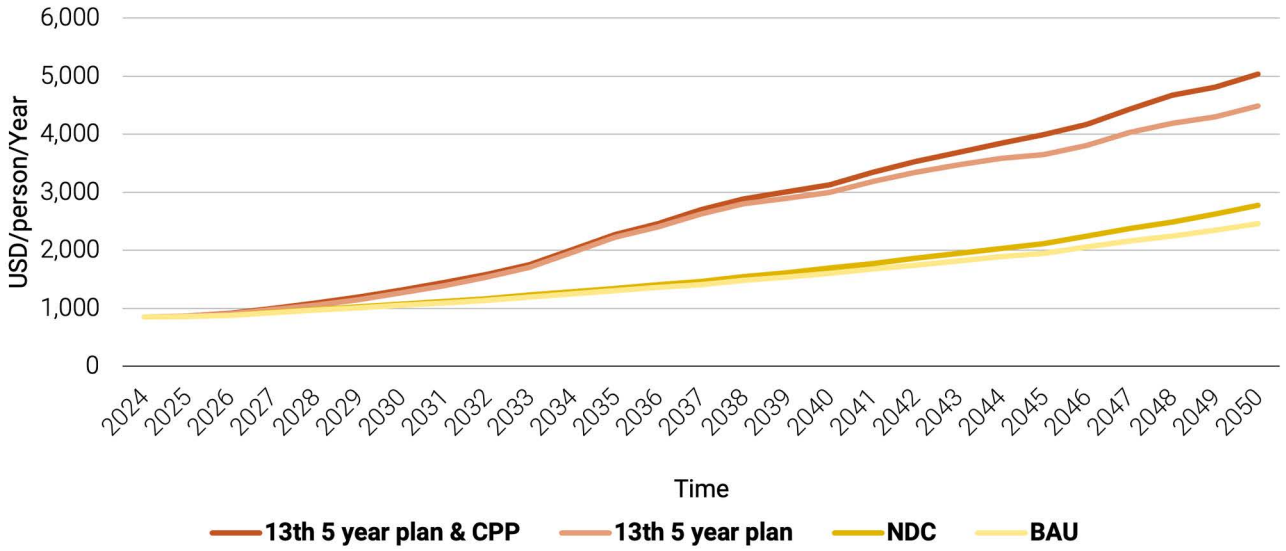


Figure 6. Real disposable income per capita, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

In the BAU scenario, real disposable income per capita presents an upward trend from 742 $/person in 2025 to 2,462 $/person in 2050. In the NDC scenario, real disposable income per capita slightly increases to $2,774 by 2050. However, with the 13th 5-year plan, the real disposable income per capita has a sharp growth to $4,490 and reaches $5,035 /person in 2050 in addition to the CPP, nearly doubling the baseline scenarios numbers.

The economic results presented are a clear representation of the growth ambition in the 13th FYP and CPP is focused on increasing the country's well-being and equal and sustainable growth of the country and Bhutanese people.

4. INSURANCE

Insurance payments are pivotal in addressing the damages incurred, contributing significantly to economic recovery. In the CPP scenario, the cumulative additional premium in 2050 is estimated at $ 65 million. The payment of the insurance premium yields almost $27 million per year in additional real GDP by 2050. The difference in damages restored through payments generates $ 784.17 billion in additional real GDP between 2025 and 2050.

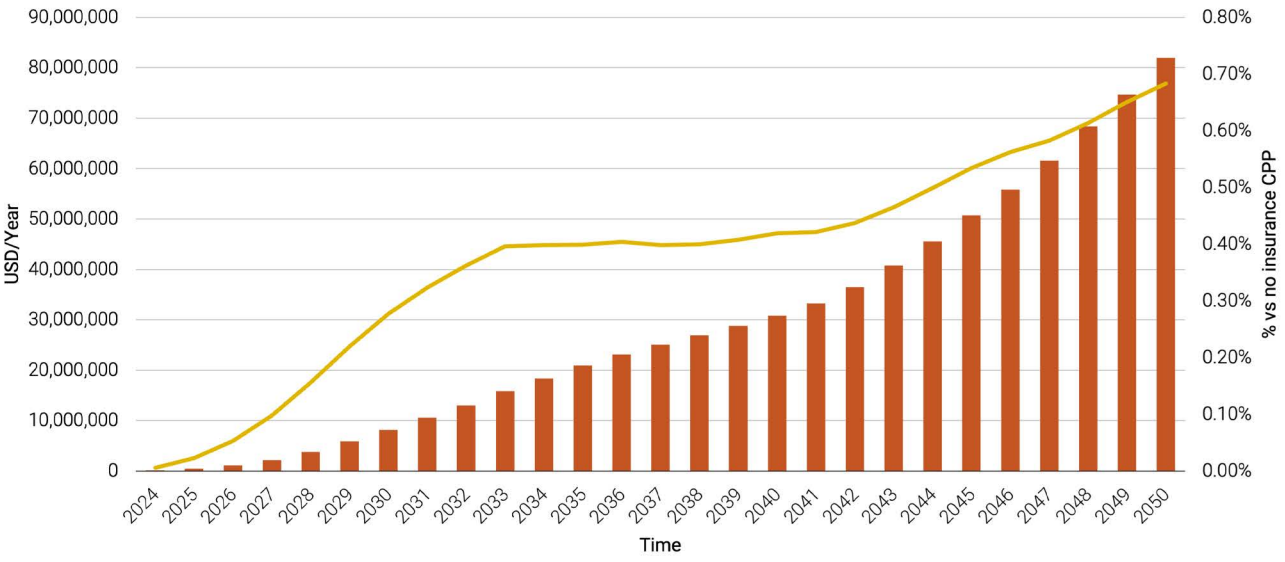


Figure 7. Additional real GDP unlocked through insurance, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

In the CPP scenario, the average additional premium between 2025 and 2050 is estimated at $99 million per year. This represents around 0.3 percent of GDP on average over the same period. Specifically, from 2025 to 2030, the premium averages 0.5 percent of real GDP annually. This contrasts with the baseline scenario, where annual insurance payments are assumed to be 0.2 percent of real GDP.

5. CARBON CREDITS

GEM calculates the potential carbon credits a country can generate through two main avenues: exporting clean energy products, which reduces GHG emissions in importing countries, and increasing domestic carbon sink capacity through afforestation, reforestation and improved forest management. The total carbon credits are the combined result of energy exports, afforestation, reforestation and improved forest management efforts .

In the BAU, no carbon credits are generated. In the NDC, the value of the carbon credits generated will reach cumulatively $63 million by 2050. In the CPP, the cumulative value of carbon credits generated by 2050 totals $132 million. The generation of carbon credits in the CPP scenario is driven by reforestation and clean energy exports. Carbon credits are generated from reforestation activities as well as the exports of clean energy.

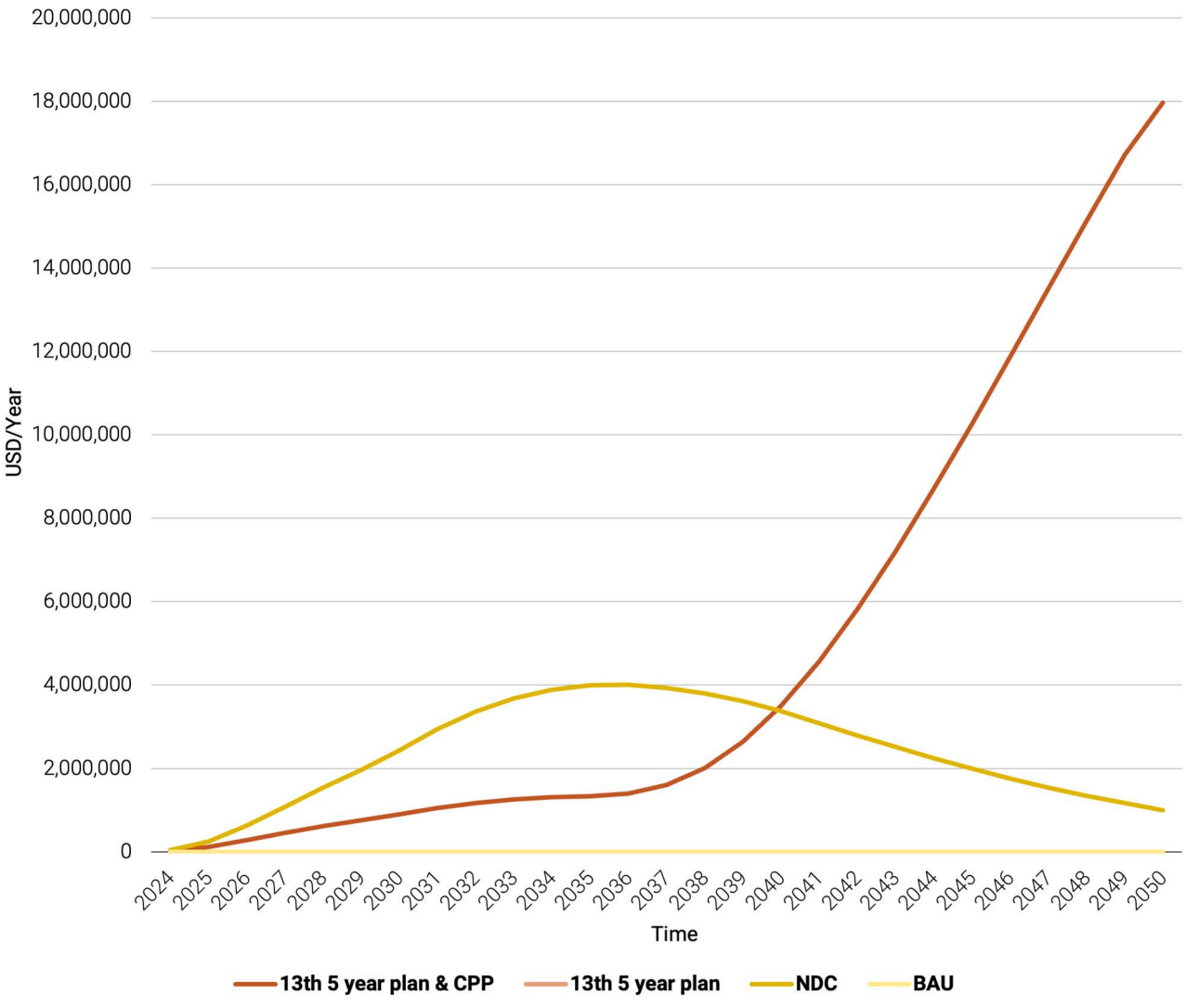


Figure 8. Total value of carbon credits, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

Photo credit: Masked dance at Dochula in Thimphu, Bhutan, April 2020 | Pema Gyamtsho | Unsplash

E. SOCIAL

Following the impact on the economic aggregates, the social section assesses the impact of the CPP scenario on employment levels, both in absolute and relative terms, following its effect on key economic indicators. Additionally, it estimates the number of new green jobs created, which is one of the CPP's primary objectives.

1. EMPLOYMENT

Total employment refers to the overall number of jobs in the economy across all sectors, including green jobs. This encompasses employment in the agriculture, industry, and services sectors, as well as additional green jobs resulting from interventions. The unemployment rate represents the ratio of unemployed individuals to the active population (subsistence farmers are not included in the calculation). In BAU, total employment is projected to reach 513,648 people by 2050. Under the 13th 5-Year Plan, total employment is expected to rise to 523,533 people by 2050. In the CPP scenario, total employment increases to 525,012 people, representing a 2.2% increase compared to the baseline scenario (BAU). The driving forces behind this surge in employment within the 13th 5 year plan and CPP scenario include the higher GDP generated by strategic investment into 14GW of hydropower, the strategic utilization of land for agriculture, and the ambitious implementation of transition and climate resilience interventions, all of which synergistically contribute to significant job creation and economic growth.

In the baseline scenario, the unemployment rate fluctuates from 5.1 percent in 2025–2030, before stabilizing at a constant rate of 4.7 percent between 2030 and 2050.

In the CPP and FYP, the unemployment rate follows a similar trajectory in both scenarios, with only a minor 0.1 percentage point difference between them. Specifically, the unemployment rate decreases from 5.6 percent in 2024 to 1.7 percent in 2030, 1.3 percent in 2040, hitting an all-time low of 0.9 percent in 2035, before increasing to 2.2 percent by 2050. Under the Prosperity scenario, total employment sees a slight increase compared to the baseline, with a 2.2 percent overall rise in employment.

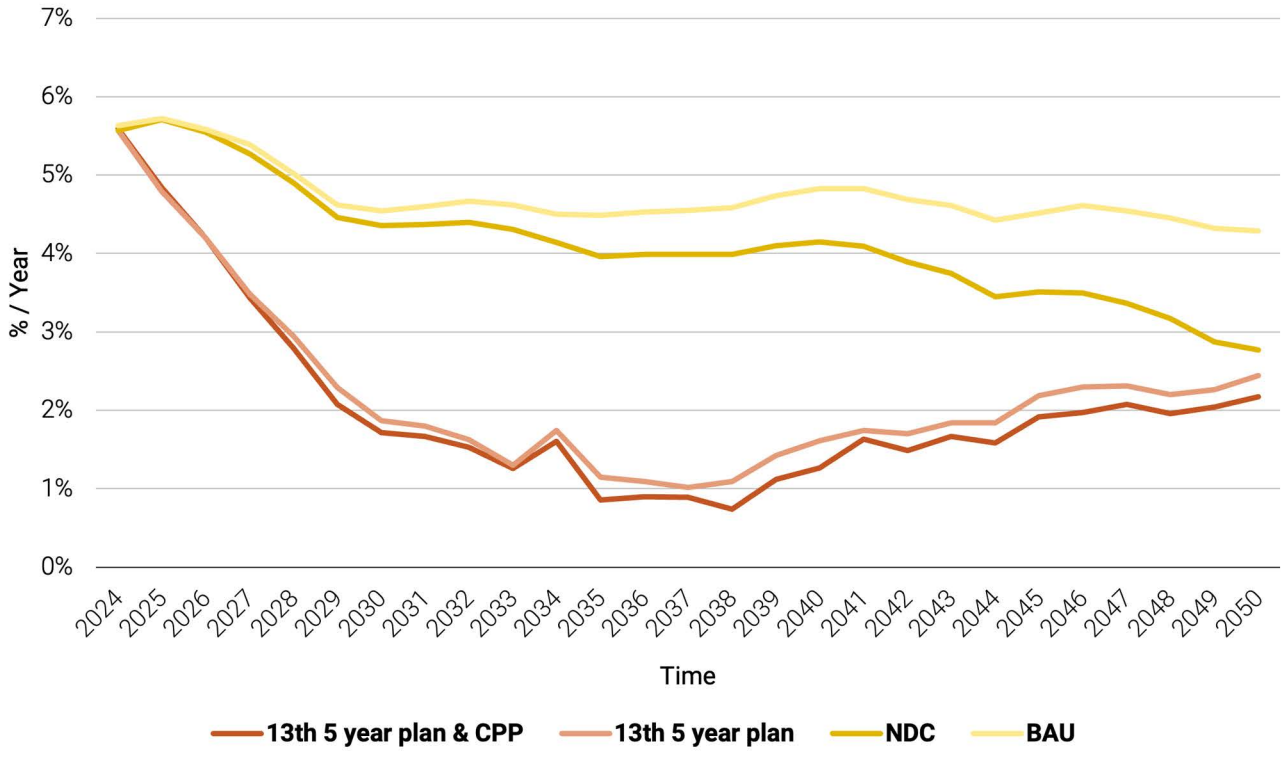


Figure 9. Unemployment rate, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

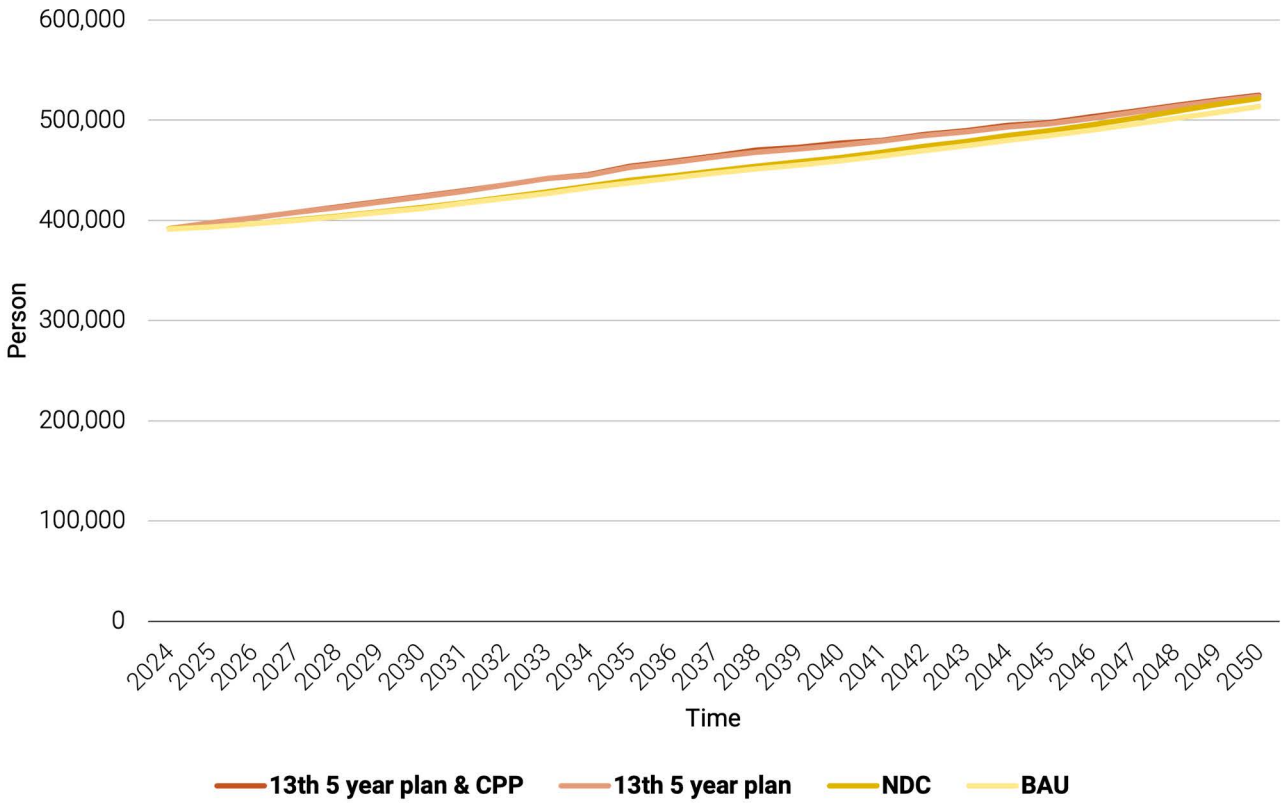


Figure 10. Total unemployment, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

Green jobs, which are created as a result of interventions in the CPP scenario positions, are an important component of total employment, contributing to environmental sustainability by reducing pollution, conserving resources, or protecting ecosystems. In the baseline scenario, the number of green jobs grows slowly, from 2.1 thousand in 2025 to 2.3 thousand in 2050. In contrast, the CPP scenario sees significant growth in green jobs, reaching 16.4 thousand in 2030 (+619% vs BAU), 26.7 thousand in 2040 (+1007% vs BAU), and 25.2 thousand by 2050 (+988% vs BAU).

