

GOVERNMENT
OF
JAMAICA



2050 Long-term Emission Reduction and Climate Resilient Strategy for Jamaica



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MINISTRY OF ECONOMIC GROWTH
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List of Abbreviations and Acronyms

2050PP	2050 Pathways Platform
ACE	Action for Climate Empowerment
ACP	Agricultural Competitiveness Programme
AdCom	Adaptation Communication
AF	Adaptation Fund
AFOLU	Agriculture Forestry and Other Land Use
ALL ACT	Alliance for Locally Led Approaches for Transformative Action on Loss and Damage
AOSIS	Alliance of Small Island States
BAU	Business-As-Usual
BEV	Battery Electric Vehicles
BOJ	Bank of Jamaica
BSJ	Bureau of Standards Jamaica
CA	Climate Analytics
CAEP	Climate Action Enhancement Package
	CARICOM Caribbean Community
CCAB	Climate Change Advisory Board
CCD	Climate Change Division
CCFPN	Climate Change Focal Point Network
CCFPs	Climate Change Focal Points
CCPF	Climate Change Policy Framework
CCREEE	Caribbean Centre for Renewable Energy and Energy Efficiency
CCS	Carbon Capture and Storage
CDEMA	Caribbean Disaster Emergency Management Agency
CFL	Compact Fluorescent Lamp
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPF	Country Programming Framework
CSA	Climate Smart Agriculture
CSP	Concentrating Solar Power
CTO	Caribbean Tourism Organization
DBJ	Development Bank of Jamaica
DRF	Disaster Risk Financing
ECLAC	Economic Commission for Latin America and the Caribbean
EDA	Enhanced Direct Access
EECP	Energy Efficiency and Conservation Project
ERP	Economic Reform Programme
EPOC	Economic Programme Oversight Committee
EV	Electric Vehicle
EWS	Early Warning Systems
FAO	Food and Agriculture Organization to the United Nations
GCCSAP	Gender and Climate Change Strategy and Action Plan

List of Abbreviations and Acronyms

GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GHGMI	Greenhouse Gas Management Institute
GOJ	Government Of Jamaica
GRSF	Global Road and Safety Facility
GW	Gigawatt
GWh	Gigawatt Hours
ha	Hectare
HFO	Heavy Fuel Oil
HRRACC	Hazard Risk Reduction and Adaptation to Climate Change
ICAO	International Civil Aviation Organization
ICCAD	International Centre for Climate Change and Development
ICEV	Internal Combustion Engine Vehicles
ICRI	International Coral Reef Initiative
IDB	Inter-American Development Bank
IEA	International Energy Agency
IIED	International Institute of Environment and Development
IKI	German Government International Climate Initiative
ILO	International Labour Organization
IMF	International Monetary Fund
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IRP	Integrated Resource Plan
ITMO	Internationally Transferred Mitigation Outcomes
Ja-NAP	Jamaica's National Adaptation Plan
JAS	Jamaica Agricultural Society
J-SRAT	Jamaica Systemic Risk Assessment Tool
JB I	Jamaica Bauxite Institute
JCNS	Jamaica's National Cooling Strategy
JIS	Jamaica Information Service
JNBC	Jamaican National Building Code
J-COOL	Jamaica - Caribbean Cooling Initiative
JPS	Jamaica Public Service
JRC	Jamaica Railway Corporation
JUTC	Jamaica Urban Transit Company
KPI	Key Performance Indicator
L&D	Loss and Damage

List of Abbreviations and Acronyms

LEAP	Low-Emissions Analysis Platform
LEAP	Long-range Energy Alternatives Planning System
LED	Light Emitting Diode
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land-Use Change and Forestry
LTS	Long-Term Strategy
MCA	Multi-Criteria Analysis
MEGJC	Ministry of Economic Growth and Job Creation
MoAF	Ministry of Agriculture and Fisheries
MoF&PS	Ministry of Finance and Public Service
MoHW	Ministry of Health and Wellness
MPA	Marine Protected Area
MSET	Ministry of Science, Energy and Technology
MtCO₂e	Million Tonnes of carbon dioxide equivalent
MRV	Measuring Reporting and Verification
MTF	Medium-Term Socio-Economic Framework
MW	Megawatt
NAP	National Adaptation Plan
NbS	Nature-based Solution
NCD	Non-Communicable Disease
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NDRF	Natural Disaster Reserve Fund
NEAP	National Environment and Action Plan
NEFCO	Nordic Environment Finance Cooperation
NEP	National Energy Policy
NEPA	National Environment and Planning Authority
NFMCP	National Forest Management and Conservation Plan
NICA	Nordic Initiative for Cooperative Agreements
NMEP	National Monitoring and Evaluation Plan
NREL	National Renewable Energy Laboratory
NSDMB	National Spatial Data Management Branch
NSMP	National Squatter Management Policy
NSWMA	National Solid Waste Management Authority
OECD	Organisation for Economic Cooperation and Development
ODPEM	Office of Disaster Preparedness and Emergency Management
OPM	Office of the Prime Minister
PA	Paris Agreement
PATH	Programme of Advancement Through Health and Education

List of Abbreviations and Acronyms

PIAB	Public Investment Appraisal Branch
PIMS	Public Investment Management System
PIOJ	Planning Institute of Jamaica
PMERS	Performance, Monitoring, Evaluation and Reporting System
PPCR	Pilot Programme for Climate Resilience
PPP	Public-Private Partnership
PSOJ	Private Sector Organisation of Jamaica
RBM	Results-based Management
RBP	Results-based Payment
R&D	Research and Development
RE	Renewable Energy
REDD+	Reducing emissions from deforestation and forest degradation +
RSF	Resilience and Sustainability Facility
SDGs	Sustainable Development Goals
SCFA	Sustainable Fishery Conservation Areas
SEI	Stockholm Environment Institute
SIDS	Small Island Developing States
SLR	Sea Level Rise
SMART	Specific, Measurable, Achievable, Relevant and Time-bound
SRAT	Systemic Risk Assessment Tool
STATIN	Statistical Institute of Jamaica
SWOT	Strengths, Weaknesses, Opportunities and Threats
TAPs	Technology Action Plans
T&D	Transmission and Distribution
TNA	Technology Needs Assessment
TNC	Jamaica's Third National Communication to the UNFCCC
TWGs	Thematic Working Groups
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UTech, Ja.	University of Technology, Jamaica
UWI	University of the West Indies
WB	World Bank
WHO	World Health Organization
WIM	Warsaw International Mechanism
WRA	Water Resources Authority

Summary

As a vulnerable Small Island Developing State (SIDS), Jamaica is acutely aware of the dangers presented by climate change. Jamaica has experienced first-hand the damage that comes with hurricanes and extreme weather events. Jamaica is also committed to supporting the Paris Agreement goal of limiting warming to 1.5°C above pre-industrial temperatures.

Jamaica was the first Caribbean country to submit its Updated Nationally Determined Contributions (NDCs) in 2020, and the eleventh nation globally to meet its commitments to share this plan to reduce carbon emissions by 2030, in keeping with the Paris Agreement.

Building on these efforts, Jamaica has taken steps to develop a “2050 Long-Term Emissions Reduction and Climate-Resilient Strategy” (LTS) in line with the expectations laid out in the Paris Agreement’s Article 4 Paragraph 19. Shortly after the submission of Jamaica’s updated NDCs in 2020, work for the preparation of the LTS began, with long-term scenario analyses and the establishment of a committee to oversee the process of developing said strategy.

Jamaica has a robust policy framework that supports the achievement of the LTS vision of sustainable, resilient, and low-carbon development:

- Vision 2030 Jamaica outlines the country’s long-term national development plan to guide the country in achieving its sustainable development and prosperity goals by 2030;
- The Medium Term Socio-Economic Policy Framework (MTF) provides strategic direction for the implementation of Vision 2030 three years at a time;
- The Climate Change Policy Framework (CCPF), first adopted in 2015 and updated in 2021, outlines governance arrangements, objectives, goals, principles, and strategies for the country to respond effectively to the impacts and challenges of climate change through measures in several priority areas;
- The National Energy Policy (NEP) was adopted in 2009 and is intended to run through 2030. The NEP establishes the way forward to achieve a modern, efficient and environmentally sustainable energy sector for the country, relying on a set of sub-policies to achieve its intended goal. The NEP is currently undergoing an update process.

Jamaica is also at present undergoing the process to undertake the development of the country’s National Adaptation Plan (NAP). This process is being spearheaded by the Planning Institute of Jamaica (PIOJ).

Previous analytical efforts have assessed potential mitigation and adaptation pathways for Jamaica, finding that achieving national objectives of reducing emissions and improving resilience will require substantial, concerted efforts across a range of sectors. These actions, necessary for achieving the already agreed-to targets in the updated NDC and critical to unlocking further long-term ambition, will represent a significant increase in pace and scale relative to the climate change mitigation and adaptation action that has occurred to date in the country.

Jamaica's low-carbon and resilient development will take a people-centric, sustainable approach, demonstrating leadership in the Caribbean's low-carbon transformation and providing a model that supports quality livelihoods, improved well-being, and health, benefitting Jamaicans and the region alike.

By 2050, Jamaica aspires to reduce significantly its greenhouse gas emissions in line with efforts to limit increases in global warming to less than 1.5 degrees Celsius above pre-industrial levels while building its resilience to the effects of climate change impacts.

Jamaica intends to undertake broad mitigation efforts, across the economy, reducing emissions 73% below 2020 levels (7.25 MtCO₂e) by 2050¹. Jamaica will aim to achieve net zero emissions by 2060.

This ambitious target will be accomplished through transformative actions undertaken in different sectors, including electricity, transport, buildings, industry, land use change and forestry, agriculture, and waste management. The sectoral plans include transitioning to renewable energy sources, implementing energy-efficient technologies, improving urban planning and transportation systems, enhancing building energy efficiency, adopting sustainable forestry and agricultural practices, and implementing waste reduction programmes. Table 1 summarises the main mitigation targets for each sector. Collectively, these measures will play a pivotal role in addressing climate change and curbing greenhouse gas emissions to achieve a more sustainable and resilient future.

¹ Estimates are based on the report prepared by a team of experts from the World Bank and Vivid Economics, with significant contribution from Jamaica's Ministry of Economic Growth and Job Creation and the Climate Change Division. It is important to note that these estimates are subject to potential revisions in the future after analysing modelling exercises and alignment with current updated NDC estimates.

Table 1*LTS Mitigation Milestones*

DATE	MILESTONE
2025	Electricity ☀️ Generate 27% of electricity from renewable sources ⚡ Limit transmission and distribution T&D system losses to no more than 25%
	Transport 🚗 8% share of private vehicle fleet is electric 🚍 10% share of public vehicle fleet is electric
	Industry 🏭 Reduce clinker-to-cement ratio to 82% (95% in 2014)
2030	Electricity ☀️ Generate 50% of electricity from renewable sources ⚡ Limit (T&D) system losses to no more than 21%
	Transport 🚗 Improve fuel efficiency of current vehicle fleet (passenger and freight) by 15% relative to 2020 levels 🚗 12% share of private vehicle fleet is electric 🚍 16% share of public vehicle fleet is electric
	Buildings 🏠 Increase the share of households with solar water-heating by at least 60% 💡 Replace 100% of electric lighting in residential buildings with LED lamps 🏫 Convert 100% of schools and hospitals from T12 (fluorescent) to T8 (LED technology) lamps 🏢 Replace 100% of public and commercial buildings with LED equivalent
	Industry 🏭 Reduce fuel consumption for alumina production by 25% relative to 2020 levels 🏭 Reduce clinker-to-cement ratio to 70%
	Forestry 🌲 Increase forest cover by 5% relative to 2020 levels 🌲 Reduce deforestation and forest degradation rates by 30% relative to 2020 levels
	Agriculture 🐄 Reduce 14% of livestock emissions through sustainable land-use management relative to 2020 levels 🐄 Reduce 20% of ruminant animal methane emissions by improved livestock management relative to 2020 levels

DATE	MILESTONE
2035	Electricity - Generate at least 65% of electricity from renewable sources - Reduce T&D system losses to no more than 17% - Fully phase out 100% Heavy Fuel Oil capacity
	Buildings: Replace wood, kerosene, and charcoal stoves with more sustainable option stoves
2040	Electricity - Generate at least 90% of electricity from renewable sources - Reduce T&D system losses to ensure that they do not exceed 14% - Phase out 100% of fossil fuel generation
	Transport Deploy at least 2,000 electric buses
	Industry Reduce share of coal for cement production from 89% in 2020 to 83% using recycled materials or biomass
2045	Electricity - Generate at least 95% of electricity from renewable sources - Reduce T&D system losses to no more than 11%
2050	Electricity - Generate 100% of electricity from renewable sources - Reduce T&D system losses to ensure that they do not exceed 11%
	Transport - Increase share of electric vehicles in Jamaica's passenger fleet to at least 67% - Reduce trucks' fuel consumption by 40% relative to 2020 levels through efficiency improvements
	Buildings - Phase out new LPG cookers, and reduce LPG use to 10% of 2020 levels - Increase the share of households with solar water-heating by at least 85% - Increase the share of low-carbon materials for the construction of new residential buildings to at least 50%
	Industry Reduce sectoral energy intensity by 15% relative to 2020 levels
	Forestry - Maintain 'No-net-loss' forest cover plus additional 3% of land covered by forest compared to 2020 levels - Increase mangrove cover by 4,000 ha - Increase forest cover by 150 ha/year
	Agriculture Deploy silvopastoral solutions with agroforestry on 10% of the total cropland with at least 27ktCO₂e annual sequestration

Improving resilience to climate impacts is a high priority for Jamaica and actions will be planned across the economy and society. These include:

- Intentional planning for more sustainable tourism
- Improving resilience of most vulnerable human settlements
- Identifying and addressing risks for critical infrastructure (water, transport, energy, etc.)
- Adopting climate-resilient crops and practices
- Protecting vulnerable ecosystems
- Monitoring and managing threats to coastal areas
- Building the health sector capacity to deliver robust health services that effectively respond to climate change risks and potential impacts and proactively ensuring the well-being of communities.

While these represent key identified areas of vulnerability where action will be taken, Jamaica is currently in the process of developing a National Adaptation Plan, which will provide further details on the country's efforts to improve resilience.

Even with investments in adaptation, Jamaica will not be able to avoid all the negative consequences of climate change, resulting in unavoidable Loss and Damage (L&D). L&D can be economic, such as reduced economic growth and productivity or economic impacts to national assets and services. It can also be non-economic: losses and damages can affect intangible assets such as Jamaica's cultural heritage and ancestral indigenous knowledge. Jamaica will prioritise key vulnerable sectors at the forefront of experiencing impacts of climate change, beyond the limits of adaptation: critical infrastructure and human settlements; agricultural sector and food security; and Jamaica's cultural heritage. Jamaica will expand its understanding of loss and damage finance to operationalise it, separately from disaster risk finance, and create an institutional framework that ensures synergies between the two.

The transition to a low-carbon economy will also have an impact on the labour force in the country, particularly those working in fossil fuel-dependent industries. Jamaica is committed to finding ways to transition in a fair and equitable way for all workers. This will be done through extensive stakeholder engagement and social dialogue to capture the needs of the workers first hand while looking for opportunities to create decent employment conditions, promote acquiring or developing new or updated skills, and enhancing social protection.

The transition will also support Jamaica's efforts to achieve sustainable development. Reduced burning of fossil fuels will improve air quality and human health, in addition to limiting the country's exposure to volatile international energy markets. Improved agricultural practices will increase food security and the productivity of ecosystem services.

Successful achievement of Jamaica's low-carbon and resilient vision will require access to the latest technologies for mitigation and adaptation. Jamaica has conducted a Technology Needs Assessment (TNA) and developed accompanying Technology Action Plans (TAPs) for Energy, Water and Coastal Resources. Following the TAPs will put the country on the right path for the technological transition in these sectors. Innovation is a near certainty and Jamaica will continue to monitor the landscape to identify where new technologies can support the country's transition.

Access to financial resources will be critical to the successful implementation of the LTS. It has been estimated that the LTS mitigation actions will cost approximately USD 5 billion, while the adaptation costs will be USD 1 billion for the period between 2023 to 2050. This will require mobilisation of a range of sources: public domestic sources, such as with national budgetary allocations; international public sources, such as bilateral and multilateral funds such as the Green Climate Fund (GCF); and private finance from domestic or international companies.

To achieve sustainable, just, and equitable outcomes, the LTS needs to be gender-sensitive and responsive. The impacts of climate change are not gender-blind, and the responses need to integrate gender inclusive and equitable principles to adequately respond to the needs of all members of society and empower those that are underrepresented. In implementation planning, vulnerability and needs assessments, and capacity-building activities will be gender responsive. Participation in climate-related decision making will have gender-equitable inclusion to ensure that men and women are represented in sectors where they are respectively underrepresented. Benefits from climate action and access to climate finance will be gender-responsive and consider gender especially in evaluating financial needs and allocating of resources.

National institutions will need sufficient capacity to undertake LTS implementation and tracking efforts. Much of the responsibility will fall under the cabinet-appointed LTS Committee. Enhancing the committee's capacity and provide robust institutional support is essential to the successful achievement of Jamaica's long-term climate goals. Equally important is ensuring that the committee is aware of the responsibilities of each of its members.

Jamaica will work to ensure the emergence of an active, engaged, and skilled society that participates in climate action, has equitable access to information, training, and capacity-building, and makes meaningful contributions to creating a sustainable and low-carbon future. By so doing, citizens will better understand climate change, how it affects them, and how they can be skilled and empowered to be active participants in climate action and the just transition.

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1

A Long-term Strategy for Jamaica



1 | A Long-term Strategy for Jamaica

Jamaica recognises the threat of climate change, its devastating effects, and the urgency to act against it. As a vulnerable Small Island Developing State (SIDS), Jamaica is acutely aware of the dangers presented by climate change. Jamaica has experienced first hand the damage that comes with hurricanes and extreme weather events. As a small island, Jamaica faces threats from sea level rise and erosion. Jamaicans have also experienced long periods of drought and are aware that these kinds of incidents may become more frequent in the future.

Jamaica recognizes that climate change poses a collective challenge to the global community, irrespective of the minimal impact its national emissions have had on global warming. Jamaica actively engages in the international climate negotiations, and was the first Caribbean country, and eleventh country globally, to submit its Updated NDC in 2020, in keeping with the Paris Agreement. The Paris Agreement (PA) states that “All Parties should strive to formulate and communicate long-term-low greenhouse gas emissions development strategies mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities in the light of different national circumstances” (UNFCCC, 2015).

Jamaica’s Long-term Strategy (LTS) aims to expand the country’s climate ambition based on its current work in terms of its updated Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) complying with the Paris Agreement (PA) as a signatory party. Jamaica’s LTS will also contribute to the country’s Vision 2030 development planning process by guiding the expansion of the country’s climate and development ambition to mid-century.

1.1 What is an LTS, and why produce one?

A **long-term low-emission development strategy, or Long-term Strategy** for short, is a comprehensive and integrated plan, holistic in nature that outlines a country’s 1.5°C compatible pathway towards a sustainable, low-carbon economy. The LTS considers national circumstances and strives to promote economic growth and address social and environmental challenges.