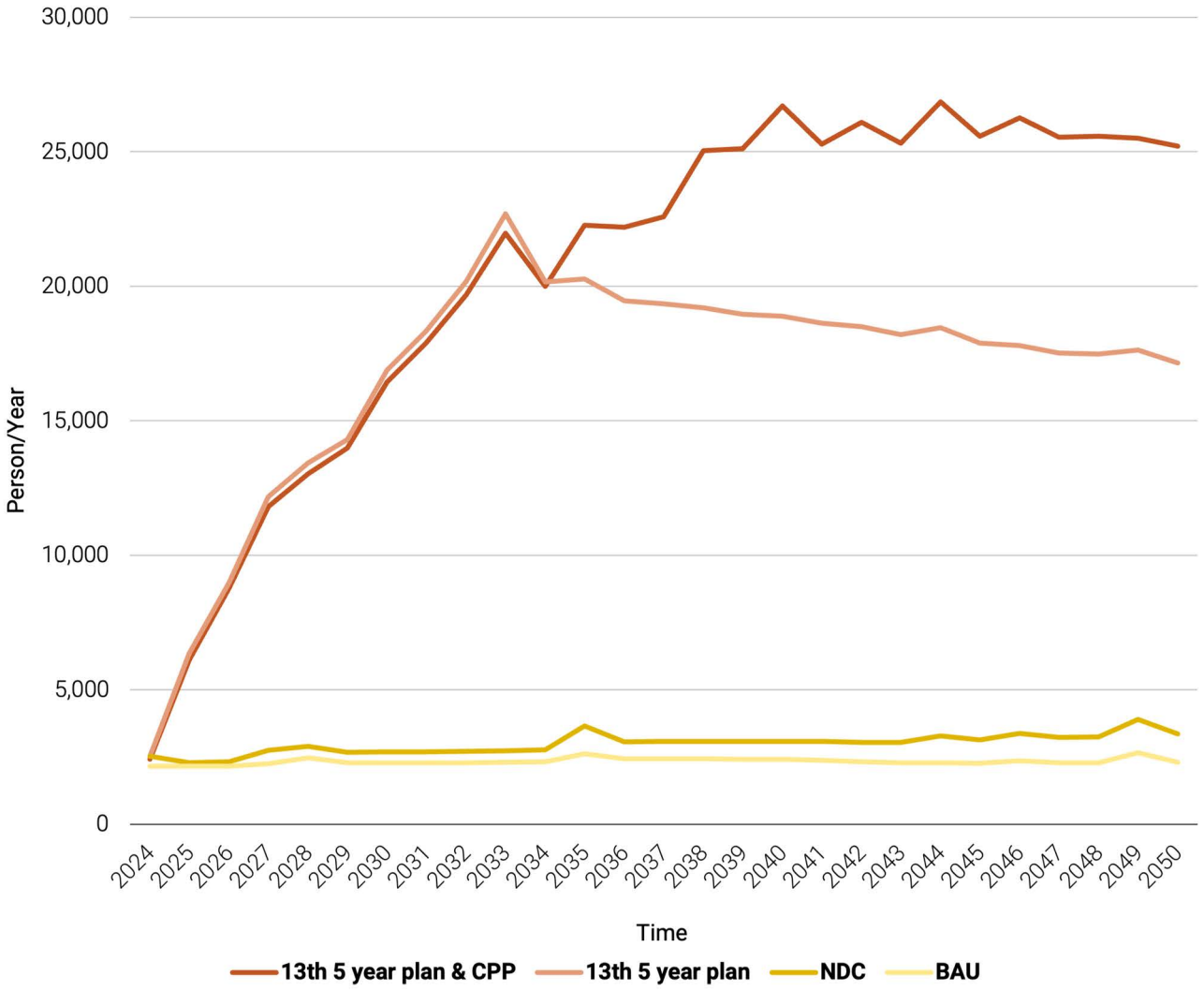


Figure 11. Total green jobs, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

Employment levels, particularly green jobs, and broader social progress are strongly influenced by the development of hydropower projects, which will absorb a large share of the national labour force, causing employment to peak between 2030s and 2040s. However, these numbers decline once the projects are completed. An important factor in this sector will be whether local or foreign companies are contracted to deliver the hydropower projects. Employment figures could vary further. If foreign companies bring in labour from abroad or hire local labour force.

F. ENERGY

The energy section allows the comparison between the baseline and the CPP scenario, of the total energy demand, the affordability through the comparison of disposable income and the energy bill, as well as the energy efficiency, in annual change and cumulative energy savings.

1. ENERGY BILL AND ENERGY AFFORDABILITY

The Energy bill indicates the total energy cost resulting from final energy consumption, it is the sum of costs for petroleum products, natural gas, coal and electricity.

In the BAU scenario, the energy bill as a share of GDP is projected to decrease from 13.3% in 2025 to 5.6% by 2050, indicating that energy expenditures will constitute a smaller portion of the overall economy despite rising consumption. Under the 13th 5-Year Plan, this share is expected to decline further to 2.5% of GDP by 2050. In the CPP scenario, the energy bill is anticipated to drop significantly to 2.1%, highlighting a strategic shift toward sustainable energy practices. Key economic drivers for these changes include higher GDP and reduced total energy expenditure, with the indicator measuring the energy bill as a share of GDP representing the total energy costs from final energy consumption relative to overall economic output.

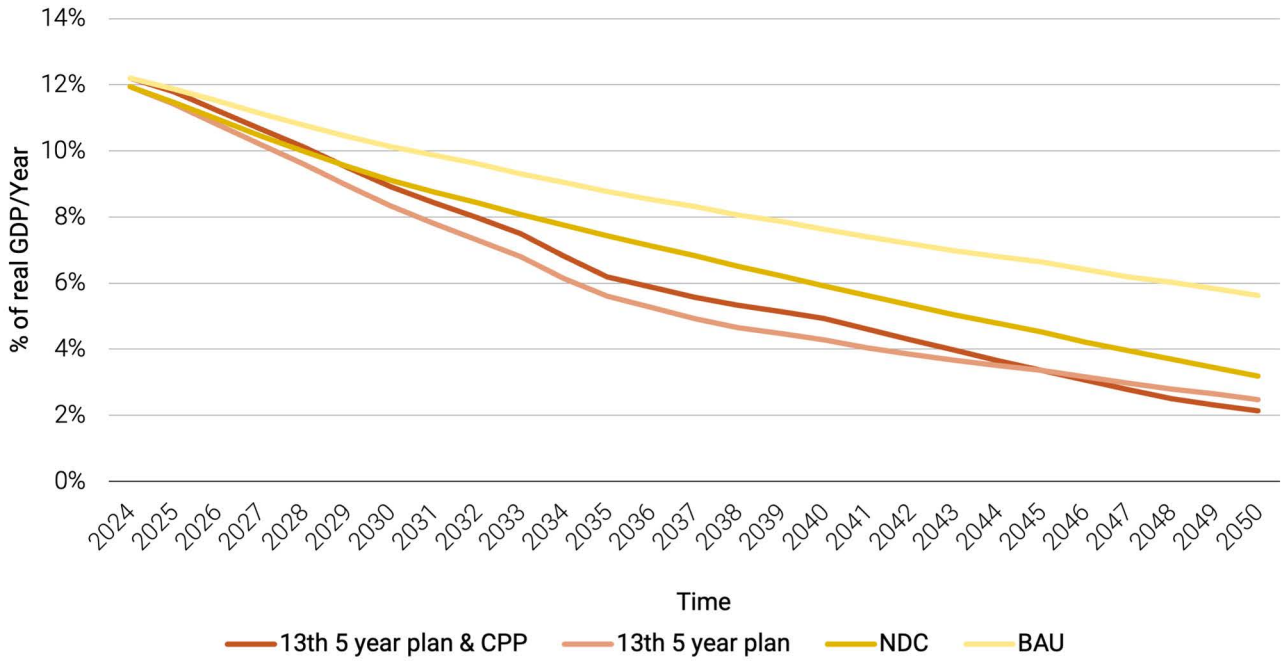


Figure 12. Energy bill as share of GDP, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

In the BAU scenario, the energy affordability index is projected to rise from 1.2 in 2025 to 2.47 by 2050, indicating a growing challenge in energy affordability as costs increase relative to income. Under the 13th 5-Year Plan, the index is expected to reach 5.62 in 2050, demonstrating the positive impact of economic reinvestment on energy affordability. In the CPP scenario, the energy affordability index is anticipated to surge to 6.49 by 2050, highlighting a significant improvement in how disposable income relates to energy costs. Key economic drivers for these changes include advancements in energy efficiency, increased electrification, and the overall cost of energy by fuel type. The energy affordability index, calculated by dividing the disposable income index by the energy bill index, provides a clear indication of how total disposable income develops in relation to total energy costs; an increase in this index signifies that energy is becoming more affordable.

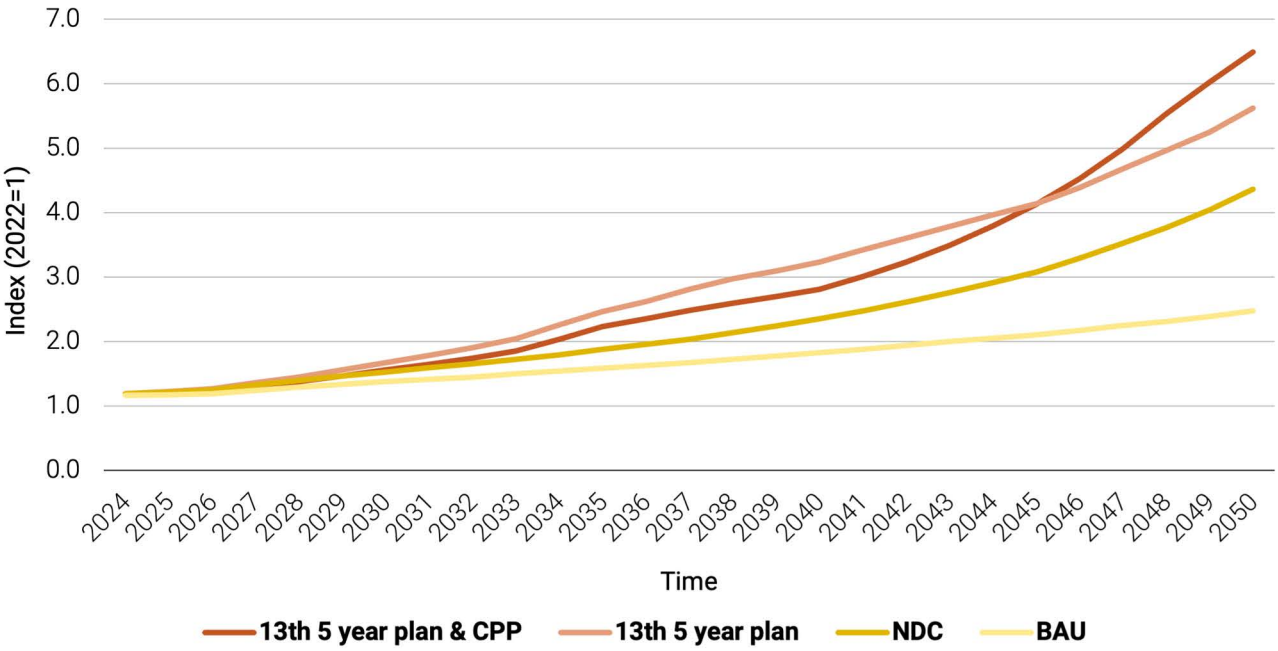


Figure 13. Energy affordability index, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

2. ENERGY EFFICIENCY

Energy efficiency is the ability to use less energy to achieve the same output or service. It reduces energy consumption, lowers costs, and minimizes environmental impact by decreasing waste and emissions.

Cumulative net savings from energy efficiency refer to the total reduction in final energy consumption, compared to a baseline scenario, achieved through the implementation of additional energy efficiency measures. This metric captures the overall impact of these improvements over time. The energy efficiency change reflects the rate of variation applied to the energy efficiency stock, acting as a key indicator shaped by policy decisions. This enables the modeling of various potential trajectories for energy efficiency.

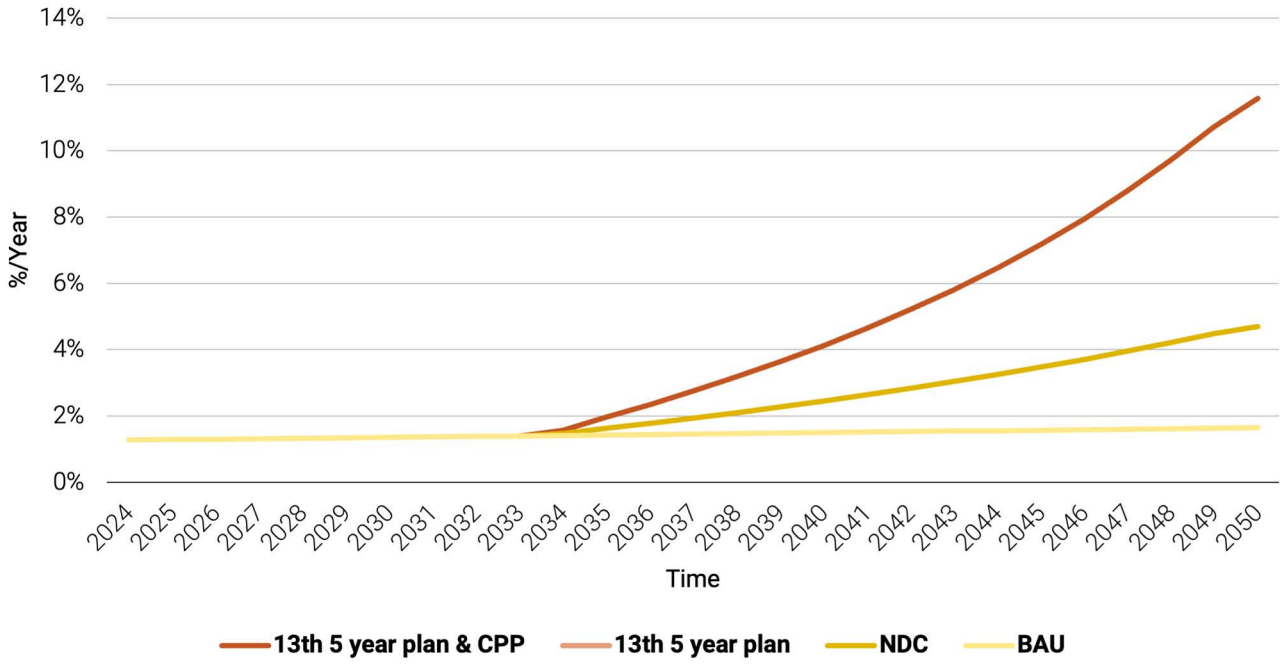


Figure 14. Annual change in relative energy efficiency, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

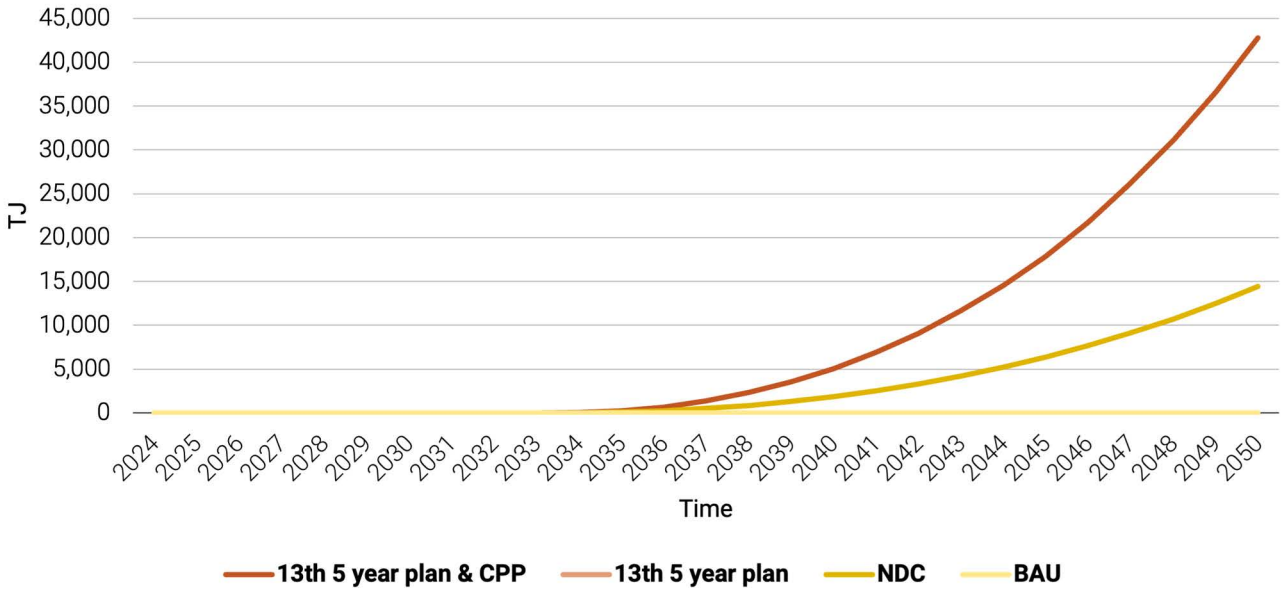


Figure 15. Cumulative energy savings from energy efficiency, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

In the baseline scenario, as well as in the FYP the model shows a stagnation around the 1% in annual change in energy efficiency, on the other hand in the CPP there is a sharp increase reaching nearly a 11.6% of efficiency driven by new mitigation policies and investment attracted throughout the years.

G. ENVIRONMENT

In this section will be presented the evaluation of the environmental model variables, starting from the evolution of the forest land cover, and total and average annual emissions. The section's main drivers are population, land use and land use change, reforestation ambitions, energy efficiency, electrification, renewable energy, and policy ambition across sectors.

1. EMISSIONS

In the BAU scenario, annual CO2e emissions are projected to increase from -5.6 million tons GHG in 2025 to -5.4 million tons GHG by 2050, indicating a gradual decline in net emissions. With the NDC interventions, the annual GHG emissions decline to -7.5 million tons annually by 2050. Under the 13th 5-Year Plan, driven by higher economic growth, emissions are expected to reach -6.3million tons GHG when factoring in the additional economic growth from the 14GW hydropower projects. In contrast, the CPP scenario anticipates annual CO2e emissions of -8.7 million tons GHG by 2050, reflecting a more aggressive approach to reducing greenhouse gas emissions. The CPP's effectiveness in achieving this significant reduction in emissions is driven by various factors, including improved energy efficiency, increased electrification, extensive adoption of renewable energy sources, reforestation and ambitious policy initiatives across various sectors, contributing to a sustainable and environmentally responsible future.

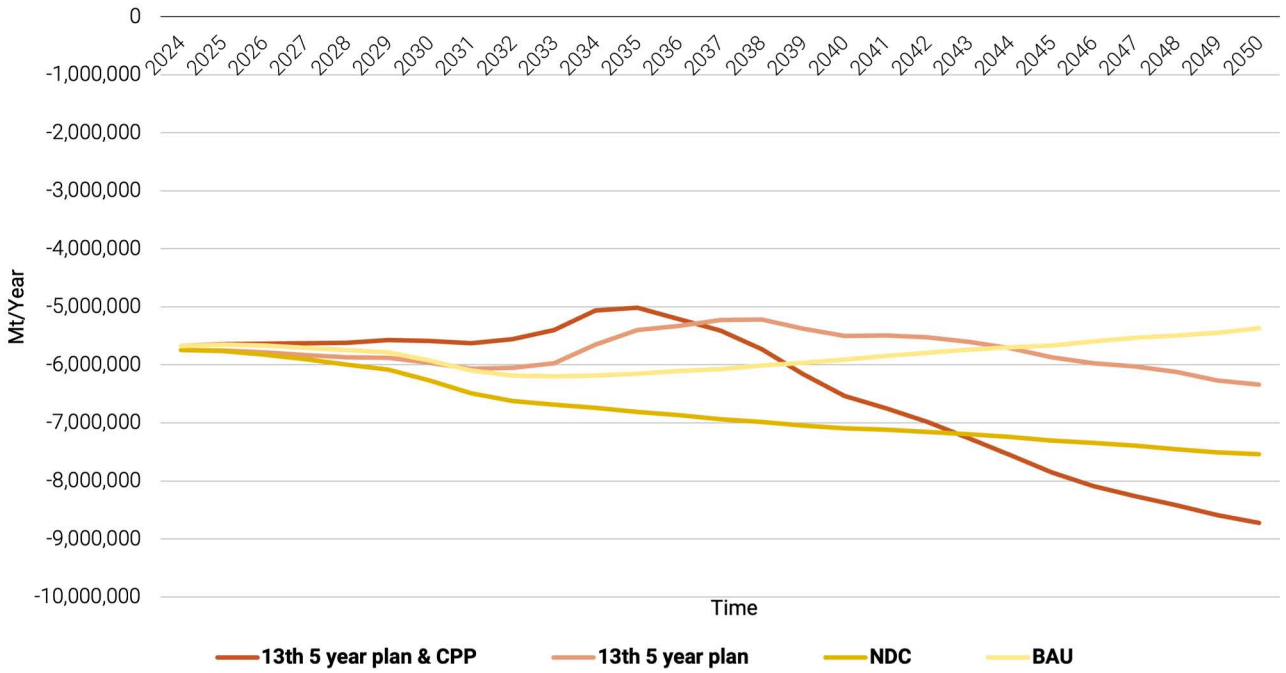


Figure 16. Average annual CO_2e emissions, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

AVERAGE ANNUAL CO_2E EMISSIONS	UNIT	2025 - 2030	2030 - 2040	2040 - 2050	2025 - 2050
CPP	Ton	-5,615,294	-5,572,573	-7,729,154	-6,457,131
13th 5 year plan	Ton	-5,847,054	-5,615,031	-5,860,267	-5,763,175
BAU	Ton	-5,747,424	-6,074,286	-5,644,891	-5,829,240
CPP vs BAU	Ton	-2.30%	-8.26%	36.92%	10.77%

2. FOREST COVER

The forest cover represents the total amount of hectares (at country level) that is covered by forests. The variable share of land that is covered by forests provides an overview of the total land area that is covered by forests over time. It is estimated by comparing the total forest land to the total land area.

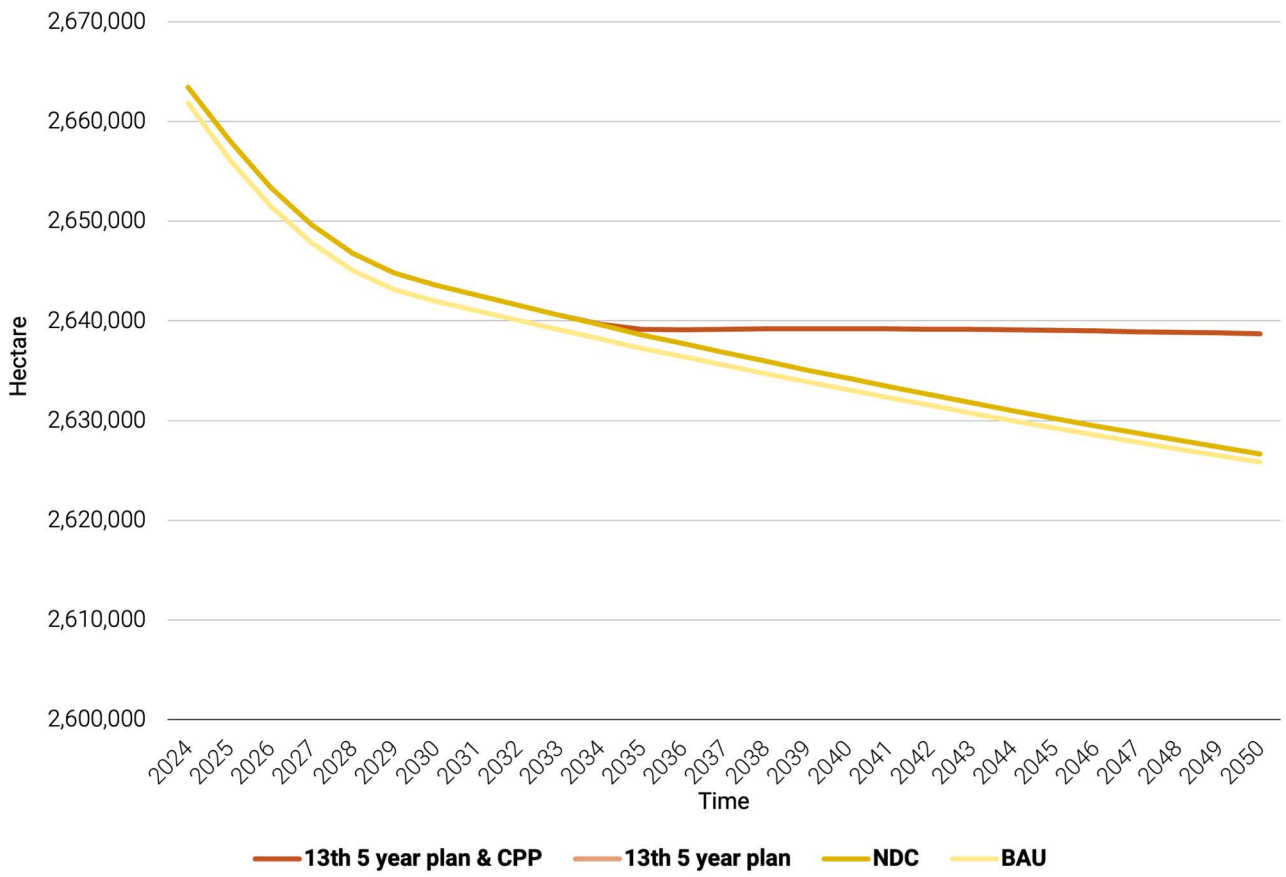
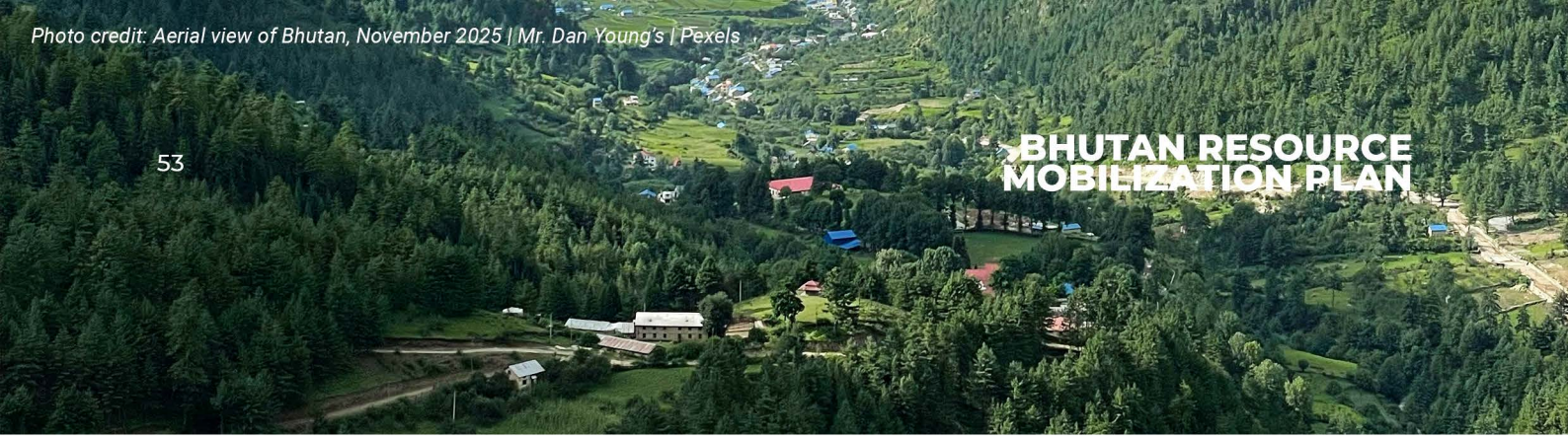


Figure 17. Total forest cover, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios



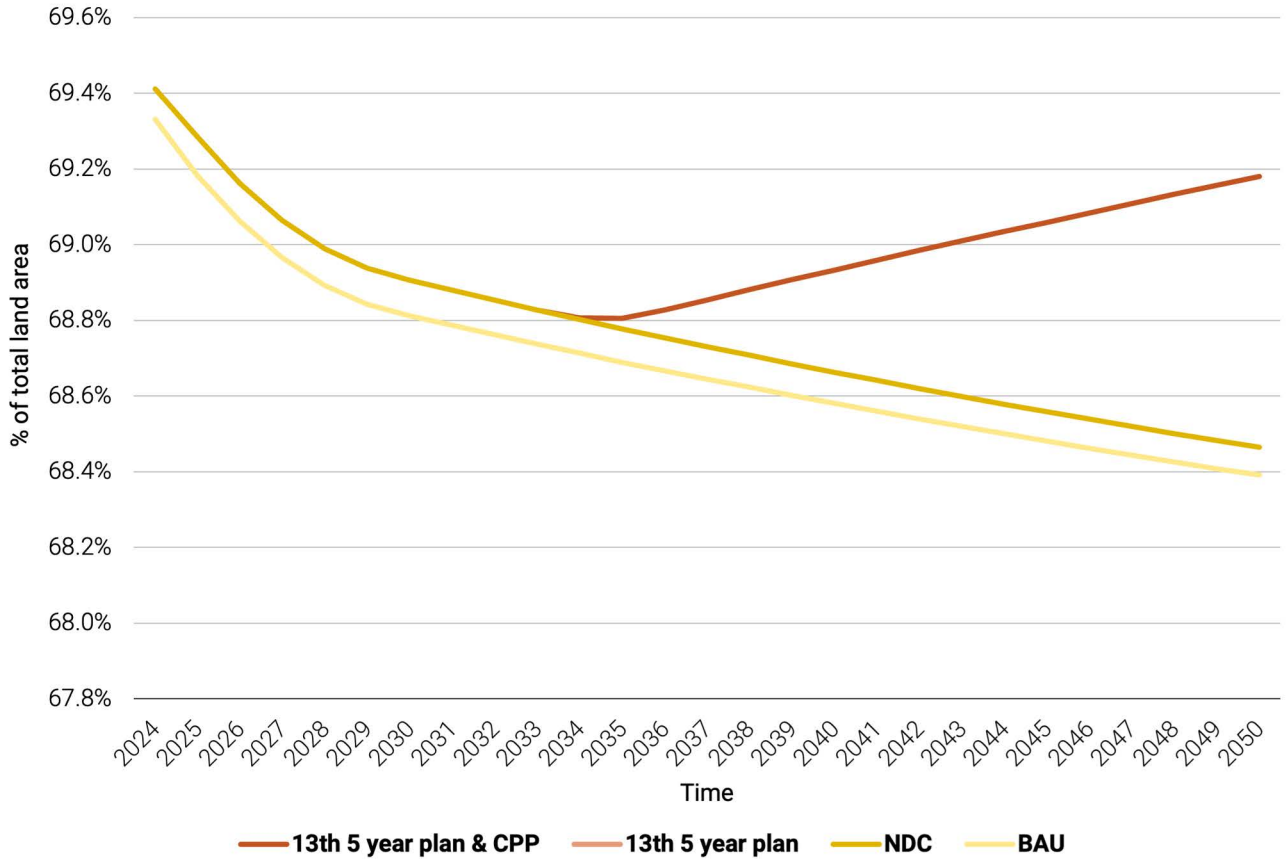


Figure 18. Forest share in total land, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

Regarding other environmental indicators, in the BAU scenario, forest cover decreases from 2.67million hectares (ha) in 2025 to 2.62 million ha in 2050. Conversely, under the CPP scenario, forest cover amounts to 2.64 million ha by 2050 (Figure 16). This outcome is driven by strategic initiatives targeting population dynamics, land use practices, and ambitious reforestation efforts.

3. CLIMATE DAMAGE

The Cumulative Climate Damage accounts for all the possible impacts that climate can cause to humans, natural resources and physical assets present in the country. Therefore, greater economic growth will increase the value of national capital, exposing a higher value of goods and services to climate-related risks.

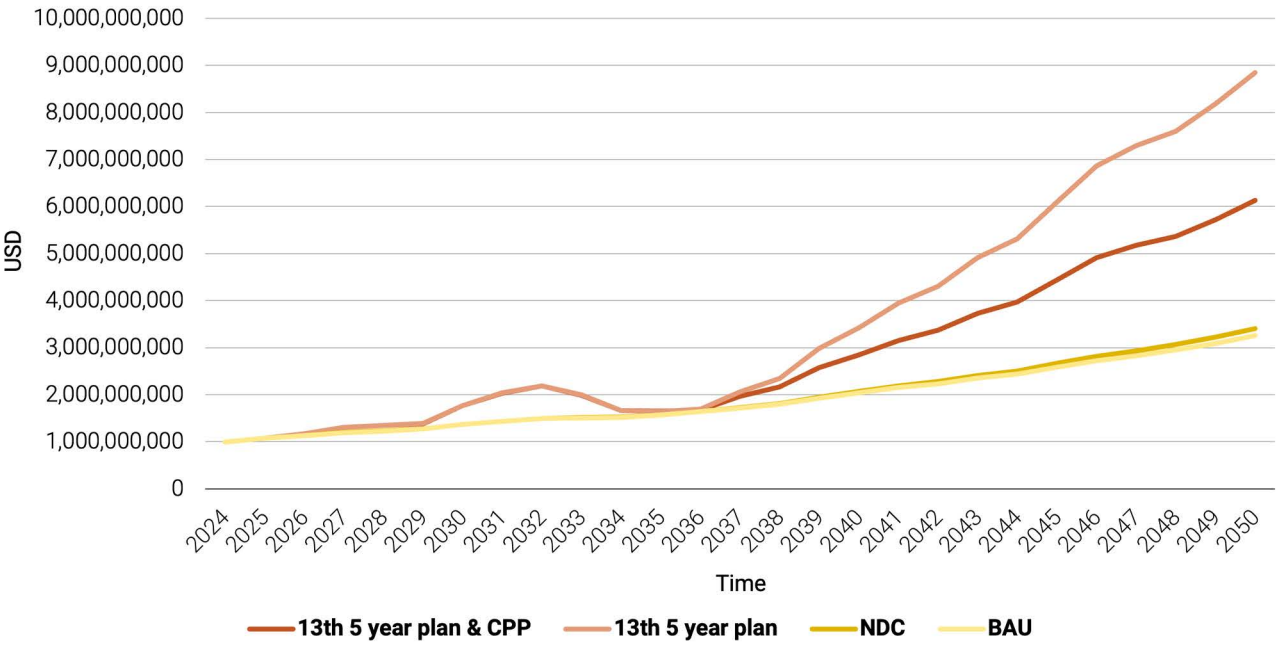


Figure 19. Cumulative climate change damages, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

In the BAU scenario, cumulative damages from climate change are projected to reach $3.3 billion over the period from 2025 to 2050. Under the 13th 5-Year Plan, with the installation of the 14GW hydropower projects, cumulative climate change damages are expected to escalate to $8.8 billion by 2050. In contrast, the CPP scenario forecasts cumulative damages from climate change to total $6.1 billion, which represents a 30.7% reduction compared to the 13th 5-Year Plan. The drivers behind this reduction in damages within the CPP include improved climate forecasts and the strategic protection of assets and economic activities, such as agriculture and livestock, exposed to extreme weather events, contributing to a more resilient and economically prosperous future. The figure below shows the results of the spatial analysis of flood risk.

SPATIAL ANALYSIS RESULTS		
SCENARIO	TOTAL RUNOFF RETENTION (M3)	CHANGE FROM 2019
2019	2,714,186,472	-
BAU	2,724,557,709	0.38%
NDC Unconditional	2,726,764,596	0.46%
NDC Conditional	2,728,551,871	0.53%
CPP	2,730,336,373	0.60%

H. SUSTAINABLE DEVELOPMENT GOALS ASSESSMENT

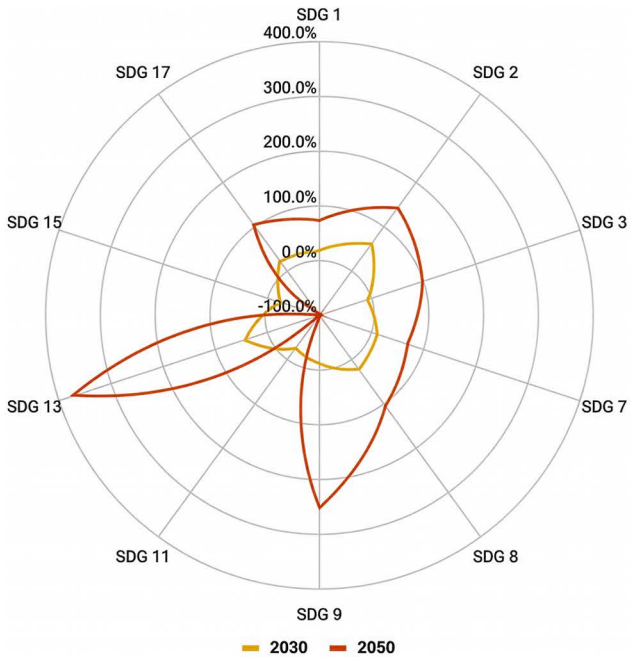


Figure 20. Sustainable Development Goals assessment, 13th FYP + CPP 2030 and 2050 scenario

SDG	INDICATOR	13TH 5 YEAR PLAN + CPP 2030	2050
SDG 1 (Household)	Percentage of population below poverty line	6.5%	29.4%
	Pc real disposable income	9.5%	59.1%
SDG 2 (Agriculture)	Agriculture production per capita	28.6%	31.8%
	Real GDP agriculture	18%	20.6%
SDG 3 (Air pollutants)	Total PM2.5 emissions from energy and power	46.3%	100%
SDG 7 (Affordable and Clean Energy)	1. Increase Bhutan's hydropower capacity by 10X 2. Diversify renewable energy resources by maximizing solar & wind 3. Bhutan becomes 100% energy exporter with zero energy imports	-	-
SDG 8 (Decent Work)	Create 97.5% quality jobs	-	-
SDG 11 & 15 (Land Use)	Forest cover	0.4%	1.7%
SDG 13 (GHG Emissions)	Total annual CO_2e emissions	81.2%	125.8%

I. INVESTMENT AND FINANCING

In the 13th Five-Year Plan scenario, cumulative additional real investment compared to the Business-As-Usual (BAU) path is projected to reach $20.8 billion by 2030 and $45 billion by 2050 The CPP (Climate Prosperity Plan) interventions, starting in 2034, are expected to total $56 billion in costs by 2050, mainly incurred between 2034 and 2050. These investments stem from ambitious policies across sectors aimed at promoting sustainability and climate resilience.

By 2027, additional real investment under the 13th Five-Year Plan scenario is expected to hit 330% of GDP, and by 2050, the CPP scenario projects it at 10.9% of GDP, with peaks around 2034 due to large hydropower projects. These investments reflect strong commitments to transitioning toward a sustainable, climate-resilient economy, with a focus on renewable energy and climate adaptation.

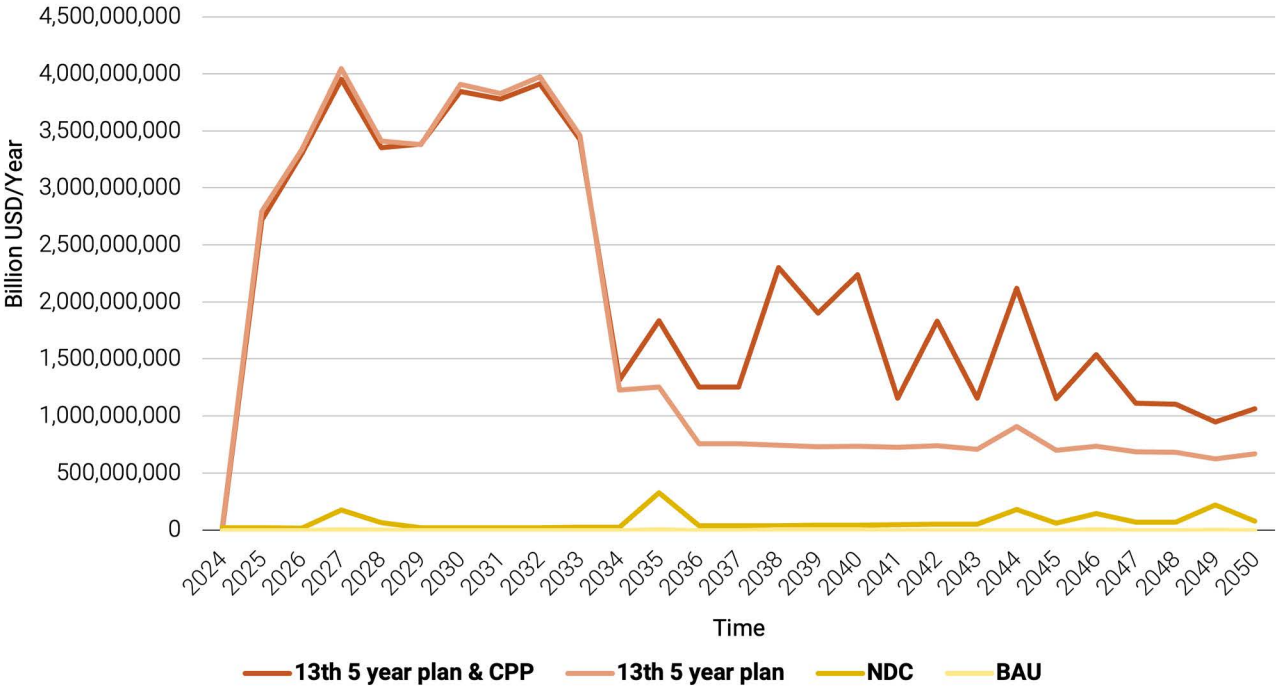


Figure 21. Additional investment in mitigation and adaptation, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

In the BAU scenario, annual public transition and adaptation investment is projected to average $59 million per year from 2025 to 2050. However, with the construction of 14GW of hydropower capacity, this investment is expected to surge to an average of $1.61 billion annually over the same period. Under the CPP scenario, annual public investment rises further to an average of $1.89 billion, reflecting a more aggressive approach to sustainable development. These investments are driven by ambitious policies across sectors, with the public sector focusing on power generation, infrastructure, flood-proofing, waste management, greening cities, and electric buses.

In the CPP scenario, private sector transition and adaptation investment is projected to reach $32.5 million by 2034. By 2050, this investment is expected to grow significantly to $247 million, demonstrating increasing private sector engagement in sustainability efforts. These investments are also driven by ambitious policies and reflect the private sector's role in areas such as electric vehicles, reducing livestock emissions, sustainable agriculture, air conditioning, and carbon capture in industry.