An LTS should therefore aim to address all key sectors of the economy, should be quantifiable, and define short-, medium- and long-term milestones. The LTS can and should be updated

and refined over time to reflect the best available science, new or updated technology developments and the evolving nature of national and international circumstances.

An LTS can play an important role in driving the alignment of NDCs and near-term action with longer-term Paris Agreement goals. The longer-term perspective of an LTS allows for discussion on larger-scale transformational changes needed for a sustainable and equitable Just Transition by integrating and accommodating interactions, synergies, and trade-offs between different sectoral approaches that can be aligned with national development priorities.

Furthermore, by complementing the setting of a country's short-term targets, longer-term planning can come with a range of benefits. A longer-term perspective can help achieve low-cost and efficient decarbonisation while avoiding "lock-in" of technologies which can reduce emissions in the short term, but are incompatible with full decarbonisation. An LTS can communicate a "direction of travel" to potential investors and donors, demonstrating how the country intends to decarbonise and contribute to the global energy transition. Additionally, it can assist in policymaking and future target setting by establishing specific targets and objectives that can serve as guideposts for public policy development (CA, 2022).

1.2 Jamaica's LTS perspective

Jamaica's LTS will outline a pathway to achieve low-carbon and climate-resilient development over the next several decades. It will aim to bring together the goals of Vision 2030 Jamaica with the updated NDC while expanding climate ambition towards 2050 following a 1.5°C compatible pathway.

An LTS is critical to putting Jamaica on a pathway to long-term sustainable growth and demonstrating its contribution to global climate change efforts. **Without policy interventions**, Jamaica may reverse its progress made to date, and **emissions could grow by 50% between 2020 and 2050** (Vivid Economics & WB, 2021a). As a Small Island Developing State (SIDS), Jamaica is vulnerable to climate impacts and will require significant economy-wide resilience-building efforts to mitigate and adapt to the effects of climate change.

1.3 Jamaica's LTS development process

The Climate Change Division (CCD) in the Ministry of Economic Growth and Job Creation (MEGJC), and the Planning Institute of Jamaica (PIOJ) have led the process of LTS development as co-chairs of the Cabinet-mandated multistakeholder committee (LTS Committee) tasked with the development of the 2050 Long-Term Emissions Reduction and Climate-Resilient Strategy for Jamaica. This committee is composed of a range of government ministries, departments and agencies, and key stakeholders such as the Private Sector Organisation of Jamaica. It has acted as the focal point for the discussion and consultations during the development process and served as a facilitator for the adoption and future operationalisation of Jamaica's LTS. The full membership of the LTS committee can be found in Annex 2.

The LTS has been informed by a wide range of literature. This includes key national development and climate policy documents along with a range of analytical work that has been completed over the past several years (see Box 1). These documents, produced through the NDC Partnership's Climate Action Enhancement Package (CAEP) draw together a range of technical inputs, from energy modelling, to costing, to capacity assessments, to research, and more, with a goal of informing Jamaica's long-term planning.

The bulk of the identified actions for mitigation and adaptation were drawn from the *Jamaica's long-term climate change strategy recommendations*, developed by Vivid Economics and the World Bank. For mitigation, this analysis conducted a scenario analysis,

using the Low Emissions Analysis Platform (LEAP). Further information on the assumptions and approach of this analysis can be found in Annex 1.

A review of good practices in LTS development was conducted to inform the development of the elements and structure of the LTS, which, in turn, assessed against the available information to identify gaps. These gaps were to be informed through engagement with key stakeholders.

Desk research was, in turn, complemented by a series of bilateral and group consultations, held both in-country and virtually. A list of these consultations can be found in Annex 3: Stakeholder Consultations. A draft of the document was shared and presented for public validation at a series of engagements across the island, held in June 2023. Participation in these validation sessions can be found in Annex 3.

BOX 1 | KEY ANALYTICAL INPUTS TO LTS

Climate Technology Centre Network and the Tropical Agricultural Research and Higher Education Centre (CATIE). 2021. Developing Jamaica's climate change research agenda. Copenhagen: CTCN/CATIE.

Commonwealth Secretariat. 2022. Socio-economic and financial implications assessment of climate change in Jamaica. "London: Commonwealth Secretariat.

GHG Management Institute (GHGMI) and Caribbean Cooperative MRV Hub. 2021. International carbon markets as an opportunity for financing mitigation activities in Jamaica. Washington: GHGMI.

GHG Management Institute (GHGMI) and Caribbean Cooperative MRV Hub. 2021. Assessing institutional capacity in Jamaica to implement the long-term low emissions and climate resilient strategy. Washington: GHGMI.

RMI. 2021. Costing and Financing Option Analysis for Jamaica's updated NDC implementation. Colorado: Rocky Mountain Institute.

Vivid Economics and the World Bank. 2021. Developing Jamaica's long-term strategy for low emission and climate resilient development. London: Vivid Economics.

Vivid Economics and the World Bank. 2021. Jamaica's long-term climate change strategy recommendations. London: Vivid Economics.

Source: (Vision 2030, 2009)

1.4 Overview of Jamaica's LTS

Jamaica's LTS aims to communicate where Jamaica is today and the direction of travel to mid-century low-emission and resilient development. [Section 2](#) lays out Jamaica's national circumstances, considering the socio-economic context, environmental context, and policy environment. [Section 3](#) contains Jamaica's vision for its transformation. [Section 4](#) addresses climate change mitigation – plans, targets, and sectoral actions intended to reduce the country's greenhouse gas emissions. [Section 5](#) focuses on how Jamaica will adapt to the inevitable impacts of climate change. However, even with adaptation, there will still be unavoidable climate impacts – these are addressed in [Section 6](#) on loss and damage. [Section 7](#) provides an overview of how LTS implementation will enable a just transition in Jamaica. [Section 8](#) highlights key co-benefits between the LTS and the sustainable development goals, and presents alignment with Vision 2030. [Section 9](#) considers the key requirements for implementation of this vision, including technology, institutional capacity needs, funding requirements, and engagement from the private sector. [Section 10](#) explores how the LTS embeds gender mainstreaming strategies to be gender inclusive. [Section 11](#) outlines a framework to enable action for climate empowerment through the LTS. Finally, [Section 12](#) looks at governance arrangements, while [Section 13](#) considers Monitoring and Evaluation arrangements for progress under this strategy.









National Circumstances



2 | National Circumstances

Jamaica is a Small Island Developing State (SIDS) and the third largest island in the Caribbean. The total area of Jamaica is estimated at 10,991 square kilometres, and the population at 2,827,695 persons (as of 2021) (WB, 2023). In 2013, the land was 40% covered by forest, 20% by mixed areas, and 20% by subsistence farming and cultivated areas; the remaining 20% included infrastructure, bauxite extraction, quarries, water bodies, bare land, and wetlands (Forestry Department, 2013).

2.1 Socio-economic Context

The Jamaican economy is characterised by a high dependency on the services sector which contributed almost 80% of the GDP in 2021, with activities including tourism, wholesale, retail trade, installation of machinery and equipment, finance, and business activities. The agriculture sector contributed around 8% of the 2021 GDP, and is primarily focused on sugarcane, bananas, and coffee, and is also an essential contributor to the economy. The mining and manufacturing sectors contributed approximately 10% to the 2021 GDP, and the principal products are bauxite, alumina, and cement (PIOJ, 2021b). The energy sector is highly dependent on Heavy-Fuel Oil (HFO) and Liquefied Natural Gas (LNG) for electricity production. Around 17% of the total capacity came from renewable energies in 2020 between solar PV, wind, and hydropower (CCREEE, 2020).

Jamaica is considered an upper middle-income country, with a Gross Domestic Product (GDP) per capita of USD 5,183.6 (WB, 2023). Historically, the country has faced several economic challenges, including low levels of economic growth, high unemployment rates at times when tourism is not

thriving (compared to the regional rate), and high levels of debt, with the debt-to-GDP ratio being over 100% from 2001 to 2020 (WB, 2023). The debt-to-GDP ratio has however, fallen back to pre-pandemic levels at 94% for the fiscal period 2021/22 thanks to efforts of the GOJ to decrease the debt burden following the implementation of an Economic Reform Programme (ERP) and in recent years unemployment has decreased significantly from almost 9% in 2020 to 6% in 2022 (IMF, 2023a).

Nevertheless, there are other economic challenges that had been exacerbated by the COVID-19 pandemic, which had a significant impact on several sectors, including the tourism industry. The effect of the post-COVID global lockdown caused a GDP contraction in Jamaica of -10% in 2020 (WB, 2023). From 2021 onwards, GDP rebounded to around 4% growth in 2021 and 5% in 2022 (ECLAC, 2022).

The economy is continuing a gradual recovery, supported by a rebound in tourism. As COVID waned, the authorities accelerated the reopening, and by mid-2022, stopover flight arrivals had rebounded to pre-crisis levels. The growth for 2023 is likely to be around 3.5% per cent, with GDP

close to pre-pandemic levels. However, the recovery has been hindered by a prolonged outage in one of the largest alumina plants in the country, as well as the effects of the negative terms of trade shock arising from the war in Ukraine, such as an increase in import prices for fossil fuels (IMF, 2023a).

In recent years, the Jamaican government has implemented economic reforms to improve the country's economic competitiveness and reduce debt. The Economic Reform Programme (ERP) included measures to achieve sustained economic growth and long-term development by reducing public debt, maintaining macroeconomic stability, facilitating job creation, and improving labour force productivity (MoF&PS, 2023). The Economic Programme Oversight Committee (EPOC) was established in 2013 to monitor the implementation of Jamaica's economic reform measures under its agreement with the International Monetary Fund (IMF) (EPOC, 2023).

The government continues to promote sustainable and inclusive development through the Medium-Term Socio-Economic Policy Framework (MTF), revised and published every 3 years, and aligned with Vision 2030 Jamaica. A description in more detail of the priorities and vision of the most recent MTF can be found in section 2.3.2.

2.2 Environmental and Climate Change Context

Jamaica is a climate-sensitive SIDS due to its location in the Caribbean Basin, topography, and geology. The country is highly vulnerable to climate variability and natural hazards, including tropical cyclones, floods, landslides, droughts, and earthquakes.

Apart from earthquakes, natural hazards have significantly impacted economic activities, human welfare, and natural resources in the last few decades.

Climate Change Risks

Jamaica has a high concentration of settlements, infrastructure, and economic activity along the coast. For example, over 60% of the country's population is in the coastal area, with key economic sectors (90% of its GDP) such as agriculture, fisheries, and tourism produced within its coastal zone. Jamaica continues to experience an increase in the frequency of natural events related to slow-onset climate change impacts, such as inclement weather conditions, tropical depressions, tropical storms, and hurricanes—primarily floods, droughts, and landslides—and between 1990 and 2020, Jamaica experienced US\$705 billion (bn) in total damage from extreme weather events (including 16 major hurricanes) and several flood events (UWI, 2022).

Sea level rise is already a problem on the coast and has increased the risks of coastal flooding. Increasing sea temperatures, overfishing, and coastal malpractices have already started eroding the coral in Montego Bay, which fell from a 50% average coral cover in 1970 to about 10% in 1990, representing an 80% decrease over two decades. More coral bleaching and erosion are expected to occur as sea temperature keeps rising, with additional effects such as blooms of Sargassum seaweed washing up on the beaches (UWI, 2021).

In 2004 hurricane Ivan caused damage and loss of an estimated 6% of Jamaica's GDP for the same year

(PIOJ, 2004), and in 2007 hurricane Dean caused damages and losses of around 3% of Jamaica's GDP for the same year (PIOJ, 2007). Hurricane Gustav in 2008 and Hurricane Nicole in 2010 caused total damages and losses of around 2% of Jamaica's GDP for the same year in each case (PIOJ, 2008, 2010a). The losses and damages were caused by flood events from the passage of the tropical storms Gustav and Nicole before they reached the hurricane category.²

Not only has infrastructure been damaged during extreme weather events, but there have also been impacts on other economic sectors, such as the availability of water resources, with estimates from the Water Resources Authority (WRA) that 10% of Jamaica's groundwater resources are lost annually to seawater intrusion (UWI, 2022), and impacts to agricultural production which fell

around 57% from an extreme drought period between 2014 and 2015. Droughts and other extreme weather events are expected to increase in frequency and duration as mean global temperatures keep increasing (Vivid Economics & WB, 2021a).

Vivid Economics estimated the damages from 1-in-100-year hazard events for several sectors in Jamaica for different scenarios with varying global average temperature increases by 2100. The results are shown in Table 2. The table shows that the damages from extreme weather events will more than double or even triple in some cases if the temperature rises over the 2°C threshold. The built environment will be the most impacted by the extreme weather events and hurricane winds will impact the most other sectors including tourism, agriculture, and infrastructure.

Table 2

Damages from 1-in-100-year Hazard Events (USD millions)

	Hurricane Winds			Fluvial Floods			Coastal Flooding		
	Today (2020)	2050 2.4°C scenario	2050 4.3°C scenario	Today (2020)	2050 2.4°C scenario	2050 4.3°C scenario	Today (2020)	2050 2.4°C scenario	2050 4.3°C scenario
Tourism	-	59.5	66.0	-	-	-	2.12	3.96	5.43
Built Environment	1,710	5,300	5,880	415	977	977	144	329	329
Agriculture	18.3	43.7	48.5	3.32	6.25	6.25	1.36	3.59	3.72
Infrastructure	-	165	183	-	31.9	3.19	7.33	21.2	21.8

Note:

Fluvial and coastal flooding damages are expressed as maximum damages at the parish level. Climate scenarios express temperature increase by 2100.

Source: (Vivid Economics & WB, 2021a)

² The original source provided the monetary values for losses and damages in USD, the percentage of GDP figures as calculated using the World Bank Data in current USD for each corresponding year. Data can be found in <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=JM>

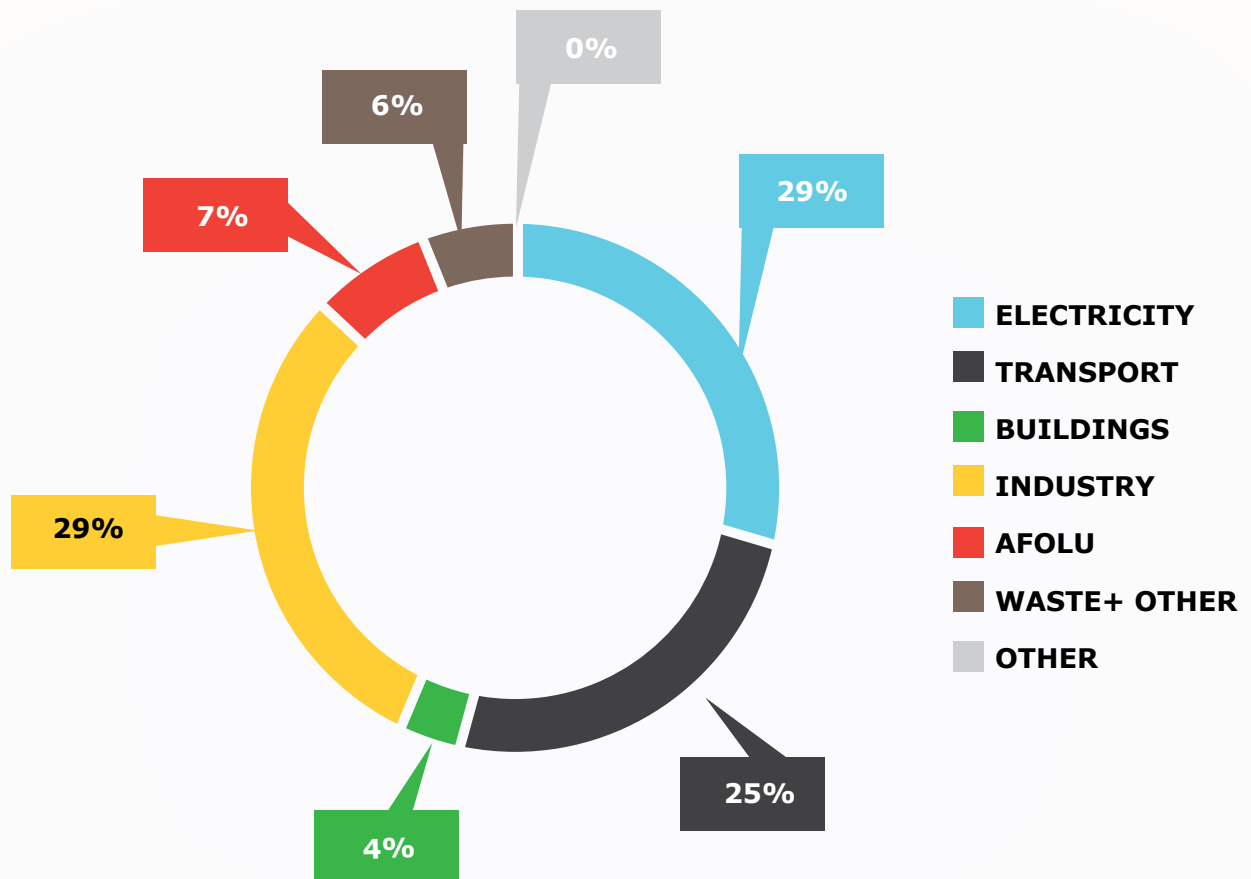
Jamaica's Emission Profile

In 2019, Jamaica's emissions were 10.15 MtCO₂e, with the industrial and electricity generation sectors contributing 58% of total emissions as shown in Figure 1. Industrial emissions, defined here as those from industrial processes, manufacturing, and construction sectors, contributed 30% of overall emissions. The emissions-intensive production of alumina and cement drives the sectoral emissions.

The second largest contributor to Jamaica's emissions is the electricity/heat sector, which contributed 29% of total emissions due to the prevalence of heavy fuel oil (HFO) in electricity generation. Transport emissions comprised 25% of total emissions, with the remaining emissions attributed to agriculture, waste, land use change, forestry, buildings, and other sectors (ClimateWatch Data, 2022a).

Figure 1

Jamaica 2019 Emission Profile



Source: (ClimateWatch Data, 2022b)

An emissions modelling projection using the Low Emissions Analysis Platform (LEAP) suggests that under a Business-As-Usual (BAU) scenario, emissions are expected to grow by 50% from 2020 to 2050. Without any climate policy interventions, emissions growth will be led by industrial production, electricity, and transport sectors. Economic growth is expected to increase emissions as there is an increase in industrial output, construction, electricity consumption and vehicle demand, while low-carbon technology deployment remains partial (UWI, 2022).

2.3 Key Climate and Development Policy Frameworks

Jamaica has robust policy frameworks governing development and climate change policy. The various policies that form this framework provide an overview of Jamaica's key issues concerning climate change and development, with commitments to align sustainable development with the United Nations (UN) Sustainable Development Goals (SDGs) while recognising the interdependence between economic growth, social development, and environmental sustainability. This commitment is reflected in Vision 2030 Jamaica, which sets out a roadmap for contributing towards the SDGs and to which other underlying policies are aligned, such as the updated Climate Change Policy Framework (CCPF) and the Medium Term Socio-Economic Policy Framework (MTF).