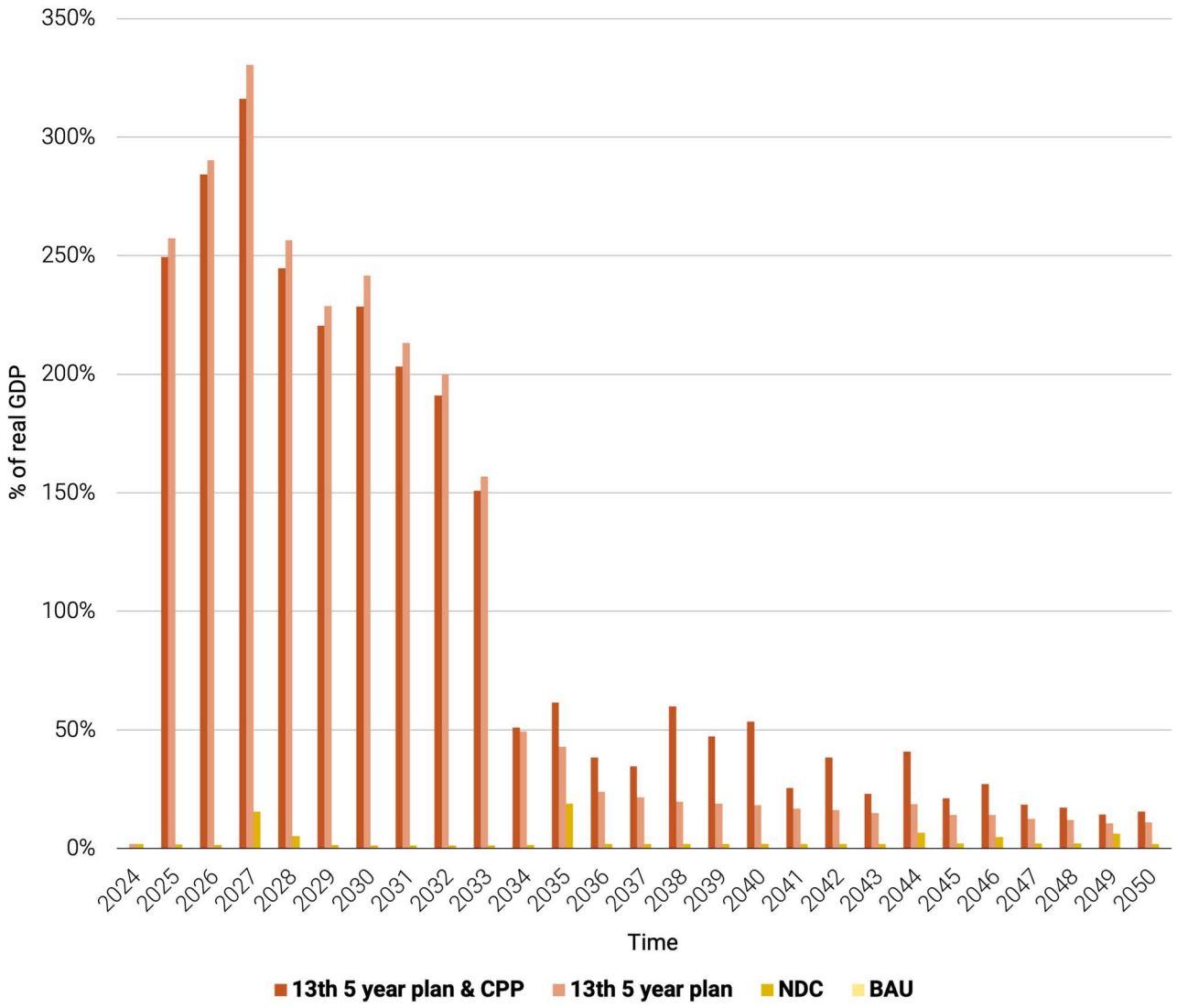


Figure 22. Additional investment as % of GDP, 13th FYP + CPP, 13th FYP, NDC, and BAU scenarios

The CPP scenario represents a viable economic development strategy, yielding a Benefit to Cost Ratio (BCR) of 1.70 by 2050, with a discount rate of 7%. This BCR indicates that for every $1 invested in the CPP scenario, there are anticipated system-wide benefits amounting to $1.70 by 2050. This positive return on investment underscores the economic viability of the CPP, suggesting that the benefits derived from the investments not only justify the costs but also contribute to broader socio-economic and environmental gains.

COST BENEFIT ANALYSIS (CBA), 2025 – 2050

CBA INDICATOR	UNIT	CPP SCENARIO 2050	
		2025-2030	2025-2050
Investments in mitigation	**USD million**	**18**	**4,379**
Power generation	USD million	18	2,382
Transmission lines	USD million	-	61
Energy efficiency	USD million	-	34
Industrial CCS	USD million	-	49
Fuel switching	USD million	-	666
Land-based interventions	USD million	-	5
Livestock related emission reductions	USD million	-	28
Sustainable agriculture	USD million	-	8
Waste management	USD million	-	-
Investment in NMT infrastructure	USD million	-	12
Total cost of transport electrification and power generation	USD million	-	1,134
Investment in fast chargers	USD million	-	75
Chargers investment	USD million	-	33
Chargers O&M	USD million	-	18
Electric buses	USD million	-	11
Electric vehicles	USD million	-	979
O&M electric buses	USD million	-	2
O&M EVs	USD million	-	15
Investments in adaptation	**USD million**	**-**	**152**
Flood protection (buildings)	USD million	-	3
Drip irrigation	USD million	-	10
Air conditioning	USD million	-	6
Drainage systems	USD million	-	12
Road network	USD million	-	3
Net shading	USD million	-	19
Retrofitting	USD million	-	4
Livestock adaptation	USD million	-	6

Power generation	USD million	-	87
Transmission lines	USD million	-	2
Greening urban areas	USD million	-	1
Total cost of water infrastructure	USD million	-	1
Capital cost freshwater	USD million	-	-
O&M cost freshwater	USD million	-	-
Capital cost sewage connection	USD million	-	-
O&M cost sewage connection	USD million	-	-
Contingency payments	**USD million**	**-**	**8**
Total investment required	**USD million**	**18**	**4,539**
Avoided cost			
Energy bill	USD million	-8	87
Cost of ICE vehicles	USD million	-	1,032
Cost of gasoline infrastructure	USD million	-	29
Cost of air pollution	USD million	-50	3,595
Cost of air pollution (power)	USD million	-	-
Cost of air pollution (final consumption)	USD million	-50	3,595
Avoided CC damages	USD million	-1	655
Total avoided cost	**USD million**	**-60**	**5,398**
Added benefits			
Additional real GDP	USD million	181	2,310
Agriculture	USD million	161	785
Industry	USD million	10	905
Services	USD million	10	621
Government revenues	USD million	187	4,194
Household savings	USD million	442	10,084
Carbon credits	USD million	2	30
Total added benefits	**USD million**	**184**	**2,340**
Net integrated benefits	**USD million**	**106**	**3,199**
Ratio avoided cost to investment	USD / USD invested	-3.32	1.19
Ratio added benefits to investment	USD / USD invested	10.20	0.52
Ratio avoided cost and added benefits to investment	USD / USD invested	6.89	1.70
Net investment	**USD million**	**18**	**3,478**

VII
FINANCING STRATEGIES FOR BHUTAN'S 13TH FIVE-YEAR PLAN PROJECTS

Photo credit: Monks walking over a bridge in Bhutan, November 2015 | Dylan Haskin | Shutterstock

This investment and financing strategy explores various options for resource mobilization for Bhutan's 13th Five-Year Plan (FYP) projects, emphasizing the unlocking of different types of capital with lower transaction costs and more responsive outcomes, while leveraging natural capital and carbon markets. The real question now is how fast we can mobilize the capital needed to build Bhutan's adaptive capacity today while securing Bhutan's long-term future.

The strategy identifies global and regional financing and funding options, as well as private sector engagement for consideration. Post finalization of the Bhutan Resource Mobilization plan, CVF-V20 will continue to work and refine the below strategy in partnership with the Ministry of Finance towards implementation through project preparation, structuring finance, and bringing projects to financial close with the right capital, potential green economic zones, carbon market participation, and debt-for-climate swaps, with strategic investor networks and roadshows. These instruments, carbon market participation, thematic bonds, guarantees, and de-risking mechanisms and local currency financing will translate the Bhutan 21st Century Roadmap's ambitions into actionable measures, ensuring that Bhutan's 13th FYP and long-term 10X growth vision are fully financed and deliverable.

A. CURRENT FUNDING ASSESSMENT

Before we delve deeper, here are some important gaps and trends to keep in mind. According to chapter 8, the total outlay of the 13th Five Year Plan is approx. US$6.15 billion (BTN 512,283 million), which is US$ 1.23 billion dollars per year, approximately a 63% increase from the previous plan.

To put further in context in terms of funding assessment, over the next 5 years, the 13th Five-year plan predicts a fiscal deficit of approximately $671 million. The resource generated as per the plan of approx. $5.48 billion already includes a massive uptake in domestic revenue with an aggressive CAGR of 7.4% and an anticipated grant base of $1.5 billion (24% of total outlay). This means that even if everything goes to plan, Bhutan will require a mobilization of approximately $134 million in additional funding every year. All this needs to happen against a backdrop where Bhutan has graduated out of LDC status, overseas development assistance (ODA) is shrinking, and debt sustainability will be important to maintain.

In terms of ODA, Bhutan has received an average of US$ 180 million per year over the last 5 years (2019-2023).

Photo credit: Thimphu, Bhutan, August 2023 | Soonam Wooeser | Pexels

OVERSEAS DEVELOPMENT ASSISTANCE	
TIME PERIOD	US DOLLARS (MILLIONS, 2022)
2019	191.45
2020	211.91
2021	128.98
2022	204.53
2023	161.33

Within ODA targeting global environmental and climate objectives, Bhutan received an average of US$143 million per year over the period (2018-2022) with US$ 31 million per year for biodiversity, US$31 million per year for climate change mitigation, US$ 20 million per year for climate change adaptation, $38 million per year for desertification, and US$ 23 million per year for the environment.

B. AID TARGETTING GLOBAL ENVIRONMENTAL / CLIMATE OBJECTIVES

Moreover, we are seeing the following sources of external flows:

- Foreign Aid from India: India has been a major development partner for Bhutan, providing substantial foreign aid through its Five-Year Plan (FYP) assistance programs. Approximately USD 290 million annually, with a USD 1.02 billion grant committed for the 13th FYP (17% of the total 13th FYP outlay). This is a primary source for infrastructure and development projects with Indian companies.

- Hydropower Exports to India: Generates USD 240 million yearly, with significant untapped potential (only 10% of 25,000 MW capacity developed[9]).

- Remittances: inward remittances in Bhutan contributed 3.3% to the country's GDP (Averaging $90 million per year) in 2022[10], supporting household economies.

[9] https://www.adb.org/features/bhutan-s-hydropower-sector-12-things-know
[10] https://data.worldbank.org/country/bhutan

- Tourism Revenue: Significant surge in tourism during the fourth quarter of 2024, attracting over 49,000 visitors. Tourism revenue soared to USD 12 million, a substantial increase from USD 5 million in the previous quarter, marking a growth of more than 150%. Consequently, revenue from the Sustainable Development Fee (SDF) also rose sharply, increasing by over 155% during the same period[11].

- Foreign Direct Investment (FDI): Low at USD 18 million in 2023 (compared to other countries in the region), indicating underutilization[12].

- Bitcoin Mining Revenue: Bitcoin miners were earning approximately USD 6 million daily, translating to an annual revenue of around USD 2.2 billion[13], an emerging but volatile/unregulated source.

- International Organizations: The World Bank, Asian Development Bank (ADB), and Japan International Cooperation Agency (JICA) provide grants and concessional loans, particularly for climate and infrastructure projects (e.g., As of 2023, ADB had committed 207 public sector loans, grants, and technical assistance totalling USD 1.2 billion to Bhutan[14]).

The attached project list is filtered as follows:

1. Economic and commercial viability, ensuring the potential to attract private capital and generate robust returns;
2. Climate-smart attributes, such as mitigation benefits or adaptation measures aligned with Climate
3. Prosperity objectives and 3rd pillar of resource mobilization;
4. Preparatory studies, research and development, assessments, and monitoring and evaluation; Social Services and regulatory reform; and
5. Large infrastructure.

Post Strategy finalization, CVF-V20 Secretariat, at the request of the MoF, will be happy to provide the support required for project design, transaction advisory, and financial structuring for projects that contribute to climate resilience (mitigation, adaptation) to make them bankable and eligible for private investment whilst addressing loss and damage through climate disaster risk financing and social protection through public resources. With Official Development Assistance (ODA) shrinking since the COVID-19 pandemic and donor governments recently making substantial reductions, it is critical to establish an additional pathway to unlock finance at scale through climate-aligned public and private sector investment strategies. An important requirement is ensuring that lending rates from multilateral development banks (MDBs), to be truly concessional, do not exceed Bhutan's medium-term GDP growth rate for financing (~6.3%). Below is an overview of potential private capital to target. While these

[11] Bhutan Broadcasting Service (2025). Bhutan sees over 49,000 tourists in Q4 2024, SDF revenue jumps to USD 12 M. Available at: https://www.bbs.bt/224568/ (Accessed: 17 March 2025).
[12] United Nations Conference on Trade and Development. (2024). World Investment Report 2024: Country Fact Sheet: Bhutan. Retrieved from https://unctad.org/wir
[13] https://cointelegraph.com/news/bitcoin-mining-earnings-post-halving
[14] https://www.adb.org/publications/bhutan-fact-sheet


Photo credit: View of Paro Rinpung Dzong and Ta Dzong with rice fields, September 2022 | Pema Gyamtsho | Unsplash

investors typically look for investment-grade projects, projects can use credit enhancements and necessary risk reduction tools to improve the project risk-return profile.

- **Equity and Convertible Debt:**

  - **Institutional Investors:** Pension funds, insurance companies, endowments, and sovereign wealth funds.
  - **Private Equity & Venture Capital:** Funds raised by firms for investment in businesses and projects.
  - **High-Net-Worth Individuals (HNWIs) & Family Offices:** Private wealth managed by ultra-rich individuals and families.
  - **Corporations & Private Businesses:** Cash reserves and reinvested earnings available for strategic investments.
  - **Sovereign Wealth Funds:** State-owned investment fund that invests in real and financial assets.

- **Debt and other hybrid instruments:**

  - **Banking & Financial Institutions:** Loans, credit facilities, and investment arms of banks.
  - **Alternative Investment Funds (AIFs):** Hedge funds, infrastructure funds, and private debt markets.

C. DOMESTIC MOBILIZATION AND INSTITUTIONAL STRENGTHENING EFFORTS

1. COUNTRY-LED PLATFORM TO FACILITATE BANKABILITY AND INVESTOR ENGAGEMENT

Given the need to coordinate the investor effort and early-stage resources to improve the bankability of projects, Bhutan can consider establishing a country-led platform in the finance ministry. Specifically, the country-led platform can apply for philanthropic capital to enable cross-ministry collaboration, resource feasibility studies, and facilitate investor engagement. The country-led platform can support efforts to strengthen transactions within the Bhutan Climate Fund.

2. BHUTAN CLIMATE FUND

The Bhutan Climate Fund will work on enabling access to Article 6.2 & 6.4 carbon credit frameworks in coordination with sectoral agencies to enhance Bhutan's participation in international high-integrity carbon markets with mitigation projects from nature-based solutions, particularly in forestry and regenerative agriculture, and renewable energy projects.

- Relating to Article 6.2, Bhutan can target the following bilateral partners:
  - Japan
  - Korea
  - Norway
  - Singapore
  - Sweden
  - Switzerland
- Article 6.4 can target:
  - Corporations with net zero targets
  - Other countries
  - Individuals, including partnerships with airliners and the high-emitting sector

The Bhutan Climate Fund can therefore monetize carbon credits, which can then be used as early-stage capital, convertible loans and investment funds for high-growth opportunities. The Bhutan Climate Fund can also support co-financing equity funds in Bhutan.

3. BHUTAN ACCELERATOR FUNDS WITH BHUTAN CLIMATE FUND AS AN ANCHOR EQUITY INVESTOR

Privately managed funds can be deployed to catalyze investment in commercial and industrial renewable energy projects, energy storage and electric vehicle fleets. Privately managed funds through Singapore or other strategic financial hubs can support ensuring efficient capital flows into domestic markets. Structured as convertible debt or equity, these funds can de-risk investments and attract additional private sector participation while opening the door for joint ventures and domestic co-investment opportunities. The Government of Bhutan can play a strategic role as a co-investor through the Bhutan Climate Fund, ensuring that public capital is used to unlock private financing at scale and accelerate the clean energy transition. Philanthropies can support the funds by taking first loss, junior equity or subordinated debt.

4. BHUTAN'S DEBT PROFILE AND DEBT SUSTAINABILITY

As of 30 September 2025, Bhutan's public debt stood at approximately Nu. 302.7 billion, equivalent to 86.9% of its GDP, with external debt accounting for 92.8% of total public debt (80.6% of GDP). Over the last ten years, public debt has increased notably due to investments in hydropower and the effects of the COVID-19 pandemic. Nearly 60.2% of this external debt is related to hydropower-related borrowing, which have expanded the country's renewable energy capacity but also elevated overall debt levels. To reduce risks, most hydropower projects were financed by the Government of India, with 64.7% of external debt issued in Indian rupees which does not pose foreign exchange risk due to Ngultrum's peg to Indian Rupee. In addition, 91.4% of hydropower debt is INR-denominated, further strengthening external debt resilience. External debt service is projected to remain elevated through the mid-2030s due to hydropower loan repayments.

Domestic debt remains relatively low at 6.3% of GDP. It mainly includes treasury bills and bonds, with maturity ranging from 2 to 12 years, mostly held by local banks, insurance firms, and the public pension fund.

LIABILITIES MANAGEMENT:

Given the ambitious nature of the 13th five-year plan, it is imperative that the balance sheet of the country is managed effectively. Bhutan's debt profile is assessed as manageable, and is underpinned by the long average time to maturity (11.7 years), high share of fixed-rate debt (95.5%), and the commercial viability of hydropower projects. Furthermore, a significant portion of non-hydropower external debt is concessional, carrying low interest rates, long grace periods, and extended maturities.

To manage and reduce long-term liabilities, Bhutan can leverage natural capital with carbon credits, debt-for-climate swaps, exchanged for renewable energy investments and biodiversity conservation, as well as enabling equity investment to capitalize the holding company of the hydro power assets.

Bhutan must also position itself as a global leader in natural capital valuation, integrating its vast forests and biodiversity reserves into its fiscal policy and debt sustainability framework. This could include securing green debt swaps with multilateral institutions, where a portion of external liabilities is forgiven in exchange for dedicated conservation investments.

Moreover, it is important to note that Bhutan can advocate for the Debt Sustainability Analysis by the IMF to include natural capital value because there is no macroeconomic stability without ecological stability. Specifically, the DSA can include the impact of natural risks and mitigating natural capital investment in baseline scenarios and volatility assessments.

Specifically, Bhutan can leverage:

- Debt-for-Nature Swaps to monetize its biodiversity and forest cover, partnering with creditors to exchange debt relief for commitments towards conservation efforts.
- Debt-for-Renewables Agreements can attract climate funds to support its hydropower sector by monetizing carbon credits.
- Additionally, Bhutan can issue green bonds to refinance high-cost debt. These strategies can stabilize finances while enhancing conservation and renewable energy efforts.

5. ENHANCING BHUTAN'S CREDIT RATING THROUGH NATURAL CAPITAL

Bhutan has a unique opportunity to ensure that its sovereign credit profile captures its large natural capital as productive capital as well as a assigning value to efforts that mitigate the impact of (planned) climate adaptation and natural capital investments and policies (e.g. insurance, investments in physical and natural capital), when it comes to GDP forecasts. An strengthened credit rating can support a reduction of the cost of capital for capital intensive projects such as hydro and other infrastructure. Moreover, Bhutan can consider cross-border capital market listings (e.g. Singapore Stock Exchange) for its hydro assets, among others.

D. VERTICAL CLIMATE FUNDS AND SPECIAL TRUST FUNDS IN MDBS

The strategy can maximize direct access to resources from vertical climate funds including:

- **Green Climate Fund (GCF):** To finance large-scale adaptation, low-carbon, and resilience-building projects, and to provide payments for emissions reductions from REDD+ activities. For example, GCF grants access to $4m over 4 years, $3m for national adaptation plans, and $1m to support accreditation.
- **Global Environment Facility (GEF):** To support communities, biodiversity conservation, land degradation reversal, and climate-smart agriculture investments, among others.
- **Adaptation Fund (AF):** To finance community-led climate adaptation initiatives that align with national climate policies.
- **Climate Investment Funds (CIFs):** Engage with Asian Development Bank to unlock financing for

transformational climate and energy projects, including renewable energy expansion and climate-resilient infrastructure.

- **Fund for responding to Loss and Damage (FRLD):** Upon the Fund's operationalization, ensure access to support communities affected by climate-induced loss and damage.

- **Asia–Pacific Climate Finance Fund (ACliFF) managed by the ADB:** To support development and implementation of innovative, scalable, and commercially viable financial risk management products aimed at achieving at least one of the following objectives: (i) scaling up the adoption of climate technologies, (ii) mobilizing new sources of private sector climate financing, (iii) supporting investment in climate-sensitive sectors, and (iv) addressing extreme weather events.

E. DE-RISKING MECHANISMS AND RISK REDUCTION TOOLS

Green guarantees, including through multilateral (MIGA), Asian Development Bank, and bilateral sources, can support scaling-up private capital by de-risking investments in renewable energy, EV infrastructure, and climate-smart industrial parks. Expanding climate and disaster risk tools and credit guarantees can protect lending portfolios from climate shocks and lower the cost of capital.

Photo credit: Trashigang-Semtokha Highway, Lobesa - Metsina, Bhutan, September 2019 | Tanay Dedhia | Unsplash

VIII
CONCLUSION

Photo credit: Yak parade during the Royal Highland Festival in Laya, Bhutan, October 2025 | Ferry.Widjaja | Shutterstock

Photo credit: Punakha, Bhutan, April 2022 | Unma Desai | Unsplash

Bhutan's 13th Five-Year Plan presents an ambitious and strategic roadmap for sustainable development, economic diversification, and climate resilience. The investment and financing strategy outlined in this document provides a robust framework to unlock new and existing financial resources, ensuring that the projects identified under the plan receive adequate funding while minimizing fiscal pressure on the government. By leveraging innovative financing mechanisms, such as blended finance, capital stacking, climate funds, and public-private partnerships, Bhutan can optimize its access to concessional finance, private capital, and philanthropic investments.

The country's unique positioning as a carbon-negative nation, coupled with its commitment to Gross National Happiness and sustainable development, makes it an attractive destination for impact investors, climate finance institutions, and multilateral organizations. This strategy ensures that Bhutan not only secures funding for critical infrastructure and economic transformation but also aligns with global climate goals, thereby reinforcing its leadership in climate resilience and sustainability.

To achieve these objectives, the successful execution of this financing strategy requires strong coordination between the government, development partners, and the private sector. Institutional capacity-building, regulatory enhancements, and policy coherence will be essential to maximize resource mobilization and investor confidence. Additionally, ensuring that projects integrate climate resilience, mitigation, and adaptation measures will enhance their bankability and long-term sustainability.

Ultimately, the financing strategy serves as a foundation for Bhutan's transition toward a climate-resilient and economically dynamic future. By fostering innovative financing solutions and strategic partnerships, Bhutan can secure the necessary capital to implement its 13th Five-Year Plan, drive inclusive growth, and achieve long-term prosperity for its people while preserving its unique environmental and cultural heritage.

IX
COMPLEMENTARY INFORMATION

Photo credit: Memorial Chorten in Thimphu, Bhutan, October 2023 | Chandi Saha | Pexels

A. DDT AND GEM

The output provided by GEM can inform aspects of the Public Debt Dynamics Tool (DDT) created by the International Monetary Fund (IMF). DDT utilizes several data points from 2014 to 2050 to calculate the stock of total gross public debt as a percentage of GDP. Table 3 lists the inputs and data provided by GEM that can be integrated into DDT calculations, ensuring a comprehensive analysis of public debt dynamics in response to climate impacts. By incorporating GEM outputs, the DDT can offer more accurate and nuanced projections of public debt, while factoring in the economic ramifications of climate change and the effectiveness of adaptation measures from GEM.

INPUTS INTO DDT	PROVIDED BY GEM
d_t (debt including uncalled guarantees): stock of total gross public debt, percent of GDP	(X) – Debt to GDP ratio
o/w stock of local-currency guarantees (uncalled): stock of uncalled guarantees in local currency included in total debt, percent of GDP	-
o/w stock of foreign-currency guarantees (uncalled): stock of uncalled guarantees in foreign currency included in total debt, percent of GDP	-
α_t (share excl. guarantees): share of foreign currency denominated debt in total debt, percent of total debt	-
e_t (LCU/FCU, avg): nominal average exchange rate, local currency per unit of foreign currency	(X) – Data exchange rate
e_t (LCU/FCU, eop): nominal end of period exchange rate, local currency per unit of foreign currency	(X) – Data exchange rate
i_t^d: nominal effective interest rate on local currency denominated debt, percent	-
i_t^f: nominal effective interest rate on foreign currency denominated debt, percent	-
π_t: GDP deflator inflation, percent	(X) – GDP deflator
g_t: Real GDP growth, percent	(X) – smooth real GDP growth rate
pb_t: Primary balance, percent of GDP	(X) – Domestic Financing as a share of Nominal production
of_t (other net debt-creating flows): Other net debt creating flows, percent of GDP	-
π^f_t: Foreign GDP deflator inflation, percent (used in fan chart)	(X) – GDP deflator

DDT and GEM inputs, (X) = provided, blank = not provided

For DDT and GEM to match, the difference between the DDT-calculated debt-to-GDP ratio and the GEM variable must be applied to the other net-debt-creating flows. Since not all inputs are directly provided, this adjustment ensures alignment between the two models. Additionally, because the differences between the models compound annually, the net difference is manually inserted for every time step. This process is critical for maintaining consistency and accuracy in the projections. See Figure 23 and Figure 24 for DDT results, which reflect the adjusted inputs and demonstrate the impact of these modifications on the debt-to-GDP ratio over time.

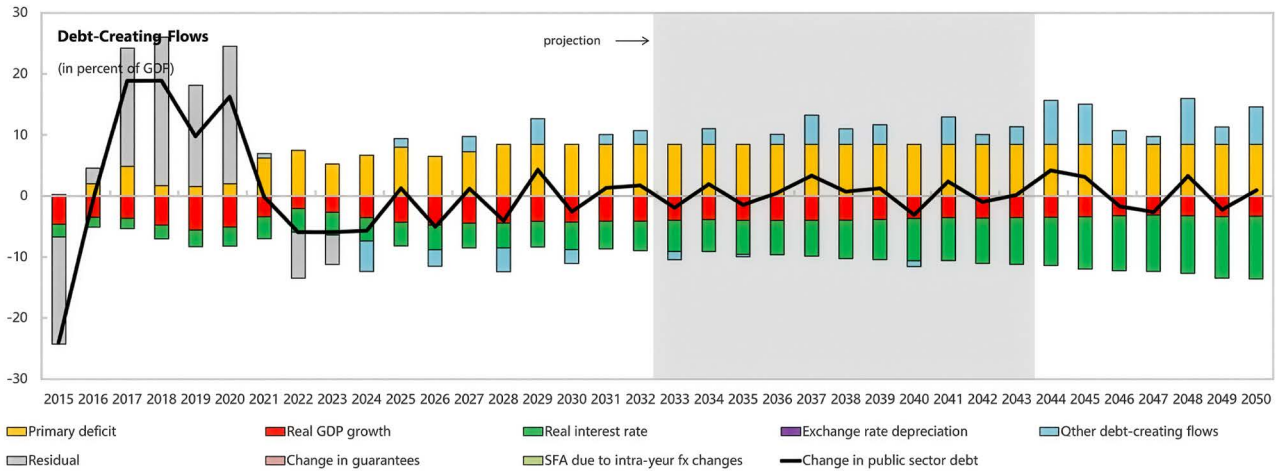


Figure 23. DDT output using BAU GEM input

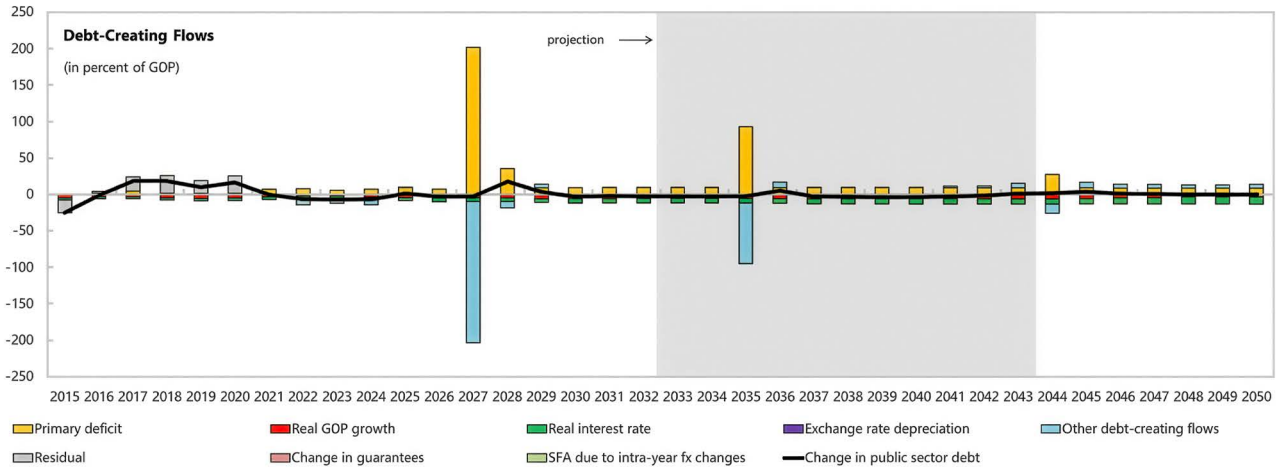


Figure 24. DDT output using CPP GEM input

The debt-to-GDP ratio under the BAU scenario reaches 126.2% by 2050. In the CPP scenario, this ratio initially starts higher due to higher investment levels. However, by 2050, it begins to decline to 118.5%. The debt-to-GDP ratio in the CPP scenario is lower than in the BAU scenario, the trend—highlighted by the blank line in Figure 23 and Figure 24—shows a rapid decrease due to higher economic growth. This

indicates that while short-term debt levels may be higher, the long-term economic benefits of increased investment in climate resilience and adaptation measures lead to a more favourable debt trajectory.

B. COST ASSUMPTIONS

ADAPTATION COST ASSUMPTIONS				
INTERVENTION/INDICATOR	UNIT	TIME 2000	2030	2050
Buildings and Roads				
Average cost of flood protection - High	USD/building	3,506	3,506	3,506
Average cost of flood protection - Low	USD/building	875.4	875.4	875.4
Average cost of Elevating Floor levels	USD/building	107,000	107,000	107,000
Initial cost of flood protection per km of road	USD/km	50,000	50,000	50,000
Average cost of flood protection per km of road	USD/km	52,595	52,615	53,499
Average cost per AC Unit	USD/unit	400	400	400
Number of AC units per dwelling	Unit/dwelling	2	2	2
Average cost of retrofitting buildings	USD/building	500	500	500
Agriculture Adaptation				
Average cost per hectare of drip irrigation	USD/ha	2,000	2,000	2,000
Average cost per hectare of drainage	USD/ha	2,500	2,500	2,500
Average cost per hectare of net shading	USD/ha	25,000	25,000	25,000
Livestock Interventions				
Nature based solution per cattle	USD/head	1.32	1.32	1.32
Nature based solution per pig	USD/head	.33	.33	.33
Nature based solution per poultry	USD/head	.08	.08	.08
Technology based solution per cattle	USD/head	39.42	39.42	39.42
Technology based solution per pig	USD/head	9.86	9.86	9.86
Technology based solution per poultry	USD/head	2.46	2.46	2.46
Power Generation and Transmission Lines				
Flood protection				
Adaptation cost for Diesel and Fuel	USD/MW	12,600	12,600	12,600

Adaptation cost for cogeneration	USD/MW	12,600	12,600	12,600
Adaptation cost for gas turbines	USD/MW	8,000	8,000	8,000
Adaptation cost for coal	USD/MW	24,000	24,000	24,000
Adaptation cost for nuclear	USD/MW	140,000	140,000	140,000
Adaptation cost for biomass	USD/MW	42,999	42,899	42,799
Adaptation cost for hydropower large scale	USD/MW	60,003	60,303	60,602
Adaptation cost for hydropower small scale	USD/MW	94,168	90,871	87,574
Adaptation cost for solar large scale	USD/MW	-	-	-
Adaptation cost for solar small scale	USD/MW	-	-	-
Adaptation cost for wind onshore	USD/MW	-	-	-
Adaptation cost for wind offshore	USD/MW	-	-	-
Adaptation cost for waste generation	USD/MW	131,998	131,798	131,598
Adaptation cost for geothermal	USD/MW	71,997	71,697	71,398
Wind protection				
Adaptation cost for Diesel and Fuel	USD/MW	63,000	63,000	63,000
Adaptation cost for cogeneration	USD/MW	63,000	63,000	63,000
Adaptation cost for gas turbines	USD/MW	40,000	40,000	40,000
Adaptation cost for coal	USD/MW	120,000	120,000	120,000
Adaptation cost for nuclear	USD/MW	-	-	-
Adaptation cost for biomass	USD/MW	215,000	215,000	215,000
Adaptation cost for hydropower large scale	USD/MW	-	-	-
Adaptation cost for hydropower small scale	USD/MW	-	-	-
Adaptation cost for solar large scale	USD/MW	91,500	91,500	91,500
Adaptation cost for solar small scale	USD/MW	123,000	123,000	123,000
Adaptation cost for wind onshore	USD/MW	53,000	53,000	53,000
Adaptation cost for wind offshore	USD/MW	157,000	157,000	157,000
Adaptation cost for waste generation	USD/MW	660,000	660,000	660,000
Adaptation cost for geothermal	USD/MW	360,000	360,000	360,000
Cost per km of flood protecting transmission lines	USD/km	1,650	1,650	1,650
Cost per km of wind protecting transmission lines	USD/km	4,125	4,125	4,125
Greening Urban Areas				
Cost per hectare of greening settlement land	USD/ha	100	100	100

MITIGATION COST ASSUMPTIONS				
INTERVENTION/INDICATOR	UNIT	TIME 2000	2030	2050
NMT Infrastructure				
Cost per km of NMT Infrastructure	USD/km	56,000	56,000	56,000
Annual operational costs per km of NMT Infrastructure	USD/km/year	665	665	665
Energy Efficiency				
Cost per TJ of energy avoided through efficiency	USD/TJ	7,165	7,165	7,165
Cost per CCS per ton of CO_2 avoided	USD/ton	80	80	80
Cost per TJ of Fuel switched	USD/TJ	3,583	3,583	3,583
Land based interventions				
Cost per hectare of mangroves restoration	USD/ha	3,000	3,000	3,000
Cost per hectare of reforestation	USD/ha	1,225	1,225	1,225
Livestock interventions				
Cost per ton of CH_4 removed from livestock	USD/ton	88	88	88
Cost per ton of N_2O removed from livestock biodigester	USD/ton	92	92	92
Cost per ton of N_2O removed from livestock pasture	USD/ton	15	15	15
Sustainable Agriculture				
Cost per hectare of sustainable agriculture	USD/ha	476	476	476
Cost per hectare of vertical farming	USD/ha	23 M	23 M	23 M
Annual operational costs per ha of sustainable farming	USD/ha/year	282	282	282
Waste related interventions				
CAPEX Waste collection	USD/ton	98	98	98
OPEX Waste collection	USD/ton/year	50	50	50
CAPEX waste composting	USD/ton	208	208	208
OPEX waste composting	USD/ton/year	28	28	28
CAPEX waste for energy recovery	USD/ton	642	642	642
OPEX waste for energy recovery	USD/ton/year	40	40	40
CAPEX waste incinerated	USD/ton	321	321	321
OPEX waste incinerated	USD/ton/year	20	20	20
CAPEX waste landfilled	USD/ton	15	15	15

OPEX waste landfilled	USD/ton/year	46	46	46
CAPEX waste recycled	USD/ton	647	647	647
OPEX waste recycled	USD/ton/year	38	38	38
Cost per ton of waste prevented	USD/ton	98	98	98
Cost per TJ of Fuel switched	USD/TJ	3,583	3,583	3,583
Energy Interventions				
Cost per charger installed	USD/Charger	1,500	1,500	1,500
Cost per electric bus	USD/Vehicle	105,000	80,000	75,000
Cost per electric vehicle	USD/Vehicle	32,000	22,000	22,000
Cost per hybrid vehicle	USD/Vehicle	32,000	22,000	22,000
Cost per PHEVs	USD/Vehicle	32,000	22,000	22,000
Annual operational costs per electric bus	USD/vehicle/year	2,000	2,000	2,000
Annual operational costs per electric vehicle	USD/vehicle/year	63	43	40
Annual operational costs per hybrid vehicle	USD/vehicle/year	69	62	61
Annual operational costs per PHEVs	USD/vehicle/year	70	47	45
Cost per ICE bus	USD/vehicle	67,000	67,000	67,000
Cost per ICE Vehicle	USD/vehicle	22,000	22,000	22,000
Annual operational costs per ICE Bus	USD/vehicle/year	1,500	1,500	1,500
Annual operational costs per ICE vehicle	USD/vehicle/year	110	110	110
Cost per fast charging station	USD/charger	49,000	49,000	49,000
Cost per gas station	USD/station	500,000	500,000	500,000
Cost per km of Transmission lines	USD/km	33,000	33,000	33,000
CAPEX for Diesel and Fuel	USD/MW	630,000	630,000	630,000
CAPEX for cogeneration	USD/MW	630,000	630,000	630,000
CAPEX for gas turbines	USD/MW	400,000	400,000	400,000
CAPEX for coal	USD/MW	1,200,000	1,200,000	1,200,000
CAPEX for nuclear	USD/MW	2,800,000	2,800,000	2,800,000
CAPEX for biomass	USD/MW	2,150,000	2,100,000	2,100,000
CAPEX for hydropower large scale	USD/MW	2,000,000	2,100,000	2,150,000
CAPEX for hydropower small scale	USD/MW	3,140,000	2,040,000	1,700,000
CAPEX for solar large scale	USD/MW	610,000	400,000	350,000
CAPEX for solar small scale	USD/MW	820,000	540,000	460,000
CAPEX for wind onshore	USD/MW	1,060,000	1,040,000	1,020,000

CAPEX for wind offshore	USD/MW	3,140,000	2,040,000	1,700,000
CAPEX for waste generation	USD/MW	6,600,000	6,500,000	6,450,000
CAPEX for geothermal	USD/MW	3,600,000	3,450,000	3,350,000
OPEX for Diesel and Fuel	USD/MW/year	22,500	22,500	22,500
OPEX for cogeneration	USD/MW/year	22,500	22,500	22,500
OPEX for gas turbines	USD/MW/year	20,000	20,000	20,000
OPEX for coal	USD/MW/year	50,000	50,000	50,000
OPEX for nuclear	USD/MW/year	140,000	140,000	140,000
OPEX for biomass	USD/MW/year	75,000	75,000	75,000
OPEX for hydropower large scale	USD/MW/year	50,000	50,000	50,000
OPEX for hydropower small scale	USD/MW/year	65,000	50,000	45,000
OPEX for solar large scale	USD/MW/year	12,000	10,000	10,000
OPEX for solar small scale	USD/MW/year	14,000	12,000	12,000
OPEX for wind onshore	USD/MW/year	26,000	26,000	26,000
OPEX for wind offshore	USD/MW/year	65,000	50,000	45,000
OPEX for waste generation	USD/MW/year	250,000	250,000	240,000
OPEX for geothermal	USD/MW/year	70,000	70,000	65,000

Photo credit: Tala hydropower plant located downstream of Chhukha hydropower plant, Bhutan | Druk Green Power Corporation Limited

C. MAPPING OF EXISTING AND PROPOSED PROJECTS

The resource mobilization for following projects and activities of 13FYP requires further initiation and coordination:

AGENCY	PROJECT	ACTIVITY	BTN (MILLIONS)
Ministry of Energy and Natural Resources (MoENR)	Construction of hydropower projects	Develop a 500kW Lunana Mini Hydropower project	662.93
	Development of Alternative Renewable Energy Projects	1MW BioEnergy projects implemented	45.00
		1MW pilot Green Hydrogen project implemented	240.00
	Geological and mineral resource mapping	Regional Geological Mapping of Bhutan (toposheet wise on 1:50,000 scale)	20.00
		Nationwide Magnetic and Gravity Surveys	1,170.00
		Nationwide Geochemical Survey	60.00
	Geohazard assessment	Landslide hazard assessment and land deformation mapping in major settlements	9.00
		Enhancement of landslide inventory map of Bhutan	6.00
		Updating and maintenance of National Earthquake Monitoring Network and Infrastructure	4.00
		Earthquake Micro hazard assessment	3.00
		Monitoring of earthquake and maintenance of earthquake stations	8.00
	Environment Policy and Regulatory Reforms	Habitat management for enhancing the conservation of Protected Areas	5.00
	Sustainable Water Resource Management	Assess climate vulnerability and risk for priority water sectors and develop guidelines on climate-resilient water infrastructures.	28.00
		Promote and adopt emerging water-efficient and innovative technologies.	20.00
		Create avenues for water-based ventures	15.00
Ministry of Infrastructure and Transport (MoIT)	Preparation of Human Settlement plans for the National Capital Region and Linked Urban Centers	Samtse - Phuntsholing LUC plan (Survey, Land use, Infrastructure, Transportation, open spaces)	30.00