Climate policy is broadly governed by the Climate Change Policy Framework, which sets out roles, responsibilities, and objectives. Jamaica submitted an initial Nationally Determined Contribution (NDC) under the Paris Agreement and updated its NDC in 2020. It has subsequently developed an NDC implementation plan. Adaptation will be governed by the National Adaptation Plan (NAP), which is currently under development.

2.3.1 Vision 2030 Jamaica

Vision 2030 Jamaica is the country's long-term national development plan, approved in 2009, to guide the country in achieving its sustainable development and prosperity goals by 2030 to advance the achievement of developed country status. It outlines the national vision to make Jamaica the place of choice to live, work, raise families and do business. In 2017, Vision 2030 Jamaica was assessed vis-à-vis its alignment with the inclusive development paradigm of the United Nations Sustainable Development Goals (SDGs) and was determined to be over 90% aligned. The Vision 2030 Jamaica Secretariat, located within the Planning Institute of Jamaica (PIOJ), is responsible for the technical coordination, and monitoring and evaluation of the plan (UWI, 2022).

Vision 2030 Jamaica articulates long-term goals and a national strategic framework that informs sectoral policies and programming for Jamaica. There are four long-term national goals: Goal 1: Jamaicans are empowered to achieve their fullest potential; Goal 2: The Jamaican society is secure, cohesive, and just; Goal 3: Jamaica's economy is prosperous; and Goal 4: Jamaica has a healthy natural environment. The four national goals are associated with fifteen (15) mutually reinforcing national outcomes, which, in turn, are pursued through national strategies

guiding the national sectoral policies and programming to advance the SDGs (UWI, 2022).

Goals 3 and 4 of Vision 2030 address energy and climate, respectively. Energy issues are dealt with under Goal 3-Outcome 10 Energy Security and Efficiency, to be implemented through national strategies focusing on diversifying the energy supply and promoting energy efficiency and conservation. The goal aims to overcome Jamaica's dependence on (imported) fossil fuels in different sectors of the economy (transport, industry, and electricity generation), promote

energy efficiency and conservation, and establish a modern, competitive, efficient, and environmentally friendly energy sector.

Environmental, sustainability and climate issues are addressed by Goal 4-Outcomes —

- 13 Sustainable Management and Use of Environmental and Natural Resources;
- 14 Hazard Risk Reduction and Adaptation to Climate Change; and
- 15 Sustainable Urban and Rural Development (see Box 2).

BOX 2 | Vision 2030 and Climate

Outcome 13

Effective and proactive management of Jamaica environmental and natural resources and put sustainable environmental management at the basis for the success of economies and social systems.

- Integrate environmental issues in economic and social decision-making policies and processes
- Develop and implement mechanisms for biodiversity conservation and ecosystems management
- Develop efficient and effective governance structures for environmental management
- Manage all forms of waste effectively

Outcome 14

Comprehensive integrated approach to these issues in the broader context of mainstreaming of disaster management and climate change into socio-economic decision-making processes.

- Improve resilience to all forms of hazards
- Improve emergency response capability
- Develop measures to adapt to climate change
- Contribute to the effort to reduce the global rate of climate change

Outcome 15

Sustainable rural and urban development

- Create a comprehensive and efficient planning system
- Create an appropriate framework for sustainability planning
- Create sustainable urban centres, including urban renewal and upgrading
- Create vibrant and diversified rural areas
- Ensure safe, sanitary, and affordable shelter for all

Source: (Vision 2030, 2009)

As explained further below, several ministries and public and private authorities are involved in advancing the achievement of Goal 4. This results from the cross-cutting nature of the environmental and climate sectors and the synergies with the other three goals (UWI, 2022).

2.3.2 Medium Term Socio-Economic Policy Framework

The Medium Term Socio-Economic Policy Framework (MTF) provides strategic direction for three years at a time to progress the Vision 2030 goals. MTFs have aligned with the outcomes of Vision 2030 Jamaica and allow for short- and medium-term

prioritisation and operationalisation. Each MTF is developed based on the progress achieved during the previous cycle. The current MTF, 2021–2024, is the fifth 3-year period for advancing the implementation of Vision 2030 Jamaica. Given its holistic approach, Vision 2030 represents a crucial tool for achieving Jamaica's sustainable development and implementing the country's LTS (UWI, 2022).

The MTF 2021–2024 was the first one to be implemented in a post-COVID era. For its development, several improvements from lessons learned were incorporated in terms of strategic planning, representation of policy imperatives and results-based management (RBM) (PIOJ, 2022a).

The MTF 2021–2024 prioritises, among others, the following areas, which are also aligned with the four national goals of Vision 2030 Jamaica:

- The strengthening of the health system — primary health care, secondary and tertiary care; health promotion and infrastructure; health systems governance; sustainable development financing; environmental health; access to essential medicines; and disease surveillance, mitigation and risk reduction as well as the responsiveness of the health system to manage communicable diseases such as COVID-19 and non-communicable diseases (NCDs).
- Achieving equity and inclusion in access to a standards-based and outcome-driven world-class education and training system — improving the quality and access to certification; improving infrastructure, financing, and competencies for the delivery of quality education; and strengthening the integration of education and training in creating an agile workforce that easily transitions from school to work and is equipped to meet current and emerging labour market needs.
- Effective social protection for all against poverty and other forms of vulnerability throughout the life course as evidenced in COVID-19 where income and social insecurity can befall even those traditionally not considered vulnerable.
- Core and transformational values and institutions — including strong families; and cultural heritage, communities, and cultural and creative industries, which form the core of the Jamaican identity and cultural capital.
- Safety and security within homes, communities, across the country, at the borders and in territorial waters as well as cyberspace. Seize opportunities for building social capital and consensus around the rule of law juxtaposed against increased opportunities for domestic and other violence and abuse as well as transnational crime.

- Rights-based approaches to sustainable development towards cohesion, multi-dimensional justice, and democratic governance. This includes advancing gender equality and equity; an equitable, effective, and restorative justice system; and strengthening and coordinating national official data, statistical and information systems; government effectiveness and participatory local governance.
- Economic prosperity and inclusion, including maintaining hard-earned macro-economic stability; developing an enabling business environment towards maximising investment, job creation, and productive capacity; building and maintaining economic infrastructure; making the society technology-enabled; improving energy efficiency and security, and reducing unsustainable energy use and energy dependency; developing internationally competitive industry structures; and advancing sustainable consumption and production through development of the circular economy as well as green, blue, purple, and orange economies.
- Sustainable management and use of environmental and natural resources; hazard risk reduction and climate change adaptation; and sustainable urban and rural development, including spatial planning. This includes integrating climate proofing in policy and planning; waste management and reducing pollution; natural resources conservation and replenishment; and local sustainable development planning.

Through its oversight activities, the Vision 2030 Jamaica Secretariat ensures the alignment of the Vision 2030 strategies with the MTF both in the planning phase and when evaluating the initiative's outcomes. The Secretariat systematically monitors and reports on sectoral performance towards each of the 15 outcomes through the Thematic Working Groups (TWGs), which previously served to inform the development of Vision 2030 Jamaica and now support plan implementation and monitoring of performance and progress towards Vision 2030 (PIOJ, 2022a).

2.3.3 Updated Climate Change Policy Framework

The GOJ approved Jamaica's first Climate Change Policy Framework (CCPF) in 2015. It was updated in 2021 to include the country's obligations as a Party to the Paris Agreement. Jamaica's updated CCPF is also intended to support the goals and outcomes of Vision 2030 (GOJ, 2021b).

Based on this Policy Framework, Based on this Policy Framework, it is expected that the relevant sectors will develop or update, as appropriate, plans to address climate change adaptation and mitigation. In the development and implementation of sectoral climate

change adaptation and mitigation plans, the following principles are to be considered (GOJ, 2021b):

- Sustainable development
- A multi-sectoral approach to climate change
- Public participation and collaboration
- The precautionary approach
- Transparency and accountability
- Best available science
- The polluter pays principle
- Inter- and intra-generational equity
- Equality and non-discrimination

The updated CCPF outlines institutional arrangements to ensure coordination among sectors and effective implementation of climate initiatives through the Climate Change Division (CCD), the Climate Change Advisory Board (CCAB) and the Climate Change Focal Point Network (CCFPN). Each of these bodies has its role and responsibilities but shall act in a coordinated manner to ensure a multi-sectoral approach to climate change monitoring, knowledge sharing, and cooperation among the sectors (UWI, 2022).

BOX 3

UPDATED CLIMATE CHANGE POLICY FRAMEWORK OBJECTIVES

Objectives of the updated CCPF

The objectives of the CCPF are:

Goal 1: Strengthening of Jamaica's adaptive capacity and resilience to reduce its vulnerability to climate change through:

- 1.1 Governance
- 1.2 Adaptation

Goal 2: Pursuit low-carbon development and enhancement of access to mobilisation of climate finance for:

- 2.1 Mitigation
- 2.2 Access and mobilisation of Climate Finance

Goal 3: Promotion of public education and awareness raising, research and technology transfer towards ambitious climate action through:

- 3.1 Public Awareness and Education
- 3.2 Research
- 3.3 Technology Transfer

Source: (GOJ, 2021b)

2.3.4 National Energy Policy

Jamaica's National Energy Policy (NEP) was adopted in 2009 and is fully consistent with Vision 2030 Jamaica to support the achievement of Jamaica's national vision. The policy aim is to create and advance "A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues and an appropriate policy, regulatory and institutional framework" (MSET, 2009). There are additionally six (6) supporting sub-policies for the achievement of the goals stated in the NEP. These sub-policies are shown in Box 4 below.

BOX 4

SUB-POLICIES SUPPORTING ACHIEVEMENT OF THE NATIONAL ENERGY POLICY

- Renewable Energy Policy
- Energy-from-Waste Policy
- Biofuels Policy
- Carbon Emissions and Trading Policy
- Energy Conservation and Efficiency Policy
- Electricity Policy

Source: (MSET, 2009)

Each of the sub-policies was drafted for specific sectors and with specific purposes in mind. For each sub-policy, a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was performed with an implementation plan and monitoring framework. The GOJ is currently aiming to update the NEP to integrate the most recent climate ambition and to ensure consistency with the Integrated Resource Plan (IRP) and the newest iterations of the MTF.

2.3.5 Updated Nationally Determined Contribution (NDC)

As a signatory party to the Paris Agreement (PA), Jamaica must submit and revise its Nationally Determined Contribution (NDC) every five years. The current revision was approved and submitted to the UNFCCC in 2020. Jamaica's updated NDC establishes a target to reduce the country's emissions unconditionally by 25.4% and conditionally increase the ambition to 28.5% by 2030 relative to a Business-As-Usual (BAU) scenario (GOJ, 2020).

The updated NDC is more ambitious, with a quantifiable emission reduction target increase from 7.8% to 28.5%. It is, however, worth noting that the energy sector emissions in the BAU scenario were also updated from 14.5 MtCO_{2eq} to 8.2 MtCO_{2eq} by 2030 based on measurement improvements made for the projections of the BAU emissions (GOJ, 2020).

The sectoral coverage of Jamaica's updated NDC only includes Energy and Land Use Change and Forestry, with considerations for extending the scope of the NDC to other sectors and gases in subsequent iterations of the NDC. Sectors already qualitatively mentioned include Agriculture and Waste with interventions that might support mitigation and adaptation, but their contribution was not quantitatively measured.

The updated NDC is grounded in a set of energy and forestry sector commitments in the current period to 2030, such as the deployment of renewable energy technologies or increased afforestation targets to increase emissions sequestration. This approach ensures Jamaica's NDC is credible and achievable. The NDC commitments also offer a variety of co-benefits, such as reducing air pollution due to a reduced reliance on heavy fuel oil in electricity generation (Vivid Economics & WB, 2021a).

Adaptation is not explicitly addressed in the updated NDC but might be included in future NDC iterations and as the development of Jamaica's National Adaptation Plan (Ja-NAP) progresses accordingly.

2.3.6 National Adaptation Plan Development Process

Jamaica's National Adaptation Plan (Ja-NAP) is currently being developed through the Green Climate Fund (GCF) Readiness Programme and with the Planning Institute of Jamaica (PIOJ) acting as the implementing entity delivery partner for the readiness support. The Ja-NAP will comprise adaptation plans for relevant sectors and will be developed in coordination with the relevant ministries, departments, government offices, and non-governmental stakeholders. A financing plan and investment strategy for adaptation will complement the Ja-NAP (UWI, 2022).

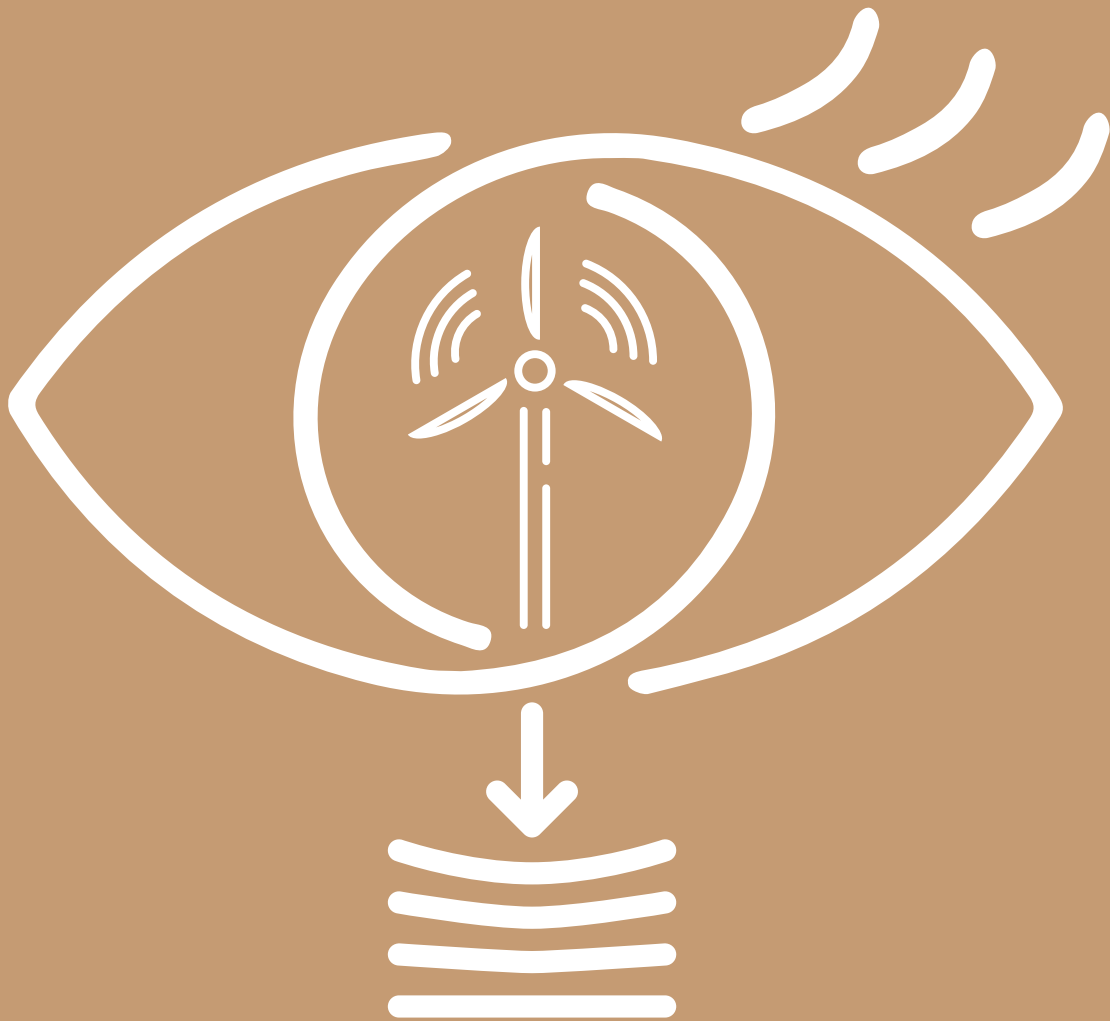
Ja-NAP will be aligned to Jamaica's portfolio of GCF Readiness and Preparatory Support projects focusing on country programming, gender responsiveness, private sector mobilisation and civil society engagement. Ja-NAP will apply a consultative, inclusive, gender-responsive and science-based approach to formulating the Ja-NAP (GCF, 2020).





3

**Jamaica's Vision for Low-Carbon,
Resilient Development**



3 | Jamaica's Vision for Low-Carbon, Resilient Development

To contribute to global efforts to address the threat of climate change, and seize socio-economic opportunities, Jamaica will need to take ambitious mitigation measures to reduce its contribution to the greenhouse gas emissions that cause global warming. At the same time, Jamaica will take actions to adapt to the inevitable impacts of climate change that are already being seen and will continue to worsen. Addressing these challenges will require wide-ranging action across all sectors of the economy and all parts of society.

During the development of Jamaica's LTS, a set of bilateral discussions and broader stakeholder consultations were conducted to provide input on the proposed socio-economic vision. The full list of stakeholder engagement and consultations for the preparation of the LTS can be found in Annex 3: Stakeholder Consultations.

The resulting vision for Jamaica's LTS is as follows:

Jamaica employs a people-centric approach towards a net-zero, sustainable, and resilient development that provides quality livelihoods and improved health and well-being, leveraging opportunities to benefit all Jamaicans.

Diverse approaches can be taken to low-carbon and resilient development. It would be possible to try to keep things as close to how they are today, while making small changes around the edges. Consider ground transportation — while it technically is possible to reduce these emissions to nearly zero by taking every vehicle that is currently on the road and replacing it with an identical vehicle with an electric engine. The result would be the same traffic jams and the same accidents, but without the associated emissions. Alternatively, a country could take the opportunity to consider transformations in mobility and the opportunities presented by sustainable pedestrian and transit-oriented development to improve people's lives and achieve tangible development outcomes. Where possible, this strategy seeks to take the latter approach.

Jamaica is undertaking this transformation with open eyes and a plan to ensure that this transformation builds on the hard-fought progress made on achieving sustainable development for Jamaicans and creates new opportunities for the Jamaican people and economy. The LTS will seek to build on the goals laid out in Vision 2030 Jamaica and further advance them. With the luxury of longer-term planning, it seeks to take a moment to consider the assumptions made about how things are done, and the status quo bias that can thwart progress, and envision a future where low-carbon development can be leveraged to benefit Jamaica and the lives of Jamaicans.

In line with the country's sustainable development imperatives, several core principles have been identified for Jamaica's transition to a low-carbon and resilient economy and society:

- **Jamaica will follow a low-carbon and resilient pathway that leads to greater public health:**

Many efforts to reduce emissions or build resilience can help improve public health: reduced fossil fuel burning can improve air quality and reduce respiratory disease; greater pedestrianisation can improve people's cardiovascular health; and improved resilience in agriculture can enhance food security and reduce malnutrition. Jamaica will work to take advantage of these opportunities as part of the transition.

- **Jamaica will ensure equity in its efforts to decarbonise and protect Jamaicans from the impacts of climate change:**

All Jamaicans, irrespective of wealth, gender, age, disability, or other vulnerabilities, deserve to be protected from the impacts of climate change and to be included in the opportunities presented by a transition to a low-carbon economy. Jamaica will seek to guarantee such equity in the development and implementation of its efforts to confront climate change.

- **The response to climate change will protect our cultural heritage and what makes us uniquely Jamaican:**

Jamaica has a rich and vibrant culture, from music, to food, to art, literature, sports and more. These inform the Jamaican identity. As Jamaica works to decarbonise and build resilience, special attention will be paid to ensure that the tangible and intangible heritage of the country is protected and nurtured.

- **Jamaica will pursue a just transition to clean energy and will ensure that no Jamaican is left behind:**

Many Jamaicans work in industries that will be impacted by the transition to a low-carbon economy. Jamaica recognises the contribution of these people to the efficient functioning of Jamaica's modern economy and will work to create new opportunities for them within tomorrow's economy.

- **Jamaica will ensure responsible stewardship of the natural environment:**

In efforts to achieve low-carbon and resilient development, Jamaica will protect the health of the natural environment for the humans, communities, and ecosystems that depend on it.

- **Jamaica will continue to demonstrate regional leadership and support a Caribbean transition to low-carbon and resilient development:**

Jamaica has historically played an important leadership role among Caribbean countries, including through efforts to reduce emissions and build resilience. Jamaica will continue to work at a regional level to support its neighbours in their efforts to address climate change.

- **Jamaica's national efforts will be guided by communities:**

Local communities and local governments will feel the impacts of climate change and be called upon to address them. Action on climate has been, and will continue to be, informed by local voices.

- **The transition to low-carbon and resilient development will provide Jamaicans with high-quality and safe access to mobility:**

Efforts will be made to provide safe and affordable modes of transportation by improving road infrastructure and the public transportation system to encourage safer walking and biking, and reduce dependency on high emission vehicles.

Giving form to the transition toward low-carbon and resilient development, Jamaica has identified pathways for reduction of emissions (mitigation) and building of resilience. These are found below.

3.1 Net-Zero Climate Ambition

Over the period leading to 2050, Jamaica will transition to a deep decarbonisation pathway that would put the country close to net-zero emissions, delivering at least its fair share of effort in combatting climate change (Vivid Economics, 2022).

Jamaica will work to achieve full decarbonisation in the second half of the century, in line with the goals of the Paris Agreement. This objective will act as a north star for the country's climate and development objectives. Jamaica will aim to achieve net zero emissions as soon as possible, and if it is not achievable by 2050, will do so as soon as possible thereafter.

The technological and innovation landscape of 2050 will not be the same as that of today. It is hoped that novel solutions to seemingly intractable problems will emerge. Jamaica will do its best to ensure that such solutions find a welcoming home on the island. At the same time, Jamaica will not rely on miracles, and plans to work toward full decarbonisation with the tools at its disposal today.

A deep decarbonisation scenario anticipates that Jamaica can reduce its emissions by 73% relative to 2020 by 2050. Jamaica will aim to continue this rate of progress and set an indicative target to achieve net zero emissions by 2060, or earlier if possible.



4

Mitigation



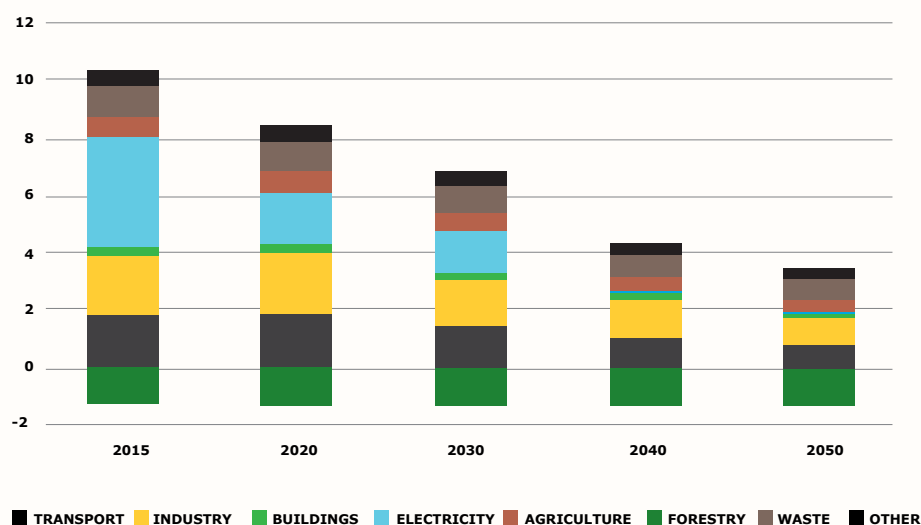
4 | Mitigation

The next thirty years present a series of opportunities and challenges associated with Jamaica's climate. While Jamaica's growing economy may lead to upward pressure on emissions, a range of mitigation options available to Jamaica can reduce forecasted emissions. Low-carbon technology deployment and energy efficiency improvements have led to emissions reductions in several economies worldwide. These emissions reductions have contributed to global efforts against climate change while delivering national benefits through cleaner air or reduced pollution, healthier populations, greener jobs, and sustainable growth (Vivid Economics & WB, 2021a).

With ambitious action, Jamaica can reduce its emissions by 73% relative to 2020 levels as seen in Figure 2. This level of ambition represents the best contribution Jamaica can make in the effort to limit warming to 1.5°C above pre-industrial levels. In contrast, following a Business-As-Usual pathway, Jamaica's emissions could reverse the progress made to date, and emissions could grow by as much as 50% between 2020 and 2050.

Figure 2

Jamaica's Economy-wide Emission Trajectory under a deep Decarbonisation Scenario



Source: (Vivid Economics & WB, 2021a)

Jamaica's mitigation efforts focus on the most polluting sectors in terms of carbon emissions. These include Electricity, Transport, Buildings, Industry, Land Use Change and Forestry, Agriculture, and Waste.

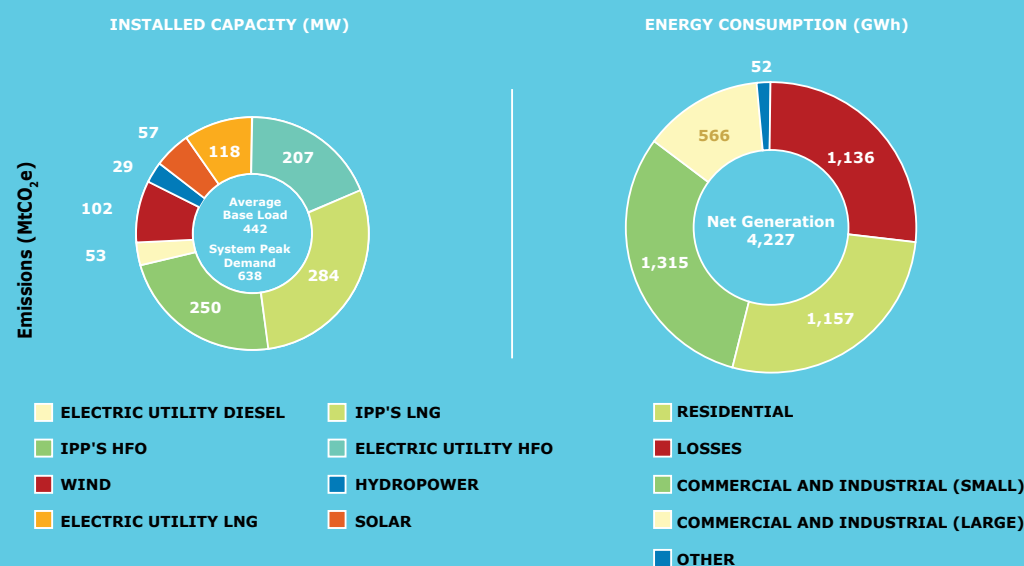
Though these ambitious efforts do not quite lead to a complete decarbonisation by 2050, **Jamaica will strive to achieve net zero emissions by 2060, or earlier if possible.**

4.1 Electricity

Jamaica's electricity or power generation sector comprises mainly capacity from Heavy Fuel Oil (HFO) and Liquefied Natural Gas (LNG) generation. Approximately 40% of the generation is used for industrial purposes, while almost 30% is for residential users. The remaining 30% is lost in transmission and distribution. The installed capacity and energy consumption by type of user for 2020 are shown in Figure 3.

Figure 3

Jamaica's Installed Capacity and Energy Consumption (2020)

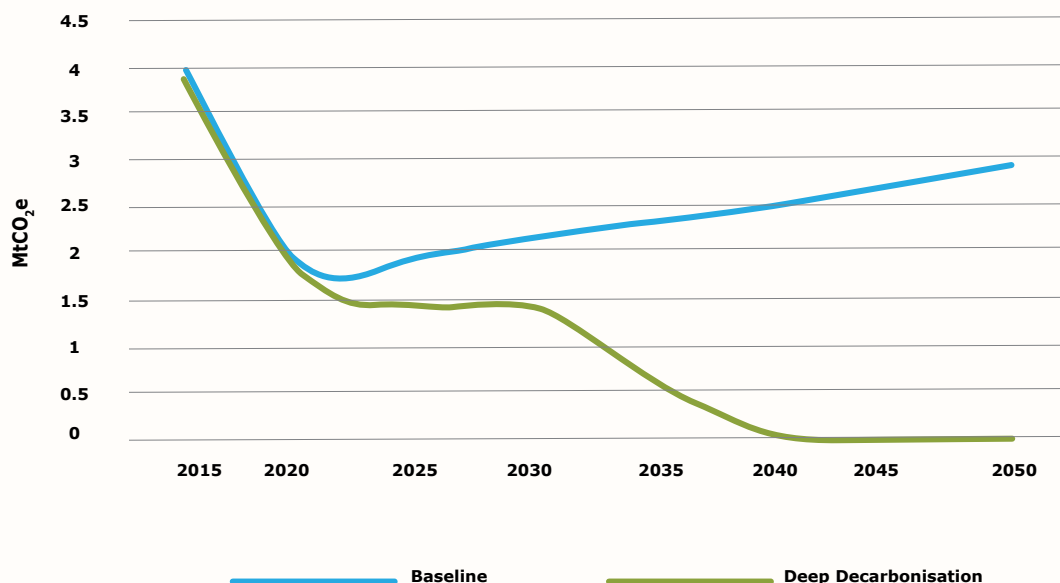


Source: (CCREEE, 2020)

Emissions Trajectory

The power generation sector in Jamaica contributed almost 40% of the country's total emissions in 2015 and is estimated to increase by 58% in 2050 from 2020 levels following a baseline scenario (Vivid Economics & WB, 2021a).

A scenario analysis has shown that the emissions from power generation could be reduced 98% by 2050 from 2020 levels. Figure 4 shows the emission trajectory for the electricity sector through 2050. The sector could achieve virtual carbon neutrality following an expanded ambition to the IRP and reaching a 93% share of intermittent renewable energy (RE) penetration from solar and wind, which should be coupled with battery storage, hydropower, and other low-carbon options, such as biomass, to allow for enough system flexibility in its operation (Vivid Economics & WB, 2021a).

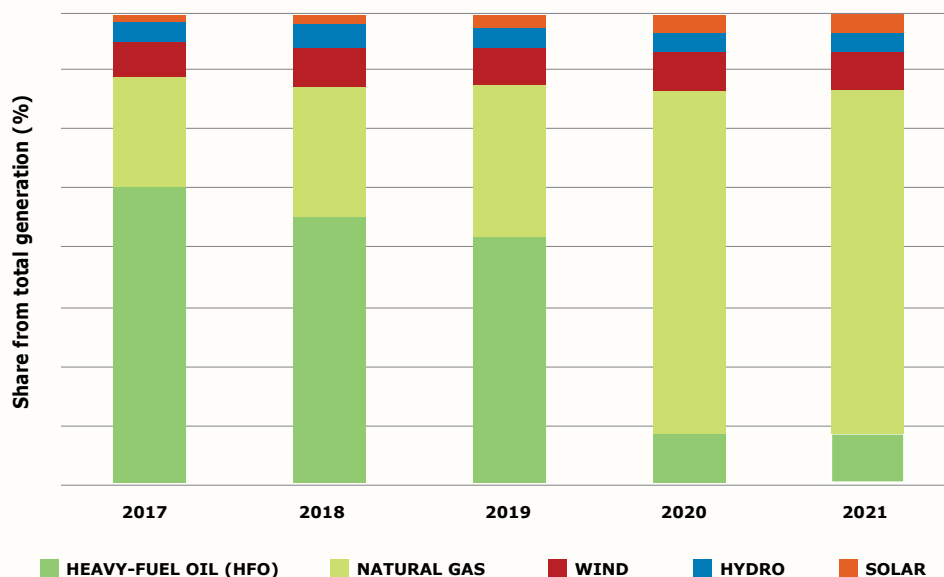
Figure 4*Electricity Sector Emission Trajectory 2015–2050*

Source: (Vivid Economics & WB, 2019)

Drivers of emissions

The emission drivers include generation based on heavy fuel oil and growing electricity demand. In 2020, the share of HFO in the total installed capacity including IPPs was 41%, with LNG representing 36% of the total installed capacity, while Renewable Energy (RE) technologies only represented 17% as seen in Figure 3.

Figure 5 shows the electricity generation for different source categories. The use of HFO for electricity generation has reduced from around 70% in 2017 to 28% by 2021. In turn, generation from LNG increased from 19% to 60% over the same period.

Figure 5*Share of Electricity Generation by Source 2017–2021*

Source: (MSET, 2022)

A shift in fuels will reduce some of the sectoral emissions in the short term, but a phase-out of the fossil fuel-based generation will be needed to fully decarbonise the sector. It is possible for Jamaica to reach 100% RE capacity if sufficient battery storage is in place to deal with the intermittency of some RE sources; according to the CCREEE energy report card, the combined potential for RE from solar and wind is around 3.2 GW versus the currently installed capacity of 1.1 GW (CCREEE, 2020).

Vision 2030 Jamaica calls for diversification of energy sources with clean technologies and increasing efficiency of energy generation, transmission, and distribution (PIOJ, 2022a). Sources of energy generation being examined include solar, wind, and small-scale nuclear (GOJ, 2023).

Barriers to low-carbon and resilient development

Although a 100% RE capacity for electricity generation is possible with the current technologies available, the electricity sector in Jamaica faces a series of challenges for a long-term decarbonisation. These barriers have been studied and are presented in Table 3.

Table 3*Electricity Sector Barriers to Low-carbon and Resilient Development*

Electricity sector barriers to low-carbon and resilient development	
Technical	- High dependence on imported petroleum products (embedded in infrastructure, regulation, contracts, etc.) - Inefficient transmission and distribution (T&D) infrastructure with high losses in the system - Lack of technical expertise for designing, installing and operating RE facilities
Financial	- High transaction and lending costs to move away from fossil fuel technologies in the electricity sector - Lack of public financial resources for implementation of RE or upgrade of the T&D grid - Lack of economically sound contractual agreements - Inadequate financial and fiscal incentives for deployment of sustainable alternatives within the sector
Regulatory	- Imprecise legal formulations and lack of uniform net-metering and interconnection standards for small-scale power generation units - Lack of standards for RE solutions in buildings (e.g., solar heaters) - Weak enforcement and no penalties for not fulfilling climate ambition of the sector
Institutional/Capacity	- Institutional gaps in communication for coordination between the implementation of the mitigation policy and the energy system - Time-consuming administrative procedures related to RE project development - No data gathering system for development and tracking of RE projects - Low public awareness on energy efficiency and conservation and its associated benefit

Source: (MSET, 2010; Vivid Economics & WB, 2021a)

Key targets and milestones

Jamaica will build long-term energy security that is affordable and accessible to all Jamaicans, by ensuring its energy sector is modern, efficient and diversified in its offering of low-carbon and environmentally sustainable energy sources.

Jamaica has committed to increasing generation from renewable sources to 50% of all electricity generation by 2030 (New Energy Events, 2018). In the longer run, Jamaica plans to phase out dated and fossil fuel technologies and generate

100% of its electricity from renewable sources by 2050. Jamaica will increase the efficiency of the transmission and distribution grid to reduce losses in the system from 26% in 2019 to 8% (Vivid Economics & WB, 2021b).

To achieve these targets, the country needs to scale up the construction of RE facilities through the implementation of the Integrated Resource Plan (IRP), complemented with additional capacity deployment of intermittent renewables of around 2GW between 2030 and 2050. In addition, battery storage and investment in grid improvements will enable the high penetration of RE in the mix (Vivid Economics & WB, 2021a).

The decarbonisation of the sector is possible given its high share of fossil fuels in the electricity mix. By reducing the dependence of the sector on fossil fuels, the decarbonisation of other sectors of the economy can be supported through the electrification of industry, transport, and buildings, for example (Vivid Economics & WB, 2021a).

The electricity sector targets and milestones for Jamaica's LTS until 2050 are shown in Table 4.

Table 4

Electricity generation targets and milestones^{3,4,5}

Date	Milestone
2025	● Increase to at least 27% of electricity generation from renewable sources. ● Transmission and distribution losses do not exceed 25%.
2030	● Increase to at least 50% of electricity generation from renewable sources. ● Transmission and distribution system losses do not exceed 21%.
2035	● Increase to at least 65% of electricity generation from renewable sources. ● Transmission and distribution losses do not exceed 17% ● Phase-out 100% of HFO capacity.
2040	● Increase to at least 90% of electricity generation from renewable sources. ● Transmission and distribution losses are no more than 14% ● Phase-out 100% of fossil fuel generation.
2045	● Increase to at least 95% of electricity generation from renewable sources. ● Transmission and distribution losses do not exceed 11%.
2050	● Increase to 100% of electricity generation from renewable sources. ● Transmission and distribution losses do not exceed 8%.

Source: (GHGMI, 2021; Vivid Economics & WB, 2021a)

3 Targets and milestones for RE were defined based on the latest information available and the work of Vivid Economics

4 T&D Losses milestones were calculated using a linear regression based on the target for 2050 of 8% proposed by Vivid Economics and which is in line with international standards; the starting baseline was chosen based on information provided by the Jamaican Public Service Company (JPS), which is currently at 28% in 2023.

5 Phase out dates were suggested considering around 10 years for HFO and 20 years for LNG (since some LNG capacity has been recently installed).

4.2 Transport

The Jamaican transport sector plays a crucial role in the country's economy and critical infrastructure. It includes various modes of transportation, such as road, rail, air, and maritime transport. Jamaica's transport sector is heavily dependent on imported oil products, with the majority of the country's transportation needs met by road transport.

Road transportation is the dominant mode of transport in Jamaica, accounting for the majority of passenger and freight movement. The national fleet in 2018 consisted of almost 620,000 four-wheeler vehicles (data includes passenger cars, vans, pick-ups, lorries, road tractors, buses, and motor coaches), and almost 20,000 two-wheeler vehicles (International Road Federation, 2019). The road transport sector in Jamaica is dominated by private cars, which account for approximately 73% of the country's registered vehicles. The remaining vehicles are classified as commercial and include buses and taxis, and freight transport vehicles.

The country's public transportation system is primarily composed of privately-owned minibuses and taxis, which operate on fixed routes. More than half of the population uses public transportation to fulfil mobility needs (IDB, 2020). Route taxis are the most popular mode of public transportation followed by bus services from Jamaica Urban Transit Company (JUTC).