	Samdrup Jongkhar-Nganglam LUC Plan (Survey, Land use, Infrastructure, Transportation, open space, 1 Structure Plan, 2 Local Area Plans	30.00
Energy Efficiency and Disaster Resilient Buildings, and Disaster Resilient Settlement	Implementation of Disaster Management & Contingency Plan (Stockpiling of emergency shelter items, water and sanitation items, and bridge parts, Revision of current DMCP)	300.00
	Implementation of Street addressing system for planned areas including guidelines and standards	53.00
	Case study and capacity development on mass timber construction	10.00
Improvement of Primary National Highways	Sunkosh - Dagana	500.00
	Samtse – Tendu	500.00
Expansion and Improvement of Paro International Airport	Construction of Domestic Terminal, General Aviation Terminal, Cargo Complex and Apron	585.00
	Enhancement of airside infrastructure (GSE Shed and runway extension)	250.00
	Maintenance of infrastructure for airports (taxiway resurfacing, drainage system, control tower renovation and general infra)	365.00
Expansion and Improvement of Bumthang Domestic Airport	Construction of Ceremonial Lounge, outdoor canteen, and public toilet	45.00
	Construction of Air Traffic Control Tower	30.00
Expansion and Improvement of Yonphula Domestic Airport	Construction of the terminal building, Apron, public toilet, and access road	50.00
	Construction of Air Traffic Control Tower	15.00
	Construction of Ceremonial Lounge and Emergency Response Center	75.00
	Installation of visual landing system- (PAPI) Precision Approach Path Indicator and runway lighting systems	38.00
Identification and development of airport/airstrips	Construction of airport/airstrips	-
Enhancement of Airport safety, security, and services (For all Airports)	Enhancement of air navigation services (ATS/CNS equipment and system upgrades, flight inspection services, and introduction of navigation technology and visual aids, etc.)	150.00
	Enhancement of airport emergency services (Fire extinguishing agents/equipment and Crash Fire Tender (CFT) upgrades, etc.)	100.00
	Enhancement of Airport Security services (security screening/surveillance equipment upgrades, biometrics, e-Gate, etc.)	100.00

		Enhancement of airport services (digitization of check-in counters, cleaning, horticulture, beautification/landscaping, utility and heating system upgrades, etc.)	50.00
		Strengthening of Safety Management System (wildlife hazard mitigation measures, Foreign Object Debris (FOD) remover equipment, etc.)	10.00
	Improve Public Service Delivery	Enhance eRALIS, eZOTIN system, and mobile app	15.00
		Develop online Passenger Bus Services system (Bus Information, Route Approval, automated fare revision, and enhancement of GPS Tracking System)	15.00
		Institute smart card system (customized registration certificate and licenses)	10.00
Ministry of Agriculture and Livestock	Large-scale commercial farming	Promote large-scale commercial farms (Total area: 435 acres) at Yarjugang, Wangduephodrang	250.00
		Establish a large-scale high-tech pig breeding farm in Samtse with a capacity of 240 sow-level	150.00
	Building resilience of smallholder farmers	Generate and promote innovative agriculture technologies through R&D and support services, including CSA technologies	140.20
		Enhance animal nutrition services for enhanced productivity	179.00
		Establish 'Sanam Tshongkhang' Farm Shops in viable locations	279.00
	Promotion of high-value products for export markets	Establish commercial strawberry farm (Greenhouse -100m*24 m and supply of runners)	-
		Enhance production of Cage-free eggs for the export market (10 million)	19.70
Ministry of Industry, Commerce and Employment	Diversification of Trade and Enhancement of Exportability of Domestic Products	Facilitate diversification and promotion of exports	22.80
	Enhancement of Market Access and Promotion of CSI Products Outside Bhutan	Pursue Trade Negotiations.	61.50
		Promote CSI's products outside Bhutan	24.00
	Enhancement of Industrial Linkages and Productivity	Support and enhance industries.	30.25
	Development and Operation of Trade-related Infrastructure	Develop Samtse Dry Port (New: Gawadrong)	973.50
	Development and Maintenance of Industrial Parks	Develop and Expand Norbugang Industrial Park, Samtse.	1,226.63

		Develop New Industrial Park (Lhamoizingkha/ Nganglam).	1,000.00
		Develop New Infrastructures within the existing 4 Industrial Parks (Damdum, Bjemina, Passakha, Changchey).	415.00
		Maintain existing Industrial Parks (Damdum, Bjemina, Phuntsho Rabtenling (Motanga), Passakha, Changchey).	212.50
	Development and Promotion of Tourism	Position Bhutan as a model sustainable and ecotourism destination (Marketing and promotion).	240.00
		Promote tourism as a sustainable solution for development and value creation.	172.97
		Promote tourism in Dzongkhags with fewer or no tourist arrivals.	10.00
	Facilitation of Employment Generation	Implement Entrepreneurship Development Program.	268.08
		Implement Employment Facilitation Programs.	450.63
		Enhance abour market Intelligence System and Create Innovative Post-Schooling Career Guidance Programs.	57.96
	Promotion of Conducive Working Conditions and Environment	Transform Labour Administration for a modern, advanced, and dynamic labor market.	27.00
		Introduce data-driven wage adjustment and a system for the protection of Wages.	11.00
		Align national labor practice with international standards.	43.00
		Leverage technology to improve labor administration.	50.00
	Facilitation of the growth of Digital Industry	Support the Over-The-Top (OTT) sector.	10.00
	Safeguarding intellectual property rights, ensuring media sustainability, and promoting creative industries & Indigenous craftsmanship	Identify, register, and commercialize 20 potential National Geographical Indication (GI) products from the Agro, Livestock, Textile, and Craft Sectors.	50.00
		Establish National Craft Market at Thimphu/Paro, Punakha, Pemagatshel, Trashiyangtse, and Zhemgang	300.00
Bhutan InfoCom and Media Authority	Facilitation of the growth of Digital Industry	Facilitate and enhance private sector investment in ICT and media services.	469.00
Corporate Regulatory Authority	Development of Alternative Financial Instruments	Develop alternate financial instruments through the capital market for CSIs & LLCs and create alternative investment markets for the Private Sector.	105.00

		Recommend and drive fiscal & non-fiscal measures to MoF, RMA & Cabinet on developing alternative financial markets and improved investment avenues for LLCs, CSIs, and the private sector.	10.00
Bhutan Standard Bureau	Diversification of Trade and Enhancement of Exportability of Domestic Products	Develop /adopt national standards and facilitate their implementation	17.50
		Establish an internationally recognized National Metrology Institute and operate product testing services.	66.00
Ministry of Education and Skills Development	Inclusive, Safe and Enabling Education Environment	Development of inclusive infrastructure for SEN Schools	980.00
		Disaster Resilience and Mitigation measures for existing school infrastructures	990.00
	Education and Curriculum & Assessment for 5th IR	Revamping of School Curriculum by benchmarking with International Standards	370.00
		Strengthening and integrating technology in the online courses for 7 TVET Specialized schools	400.00
		Enhancing National and Global Competence in Education Assessment and Certification	112.00
	STEM and Digital Learning	STEM and digital resources	1,070.00
	Health & Well-being of Learners and Education Professionals	Strengthen school feeding and nutrition program	555.00
Royal University of Bhutan	Research and Development	Enhance the current research centers to the national/international level.	32.84
Khesar Gyalpo University of	Simulation-Based Medical Teaching and Learning	Upgrade of center for simulation-based training	10.00
Medical Sciences of Bhutan	Competent Health & Medical Graduates	Develop and adopt a curriculum that anticipates future needs	126.27
Jigme Singye Wangchuk School of Law	Facilities' Augmentation and Digitalization	Develop and maintain green and sustainable digital infrastructure	36.10
	Excellence in Legal Education and Research	Establish and operate specialized centers and services.	32.00
Ministry of Health	Bhutanese Traditional Medicine (TM) as a Centre of Excellence	Ensure access to adequate traditional medicinal resources and products	28.00
		Engagement of traditional medicine in public health interventions	28.50
	Pre and Post Market Control of Medical Products	Pre-market control of medical products	15.00
		Post-market control of medical products	12.95
		Enhancement of drug testing program	2.50

	Sanitary and Phytosanitary Certifications Capacity	Strengthen animal quarantine stations and improve the laboratory testing for animal quarantine	7.20
		Strengthen biosecurity infrastructure facilities and necessary equipment for biosecurity enforcement	187.11
Bhutan Olympic Committee	Recreational Facilities and Opportunities	Establishment of the National Sports Science Centre	70.00
		Upgradation of the National Olympic Archery Training Centre	45.00
		Construction of multi-sports arena at Depsi	193.00
Ministry of Finance	Special priority common public expenditure	Special priority and common public expenditure	9,637.00

Photo credit: Nikachhu hydropower plant, Bhutan | Druk Green Power Corporation Limited

X
ANNEX

Photo credit: Black-necked Crane Festival in Phobjikha, Wangduephodrang, Bhutan, September 2022 | Pema Gyamtsho | Unsplash

EARLY IDEAS FOR FINANCIAL SOURCES TO ENHANCE AND OPTIMIZE

1. PUBLIC DEVELOPMENT BANKS (PDBS)

Public Development Banks are crucial in de-risking financial instruments, which helps reduce the cost of capital and attract private sector investments. They can support Bhutan through mechanisms such as partial credit guarantees, first loss guarantees, and political risk insurance, thereby enhancing project viability and investor confidence. Additionally, PDBs can participate in capital stacking by combining their resources with other public and private funds, allowing access to more substantial sources of low-cost financing for large-scale projects, which is essential for sustainable development initiatives.

2. MULTILATERAL DEVELOPMENT BANK (MDBS)

Although multilateral development banks such as the World Bank and Asia Development Bank are already providing loans and technical assistance and have ongoing engagements in Bhutan's development sectors, multilateral development banks have concessional windows (e.g., ADB's Asian Development Fund, World Bank's IDA) and can scale up support for climate-resilient and infrastructure projects. MDBs can also engage in capital stacking by leveraging their capital to attract more private investment. For every dollar invested by MDBs, they can mobilize additional capital, often up to three to four times more, enhancing project financing capabilities. MDBs also provide a credit enhancement effect, reducing the risk for private investors and making projects more attractive. This encourages private sector participation in development projects that might otherwise be deemed too risky.

3. DFIS OF BILATERAL PARTNERS

Bilateral Development Finance Institutions (DFIs) have yet to invest significantly in Bhutan due to several challenges, including the country's small market size, underdeveloped private sector, and complex regulatory environment. Bhutan's economy remains heavily reliant on hydropower, limiting diversification opportunities, while inadequate infrastructure and bureaucratic hurdles deter foreign investments in other sectors. Despite these barriers, Bhutan offers unique opportunities aligned with DFI priorities, such as sustainable tourism, renewable energy, agriculture and agro processing, and green industries. By addressing these challenges through targeted policy reforms, such as simplifying

regulatory frameworks, improving financial access, and enhancing public-private partnerships, Bhutan can create a more favorable investment climate.

The government intends to build stronger collaborations with DFIs to leverage their expertise and financing capabilities for transformative projects that align with Bhutan's development philosophy of Gross National Happiness (GNH). This partnership can accelerate economic diversification and sustainable growth while ensuring mutual benefits for both Bhutan and its international partners.

Austria	Austrian Development Bank (OeEB)
Belgium	Belgian Investment Company for Developing Countries (BIO) Belgian Corporation for International Investment (BMI-SBI)
Denmark	The Investment Fund for Developing Countries (IFU)
Finland	Finnfund
France	Promotion and Participation Company for Economic Cooperation (Proparco)
Germany	German Investment and Development Company (DEG)
Netherlands	Dutch Entrepreneurial Development Bank (FMO)
Norway	Norwegian Investment Fund for Developing Countries (Norfund)
Sweden	Swedfund International AB
Switzerland	Swiss Investment Fund for Emerging Markets (SIFEM)
United Kingdom	CDC/British International Investment (CDC/BII)
United States	US International Development Finance Corporation (DFC)[15]

The strategy diversifies funding by engaging global and regional organizations, leveraging Bhutan's carbon-negative status, Gross National Happiness philosophy, and climate-smart project designs. It prioritizes:

- **Additionality:** Targeting new funders such as climate funds, Bilateral DFIs, and private investors to supplement existing sources.

[15] The DFC's authorization is set to expire on October 6, 2025, and efforts are underway for reauthorization. It committed significant funds to projects, such as over $12 billion in FY 2024.

- **Optimization:** Optimizing current allocations (e.g., from ADB, India) by aligning projects with funders' priorities.
- **Innovative Financial Structuring:** Leveraging new funding sources, use of creative and novel financial instruments, mechanisms, and strategies to raise funds, manage risks, and optimize financial flows for development projects.
- Projects are categorized by sector, with financing options matched to their commercial viability, climate impact, and social benefits.

By matching the right funding instruments or combination of funding instruments to each project's nature and risk profile, we avert resource-mobilization bottlenecks and accelerate Bhutan's transition to a climate-resilient, economically dynamic future.

4. ENERGY & NATURAL RESOURCES

HYDRO POWER PROJECTS AND SPECIFICATIONS		
PROJECT NAME	**CAPACITY**	**ESTIMATED PROJECT COST (USD)**
Punatsangchhu-I	1,200 MW	1.2B
Punatsangchhu-II	1,020 MW	2B
Nyera Amari	404 MW	320M
Kholongchu	600 MW	500M
Dorjilung	1,125 MW	1.25B
Bunakha	180 MW	200M
Wangchhu	900 MW	800M
Khomachhu	363 MW	380M
Dangchhu	170 MW	50-100M
Chamkharchhu-I	770 MW	900M
Kuri-Gongri	2,800 MW	2.5-3B
Total	**9,532 MW**	**10.65B**

The most promising business models for hydropower projects in Bhutan include:

- **Joint Venture (JV) Model:** This involves RGoB or a state-owned entity taking an equity position in a project entity, with private partners holding the balance. This model allows for risk sharing and can include multilateral participation.

- **Build-Own-Operate-Transfer (BOOT) Model:** This model offers off-balance sheet financing, transferring construction, finance, and operational risks to the private sector. The private operator develops and operates the project for a concession period (typically 30 years) before transferring it back to the government.

- **Public-Private-Partnership (PPP) with Strategic Partners:** The government can allocate projects directly to its undertakings, with private partners selected through an open process, holding up to 26% equity.

- **Triodos Investment Management**[16] **– Investment:** Focuses on renewable energy in emerging markets, offering equity or debt for small-scale projects.

- **Asia Development Bank:** The ADB can provide loans to support project development, as seen in the Nikachhu and Dagachhu hydropower projects. These loans can cover a significant portion of project costs and are often complemented by grants for capacity building and technical assistance.

- **Green Climate Fund (GCF) – Grants:** The GCF can offer grants, first loss, and equity to support climate-resilient infrastructure and renewable energy projects. These financial instruments can help bridge viability gaps, enhance project feasibility, and support environmental and social impact assessments.

- **International Finance Corporation (IFC):** The IFC can provide equity investments and advisory services to support project structuring, risk management, and private-sector participation. This can help attract additional private investors and enhance project viability through sound financial structuring and governance. The IFC can also offer partial risk guarantees to protect against specific risks, such as political or regulatory risks, making projects more attractive to private investors.

- **Export Credit Agencies (ECAs):** ECAs can provide guarantees for equipment exports and construction services, reducing the risk of non-payment or project delays.

- The **World Bank, through MIGA,** can offer guarantees to mitigate risks associated with project development, such as construction and operational risks. These guarantees can enhance the creditworthiness of projects and attract private investors.

These institutions can collectively enhance the financial viability and sustainability of hydropower projects in Bhutan by combining loans, grants, guarantees, equity investments, and technical expertise.

[16] This is an impact investment manager and manages both private debt and equity funds as well as listed equities and bonds through its impact-focused funds. Triodos investment funds offer investors the opportunity to directly invest in sustainable sectors. In 2023, Triodos Investment Management's assets under management increased to EUR 5.7 billion (end of 2022: EUR 5.5 billion). https://www.triodos-im.com/press-releases/2024/triodos-investment-management-in-2023

a. 1 MW BioEnergy Projects

- **Commercial Viability:** Can generate power or heat from biomass, attracting private investment if feedstock supply and offtake agreements are well structured.
- **Climate Resilience/Mitigation:** Low-carbon energy source that can help reduce emissions and improve waste-to-energy practices.

BLENDED FINANCE WITH A FIRST-LOSS FACILITY & CONCESSIONAL DEBT

The 1 MW BioEnergy Project in Bhutan aims to generate low-carbon energy from biomass, reduce emissions, and support Bhutan's waste-to-energy transition. A hybrid financing structure will minimize government liabilities while maximizing private sector participation.

Key aspects include:

- First-loss capital & risk mitigation to encourage private investment.
- Blended finance approach with concessional funding.
- Off-balance sheet financing to reduce sovereign debt exposure.
- Carbon credit monetization & alternative revenue sources.

The financing structure is designed to optimize low-cost capital, de-risk private investments, and ensure long-term sustainability.

SHORT-TERM STRUCTURING: DE-RISKING & LOW-COST CAPITAL	
First-Loss Capital (Catalytic Grant/Equity)	• Funding from Green Climate Fund (GCF), Climate Investment Funds (CIF), or Rockefeller Foundation. • Used to absorb initial losses, reducing investment risks. • Typically, 15-25% of the total project cost. Acumen Fund I Leapfrog Investments (Climate & Emerging Market Fund)
Partial Risk Guarantee (PRG)	• Provided by Multilateral Investment Guarantee Agency (MIGA), World Bank, or ADB. • Protects investors from political risk, regulatory changes, and non-payment risks under Power Purchase Agreements (PPAs).
Climate Insurance-Backed Lending	• World Bank -MIGA • Asian Development Bank (ADB) - Asia-Pacific Climate Finance Facility (ACLIFF)

	Private sector-driven climate insurance, offering customized products for renewable energy projects. 1. **Swiss Re - Climate Risk Solutions** A global reinsurer providing customized climate risk insurance and parametric coverage for energy projects. 2. **Munich Re - Green Tech Solutions** Offers weather and climate risk coverage for renewable energy projects, including bioenergy and biomass plants
Carbon Credit Pre-Financing	• Advance sale of carbon credits to institutional buyers via Verra (VCS) or Gold Standard. • Carbon revenue is securitized for upfront financing. Potential investors [Countries]: Sweden, Japan, South Korea, and Singaporean Government GenZero - a Singaporean state-backed investment firm, GenZero collaborates on carbon credit projects.
Impact Investing	• Asia Infrastructure Investment Bank (AIIB) • InfraCo Asia • ADB Clean Energy Financing Partnership Facility

b. 1 MW Green Hydrogen Pilot

- **Commercial Viability:** Hydrogen has potential for export or domestic use (transport, industry) if scaled.
- **Climate Mitigation:** Green hydrogen is produced from renewable energy, which can significantly reduce GHG emissions in hard-to-abate sectors.

The 1 MW Green Hydrogen Pilot project represents a transformative step toward a sustainable energy future, leveraging renewable energy to produce green hydrogen. This initiative is designed not only to meet immediate energy demands but also to establish a foundation for a robust hydrogen economy in Bhutan.

A STRATEGIC PILOT FOR SCALABILITY

As a pilot, this project serves as a critical proof-of-concept. It will generate essential data and insights to guide future expansion, demonstrating the practicality and advantages of green hydrogen production. Success here can attract additional investment, paving the way for broader hydrogen infrastructure development across Bhutan and potentially the region.

Green hydrogen offers significant commercial potential, both domestically and internationally.

Hydrogen can transform sectors like transportation and industry, where decarbonization is challenging. For instance, hydrogen-powered vehicles could reduce dependence on fossil fuels, while industrial uses could cut production costs and emissions, enhancing efficiency.

With the global hydrogen market poised for rapid growth, scaling up production could position Bhutan as a competitive supplier, tapping into international demand for clean energy solutions.

Produced using renewable sources, green hydrogen can significantly reduce greenhouse gas (GHG) emissions, particularly in hard-to-abate sectors. In heavy industry, it can replace carbon-heavy processes, while in long-haul transportation, it offers a viable alternative to diesel, cutting emissions where traditional solutions fall short.

FINANCING STRUCTURE

Grant and/or concessional loan from KfW Bilateral funding aligned with Germany's green hydrogen interests. The KfW Loan/Grant represents a remarkable opportunity to strengthen the partnership between Bhutan and Germany, elevating their long standing bilateral ties to new heights. This project centers on technology transfer, offering far more than financial support—it aims to empower Bhutan with the advanced knowledge and skills required to cultivate a robust hydrogen sector. By tapping into Germany's expertise in hydrogen production and application, Bhutan can integrate cutting-edge technologies into its energy framework, paving the way for sustainable development and greater energy security.

A GCF Grant provides a critical platform to propel innovative climate mitigation efforts in Bhutan. By zeroing in on pioneering technologies and solutions, this grant will spark the creation of bold, new strategies to slash carbon emissions.

Partnering with Breakthrough Energy Ventures (BEV) through equity investments offers a game-changing opportunity to scale clean energy solutions in Bhutan. By highlighting the scalability of local projects and enterprises, Bhutan can capture the interest and funding of BEV, a leader in supporting high-potential, growth-driven ventures. This influx of investment could drive significant economic progress, expanding clean energy industries and generating valuable employment opportunities. Additionally, by leveraging BEV's vast network, Bhutanese businesses will gain access to top-tier technology providers, unlocking cutting-edge innovations and expertise. This powerful combination accelerates the rollout of clean energy technologies and establishes Bhutan as a regional powerhouse in sustainable development, drawing further investment and fostering global partnerships.

Photo credit: Teoprongchu, Punakha, Bhutan, September 2024 | Phuntsho Wangdi | Unsplash

5. AGRICULTURE & LIVESTOCK

a. Large-Scale Commercial Farms (Total area: 435 acres)

- **Commercial Viability:** Well-organized commercial agriculture (fruits, vegetables, cereals) has strong domestic and export market potential.
- **Climate Resilience:** If managed as climate-smart agriculture—using drought-resistant varieties, efficient irrigation, soil-conservation practices—this can enhance adaptation and productivity under changing climate conditions.

This initiative involves developing 435 acres for commercial agriculture, producing fruits, vegetables, and cereals for domestic and export markets. By adopting climate-smart practices—such as drought-resistant varieties, efficient irrigation, and soil conservation—the farms will enhance productivity and resilience to climate change. This initiative aligns with Bhutan's goal to strengthen commercial agriculture, targeting crops with potential for both domestic consumption and export markets.

For export, the 13th FYP focuses on high-value and specialty crops that can fetch premium prices in international markets, leveraging Bhutan's ambition to become a 100% organic nation. The plan highlights organic production and traditional cash crops with established export potential.

The key crops targeted for export include:

- Organic Strawberries: High-value fruit promoted through commercial farms for export markets.
- Organic Mushrooms: Speciality produce with growing international demand.
- Organic Asparagus: A premium organic vegetable targeted for export.
- Organic Broccoli: Another high-value organic crop aimed at global markets.
- Organic Fruits and Vegetables: A broader category of organic produce to enhance export diversity.
- Cardamom: A traditional export crop valued for its quality and market demand.
- Ginger: A well-established cash crop for international trade.
- Turmeric: A spice crop with export potential, especially in organic form.

Crops targeted for domestic consumption include:

- Rice: A staple food widely consumed in Bhutan, prioritized to increase self-sufficiency.
- Wheat: Another essential staple crop aimed at meeting domestic dietary needs.
- Maize: A versatile staple used for both human consumption and livestock feed.
- Potatoes: A widely grown vegetable critical for local food security.
- Tomatoes: A high-demand vegetable for household and institutional use.
- Cole Crops: Including cabbage, cauliflower, and broccoli, these are nutritious vegetables targeted for domestic markets.
- Avocado: Promoted for its nutritional value and growing domestic appeal.
- Quinoa: A nutrient-rich crop gaining popularity for local consumption.
- Chili: A key ingredient in Bhutanese cuisine, prioritized to meet cultural demand.
- Mustard: Grown for both its greens and seeds, supporting local food systems.

POTENTIAL INVESTORS

- **Acumen:** An impact investor focused on solving poverty-related challenges, Acumen has invested in agricultural projects across Asia. Their interest in scalable, market-driven solutions aligns with the farms' export potential and social impact.

- **Root Capital:** Specializes in financing agricultural businesses in developing countries, connecting smallholder farmers to markets. Their focus on sustainability and rural development matches this project's goals.

- **Tata Group (India):** A conglomerate with agricultural investments, Tata could see strategic value in Bhutan's proximity and premium organic produce.

- **Rationale:** These investors would be attracted by the profitability of well-organized agriculture, Bhutan's organic reputation, and export opportunities to India and beyond.

- **Public Financing:** 40%, $4 million + catalytic support.

PROJECT PREPARATION FUNDS

- **Green Climate Fund (GCF) Project Preparation Facility:** Provides grants (e.g., $200,000) for feasibility studies, climate-smart design, and market assessments.

- **Catalytic Funds:**

    - **Global Agriculture and Food Security Program (GAFSP):** GAFSP has provided multi million dollar support to agricultural commercialization in Bhutan, offering grants for infrastructure like irrigation systems and access roads. The programme could also provide funds for these farms at Yarjugang, Wangduephodrang.
    - **World Bank's International Development Association (IDA):** Supports Bhutan's agricultural development with low-interest loans (e.g., $4 million) for large-scale infrastructure and should continue to do.
    - **First Loss Capital:** the International Finance Corporation can provide first loss guarantees (e.g., covering the first 10% of losses) to de-risk private investments.
    - Grants from the International Fund for Agricultural Development

KEY FEATURES

- Private investors fund operational costs (e.g., seeds, equipment, labor), while public funds cover initial infrastructure and climate resilience measures.

- Export potential and climate-smart practices enhance attractiveness to both investor types.

b. High-Tech Pig Breeding Farm (240 sow-level)

- **Commercial Viability:** High demand for pork products, potentially viable with modern feeding and breeding systems.
- **Climate Resilience:** With proper waste-management (e.g., biogas from manure), feed efficiency, and disease-control measures, it can reduce emissions intensity and improve resilience.

The High-Tech Pig Breeding Farm in Bhutan, with a capacity of 240 sows, presents a compelling investment opportunity due to its commercial potential and sustainability focus. The project leverages high demand for pork products and modern feeding and breeding systems to ensure viability, while incorporating climate-resilient features such as biogas production from manure, efficient feed use, and disease control measures to reduce emissions and enhance resilience.

Below are five private sector investors whose investment objectives align with the project's goals:

1. **responsAbility Investments:** a Switzerland-based impact investor, responsAbility manages funds focused on sustainable agriculture and food value chains in developing countries, including Asia. The firm places emphasis on environmental sustainability and social impact which complements the climate resilience features of the project, such as biogas-based waste management and emissions reduction. With a track record of supporting agricultural projects that deliver financial returns alongside positive outcomes, responsAbility is one potential avenue to explore to fund this initiative.

2. **Bamboo Capital Partners:** an impact investment firm operating in emerging markets, Bamboo Capital Partners targets sectors like agriculture to address social and environmental challenges. The firm's focus on sustainable solutions in developing regions aligns with the farm's high-tech approach and eco-friendly practices. Bamboo Capital Partners' willingness to invest in innovative projects in emerging markets makes them a good fit for Bhutan's unique context.

3. **Charoen Pokphand Group (CP Group):** Based in Thailand, CP Group is one of Asia's largest agribusiness conglomerates, with extensive operations in livestock, including pig farming. Beyond capital, CP Group offers technical expertise and regional market connections, enhancing the farm's commercial viability. Their experience in large-scale pig farming aligns with the project's use of modern systems, and the proximity of Thailand to Bhutan could facilitate supply chain integration. As a regional player, CP Group could view this farm as a strategic expansion opportunity, tapping into Bhutan's pork demand and potentially exporting to nearby markets.

4. **ADM Capital's Asia Sustainable Agriculture Fund:** Managed by ADM Capital, this fund invests in sustainable agriculture across Asia, prioritizing resource efficiency and environmental impact reduction. The farm's climate resilience features—such as biogas production and feed efficiency—match the fund's mission to support projects that mitigate environmental harm. Their focus on sustainability-driven agriculture in Asia makes them a natural partner.With a regional investment scope, the fund is likely equipped to assess and support opportunities in Bhutan's agricultural sector.

5. **Rabo Rural Fund:** Part of Rabobank, a global leader in agricultural financing, the Rabo Rural Fund invests in sustainable agricultural projects in developing countries. The fund's expertise in environmentally responsible farming practices aligns with the project's goals of reducing emissions and improving resilience. Their global experience in agriculture, including livestock, enables them to support the farm's high-tech innovations. Its focus on developing countries and sustainable agriculture suggests adaptability to Bhutan's context, despite its small scale.

WHY THESE INVESTORS FIT THE PROJECT

- **Commercial Viability:** Investors like CP Group and responsAbility recognize the high demand for pork in Bhutan and the profitability potential of modern systems, ensuring the farm's financial success.

- **Climate Resilience:** Bamboo Capital Partners, ADM Capital's fund, and Rabo Rural Fund prioritize sustainability, valuing the project's biogas production, emissions reduction, and disease control measures.

- **Regional and Emerging Market Expertise:** All five investors have experience in Asia or developing countries, equipping them to handle Bhutan's unique geographic and economic landscape.

c. Additional Agriculture & Livestock Projects (MoAL)

- **Building Resilience of Smallholder Farmers:** Currently aims to promote climate-smart tech. Scaling up those practices and linking them to commercial supply chains can enhance both commercial viability and adaptation benefits.

The GCF has been active in supporting climate resilience projects in Bhutan, focusing on integrating climate change risk data into agricultural practices and supporting smallholders. Their collaboration with private investors can provide the necessary funding and expertise for climate-smart agriculture projects. The Green Climate Fund (GCF) Grant will serve as a key financial instrument to facilitate the transition to climate-smart agriculture. This funding will be used to promote the adoption of drought-resistant crops, climate-resilient seed varieties, and efficient irrigation systems. Additionally, soil conservation measures and agroforestry practices will be introduced to improve soil health and enhance carbon sequestration. The grant will also provide direct financial assistance to smallholder farmers, enabling them to adopt sustainable agricultural methods and reduce their vulnerability to climate risks.

In parallel, the International Fund for Agricultural Development (IFAD) Grant will support the development of critical agricultural infrastructure. Investments will be made in storage facilities to minimize post-harvest losses and ensure food security, while rural access roads will be constructed to improve market connectivity for small-scale farmers. The grant will also finance farmer training programs focused on climate-smart agricultural techniques and business management, equipping farmers with the necessary skills to increase productivity and enhance their resilience against economic and climate-induced disruptions.

Complementing these efforts, the Bill & Melinda Gates Foundation Grant will drive innovation in Bhutan's agricultural sector by funding the development and adoption of advanced agricultural technologies. This will include digital tools for weather forecasting, pest control, and soil monitoring, as well as market information platforms that provide real-time price transparency and trade efficiency. The grant will also support initiatives that link smallholder farmers with commercial supply chains, ensuring fair pricing, improved market access, and sustainable livelihoods.

Nabventures

- Nabventures is a venture growth equity fund anchored by the National Bank for Agriculture and Rural Development (NABARD) in India. The fund focuses on investments in agriculture, food, and rural development, aiming to support innovative and scalable business models that enhance productivity and sustainability in these sectors.

- Given Bhutan's geographical proximity and similar agricultural contexts, Nabventures' experience in supporting agribusinesses in the region could be highly beneficial. Their focus on climate-smart agriculture aligns with Bhutan's goals of enhancing resilience among smallholder farmers.

International Finance Corporation (IFC)

- The IFC, a member of the World Bank Group, has a strong track record of investing in climate-smart agriculture projects globally, including in Asia. They focus on enhancing productivity, improving market access, and promoting sustainable practices among smallholder farmers.

- The IFC has previously invested in Bhutan's agricultural sector, notably in the Mountain Hazelnuts project, which aimed to integrate smallholder farmers into commercial hazelnut production. This demonstrates their interest and experience in Bhutan's agribusiness landscape.

Asian Development Bank (ADB)

- The ADB supports private sector development in its member countries, including investments in agriculture and rural development. Their initiatives often focus on enhancing value chains, promoting sustainable practices, and improving market connectivity.

- ADB has been involved in various projects in Bhutan aimed at boosting agricultural productivity and sustainability. Their continued interest in supporting agribusiness initiatives makes them a potential investor for climate-smart agriculture projects in the country.

Mountain Hazelnuts

- Mountain Hazelnuts is a social enterprise operating in Bhutan, partnering with thousands of farmer households to plant millions of hazelnut trees across the country. They aim to create shared value for rural communities, shareholders, and the environment by integrating smallholder farmers into commercial supply chains.

- As Bhutan's largest private sector employer, Mountain Hazelnuts has demonstrated a successful model of private investment in the country's agricultural sector, focusing on sustainability and community engagement. Their experience can provide valuable insights for similar initiatives.

- **Additional Mechanisms Across All Agricultural Projects:**

  - **Carbon Credits:** Projects that lower emissions, such as producing biogas from pig waste, or store carbon, like through soil conservation, can earn carbon credits, creating an extra source of income.

  - **Payment for Ecosystem Services:** Bhutan's current program can support these projects by providing payments for efforts like soil conservation that enhance water quality.

  - **Off-Take Agreements:** Locking in contracts with buyers, such as Indian supermarkets, decreases market risk and strengthens investor trust.

  - **Blended Finance:** Mixing equity, debt, grants, and guarantees makes these projects more affordable while reducing financial risks.

d. Industrial Parks (Norbugang, Lhamoizingkha/Nganglam, etc.)

- **Commercial Viability:** Industrial land lease, service charges, potential for PPPs.
- **Climate Resilience:** Incorporate green building standards, energy efficiency, and on-site renewable power to reduce emissions and improve resilience, rainwater harvesting, waste-management. These parks could qualify for green financing.
- **Climate risk screening:** For location, design, and operation.

Developing industrial parks in Bhutan, such as those in Norbugang and Lhamoizingkha/Nganglam, presents a significant opportunity to bolster economic growth while promoting environmental sustainability. A well-structured financing strategy that leverages private investment and green financing mechanisms is essential for the successful realization of these projects.

FINANCING STRATEGY

- **Public-Private Partnerships (PPPs):** Collaborate with private investors to share the costs, risks, and benefits of developing and operating the industrial parks. This approach can attract private capital and expertise, thereby reducing the government's financial burden.

- **Green Financing:** Incorporating sustainable practices such as green building standards, energy

efficiency measures, on-site renewable energy generation, rainwater harvesting, and waste management systems into the industrial park designs. These features can qualify the projects for green financing options, including green bonds and sustainability-linked loans.

- **International Financial Institutions (IFIs):** Seek funding and technical assistance from IFIs like the International Finance Corporation (IFC) and the Asian Development Bank (ADB), which support sustainable infrastructure projects in developing countries.

- **Blended Finance:** Combine concessional funds from development agencies with private capital to improve the risk-return profile of the projects, making them more attractive to private investors.

- **Tax Incentives and Subsidies:** The government to offer fiscal incentives, such as tax breaks or subsidies, to private investors who commit to sustainable development practices within the industrial parks.

POTENTIAL PRIVATE INVESTORS

- **Sembcorp Industries:** This Temasek-backed company plans to invest S$700 million over the next three years to develop green industrial parks in fast-growing Southeast Asian economies. Their focus on sustainability aligns with Bhutan's climate resilience goals.

- **Sumitomo Corporation:** With experience in developing and operating industrial parks across Asia, including the Philippines, Vietnam, Myanmar, and India, Sumitomo could bring valuable expertise and investment to Bhutan's industrial park projects.

- **Investcorp:** Their Asia Private Equity team invests in companies based in China and Southeast Asia, focusing on sectors benefiting from the region's expanding middle class and digital transformation. Their investment model involves close collaboration with management, leveraging Investcorp’s international network, sector expertise, and operational best practices to create significant value.

- **IndoSpace:** As India's largest investor, developer, and manager of industrial real estate, IndoSpace has announced plans to boost its investment in Tamil Nadu by 41% over the next three years, responding to growing demand for industrial parks. Their experience in developing industrial parks in emerging markets could be beneficial for Bhutan.

- **Ares Management:** Ares is acquiring the international division of GLP Capital Partners for up to $5.2 billion, bolstering its real estate assets by $44 billion and bringing it closer to managing $750 billion by 2028. This acquisition enhances Ares's presence in the property sector outside of Greater China, particularly in Japan and Europe, positioning it as one of the top investors in industrial real estate.

e. Sustainable Tourism Development

- **Positioning:** Bhutan as a model sustainable/ecotourism destination
- **Commercial Viability:** Bhutan's brand of high-end, low-volume tourism can yield significant revenue.
- **Climate Mitigation/Resilience:** Sustainable tourism can protect ecosystems, reduce the tourism sector's carbon footprint (e.g., eco-lodges, local renewable energy), and help local communities adapt financially to climate changes.

To attract both international and regional investors, the project will be designed to deliver long-term financial returns through a combination of premium ecotourism experiences, sustainable real estate assets (eco-lodges, resorts), and sustainability-linked tourism bonds. By leveraging Bhutan's high-end, low-volume tourism model, this strategy aims to position the country as a global leader in sustainable and eco-tourism while ensuring economic viability and environmental stewardship.

The financial structure will integrate private investors, multilateral institutions, and regional funds with a demonstrated commitment to sustainable tourism and climate-resilient development across Asia. By aligning investor incentives with Bhutan's unique tourism approach, the project will create a scalable and commercially viable ecotourism framework that balances profitability with conservation and community benefits.

KEY INVESTMENT FOCUS AREAS

- **Development of eco-lodges and sustainable tourism infrastructure** – Establishing world-class, environmentally responsible accommodations that minimize ecological impact while offering premium guest experiences.

- **Integration of local communities into tourism value chains** – Empowering local artisans, farmers, and businesses through direct participation in the tourism economy, ensuring equitable benefits.

- **Promotion of cultural heritage and biodiversity protection** – Strengthening Bhutan's identity as a destination that preserves traditional culture, protects biodiversity, and promotes responsible tourism practices.

- **Investments in off-grid renewable energy systems for hospitality** – Deploying solar, hydropower, and bioenergy solutions to reduce the tourism sector's carbon footprint and align with Bhutan's carbon-negative status.

Photo credit: Traditional Bhutanese festival mask dance, March 2024 | Rinchen Sonam | Pexels

POTENTIAL PRIVATE INVESTORS

Six Senses Hotels Resorts Spas	Luxury, sustainability-focused hospitality group (already operates in Bhutan).
Aman Resorts	Invests in high-end tourism with a focus on cultural and environmental preservation.
Banyan Tree Holdings	Asian eco-resort group investing in high-end sustainable tourism.
Patina Hotels & Resorts	Focused on luxury eco-conscious tourism.
Shangri-La Group	Sustainable hospitality investments in Asia.

Deploying de-risking instruments will be essential to unlocking private-sector participation and ensuring the long-term viability of investments. To this end, the Asian Infrastructure Investment Bank (AIIB) and the International Finance Corporation (IFC) would play a pivotal role in providing risk mitigation mechanisms that enhance the bankability and attractiveness of private investments in tourism infrastructure.

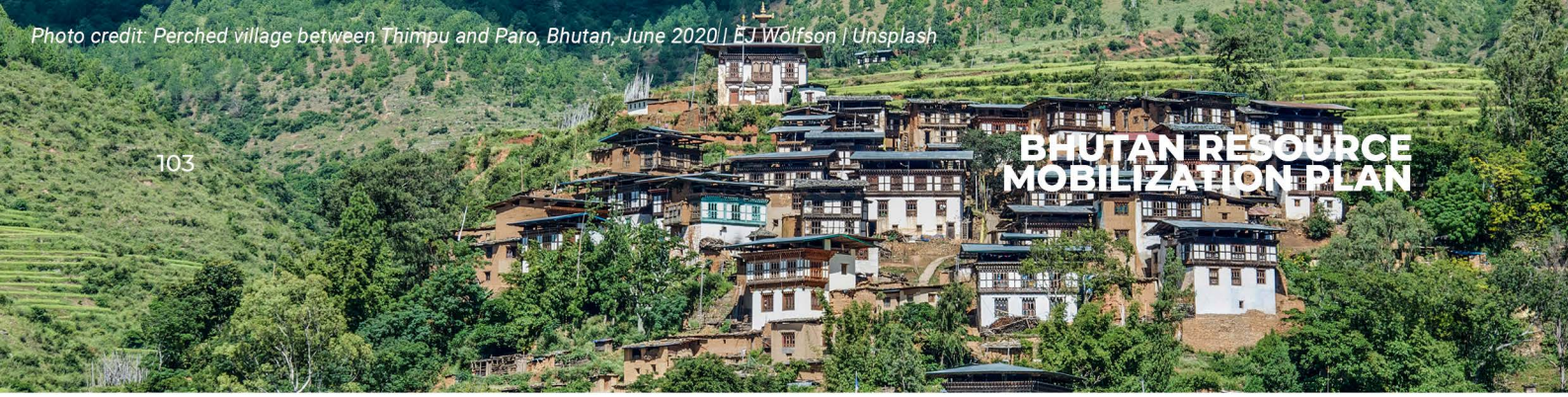
AIIB's expertise in infrastructure financing and IFC's comprehensive risk-mitigation tools should be leveraged to create a secure and investment-ready environment. Through credit guarantees, concessional financing, political risk insurance, and sustainability-linked funding mechanisms, these institutions can help reduce investor exposure, incentivizing long-term, sustainable private capital flows into Bhutan's high-value, low-impact tourism sector.