Rail transportation in Jamaica is limited. Only a single line offers mine-to-port connectivity, which runs from Kingston to Montego Bay and is used mainly for the transportation of bauxite and alumina, which are important exports for the country. However, the Jamaica Railway Corporation (JRC) took a significant step forward in early 2022 with the launch of the "Back on Track School Train Service". This initiative aims to expand the railway services to accommodate passenger transportation, with the initial phase focusing on serving students. Operated by the JRC, the commuter rail service will run along two segments of the existing network in the parish of St. Catherine. The implementation of this service holds the promise of providing a safe and cost-effective means of transportation for school-age children who rely on the public transport system for their daily commute.

Air transportation is another critical component of the Jamaican transport sector. Jamaica's economy heavily relies on tourism, which is the country's primary source of foreign exchange earnings. Air transport is a crucial component of the tourism industry and is essential for international trade, as it enables the transportation of goods and services. The aviation sector accounts for approximately 3% of the country's GHG emissions (GOJ, 2017).

Maritime transport in Jamaica plays a vital role as the country is an island nation with extensive coastlines and numerous ports. Maritime transport facilitates international trade and commerce and supports the tourism industry. It is also an essential mode of transportation for domestic goods and passengers, particularly in rural areas that are not well-served by other forms of transport (USAID, 2018). The relative potential to abate shipping emissions is likely to be low and driven by global efforts. Currently, there are no commercial low-carbon shipping options available. Therefore, improving energy efficiency is going to be particularly important in reducing shipping emissions in the short to medium term (Vivid Economics & WB, 2019).

The transport sector is a key area of focus in Vision 2030, with several goals and targets identified for its development (Government of Jamaica, 2017). Vision 2030 aims to:

1. Develop a modern and efficient transportation system by improving the quality and efficiency of Jamaica's transportation system through the development of modern and well-maintained infrastructure, such as roads, airports, seaports, and railways.
2. Encourage the use of sustainable transport modes, such as public transportation, bicycles, and walking, in order to reduce traffic congestion, improve air quality, and reduce greenhouse gas (GHG) emissions.
3. Improve connectivity within Jamaica and with the rest of the world by developing efficient and reliable transport links between urban and rural areas, and also by increasing connectivity with the rest of the world through improved air, sea, and land transportation.
4. Improve the safety and security of the transport system by developing and enforcing regulations and standards for road safety, as well as by improving security measures for airports and seaports.

Jamaica is actively promoting the adoption of electric mobility. The Government has developed a Strategic Framework for Electric Mobility that includes the development of a fiscal and tax strategy efficiency, and regulation considerations for electric mobility, energy sector guidelines for electric mobility accommodation, guidelines towards mobility transition, and for the development of an electric mobility ecosystem, including training and capacity building and mechanisms for the evaluation and monitoring of the strategy implementation (MSET, 2022).

The Government, through the Jamaica Urban Transit Company Limited (JUTC) and the Ministry of Transport and Mining, has started to adopt electric mobility in public transport. The first electric bus arrived in country in January 2023 and the Government has committed to 200 EV buses over the next three years. Jamaica is placing financial incentives to lower the costs of EVs. In April 2023, the House of Representatives approved three resolutions to reduce EV import tariffs from 30 per cent to 10 per cent and lifted the EV licensing fee requirement. The country

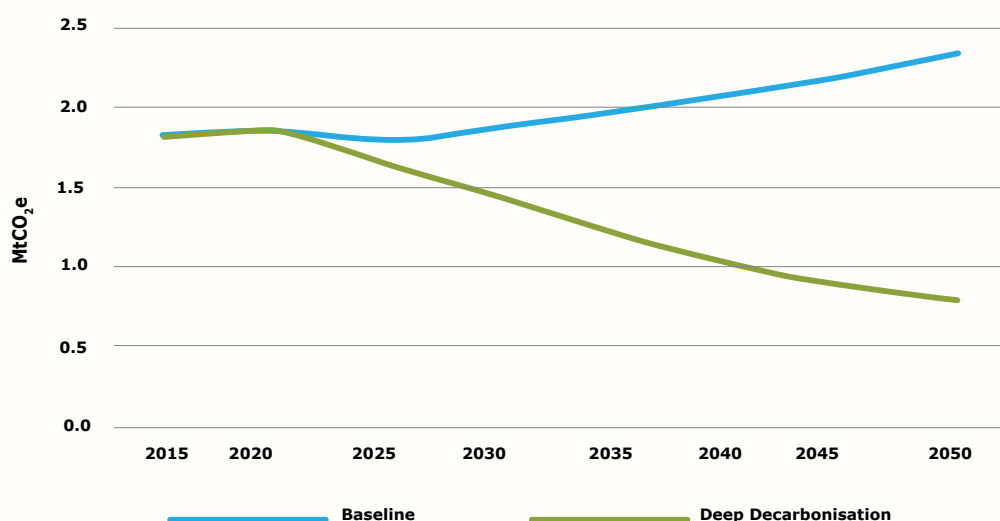
is advancing in deploying EV charging infrastructure as well. The Jamaica Public Service Company (JPS) currently operates 14 public charging stations across the country and is planning to scale up the number of stations and there are also private charging stations owned by private companies.⁶ Despite this progress, the transport sector remains one of the largest GHG emitters.

Emissions Trajectory

The transport sector is a significant contributor to the country's GHG emissions and is responsible for approximately 19% of the total GHG emissions in 2016 (Government of Jamaica, 2017). Under a BAU scenario, emissions in the transport sector are expected to reach 26% of the total share of emissions by 2050. Under a low-emission pathway, EVs will make up 67% of Jamaica's passenger fleet by 2050, and 2,000 electric buses are expected to be deployed by 2040. By 2050, Jamaica will reduce its transport emissions by investing in public transport and reducing private vehicle demand. Freight transport will be more fuel-efficient and EVs will be supported through charging infrastructure and financial incentives. Combined with fuel efficiency measures, these measures offset the increase in transport demand under the baseline scenario and reduce GHG emissions by 2050 from 2.34 to 0.79 MtCO₂e (a 66% decrease relative to 2020 levels) as seen in Figure 6.

Figure 6

Transport Sector Emission Trajectory 2015–2050



Source: (Vivid Economics & WB, 2019)

⁶ Currently only one company has reliable data on the number of EV charging stations. <https://evergo.com/en/map/>.

Drivers of emissions

Jamaica's transport sector is heavily dependent on imported fossil fuels, with the majority of the country's transportation needs met by road transport. Road transportation is the largest source of GHG emissions in Jamaica's transport sector, accounting for approximately 87% of total emissions, with gasoline and diesel accounting for 95% of total transport energy consumption in 2018 (Jamaica's Third National Communication to the UNFCCC, 2017). Social trends, including economic and population growth and accelerated spread urbanization patterns, have led to a higher reliance on personal vehicles for transportation (IDB, 2020). The primary driver of emissions from road transport is the use of fossil fuels, particularly gasoline and diesel, in cars, trucks, and buses. Other factors that contribute to emissions from road transportation include traffic congestion, inefficient driving practices, and the age and condition of the vehicle fleet.

Aviation and maritime transport also contribute to GHG emissions in Jamaica's transport sector, although to a lesser extent than road transportation. Emissions from aviation are primarily driven by the burning of jet fuel, while emissions from maritime transport are driven by burning fossil fuels like heavy fuel oil and diesel, which power most ships.

Additionally, the country's reliance on imported petroleum products means that Jamaica is vulnerable to global oil price fluctuations and supply disruptions, making it difficult to ensure a stable and affordable energy supply.

Barriers to low-carbon and resilient development

The transport sector in Jamaica faces several barriers and challenges to reach a low-carbon and resilient pathway by 2050. The most important barriers are outlined in Table 5.

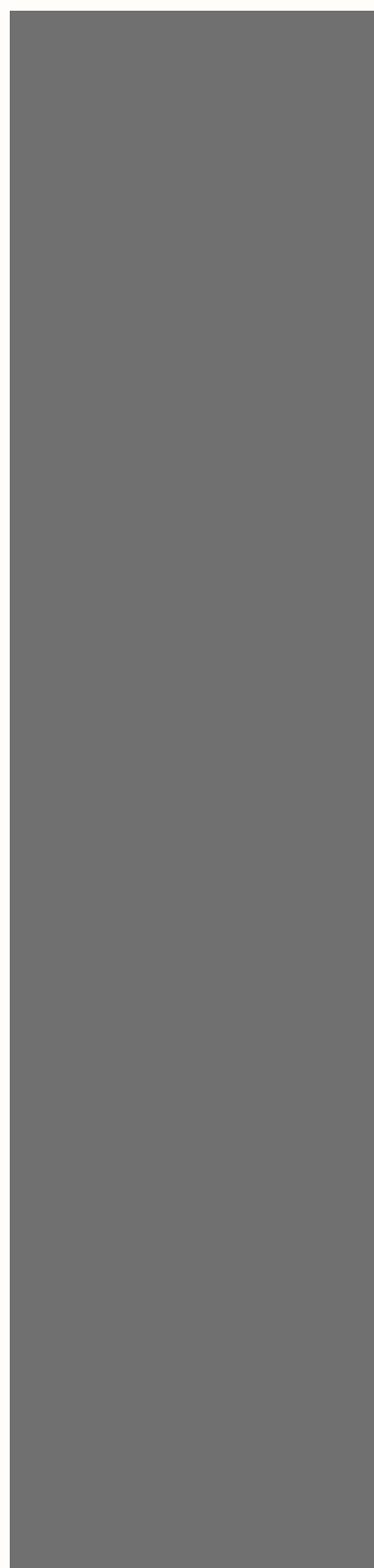


Table 5*Transport Sector Barriers to Low-carbon and Resilient Development*

Technical	 Lack of infrastructure for the adoption of EVs: One of the biggest barriers to the adoption of electric vehicles (EVs) is the lack of charging infrastructure. Jamaica's existing electricity infrastructure is not equipped to handle the increased demand for electricity that would result from widespread EV adoption.  Limited integration of transport modes: The lack of integration among different transport modes, such as bus, rail, and water transport, poses a challenge to achieving a sustainable transport system. Seamless connectivity between various modes of transport is essential for efficient travel and reducing dependency on private vehicles.  Limited public transportation infrastructure leading to a high reliance on personal vehicles: Inadequate public transport infrastructure and connectivity between different modes of transportation, such as buses, taxis, and trains, which can make it difficult for people to travel efficiently.
Financial	 High upfront cost of EVs: The initial cost of purchasing an EV is higher than that of a traditional gasoline-powered vehicle. This can be a significant barrier for many consumers, particularly in a country like Jamaica, where the average income is relatively low.  Limited financial resources: Overall, the country has limited financial resources to support the implementation of sustainable transport policies and initiatives. There is a need for greater collaboration among stakeholders in government, private sector, and civil society to promote and foster shared schemes of cooperation for sustainable transport.
Regulatory	 Inadequate legislative framework: The current legislative framework for transport in Jamaica is considered outdated and insufficient to address sustainability concerns effectively. There is a need for comprehensive legislation that promotes sustainable transport practices and provides clear guidelines for implementation.
Institutional/ Capacity	 Lack of urban design integration into transport policies: A shift towards public and active transport such as walking, cycling, shared mobility and public transport can deliver emission reductions while also delivering co-benefits  High incidence of crime and violence in public transportation: This drawback hinders the potential transport modal shift. Improving infrastructure, such as providing more secure parking facilities and improving lighting and signage, could help to reduce security risks (Morrison, 2016).  Limited public awareness and understanding of the benefits of sustainable transport: This lack of knowledge leads to a preference for personal vehicles. Many Jamaicans are not familiar with EVs or their benefits, which can make them hesitant to consider purchasing such a vehicle.

Key targets and milestones

Jamaica's transport sector in 2050 will provide inclusive, safe, and reliable public mobility for all citizens by ensuring affordable access to diverse and equitable, low-emission modes of transportation.

In its updated NDC, Jamaica has established several goals for the transport sector by 2030:

1. Increase the share of public transport in urban areas to 35% by 2030. This will be achieved through the implementation of policies and measures that promote the use of public transport, such as the expansion of bus and rail services and the implementation of bus rapid transit systems.
2. Improve the fuel efficiency of vehicles in the transport sector by 15% by 2030. This will be achieved through the implementation of policies and measures that encourage the use of more fuel-efficient vehicles, such as the promotion of hybrid and electric vehicles and the introduction of fuel efficiency standards
3. Set a target to increase the use of alternative fuels in the transport sector to 20% by 2030. This will be achieved through the implementation of policies and measures that promote the use of alternative fuels, such as the development of biofuels and the promotion of natural gas vehicles.
4. Improve the quality and efficiency of transport infrastructure, such as roads and ports, to facilitate the movement of goods and people. This will be achieved through the implementation of policies and measures that promote the development of modern and efficient transport infrastructure.

Given the low-emission pathway to 2050, Jamaica will require an increased modal shift from more emissions-intensive passenger vehicles to public and active transport. A share of Jamaica's growth in passenger demand could be met by these new developments in public transport.

By 2050, Jamaica's transport sector will require an ambitious deployment of EV policies and increased investment in infrastructure, support for procurement, and exploration of financial mechanisms to incentivise EV adoption and replacement of internal combustion engine vehicles (ICEVs). In the deep decarbonisation scenario, EVs are assumed to make up 67% of Jamaica's passenger fleet by 2050, in line with the International Energy Agency's (IEA) 'Below 2-degree scenario' global projections.

Jamaica will need to deploy aggressive improvements in fuel efficiency in freight transport. Improvements to trucking efficiency in line with global best practices could reduce fuel consumption by 40% relative to baseline estimates by 2050.

Across the transport sector, improvements in efficiency and shifting to low-carbon vehicles can provide material improvements in air quality, reducing pollution, while shifting towards public transport helps reduce congestion in urban areas.

The key targets and milestones for the transport sector are shown in Table 6.

Table 6*Key Targets and Milestones for the Transport Sector*

Date	Milestone
2025	 8% share of private vehicle fleet is electric
	 10% share of public vehicle fleet is electric
2030	 Improve the fuel efficiency of vehicles by 15% from 2020 levels
	 12% share of private vehicle fleet is electric
	 16% share of public vehicle fleet is electric
2040	 Deploy at least 2,000 electric buses
2050	 EVs make up 67% of Jamaica's passenger fleet
	 Reduce trucks' fuel consumption by 40% through efficiency improvements from 2020 levels
	 Modal shift from more emissions-intensive passenger vehicles to public and active transport.

Source: (GOJ, 2020; Vivid Economics & WB, 2021a)

The country will also continue exploring additional policies in the transport sector. For example, there is a potential use for recycled batteries. Used EV batteries can provide particularly important low-cost storage capacity in renewable energy grids. Especially for small and isolated territories, increased penetration of renewables requires sufficient energy storage systems.

For maritime transport, Jamaica is one of the pilot countries for the United Nations Development Programme's (UNDP) Global Maritime Energy Efficiency Programme, which supports countries in the adoption of energy efficiency measures. In the future, a combination of battery electric or hydrogen could play a role in short-distance shipping. In the absence of breakthroughs in battery technology, alternative fuels for long-distance shipping are likely to include biofuels, hydrogen, or ammonia (based on zero-carbon hydrogen). However, the deployment of these technologies will require international coordination (for example, on refuelling infrastructure).

For air transport, Jamaica is committed to engaging with international initiatives aimed at reducing GHG emissions in the aviation industry, such as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and the International Civil Aviation Organization's (ICAO) Carbon Neutral Growth 2020 strategy. These initiatives aim to achieve carbon-neutral growth in the aviation industry from 2020 to 2040 and to offset any emissions that exceed this level.

Finally, the transport sector will also follow the guidance on how to climate-proof future and current investments in light of a changing and more variable climate in line with the Vulnerability Assessment of Jamaica's transport sector (USAID, 2018).

4.3 Buildings

Guidelines for buildings construction and the appliances within them have a significant impact on energy consumption and emissions. Deep decarbonisation and low-carbon development of the buildings sector refer to emissions from the construction and operations of buildings and the emissions from use of appliances in these buildings. The buildings sector emissions directly contributed to 3% of Jamaica's total emissions in 2016 (Vivid Economics & WB, 2021a). However, most emissions from buildings are indirect, through electricity consumption, and thus are reflected elsewhere in the country's emissions profile

The Building Act 2018 introduced the National Building Code of Jamaica which is a series of regulations for different categories of buildings (Building Act 2018, 2018). The Act includes minimum standards and controls for building performance and functionality including increasing accessibility for people with disabilities, sanitary improvements, and energy performance criteria for buildings. In accordance with the Act, the Bureau of Standards Jamaica (BSJ) is developing an improved Jamaican National Building Code (JNBC). The BSJ has also declared standard specification for building codes for conservation, property maintenance, sewage gas and the use of fuel gas, thus taking the necessary steps to begin creating a more sustainable and robust framework for buildings sector monitoring.

The buildings sector in Jamaica is actively undergoing a transformation. A new Energy Efficiency Policy is being drafted, and this aims to fill existing gaps in targets, goals and measures for energy efficiency, indicators for measuring and monitoring progress, and rules to promote energy efficiency in the buildings sector. An energy security and efficiency enhancement project is currently underway with a focus on improving building and energy efficiency of appliances across 19 public sector buildings, and 11 public institutions, including libraries, schools, and healthcare facilities.

Emissions Trajectory

With rising incomes, energy use from appliances and households, but also from commercial buildings has seen an increase. Between now and 2050, direct emissions from buildings are to remain largely constant, at 0.33Mt (Vivid Economics & WB, 2021a). While fuel demand is expected to grow in a baseline scenario, due to higher incomes, this is expected to be offset by a transition to lower-carbon fuels. However, there are opportunities to decrease these emissions through mitigation opportunities, as well as reduced emissions from the electricity sector corresponding to electricity use in buildings.

Table 7 highlights the shift in fuel consumption patterns within the buildings sector in Jamaica from 2006 to 2012. Notably, kerosene usage exhibited a gradual decline in both sub-sectors, namely, public/commercial and residential, over the specified period. Conversely, consumption of liquefied petroleum gas (LPG) experienced an upward trajectory in both sub-sectors, emerging as the primary fuel source for buildings. In the residential sub-sector, wood consumption remained steady and stood as the second-largest fuel source. Conversely, for public/commercial buildings, charcoal emerged as the secondary fuel source. These findings highlight the changing landscape of fuel preferences within the buildings sector, underscoring the growing prominence of LPG.

Table 7

Fuel Type Consumption from the Buildings Sector from 2006–2012

Building Sub-Sector	Fuel type	Fuel consumption (Thousand Barrels of Oil Equivalent – KBOE)						
		2006	2007	2008	2009	2010	2011	2012
Public/ Commercial/ Institutional	Gasoline	0	51	26	0	0	0	0
	Diesel oil	33	250	49	38	34	37	35
	Fuel oil	92	0	0	0	16	0	0
	LPG	269	236	260	264	272	284	298
	Charcoal	130	130	191	191	191	134	134
Residential	Kerosene	180	256	0	8	5	5	20
	Kerosene	239	339	17	9	6	6	22
	LPG	358	401	246	208	321	335	351
	Wood	222	222	228	228	228	228	228

Source: (MEGJC, 2018)

Drivers of Emissions

Emissions from the buildings sector come from a variety of different sources—the buildings themselves, appliances, and construction. Buildings that are energy inefficient due to poor planning, construction, and infrastructure lead to high emissions. These are specific upstream emissions from power generation and utilisation within buildings, as well as heating and cooling processes within buildings.

Another source of indirect emissions in buildings comes from the energy efficiency of appliances: when appliances are inefficient, they require more energy than necessary, such as in the case of refrigerators, freezers, air conditioning systems, and washing machines, to name a few (BSJ, 2019).

Additionally, a small, but avoidable direct source of emissions comes from combustion of fuels for cooking and/or lighting (such as kerosene). By shifting to low-carbon fuels and energy-efficient appliances, the drivers of emissions will be reduced and the total amount of emissions, decreased.

Barriers to Implementation

Understanding the emissions trajectory, tracking of emissions, and planning for mitigation solely for buildings can be complex as the sector is heavily affected and influenced by various direct and indirect sources of emissions, but is also affected by the global supply chain. Given many materials and resources used in the buildings sector are imported, the mitigation of embodied emissions in this sector will rely on emissions reductions across the global supply chain of traded commodities. Embodied emissions refer to the greenhouse gas emissions that arise from manufacturing, transportation, installation, maintenance, and disposal of building materials. These emissions include the GHG emissions from construction of buildings to the transportation of appliances, to installation emissions, if any (Carbon Leadership Forum, 2020).

The buildings sector is closely linked with the construction and installation sub-sector which similarly has linkages with other domestic sub-sectors: tourism, housing, manufacturing, transport, storage and communication, distribution, and business services (GOJ, 2009b). Given the interlinkages between all these sectors and their various activities, accounting for emissions tracking as well as mitigation strategy can be challenging.

In recent years, there have been increasing capacity and quality constraints from the importing of input materials which has growth implications on the construction sector. The reliance on importing key building materials, including cement and steel, leaves the buildings sector vulnerable to global market demand and supply issues like price spikes or shortages of materials in the long run. The lack of a competitive environment for such materials within Jamaica disincentivises the exploration of innovative low-carbon construction materials within the country. The country therefore needs to ensure that its trade policy supports the requirements for competitive access to sources of building materials in the long run (GOJ, 2009b).

In 2008,⁷ approximately 20% of the Jamaican population lived in informal housing (MoHW, 2008) and a large share of the population continues to do so. Both due to the large size of the informal housing settlements as well as lack of accurate and current data, the implementation of enhanced standards and productivity is challenging. To ensure compliance, enhanced enforcement, and regulatory measures, such as monitoring and reporting requirements, will need to be put in place (GOJ, 2009b).

The following table describes the technical, institutional, regulatory and capacity barriers facing the buildings sector in Jamaica.

⁷ The latest year for which data is available.

Table 8*Buildings Sector Barriers to Low-carbon and Resilient Development*

Technical	■ Infrastructure and Sustainable Practices: Many existing buildings lack the necessary infrastructure to support sustainable practices, such as efficient water and energy systems. Retrofitting or upgrading these structures to meet sustainability standards can be costly and technically challenging. ■ Limited Technical Expertise: Sustainable practices along the value chain in the building sector are relatively new. There is limited adoption of energy-efficient building design and construction practices
Financial	■ Limited Access to Financing: The building sector (public/institutional and housing buildings) faces a lack of affordable financing options for sustainable projects. High interest rates, stringent lending criteria, and limited availability of funds often impede the adoption of sustainable technologies, such as energy-efficient appliances, renewable energy systems, and sustainable building materials (Vision 2030 Jamaica – National Development Plan, 2015). ■ High Upfront Costs associated with Sustainable Technologies: The initial investment required for energy-efficient appliances, solar panels, and green building materials exceeds the financial capabilities of many individuals and organizations, limiting their implementation.
Regulatory	■ Lack of Clear Sustainability Regulations: The lack of specific guidelines and standards for sustainable construction and building practices makes it difficult for developers and stakeholders to navigate the regulatory landscape and implement sustainable initiatives effectively. ■ Inadequate Enforcement Mechanisms: Insufficient monitoring and enforcement of sustainability standards contribute to non-compliance and hinder the overall progress towards sustainable development and GHG emission reduction.
Institutional/ Capacity	■ Limited Interagency Collaboration: Limited capacity and expertise within regulatory bodies for enforcing and implementing sustainable building practices. ■ Insufficient Collaboration and Knowledge-sharing Platforms: Limited opportunities for sharing knowledge and expertise among professionals, researchers, and practitioners in the buildings sector.

Key Targets and Milestones

In 2050, Jamaica will have a low-carbon and environmentally sustainable buildings sector that integrates energy efficiency with social and economic development and reduces health and environmental impacts of building operations and appliances.

Current mitigation practices and future mitigation strategies aim to incorporate aspects of direct as well as embodied emissions. From building efficiency and building construction choices, to improved efficiency of appliances, there are a range of mitigation options that will allow Jamaica to transition the buildings sector to a low-carbon and efficient future.

Shifting to low-carbon cooking by phasing out certain cooking appliances will enable the subsequent phasing out of certain fuels within the sector, such as wood and charcoal, and that will reduce the pollutants and health hazards as a co-benefit. While 92% of Jamaicans have access to clean cooking, a small proportion of the population still uses wood or kerosene stoves (MEGJC, 2018). By 2035, kerosene stoves will be replaced with more sustainable options and where possible with electric stoves, ensuring compliance in rural areas and informal settlements to enable sustainable practices and increase rural population health. At the same time, the use of LPG cookers will be halved as well. By 2050, no new LPG cookers will be in the market, and the number in use will be reduced to 10% of current levels.

The percentage of households using solar water heating will be increased to 60% by 2030, and 85% by 2050 based on current levels so as to tackle the expected increase in electricity demand (Vivid Economics & WB, 2021a).

The Bureau of Standards Jamaica (BSJ) already has energy efficiency standards for certain goods like refrigerators and freezers. It will expand these stand-

ards to include more goods including televisions, washing machines and air conditioning units. By making appliances more efficient, the demand for energy will be reduced.

Appliance energy labelling will be made mandatory in an effort to shift consumer attitudes to creating more customer demand towards energy-efficient appliances. At the same time, GOJ will also provide incentives for retooling, uptake, and the expansion of energy-efficient equipment in the construction sector.

Lighting control can reduce energy consumption and by using tighter policy incentives and standards, Jamaica can transition towards low-carbon lighting. The current Energy Efficiency and Conservation Programme (EECP) invests JMD\$1 billion to accelerate energy-efficient improvements. It covers 50 public sector buildings and six public hospitals and aims to reduce electricity demand by implementing lighting upgrades. Minimum performance standards and quality standards for lighting products will be raised, along with the introduction of labelling schemes. GOJ will also lower prices of LEDs through bulk procurement to encourage their uptake. By 2030, all electric lighting in residential buildings will be LED lamps, replacing compact fluorescent lamp (CFL) technology. All schools and hospitals will convert from T12 linear fluorescent lamps to more efficient T8 lighting, and all incandescent, linear, and compact fluorescent lighting in public and commercial buildings will be replaced by their LED lighting equivalent product.

While current building standards already exist within the country, they will be expanded to include key mitigation strategies: low-carbon cooling, minimum performance standards, and building energy efficiency. Considerations for low-carbon cooling will be central to energy-efficient building design measures for all new residential and commercial buildings (Vivid Economics & WB, 2021a).

They will consider four key features:

- Orientation: Having good orientation to the sun can reduce the need for cooling, and improves the exposure of solar panels that can be used for hot water;
- Shading: Effective shading can block out up to 90% of the heat;
- Passive cooling: Using passive cooling design techniques reduces the energy demand from using air conditioners;
- Windows and glazing: By using the right glazing systems, windows can be used as a cooling measure, instead of a source of heat when used incorrectly.

Alongside low-carbon passive cooling, 25% of existing buildings will be retrofitted with active cooling.

Building standards will be improved to ensure that buildings themselves

are low-carbon and avoid as many embodied emissions as possible. This largely depends on managing building design and ensuring that it, alongside the construction, is low-carbon. By maximising structural efficiency, the use of materials will be minimised so that embodied emissions decrease (Strain, 2023). Where possible, renovation and reusing of pre-existing buildings will be encouraged instead of new construction projects.

Material substitution from carbon-intensive materials to low-carbon concrete mixes can also reduce these embodied emissions. By 2050, fifty per cent (50%) of new residential buildings will be built using low-carbon materials. There is also scope to use carbon sequestering materials for construction whereby engineered timber, bamboo and eco-composites sequester carbon in their harvesting process while creating opportunities in the agricultural sector (Clayton, 2021). Transitioning to low-carbon inputs for building will also be coupled with enhanced waste reduction and disposal. Having improved waste reduction can reduce emissions by 10–20% within construction. To ensure the appropriate implementation for these actions, standards and regulations will be created or improved upon where they already exist to limit the use of carbon-intensive materials. This will also provide guidance for what can be reused and recycled to better encourage circularity within the sector.

Table 9 below provides an overview of all quantitative milestones and targets for the building sector.

Table 9*Overview of Milestones and Targets in the Buildings Sector*

Target Date	Milestone
2030	■ Increase the use of Solar Water Heating to at least 60% of households ■ Replace 100% of electric lighting in residential buildings with LED lamps ■ Convert 100% of schools and hospitals from T12 to T8 lamps ■ Replace 100% of public and commercial buildings with LED equivalent
2035	■ Replace all wood, kerosene and charcoal stoves with electric stoves
2050	■ Reduce LPG use to 10% of 2020 levels, and phase out new LPG cookers ■ Increase the use of Solar Water Heating to at least 85% of households ■ Increase the share of low-carbon materials for the construction of new residential buildings to at least 50

Source: (Vivid Economics & WB, 2021a)

4.4 Industry

The industry sector in Jamaica is made up of mining and manufacturing operations. In mining, bauxite and limestone are the most important metallic and non-metallic minerals respectively. Other products mined in the country, but with smaller relevance for the sector, include gold, clay, dolomite, gypsum, marble, and gravel.

The main manufacturing activities are processing of bauxite into alumina, cement production, and food and beverages processing.

The contribution from both mining and manufacturing accounted for 10.4% of the total GDP in 2021, although the contribution from both activities has been decreasing over time.

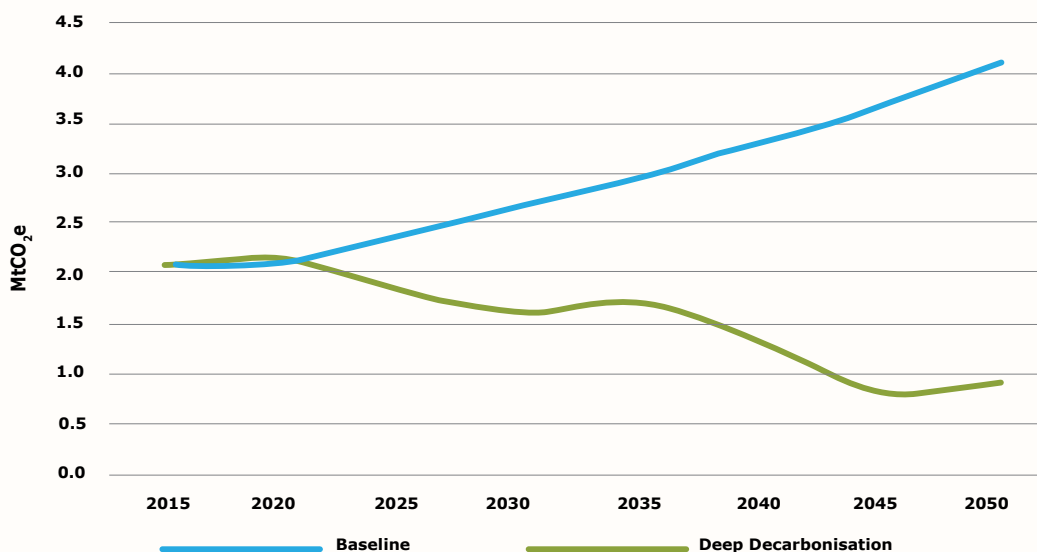
The mining and quarrying contribution to the GDP has been declining over time, from 10.3% in 1962 to 1.5% in 2021 (PIOJ, 2021c). The sector faces several challenges in terms of competitiveness with other alumina-producing economies such as China, Australia, USA, and Brazil. The energy costs from the alumina production process have been increasing in the last decades, thus raising the alumina production price and making it unattractive compared to countries which can benefit from cheaper energy prices (GoJ, 2009). Furthermore, bauxite is a finite resource, and Jamaica's reserves of the mineral are dwindling, suggesting the industry will sunset in the near future.

There has been some interest expressed in the processing of waste from Jamaica's bauxite industry as a source of rare earth minerals, though the viability of this as an alternative to present sources of such minerals is yet to be determined.

Emissions Trajectory

Jamaica's Third National Communication to the UNFCCC (TNC) estimated that in 2012, mining contributed 21% of the country's total CO₂ emissions (9% of total GHG emissions), while cement and lime contributed 6% (4% of total GHG emissions) (MEGJC, 2018).

In 2015, the contribution from industrial processes for alumina, bauxite, and cement was approximately 20% of the total country emissions. By 2050, the country's industrial emissions are estimated to increase by 90% relative to 2020 levels under a baseline scenario. However, under a deep decarbonisation pathway, almost 60% of the sector's emissions could be abated by 2050 (relative to 2020 levels) as seen in Figure 7 (Vivid Economics & WB, 2021b).

Figure 7*Industry Emission Trajectory 2015–2050*

Source: (Vivid Economics & WB, 2021a)

The modelled mitigation actions that can achieve high levels of emission reductions in the sector include the following:

- additional energy efficiency improvements in mining and alumina processing
- reduction in fuel consumption
- substituting the share of clinker for cement production and
- more ambitious technologies such as emerging low-carbon technologies which might not be deployed at scale before 2035 and Carbon Capture and Storage (CCS) for residual emissions (Vivid Economics & WB, 2021a).

However, based on consultations for the development of the LTS, experts in the field have seen a decline in national alumina production and estimate that the industry might have 10 to 15 years left, leaving only energy-efficiency improvements as a viable option to reduce the sectoral emissions, with the need to evaluate emerging low-carbon technologies in the future as technologies mature.

Drivers of emissions

Since 2008, the bauxite and alumina sector in Jamaica has been in decline due to lower global demand for aluminium and the high cost of energy in Jamaica. Carbon Dioxide (CO₂) emissions from cement and lime production fell by around 20% between 2006 and 2012. This was driven by a reduction in emissions from lime manufacturing. Large quantities of lime are used in the production of alumina and bauxite. In addition, lime is used in sugar refining, which has also been in decline in Jamaica. As a result, lime production has decreased from around 300,000 tonnes in 2006 to 130,000 tonnes in 2012, resulting in lower emissions from this source. By contrast, emissions were relatively stable in cement, reflecting a more stable production (MEGJC, 2018).

In 2021, the bauxite and alumina sector represented 9% of the country's total demand for petroleum products; the demand has decreased from 14% in 2017 showing the decline in production from these products over time. The aggregated demand from cement, sugar and other manufacturing processes only accounted for less than 0.5% of the total petroleum products demand (MSET, 2022). The bauxite and alumina activities are the main driver for emissions in the country with a much higher contribution to the demand for petroleum products.

On the other hand, the GHG emissions from the lime extraction and cement production are hard to abate as they are created during the calcination process to obtain clinker; thus, the emissions are also directly linked to the clinker-to-cement ratio used in the production process. It is expected that in the future, the global demand for these products will keep increasing over time, which might be also a driver for emissions if the production in the country also increases.

Barriers to low-carbon and resilient development

The industry sector in Jamaica faces several challenges in terms of feasibility of its long-term operation. The sector contribution to GDP has been declining over time; there is high market competition, low demand for industrial products, and low profitability arising from a high-cost structure for some products.

The activities in the sector are also the most difficult ones to decarbonise. The current solutions include energy-efficiency improvements, fuel switching to low-carbon alternatives for the energy demand of the processes, and Carbon Capture and Storage (CCS) technologies, which are still expensive to deploy.

A carbon neutral sector could potentially be achieved with the development of newer technologies and innovations for reducing the hard-to-abate emissions of the sector. However, these solutions might become available long after the sector is not able to thrive in the highly competitive markets.

The barriers for reducing emissions and for being competitive in a declining market of the sector which have already been identified and are shown in Table 10.

Table 10

Industry Sector Barriers to Low-carbon and Resilient Development

Technical	- High dependence on imported energy sources for mining and manufacturing - Ageing, small, and inefficient alumina plants with increasing pressure from more competitive markets - Knowledge and information gaps for feasibility of RE coupling in the sector - Unavailability of bulk-handling port and loading facilities to accommodate mineral exports - Lack of alternatives for a long-term decarbonisation of the sector apart from CCS technologies
Financial	- Declining GDP contribution from sectoral activities - High capital costs associated with sectoral upgrades for basic operation and sustainability needs - High energy price volatility from imported fuels - High-cost structure dwindling profitability in the sector
Regulatory	- Lost support from a constitutional and regulatory standpoint - More rigorous metrics for sustainability in the sector - Illegal and unregulated activities within the sector - Lack of regulation or standards related to quality, environmental, safety and management best practices
Institutional/ Capacity	- Lack of trained personnel related to basic operations and sustainability best practices - Lack of coordination among agencies to consolidate energy efficiency measures in the sector - Lack of coordinated Research and Development (R&D) efforts and inter-agency collaboration for development of new technologies for increased sectoral sustainability - Lack of continuous and comprehensive training plans for human resource capacity

Source: (GOJ, 2009a)

Key targets and milestones

By 2050, Jamaica will seek to develop a thriving and competitive industry sector guided by responsible environmental stewardship and which reduces and mitigates negative and harmful environmental impacts by prioritizing low-carbon solutions.

Given the challenges that the sector faces to sustain its operation and abate emissions in the long term, the short- and medium-term targets and milestones will pave the way towards the long-term sustainability of the sector through emission reductions and for the continuous operation of the sector.

The main interventions for the sector are aimed at reducing the high-cost structure of the most relevant industrial products, while increasing the efficiency of the processes to reduce costs and emissions with the current available technologies. Clinker substitution and efficiency improvements are important in the cement sector, while efficiency improvements can reduce the energy use associated with bauxite mining. However, emerging technical solutions such as the electrification of alumina production or deployment of Carbon Capture and Storage (CCS) in cement will be required to reduce emissions in line with the deep decarbonisation scenario (Vivid Economics & WB, 2021a).

The current clinker-to-cement ratio is 86%, but it is envisioned it could be reduced to 70% by 2030. The sector can achieve a 15% energy intensity reduction by 2050 (Vivid Economics & WB, 2021a).

However, for achieving the sector carbon neutrality, more Research and Development (R&D) in new processes, technologies and products is needed to get to net-zero by 2050.