PREPARATORY STUDIES, RESEARCH AND DEVELOPMENT, ASSESSMENTS AND MONITORING AND EVALUATION - LEVERAGING GRANTS AND READINESS RESOURCES FROM VERTICAL & CLIMATE FUNDS

Given that these projects focus on climate change adaptation/mitigation, disaster risk reduction, environmental protection, and ecosystem services, they qualify for preparatory funding (readiness resources) from institutions that support technical assistance, feasibility studies, pilot projects, and policy integration—prerequisites for larger grants or concessional loans.

Photo credit: Prayer bell near Tiger nest in Paro, Bhutan, June 2019 | aaron boris | Unsplash

Sustainable Water Resource Management Climate vulnerability/risk assessments for key water sectors; Guidelines for climate-resilient water infrastructure; and Emerging water-efficient technologies and water-based venture	Grants & technical assistance for climate-resilient infrastructure, vulnerability assessments, and policy development. **Funding sources:** • **Adaptation Fund** – Funds water efficiency technologies and climate-resilient water infrastructure and provides technical assistance for climate vulnerability and risk assessments. • **Global Water Partnership (GWP)** – Funds policy integration, feasibility studies, and best practices for water adaptation. Has funded climate resilience programs in South and Southeast Asia. • **Korea International Cooperation Agency (KOICA)** – Offers grants for water-efficient technologies and climate-resilient infrastructure.
Geohazard & Disaster Risk Assessments Landslide hazard assessments, inventories, deformation mapping; and Earthquake micro-hazard assessment, network maintenance	Readiness resources for hazard mapping, modeling, and risk analysis • **Global Facility for Disaster Reduction and Recovery (GFDRR)** – Supports early warning systems, landslide hazard assessments, and earthquake risk analysis and provides technical grants for hazard modeling and resilience planning. • **JICA Disaster Risk Reduction Program (Japan International Cooperation Agency)** - Offers grants and concessional loans for earthquake micro-zoning, hazard mapping, and disaster preparedness. JICA has a history of supporting geohazard research in the Himalayas and can expand its support to Bhutan. • **Asian Preparedness Partnership (APP)** – focuses on early-stage preparedness initiatives, including data-driven disaster management strategies. APP provides technical support for resilience modeling and emergency response planning.
Habitat/Protected Areas Conservation Habitat management in Protected Areas (conservation-focused)	Biodiversity and ecosystem-focused funding for protected area management • **Biodiversity Finance Initiative (BIOFIN)** – UNDP funds conservation planning, sustainable financing strategies for protected areas. Expand Engagements with this initiative. • **Arcadia Fund** – Climate & Conservation Grants Private philanthropic fund supporting habitat protection and sustainable tourism models. Arcadia Fund works with governments to fund biodiversity conservation and nature-based solutions. • **The Nature Conservancy (TNC)** – Asia-Pacific conservation finance. TNC offers blended finance and grants for ecosystem restoration and sustainable land use. It has active projects in Indonesia, the Philippines, and Vietnam.



Disaster Management & Contingency Plan Already includes hazard mapping and stockpiling; can be strengthened with green building standards, emphasis on renewable energy backup, and integrated climate hazard modeling.	Grants for green building standards, early warning systems, and renewable energy integration
Smart Card Systems, Bus Tracking, eRALIS/eZOTIN While not strictly climate projects, improved transport efficiency (e.g., route optimization, passenger load management) and digitization can reduce emissions indirectly and enhance overall sustainability.	Readiness funding for feasibility studies, transport digitization, and emissions reduction strategies • **Smart Cities Mission – Asia-Pacific (ADB & World Bank)** - Supports smart transport, e-government platforms, and green mobility solutions. Potential to fund Bhutan's bus tracking and Smart Card Systems to improve efficiency and reduce emissions. • **Google.org AI for Climate & Sustainability Grants** - Offers funding for digital climate monitoring tools and e-governance. It has funded transport digitization projects in India, Indonesia, and Malaysia). • **Mastercard's Center for Inclusive Growth – Smart Infrastructure Financing** - Invests in data-driven urban development solutions, such as digital payments for public transport. It has partnered with Asian governments for e-mobility and digitization projects.

6. SOCIAL SERVICES AND REGULATORY REFORM

These are public-good or social-sector projects with limited or no direct revenue model, making them less suitable for commercial finance. These projects are best funded through grants, highly concessional financing, strategic public-private partnerships (PPPs) and bilateral funding arrangements. The financial strategy outlined here identifies low-cost capital sources, international grant-making institutions, and philanthropic donors that align with Bhutan's development priorities.

a. Projects

Education and Health	• Inclusive infrastructure for Special Educational Needs (MoESD) • Disaster resilience for existing school infrastructure (MoESD) • Revamping school curriculum (MoESD) • STEM and digital resources (MoESD) • Strengthening school feeding/nutrition programs (MoESD) • Traditional Medicine (TM) center of excellence (MoH) • Biosecurity infrastructure for animal quarantine (MoH) • Pre-/post-market control of medical products (MoH)
Sports and Recreation (Bhutan Olympic Committee)	• National Sports Science Centre • Upgrading National Olympic Archery Centre • Multi-sports arena at Depsi
Specific Regulatory or Administrative Initiatives	• Transform Labour Administration" (MoICE) if not revenue-generating. • Strengthening safety/security at airports beyond normal user-fee scope.
Special Priority Common Public Expenditure (MoF)	• The large "9,637.00 million BTN" budget item for broad government programs.

b. Potential Grant-Making Institutions and Low-Cost Capital Options

EDUCATION & DIGITAL LEARNING (MOESD)		
FUNDING SOURCE	**FOCUS AREAS**	**GRANT TYPE**
Global Partnership for Education (GPE)	Curriculum reform, STEM, teacher training, disaster-resilient schools	Grants & technical assistance
Education Above All Foundation (Qatar)	Digital learning, inclusive education for Special Educational Needs (SEN)	Direct project funding

Asia Foundation – Digital Education Grants	STEM education, e-learning platforms, ICT in schools	Grants
Lego Foundation – Play-Based Learning	STEM education, innovation in curriculum design	Grants & partnerships
Global Schools Program (UN SDSN)	Sustainable curriculum development and digital resources	Technical assistance & grants

HEALTH & TRADITIONAL MEDICINE (MOH)		
FUNDING SOURCE	**FOCUS AREAS**	**GRANT TYPE**
Wellcome Trust – Health Research & Infrastructure	Traditional medicine research & Center of Excellence	Grants
Bill & Melinda Gates Foundation – Health Systems Grants	Biosecurity, medical product regulation	Technical assistance & direct funding
Global Fund – Health & Biosecurity	Infectious disease prevention, medical control programs	Grants
Asian Development Bank (ADB) Health Sector Fund	Public health infrastructure, medical regulation	Concessional finance
World Bank Pandemic Prevention Fund	Strengthening Bhutan's biosecurity infrastructure	Grants & loans
Rockefeller Foundation – Health Equity Grants	Strengthening traditional medicine and healthcare infrastructure	Grants

ADB and World Bank concessional loans for major health infrastructure needs while securing Global Fund and Gates Foundation grants for biosecurity and medical product regulation.

Photo credit: Punakha, Bhutan, October 2025 / Anil Sharma / Pexels

SPORTS & RECREATION (BHUTAN OLYMPIC COMMITTEE)		
FUNDING SOURCE	**FOCUS AREAS**	**GRANT TYPE**
International Olympic Committee (IOC) Solidarity Fund	National Olympic Archery Center upgrades, multi-sport arena	Grants
Laureus Sport for Good Foundation	Sports for development, youth engagement	Grants
FIFA Foundation	Multi-sport arena & football development in Bhutan	Infrastructure grants
Asian Football Confederation (AFC) Dream Asia Grants	Sports development in Bhutan	Direct project funding
Korea Sports Promotion Foundation (KSPO)	High-performance training and national sports centers	Grants & technical assistance
UNESCO – Sport for Development Program	Capacity-building and infrastructure	Grants

Engage IOC, FIFA Foundation, and UNESCO for direct grants, and secure technical partnerships with AFC and KSPO.

LABOUR & REGULATORY INITIATIVES (MOICE, MOF)		
FUNDING SOURCE	**FOCUS AREAS**	**GRANT TYPE**
ILO (International Labour Organization) Grants	Labour administration reform, workforce upskilling	Technical assistance & grants
World Bank Governance & Public Sector Grants	Public administration digitalization, labour market transformation	Grants
IMF Capacity Development Program	Financial governance and regulatory strengthening	Grants
ADB Governance & Institutional Strengthening	Labour policy reform, safety at airports	Concessional finance & grants

Smart Africa Secretariat (ITC)	Digital transformation of labour administration & e-government	Grants & partnerships

ILO and World Bank grants for regulatory modernization while securing ADB concessional funding for labour and public-sector infrastructure.

SPECIAL PRIORITY COMMON PUBLIC EXPENDITURE (MOF)		
FUNDING SOURCE	**FOCUS AREAS**	**GRANT TYPE**
EU Development Cooperation (Asia-Pacific Program)	Broad social sector financing, public expenditure management	Budget support & grants
Norwegian Development Fund	Institutional capacity-building and regulatory reform	Grants
United Nations Development Programme (UNDP)	Governance, e-government, fiscal reform	Technical assistance & grants
Swiss Agency for Development and Cooperation (SDC)	Fiscal transparency and public-sector governance	Grants
Islamic Development Bank (IsDB) Social Investment Fund	Public infrastructure for education, health, and governance	Concessional finance

Engage the EU, UNDP, and Norwegian Development Fund for broad social-sector financing, while leveraging IsDB concessional financing for infrastructure.

7. ENTREPRENEURSHIP INNOVATION AND RESEARCH AND DEVELOPMENT (R&D)

Bhutan's Entrepreneurship, Innovation R&D sector requires a diversified financial strategy that mobilizes grants, concessional financing, venture capital, impact investments, and industry partnerships. Given Bhutan's strategic push toward technology-driven agriculture, entrepreneurship, digital economy growth, alternative finance, and academic research, this strategy outlines financial mechanisms to support innovation ecosystems across key sectors.

Since commercial revenue models are still evolving across these fields, a blend of grant funding, research endowments, concessional finance, and venture-backed models will be leveraged.

INNOVATION & R&D

- Generate/promote new agriculture technologies (MoAL)
- Entrepreneurship development programs (MoICE)
- Support Over-the-Top (OTT) sector (MoICE)
- Alternate financial instruments for the private sector (CRA)
- Identification and registration of Geographical Indication (GI) products (MoICE)

UNIVERSITY-LED INITIATIVES

- Research centers (Royal University of Bhutan)
- Simulation-based medical teaching (KGUMSB)
- Specialized legal education centers (JSW School of Law)

a. Agricultural Innovation & Technology (MoAL)

FUNDING SOURCE	FOCUS AREAS	GRANT TYPE
Bill & Melinda Gates Foundation	Ag-tech R&D, farmer digital tools, market access	Grants
World Bank	Agri-tech solutions, sustainable irrigation	Concessional finance
Asia-Pacific Seed Alliance (APSA)	Improved seed research, biotechnology	Grants & technical assistance
International Fund for Agricultural Development (IFAD)	Digital farming solutions, smallholder technology integration	Grants & equity investments

Secure IFAD grants for agri-tech pilots, while using World Bank concessional finance for scaling successful technologies.

b. Entrepreneurship Development (MoICE)

FUNDING SOURCE	FOCUS AREAS	GRANT TYPE
Google for Startups – Asia Accelerator	Digital entrepreneurship, startup incubation	Equity-free grants
Alibaba Entrepreneurs Fund (Asia)	E-commerce, business digitalization	Seed funding
IFC – SME Growth Initiative	Alternative finance for startups	Concessional financing
UNDP's Youth Co:Lab (Asia-Pacific)	Entrepreneurship among youth, innovation in small businesses	Grants
Asian Venture Philanthropy Network (AVPN)	Impact investment for early-stage ventures	Grants & equity investments

Bhutan can develop a startup incubator fund, leveraging Google, Alibaba, and IFC-backed concessional loans to de-risk Bhutanese entrepreneurs.

c. University-Led Research & Development (Royal University of Bhutan, KGUMSB, JSW School of Law)

FUNDING SOURCE	FOCUS AREAS	GRANT TYPE
Horizon Europe Research Grants	University R&D, medical research, innovation	Research grants
Rockefeller Foundation – University Innovation Fund	R&D for sustainability, public policy research	Endowments
ADB Higher Education Grants	University research infrastructure	Grants
UNESCO – Knowledge & Innovation Fund	Science research, medical education	Grants
Microsoft AI for Science & Health Fund	AI-driven research in education, medical simulation	Grants

8. LARGE SCALE INFRASTRUCTURE

Large-scale infrastructure projects in Bhutan, such as hydropower projects, highways, airport expansions, industrial parks, and dry ports, require long-term capital, risk mitigation, and fiscal prudence. Given their high capital intensity, long gestation periods, and complex risk profile, these projects cannot be financed solely through public budgets or commercial loans without significant fiscal strain.

Instead, capital stacking, a structured approach that combines different funding sources at varying risk levels, offers a more cost-effective and sustainable financing model. This method strategically integrates multilateral finance, concessional loans, private equity, and risk mitigation tools to make projects bankable while attracting private sector investment.

MAJOR ROAD AND HIGHWAY IMPROVEMENTS (MOIT)

- Sunkosh–Dagana, Samtse–Tendu

AIRPORT EXPANSION/IMPROVEMENTS (MOIT)

- Paro International Airport expansion (terminals, cargo, apron)
- Bumthang and Yonphula Domestic Airport expansions/improvements
- Air navigation and safety/security upgrades for all airports

LARGE-SCALE INDUSTRIAL INFRASTRUCTURE (MOICE)

- Development and maintenance of large industrial parks
- Samtse Dry Port

Capital Stacking for Bhutan's Infrastructure Development

FUNDING SOURCE	APPLICATION TO BHUTAN'S INFRASTRUCTURE	ROLE IN CAPITAL STACK
Government Budget & Public Capital	Initial investment, land acquisition, regulatory oversight	Equity / project initiator

Multilateral Development Banks (MDBs) – ADB, World Bank, AIIB	Low-cost, long-term funding for transport & industrial infrastructure	Concessional loans & grants
Private Sector (PPP & Commercial Investors)	Invest in commercially viable components (e.g., toll roads, dry ports)	Equity & debts
Development Finance Institutions (DFIs) – IFC, EIB, AIIB	Risk mitigation and loan enhancement for private investors	Guarantees & blended finance
Export Credit Agencies (ECAs) – US EXIM, JBIC, Sinosure	Finance for large equipment purchases, construction contracts	Debt finance & insurance
Sovereign Wealth & Infrastructure Funds	Strategic investments in industrial zones and dry ports	Equity investment
Green & Sustainability-Linked Bonds	Infrastructure linked to climate resilience, energy efficiency, or sustainability goals	Low-cost debt

This approach ensures that no single source bears excessive risk, while unlocking private sector participation and concessional finance

The following sovereign wealth funds (SWFs) and infrastructure funds have demonstrated interest in investing in large-scale infrastructure projects in emerging markets:

1. **GIC Private Limited (Singapore):** GIC is a global long-term investor that has been actively involved in infrastructure projects across Asia. Their substantial investments in the region highlight their commitment to infrastructure development.

2. **Indonesia Investment Authority (INA):** INA, Indonesia's sovereign wealth fund, has invested in significant infrastructure projects, such as the Trans Sumatra Toll Roads. This investment underscores their focus on enhancing economic potential through infrastructure development.

3. **Abu Dhabi Investment Authority (ADIA):** ADIA has partnered with other investors to fund infrastructure projects in emerging markets. Their involvement in platforms investing in toll roads in Indonesia exemplifies their strategic approach to infrastructure investments.

4. **Global Infrastructure Partners (GIP):** GIP specializes in investing in large-scale infrastructure assets worldwide. Their expertise in sectors like energy, transport, and water positions them as a potential partner for infrastructure projects in Bhutan.

5. **Asian Infrastructure Investment Bank (AIIB):** While not a sovereign wealth fund, AIIB collaborates with SWFs to channel resources into infrastructure projects. AIIB's partnerships with SWFs in multiple projects demonstrate its role in facilitating infrastructure investments in Asia.

6. **Temasek Holdings (Singapore):** Temasek has shown interest in sectors like education technology and infrastructure, investing in markets such as India. Their focus on predictable cash flows and lower volatility makes infrastructure projects appealing to them.

Photo credit: Aerial view of Thimpu, Bhutan, August 2021 | Passang Tobgay | Unsplash

XI
GLOSSARY

Photo credit: Black-necked Crane Festival in Phobjikha, Wangduephodrang, Bhutan, September 2022 | Pema Gyamtsho | Unsplash

TERM	DEFINITION
Additional Investment in Adaptation	The annual investment required for the implementation of adaptation ambitions.
Additional Real Investment in Transition	The additional annual investment required for implementing transition ambitions compared to the baseline.
Annual CO_2e Emissions	The total greenhouse gas (GHG) emissions emitted annually across all IPCC categories.
Annual Public Transition and Adaptation Investment	The share of transition and adaptation investments by the public sector, including power generation infrastructure, flood-proofing buildings, waste management, EV charging networks, urban greening, and electric buses.
Benefit-to-Cost Ratio (BCR)	Calculated by dividing avoided costs and added benefits by total investment, O&M, and loss and damage payments. A value above 1 indicates a net positive return per dollar invested.
Carbon Credit Revenues from Energy Exports	The value of carbon credits generated from energy exports, calculated by multiplying tons avoided by the price per ton.
Carbon Credit Revenues from Mangrove Restoration	Revenue generated from carbon credits based on the increase in carbon stock from converting one hectare of land to mangroves.
Carbon Credit Revenues from Reforestation	Revenue generated from carbon credits based on the increase in carbon stock from reforesting one hectare of barren land.
Cropland	The total agricultural land used for crop production.
Cumulative Damages from Climate Change	The total financial damages resulting from climate change impacts over a defined period.
Cumulative Net Savings from Energy Efficiency	The total energy savings achieved through energy efficiency measures, calculated cumulatively.
Disposable Income Index Relative to 2022	An index measuring real disposable income relative to the base year of 2022.
Energy Affordability Index	The ratio of disposable income index to the energy bill index, indicating affordability of energy relative to income.
PM2.5 Emissions Index	An index measuring the death rate due to ambient air pollution from fine particulate matter.

PM2.5 Emissions from Energy and Power	Total PM2.5 emissions from final energy consumption and power generation fuel use.
Percentage of Population Below Poverty Line	The share of the total population living below the poverty line.
Population Below Poverty Line	The total number of people living below the poverty line.
Power Generation Capacity	The total installed power generation capacity in megawatts (MW) at the national level.
Private Savings Index	An index of private savings relative to the base year.
Private Transition and Adaptation Investment	The share of transition and adaptation investments by the private sector, including EVs, sustainable agriculture practices, and carbon capture technologies.
Real GDP	The Gross Domestic Product adjusted for inflation, measured in constant terms.
Real GDP Growth Rate	The annual percentage change in real GDP.
Real Disposable Income per Capita	The total disposable income divided by the population, adjusted for inflation.
Relative Cardiovascular Disease Risk (Physical Activity)	The change in cardiovascular disease risk associated with a shift towards non-motorized transport.
Relative Diabetes Risk (Physical Activity)	The change in diabetes risk associated with a shift towards non-motorized transport.
Relative Energy Efficiency	An index indicating the development of energy efficiency over time relative to the base year.
Services Capital Index	An index measuring the change in total services capital relative to the base year.
Taxes on Income and Profits	The total taxes paid by private individuals and corporations on income and profits.
Total Annual Deaths from Ambient Air Pollution	The total number of deaths annually caused by ambient and indoor air pollution.

Total Avoided Cost	Tangible and intangible costs avoided by implementing adaptation and mitigation measures, calculated cumulatively and discounted over a specific period.
Total Cumulative Deaths from Air Pollution	The total number of deaths from ambient and indoor air pollution since 2016.
Total Employment	The total number of jobs across all sectors, including green jobs.
Total Employment Index	An index measuring changes in total employment relative to the base year.
Total Government Revenue	The total annual revenue generated by the government from taxes, grants, and other sources.
Total Investment Required	The cumulative investment, O&M costs, and loss and damage payments required for transition and adaptation interventions, discounted over a defined period.
Total Real Investment in Transition and Adaptation	The total cumulative investment required for implementing transition and adaptation measures.
Total Tax from Goods and Services	Government revenue from taxes on goods and services, including VAT and energy tax.
Total Value of Carbon Credits	The total revenue from carbon credits generated through energy exports, mangrove restoration, and reforestation.
Trade Balance	The difference between total exports and imports.
Trade Balance (as Share of GDP)	The trade balance expressed as a percentage of GDP.
Unemployment Rate	The percentage of the total population that is unemployed across all sectors, including green jobs.
Unit Cost of Energy Consumed	The average cost per terajoule (TJ) of final energy consumed, calculated by dividing the total energy bill by total final energy consumption.

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Photo credit: Woman carrying bundles of rice straws with her little son at Punakha, Bhutan, November 2012 | Wantanee Chantasilp | Shutterstock

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