It is envisioned that as time passes, more low-cost alternatives for reducing emissions and increasing sustainability will become available within the sector. The extent to which emerging low-carbon technologies can be implemented will depend on global developments and technological breakthroughs in conjunction with a supportive policy environment, but some technologies may be risky to implement before they reach maturity (Vivid Economics & WB, 2021a).

The industry sector targets and milestones for Jamaica's LTS until 2050 are shown in Table 11.

Table 11

Industry Targets and Milestones

Date	Milestone
2025	Reduce clinker-to-cement ratio to 82% from 95% in 2014
2030	Reduce fuel consumption for alumina production by 25% from 2020 levels
	Reduce clinker-to-cement ratio to 70% from 95% in 2014
2040	Reduce share of coal for cement production from 89% in 2020 to 83% using recycled materials or biomass
2050	Reduce sectoral energy intensity by 15% from 2020 levels

Source: (GHGMI, 2021; Vivid Economics & WB, 2021a)

4.5 Land Use Change and Forestry

Jamaica has a diverse landscape, ranging from mountainous regions to coastal plains, which support various ecosystems such as forests, wetlands, mangroves, and coral reefs, as shown in Figure 8. However, Jamaica's land use has undergone significant changes over the years due to human activities, such as agriculture, mining, and urbanisation.

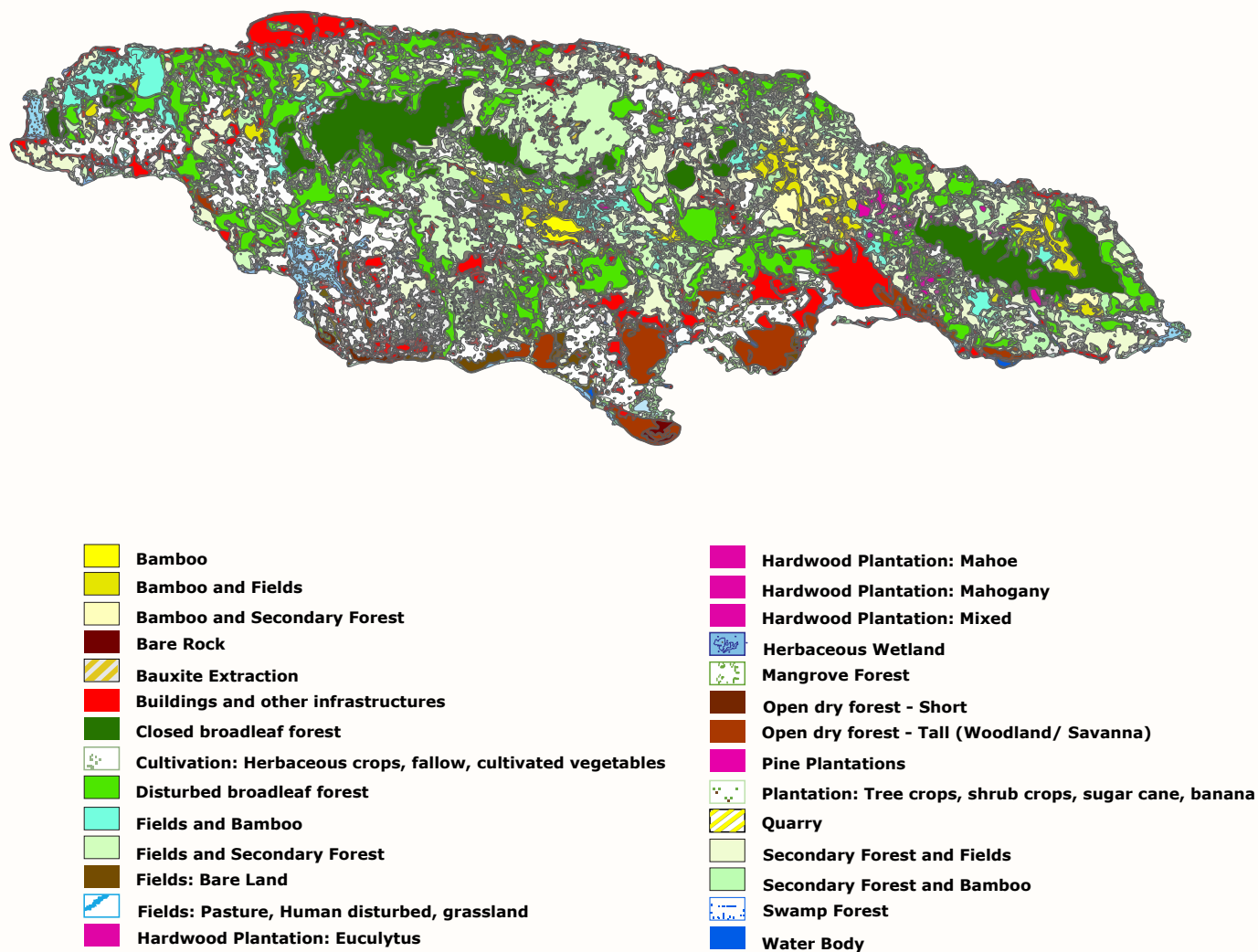
Jamaica's land use and forest face significant environmental and policy challenges. Deforestation, land degradation, and soil erosion are significant issues facing Jamaica's forests and land use practices. These challenges have prevented the forestry sector from realizing its full potential for carbon sequestration and the provision of ecosystem services.

Forests cover comprises 30% of the total land area and is highly fragmented (Jamaica's Vision, 2030). The forested areas in Jamaica are mainly composed of secondary forests, which have regrown following deforestation and land use change, resulting in biodiversity loss, soil erosion, and reduced water quality.

Jamaica has developed several policies and initiatives to address environmental and climate change challenges related to land use change and the forest sector. These include:

1. National Forest Management and Conservation Plan (NFMCP) aims to restore and protect forest ecosystems, promote sustainable forestry, and increase carbon sequestration and storage.
2. The National Environmental Action Plan (NEAP) identifies the critical environmental issues in the country, including the agricultural sector, and outlines strategies to address them. NEAP addresses land use, biodiversity conservation, and climate change.
3. Jamaica's Forest Conservation Fund aims to provide financial support for reforestation and sustainable forest management practices and can create synergies between different stakeholders involved in the sector.
4. Jamaica's Sustainable Land Management Policy aims to promote sustainable land use practices, including sustainable agriculture, agroforestry, and land restoration.

These specific sectoral policies in Jamaica have been considered to establish the long-term low-emissions development strategy for the forestry sector in Jamaica.

Figure 8*Land Use and Forest Estates in Jamaica (2020)*

Source: (Jamaica Forestry Department, 2020)

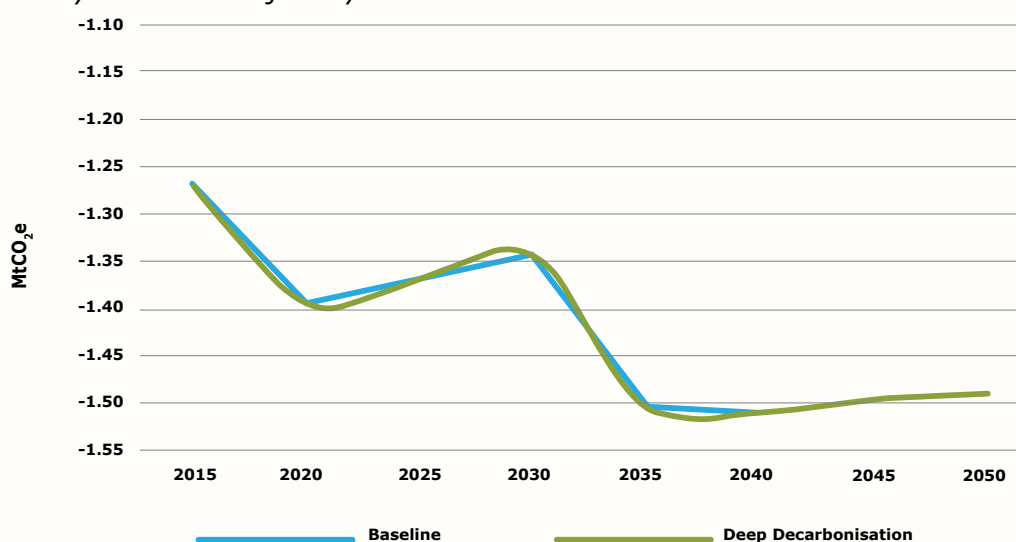
Emissions Trajectory

According to Jamaica's Third National Communication (TNC), the Land Use, Land-Use Change and Forestry (LULUCF) sector had net negative emissions in 2012 (-1.6MtCO₂e). Under a BAU scenario, carbon sinks from forest cover are constrained by the growing demand for agriculture and cropland. However, under current policies, the sector will remain a net carbon sink as it keeps lower rates of deforestation and moderate afforestation and reforestation by 2050 (Vivid Economics & WB, 2021a).

Jamaica will seek to maintain the existing no net loss of forest cover policy and increase afforestation levels (relatively modest levels of afforestation can result in significant sequestration benefits), maintaining the levels of carbon sequestration relative to BAU in 2050 as seen in Figure 9. By 2050, Jamaica will continue mangrove protection, restoring historic mangrove cover to 2005 levels. Restoring depleted mangroves will provide additional carbon sequestration and valuable co-benefits such as coastal flooding protection, aquaculture preservation, and fishing habitat preservation.

Figure 9

Forestry Emission Trajectory 2015–2050^{7 8}



Source: (Vivid Economics & WB, 2021a)

Jamaica has established ambitious plans for the forestry sector that could lead to additional GHG sequestration and ecosystem services. The NFMCP, developed in 2016, sets out the country's objectives and goals for the sustainable management and conservation of its forest resources over the 2016–2026 period. The main objectives of the NFMCP are:

1. Improve forest management practices, including sustainable harvesting, reduced impact logging, and reforestation, ensuring that forest resources are used sustainably.
2. Conserve and improve biodiversity by protecting critical habitats, promoting species recovery programmes, and implementing measures to control invasive species.
3. Reduce the deforestation rate and forest degradation, reaching and maintaining net-zero forest loss.
4. Set limits for agricultural expansion, mining, and urbanisation.
5. Enhance carbon sequestration and storage in Jamaica's forests through conservation activities and sustainable management activities.
6. Promote sustainable livelihoods for forest-dependent communities by enhancing their capacity to participate in sustainable forest management and benefit from forest resources
7. Strengthen the institutional and legal frameworks for forest management and conservation in Jamaica, including the development of new legislation, policies, and guidelines.
8. Enhance monitoring and evaluation of forest resources and management practices in Jamaica to ensure that the objectives and goals of the NFMCP are being met.

The NFMCP outlines REDD+ as a national strategic goal. The Government of Jamaica with the assistance of the International Institute of Environment and Development (IIED) is developing a national REDD+ Strategy in Phase 1 of the REDD+ programme development. The REDD+ Strategy and measures will be crucial to maintain the forest cover in the medium and long term.

The objectives and strategic priorities established in the NFMCP have been included in the long-term low-emission development strategy for the forestry sector.

Drivers of emissions

The drivers of emissions in Jamaica's forestry sector are primarily the loss of forest cover and the degradation of forest ecosystems through deforestation, forest degradation, and unsustainable land use practices (UNDP, 2015).

Deforestation is primarily driven by activities such as agriculture, logging, and mining, which often involve the conversion of forested land to other land uses (FAO, 2020).

In addition to the mentioned drivers, climate change, and land use planning policies can also affect the carbon balance of Jamaica's forests and contribute to GHG emissions (FAO, 2020).

Barriers to low-carbon and resilient development

Jamaica faces several barriers in the forestry sector to prevent deforestation and forest degradation and adopt sustainable land management practices. These include:

Table 12

Land Use Change and Forestry Sector Barriers to Low-carbon and Resilient Development

Technical	 Limited technical resources: Government agencies' lack of sufficient budget and technical capacity which hinders the implementation of policies and initiatives aimed at sustainable forest management and conservation.
	 Insufficient research and development: The lack of substantial investment in research and development activities limits the availability of innovative solutions and best practices for sustainable land use and forestry management.
Financial	 Limited financial resources and funding availability: The sector experiences constraints in accessing sufficient financial resource to support sustainable land use and forestry practices.
	 Inadequate financial incentives: The absence of suitable incentives hinders the adoption of sustainable land management practices, making it challenging for stakeholders to prioritise sustainable approaches.
Regulatory	 Unsustainable agricultural practices: Agricultural practices such as slash-and-burn farming, overgrazing, and the use of agrochemicals have contributed to soil degradation and land use change in Jamaica. This has resulted in reduced soil fertility, decreased crop yields, and agricultural expansion resulting in increased GHG emissions.
	 Illegal logging: Mostly driven by agricultural expansion, mining, and urbanisation, illegal logging continues to pose a significant threat to Jamaica's forests. The enforcement of forest laws and regulations needs to be strengthened to deter illegal activities and promote sustainable forest management.
Institutional/ Capacity	 Limited inter-agency collaboration: Insufficient coordination and collaboration among different government agencies and stakeholders hamper the implementation of integrated land use and forestry strategies.
	 High demand for land: Jamaica has been experiencing deforestation and land use change due to agricultural expansion, urbanisation, and infrastructure development. This has led to a decline in forest cover.
	 Lack of effective stakeholder engagement: The involvement of local communities, civil society organisations, and the private sector is essential for the successful implementation of forest policies and goals. However, there is a need for more effective stakeholder engagement and collaboration to ensure that policies and initiatives reflect the needs and perspectives of all stakeholders.
	 Invasive species: Invasive species such as the Giant African Snail and the Lionfish have been introduced to Jamaica and have had negative impacts on the environment and biodiversity.

Key targets and milestones

Over the period through 2050, Jamaica will conserve, sustainably use, and expand its forest and mangrove resources which will provide ecosystem services for all. Jamaica has established several goals for the forestry sector by 2030 in its updated NDC and Vision 2030:

1. Reduce deforestation and forest degradation rates by 30% by 2030. This will be achieved through the implementation of policies and measures that promote sustainable forest management practices and discourage illegal logging and land use change.
 2. Increase forest cover by 5% by 2030. This will be achieved through the implementation of policies and measures that promote reforestation, afforestation, and forest restoration activities.
 3. Enhance forest carbon stocks through sustainable forest management practices, including afforestation and reforestation, to contribute to Jamaica's overall greenhouse gas mitigation targets.
 4. Promote sustainable forest management such as community forestry, to ensure the long-term sustainability of Jamaica's forests and the ecosystem services they provide.
- By 2050, Jamaica's forestry sector will strive to maintain a 'no-net-loss' forest cover as described in its 2017 Forest Policy and its most recent National Forest Management and Conservation Plan (2016–2026) [NFMCP] and set in place additional measures. Among the most important are:
- Enhancing afforestation: Targeting 100 ha/year of afforestation beyond no-net loss can lead to an additional 3% of Jamaican land covered by forest by 2050, providing additional sequestration benefits
 - Intensifying mangrove restoration: Going beyond mangrove protection and restoring historic mangrove cover to 2005 levels would provide an additional 4,000 hectares of mangrove cover by 2050.
- Additionally, the forestry sector in Jamaica will coordinate with the agricultural sector to promote sustainable agricultural practices such as conservation and sustainable agriculture, integrated pest management, and the use of organic fertilizers.

Targets and milestones for the forestry and land-use sector are shown in Table 13.

Table 13*Targets and Milestones in the Forestry Sector*

Date	Milestone
2030	🌲 Increase forest cover by 5% from 2020 levels
	🌲 Reduce deforestation and forest degradation rates by 30% from 2020 levels
2050	🌲 Maintain 'No-net-loss' forest cover plus additional 3% land covered by forest
	🌲 Increase an additional 4,000 hectares of mangrove cover
	🌲 Increase an additional 150 ha/year of afforestation

Source: (Jamaica's NDC, 2020; Vivid Economics & WB, 2021b)

4.6 Agriculture

Agriculture is a crucial sector for Jamaica's economy, contributing to 7.9% of the country's Gross Domestic Product (GDP) and employing approximately 19% of the population in 2020 (FAO, 2021).

The sector includes a wide range of activities, including crop production, livestock farming, fisheries, and forestry. Small-scale farmers make up most of the agricultural sector in Jamaica, with over 200,000 small farmers accounting for 80% of the sector's output (Jamaica's Third National Communication to the UNFCCC, 2017). The most significant crops produced in Jamaica include sugarcane, bananas, plantains, and yams. The production of sugarcane, Jamaica's primary crop, has been declining in recent years. In 2020, the country produced approximately 232,000 metric tons of sugarcane, a decrease of about 20% from 2010. However, the production of bananas and plantains has been increasing, with the country producing approximately 125,000 metric tons of bananas and 105,000 metric tons of plantains in 2020, an increase of 28% and 60%, respectively, from 2010 (FAO, 2021).

Livestock products, such as poultry, beef, and dairy, are also produced in the country. The livestock sector has also seen growth in recent years, with the production of beef and poultry increasing by approximately 20% and 35%, respectively, from 2010 to 2020.

The agricultural sector in Jamaica has significant potential for growth, given its diversity and the increasing demand for food in the country (FAO, 2020). The government is promoting agro-processing to add value to the country's agricultural products and increase its competitiveness in local and international markets. Jamaica has favourable conditions for horticultural products such as fruit and vegetable production. The sector has significant potential for growth, given the increasing demand for fresh produce.

The livestock sector in Jamaica has seen growth in recent years. According to the Jamaica Agricultural Society, there are approximately 440,000 heads of cattle, sheep, and goats in Jamaica and the sector has potential for further development, particularly in the production of poultry, pork, and goat meat (Jamaica Agricultural Society, 2019).

The Jamaican government has developed several strategies in the sector that aimed at promoting sustainable practices and resilient agriculture. These include:

1. **National Agriculture Policy 2018–2028:** This policy aims to promote sustainable agricultural development in Jamaica by addressing issues such as food security, climate change, and rural development. It includes a focus on promoting sustainable farming practices, such as agroforestry and organic farming, and improving access to financing and markets for farmers.
2. **National Adaptation Planning process for the Agricultural Sector:** This plan is under development and will contribute to building the resilience of Jamaica's agricultural sector to the impacts of climate change. It includes measures such as promoting drought-resistant crops, improving water management, and strengthening early warning systems for weather-related disasters.
3. **Agricultural Competitiveness Programme (ACP):** This programme aims to improve the competitiveness of Jamaica's agricultural sector by promoting sustainable farming practices and providing technical assistance and training to farmers. It includes a focus on improving access to markets and financing for farmers.

These national policies and plans have been considered for the establishment of the key milestones in the agricultural sector in the deep decarbonisation pathway.

Emissions trajectory

The agricultural sector in Jamaica represented 20.3% of the total GHG emissions in 2012 (Jamaica's Third National Communication to the UNFCCC, 2017). Emissions have remained steady in recent years; increases in poultry and livestock production have been offset by a decline in crop exports. Under a BAU scenario, efficiency gains are likely to offset the growth in demand for agricultural outputs, keeping GHG emissions relatively flat.

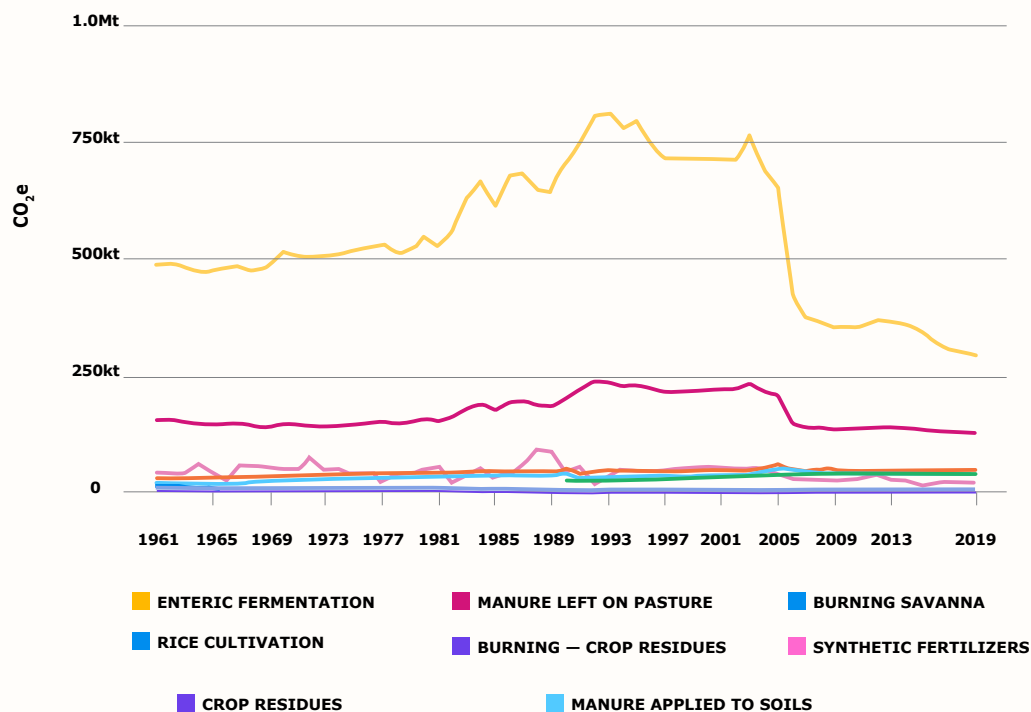
However, the government of Jamaica has developed key policies such as the National Agriculture Policy 2018–2028 and the National Adaptation Plan for the Agricultural Sector to transition to a low-carbon and resilient agricultural sector. The Government is promoting climate-smart agriculture practices such as the use of drought-resistant crops, rainwater harvesting, and soil conservation practices. Additionally, the government is promoting sustainable land management practices such as agroforestry, conservation agriculture, and reforestation to combat land degradation. Finally, the country is working to increase farmers' access to finance through initiatives such as the Agricultural Loan Guarantee Scheme and the Development Bank of Jamaica by providing a range of financing options to farmers, including loans, grants, and technical assistance.

Drivers of emissions

The main drivers of GHG emissions in the agriculture sector are shown in Figure 10.

Figure 10

Drivers of Historic Emissions in the Agricultural Sector in Jamaica



Source: (ClimateWatch Data, 2022a)

Enteric fermentation in livestock is the most relevant emission driver in the agricultural sector. It produces methane (CH₄) as a by-product, which is a potent GHG. In Jamaica, enteric fermentation is the largest source of agricultural emissions, accounting for approximately 66% of total agricultural emissions in 2016 (Second Biennial Update Report 2017). The management of animal waste, such as manure, also produces CH₄ emissions. In Jamaica, manure management is the second-largest source of agricultural emissions, accounting for approximately 18% of total in 2016 (Second Biennial Update Report, 2017).

The use of synthetic fertilizers and the management of crop residues can produce nitrous oxide (N₂O) emissions, which is another forceful GHG gas. However, in Jamaica, crop production accounts for less than 1% of total agricultural emissions (IDB, 2016).

Barriers to low-carbon and resilient development

There are several barriers that the agricultural sector faces in transitioning to sustainable development. Some of these barriers have been explored by the Country Programming Framework (CPF) Jamaica 2016–2019, setting out priority areas to guide FAO partnership and support with the Government of Jamaica (FAO, 2016). The main ones are articulated in Table 14.

Table 14

Agricultural Sector Barriers to Low-carbon and Resilient Development

Technical	🐾 Lack of Technology and Infrastructure: The agricultural sector in Jamaica lacks access to modern technology and infrastructure, which has limited the sector's growth and development. This has also made it challenging for the sector to adopt sustainable farming practices and mitigate the impacts of climate change. 🐾 Limited Technical Knowledge: Many farmers lack the technical knowledge and skills needed to adopt sustainable farming practices, such as agroforestry and crop rotation.
Financial	🐾 Lack of Access to Financing: Many small-scale farmers in Jamaica lack access to affordable financing, which makes it difficult for them to invest in sustainable farming practices. 🐾 Market Access: Many farmers in Jamaica face challenges in accessing markets for their produce, which can limit their ability to adopt sustainable farming practices.
Regulatory	🐾 Land Tenure Issues: Many farmers in Jamaica lack secure land tenure, which makes it difficult for them to invest in sustainable farming practices that require long-term investments. 🐾 Drought and Water Scarcity: Jamaica is prone to droughts, and water scarcity is a significant challenge that the agricultural sector faces. This has led to reduced crop yields and lower quality of produce, affecting the income of farmers and the country's economy.
Institutional/ Capacity	🐾 High Demand for Land: Jamaica has been experiencing deforestation and land use change due to agricultural expansion, urbanisation, and infrastructure development. This has led to a decline in forest cover. 🐾 Pests and Diseases: Jamaica has been experiencing an increase in pests and diseases in recent years, including the coffee berry borer, which has affected the country's coffee industry. The lack of proper pest and disease management practices has resulted in significant crop losses and reduced yields. 🐾 Soil Degradation: The overuse of land and unsustainable farming practices have led to soil degradation in Jamaica. This has reduced soil fertility, decreased crop yields, and increased soil erosion, leading to environmental degradation.

Key targets and milestones

Jamaica will strive to develop a technology-driven modern agricultural sector that increases carbon capture in agricultural soils through smart and sustainable use and contributes to food security and economic (rural) development.

Jamaica's updated Nationally Determined Contributions (NDC) include goals for the agriculture sector, which focus on reducing greenhouse gas (GHG) emissions and increasing climate resilience. The main goals of the agricultural sector in Jamaica's updated NDC are:

1. Increasing climate-smart agriculture practices: This goal involves promoting sustainable and climate-smart farming practices, such as agroforestry, conservation agriculture, and integrated crop-livestock systems, to reduce GHG emissions and increase resilience to climate change.
2. Promoting agro-processing and value-added activities: This goal aims to promote the development of agro-processing and value-added activities in the agriculture sector, which can increase the value of agricultural products, create jobs, and reduce post-harvest losses.
3. Strengthening agricultural research and extension services: This goal involves enhancing research and extension services in the agriculture sector to support the development and adoption of climate-smart technologies and practices.
4. Enhancing climate information and early warning systems: This goal aims to improve the availability and accessibility of climate information and early warning systems for farmers, to enable

them to make informed decisions and take appropriate actions to adapt to climate change.

5. Improving rural livelihoods and reducing poverty: This goal involves promoting inclusive and sustainable growth in the agriculture sector, which can increase income opportunities for rural communities and contribute to poverty reduction.

Under a deep decarbonisation scenario by 2050, Jamaica will incorporate agroforestry into cropland which can lead to additional sequestration benefit and provide ecosystem benefits for raising crops. Annual sequestration can reasonably reach 1-4 tCO₂e / ha of agroforest land, meaning agroforestry on just 10% of cropland could offset around 5% of current agricultural emissions (Vivid Economics, 2022).

By 2050, Jamaica's agricultural sector will improve manure management techniques that can further reduce livestock emissions by limiting the release of GHG emissions associated with manure. Also, the country will explore feeding manure and other waste into anaerobic digesters (oxygen-free containers) for reducing direct GHG emissions from animal production. In addition, the by-products can be used to create biogas for use in Combined Heat and Power (CHP) plants, providing an environmentally-friendly alternative to nitrogen-based fertilizers. Small-scale digesters can be deployed at scale with financial support and upskilling for farmers.

In a deep decarbonisation scenario, Jamaica will deploy silvopastoral solutions by 2050, providing further sequestration benefits, with agroforestry on 10% of total cropland with an additional 27ktCO₂e annual sequestration.

Given the prevalence of small farms in Jamaica, capacity building and support

are crucial to attaining Jamaica’s mitigation potential. In practice, interventions should be aligned with the crop grown and livestock raised (Vivid Economics, 2022).

The key milestones in the agricultural sector are shown in Table 15 below.

Table 15
Key Targets and Milestones in the Agricultural Sector

Date	Milestone
2030	 Reduce 14% of livestock emissions through sustainable land use management from 2020 levels.
	 Reduce 20% of ruminant animal methane emissions by improved livestock management from 2020 levels
2050	 Deploy silvopastoral solutions, with agroforestry on 10% of total cropland with an additional 27ktCO ₂ e annual sequestration

Source: (GOJ, 2020; Vivid Economics & WB, 2021a)

4.7 Waste

With a current population of 2.9 million people generating solid waste at a rate of 1kg per day per person, there is a great need to have a working and efficient solid waste management system in the country (MEGJC, 2018; Worldometer, 2023). While the rate of waste generation ranges worldwide from 0.11 to 4.54kg per day per person, the global average is 0.74kg per person per day, that is, 0.26kg lower than Jamaica's (Kaza et al., 2018).

Waste is a particularly important and high-profile sector due to the presence of landfill fires, such as those at Riverton City, which occurred in 2018 and 2022. Such fires have posed health risks to the population of the capital.

The National Solid Waste Management Authority (NSWMA) is the government body that is responsible for waste management in the country, and with the goals of Vision 2030, it aspires to be a model waste management entity by 2030. As of 2017, the NSWMA was seen to service 70% of the entire island with 27.8% of households in the country resorting to disposal of waste by burning. Not only does this contribute to the total emissions of the country, but it also presents harmful health impacts through the release of dangerous pollutants.

The National Energy-to-Waste Policy 2010–2030 lays out four broad goals for the country: creating infrastructure and plans that are conducive to the development of the energy-from-waste sector; building of appropriate technologies that produces clean, reliable and renewable sources of energy; creation of partnerships between the energy sector and waste management, and where appropriate, the agricultural sector, to facilitate the generation of continuous streams of waste into energy-from-waste; and having well-defined governance, institutional, legal and regulatory framework for energy-from-waste in the country.

Since 2019, the country has also successfully implemented a ban on single-use plastics which puts a ban on the importation, manufacture, and distribution of single-use plastic bags of certain sizes, and plastic straws. This ban on polystyrene foam for use in the food and drink industry has ultimately led to a reduction of inorganic, unrecyclable waste. The JMD\$33 million Plastic Waste Minimisation project, implemented by the National Environmental Planning Agency (NEPA), launched a plastic recycling project in Rae Town to reduce the levels of plastic entering the Kingston Harbour. The project offers plastic recycling opportunities for communities. Similarly, a Public-Private Partnership (PPP) for integrated Waste Management is currently underway with a Waste Enterprise Team developing proposals for countrywide concession. The concession aims to cover multiple sources of waste across the country through a PPP for waste collection, transfer, and disposal. At the same time, Jamaica's solid waste management plan is being updated.

Emissions Trajectory

The waste sector was responsible for 6% of the total emissions share in 2016, with solid waste disposal on land accounting for 3% of net greenhouse gas emissions, primarily from methane. The sector was responsible for emitting 552 of the 852 GgCO₂eq of emissions of methane across all methane-emitting sectors in 2012.

The waste sector's share in total emissions was 6% in 2016. The recent trend has been a high per capita level of waste generation coupled with informal management resulting in keeping emissions from the waste sector growing in line with population trends. The emissions from the sector are expected to grow by 21% in 2050, up to 1.3Mt compared with 2016 levels (Vivid Economics & WB, 2021a). The outlook for the baseline trajectory for 2050 sources of emissions in the waste sector includes the projection that residential and agricultural sectors are likely to increase waste generation.

Drivers of Emissions

The emission drivers for the waste sector can be broken down into:

- Solid waste disposal on land
- Domestic wastewater handling
- Industrial wastewater handling
- Waste incineration
- Biological treatment of waste
- Open burning of waste (backyards)
- Open burning of waste (landfills)

There are eight municipal waste disposal sites across the country: Riverton, Church Corner, Doctorswood, Hadden, Toboloski, Myreseville, Martin's Hill and Retirement. Collectively, these sites serve approximately 67% of households. None of these qualify as sanitary landfills and are thus associated with fugitive emissions and soil leaching.⁸ Riverton, the main collecting site, exceeded its capacity in 2014. The four main waste sites recorded 744,280 tonnes of waste (PIOJ, 2019) compared with 836,000 tonnes of waste in 2009 from all eight waste sites. Table 16 below illustrates the total amount of solid waste disposed in each of the eight sites in 2014. There is no designated hazardous waste facility in the country.

The garbage collection fleet is insufficient to service the whole of the island's population with most of the trucks aging and having broken down, or out of commission for a time (MEGJC, 2018). The waste disposal and collection services are thought to be unreliable, leading large populations across the island manage

⁸ As of 2012 values

their garbage by burning—approximately 27.8% of households in 2012—acting as an additional source of emissions. 60-69% of Jamaica’s solid waste stream is organic matter, and landfill emissions are directly related to the anaerobic decomposition processes of this organic waste, resulting in methane production. Solid waste disposal of municipal solid waste is not only the largest driver of emissions in the waste sector but is also the 9th most polluting source of emissions across all sectors: the 463 GgCO₂eq makes up 3% of total emissions in 2012 (MEGJC, 2012).

Further mismanagement of waste is seen in poor wastewater treatment; only 35% of domestic wastewater was treated in 2017. Organic pollutants from untreated wastewater decay and decompose over time, releasing methane gas which is what results in GHG emissions. While corresponding emissions data is unavailable, there has been a trend of CH₄ emissions from wastewater handling, slowly declining from 4.68Gg in 2006 to 3.63Gg in 2012 (MEGJC, 2018). Jamaica currently has 307 sewage treatment plants monitored by NEPA, yet only 25% meet the national standards for water quality.

Table 16

The Volume of Solid Waste disposed at each Waste Disposal Site in Jamaica, in 2014

Disposal Site	Acreage	Volume of Solid Waste Annually (Tons in 2014)
Riverton	106	390,585
Church Corner	3	17,760
Doctorswood	7.4	17,522
Hadden	9	25,053
Tobolski	12.2	8,432
Myresville	9	15,348
Martin’s Hill	19	61,976
Retirement	27	153,222

Source: (UNICEF & WHO, 2019)

Barriers to Low-Carbon and Resilient Development

There are several barriers that the waste sector faces in transitioning to sustainable development. Table 17 compiles the technical, financial, regulatory, and capacity barriers in the sector.

Table 17*Waste Sector Barriers to Low-carbon and Resilient Development*

Technical	▲ Inadequate Waste Management Infrastructure: This includes waste collection and disposal facilities and poses challenges in managing waste effectively and sustainably. ▲ Limited Recycling and Waste-to-Energy Facilities: The lack of advanced recycling facilities and waste-to-energy plants restricts the potential for waste diversion and resource recovery, hindering sustainable waste management practices.
Financial	▲ Funding Constraints: Limited financial resources allocated to waste management hinder the implementation of sustainable initiatives, including infrastructure development, technology upgrades, and public education campaigns. ▲ Cost Recovery Challenges: Difficulties in recovering costs associated with waste management operations impede the ability to invest in sustainable practices and infrastructure.
Regulatory	▲ Incomplete or Inadequate Waste Regulations: Inconsistencies and gaps in waste management regulations may impede the establishment of comprehensive and effective waste management practices, including waste reduction, recycling, and proper disposal. ▲ Limited Enforcement and Compliance: Weak enforcement mechanisms and limited compliance with waste management regulations contribute to improper waste disposal practices and hinder progress towards sustainable development.
Institutional/ Capacity	▲ Limited and infrequent garbage collection pick-up times, coverage area and fleet size: This results in inconsistent garbage collection and thus, disposal services. As a result, garbage burning is seen as an alternative to which many households resort due to lack of appropriate infrastructure. ▲ Lack of Interagency Coordination: Insufficient coordination among different government agencies responsible for waste management results in fragmented efforts and undermines the overall effectiveness of waste management practices.

Key Targets and Milestones

Jamaica will have an efficient integrated waste management system. To decarbonise the waste sector of Jamaica and enabling low-carbon and resilient development, Jamaica will work to:

- Reduce the amount of solid waste to be collected by improving waste separation, increasing the number of recycling projects and plants, and promoting composting as an alternative treatment option;
- Reduce improper disposing of garbage by implementing waste-to-energy projects;
- Reduce the adverse impacts of waste on the environment and public safety with well-managed waste infrastructure;
- Develop and enforce solid waste management regulations.

Low-carbon development and emissions mitigation within the waste sector will come from improvements in the management of solid waste infrastructure in the country. This will involve improving waste processing for separation, increasing recycling projects and plants for both organic and inorganic matter, encouraging composting and expanding waste-to-energy projects to name a few. Having a well-managed waste infrastructure will allow for robust emissions reduction strategies to be implemented for deep decarbonisation in the waste sector.

Low-carbon development in the waste sector will primarily come from reducing methane emissions. One key means by which this will be achieved is through increasing organic waste recycling to reduce the production of methane in waste sites. Transfer centres will be established to aid the process of separating solid waste streams so that organic matter can be processed for compost, as recycled matter for agricultural use, or for waste-to-energy projects. Municipal recovery facilities will also be used in upgrading the collection processes of waste to make the process of waste collection to disposal more efficient.

To encourage industrial scale recycling for reducing waste entering the landfills, Vision 2030 calls for the imposition of landfill taxes or fee structures alongside greater industrial recycling projects (GOJ, 2009c). Jamaica will aim to establish collection and resale markets for tyres, for use in cement kilns and asphalt production. There is presently a partnership with the Caribbean Cement Company to remove between 1.5 to 2 million tyres from the Riverton City landfill for incineration and energy generation. Projects such as these will be scaled up and expanded in the longer term to ensure recycling

of industrial waste either into other products, or for energy generation. Other products include reusing ceramic and concrete waste for reef restoration which additionally provides adaptation co-benefits.

Having a more robust waste management infrastructure will involve strengthening the waste disposal site management, establishing standards for sanitary waste disposal, and mitigation actions to reduce emissions. This will be achieved by introducing waste-to-energy projects across Jamaica to establish a sustainable waste minimisation scheme by recycling waste for energy recovery. With Integrated Solid Waste Management Public- Private Partnerships already underway, the waste-to-energy technology will be expanded to beyond the two currently suggested facilities (DBJ, 2022). The current project will see an increase in the collection rate of MSW from around 60% to over 90%, and a reduction in emissions from the waste sector by 70% due to the waste-to-energy transition. They will serve a total of 11 parishes in the country. Currently, none of the eight landfills is considered sanitary. At least one of these eight will be made sanitary for the safe disposal of hazardous waste under this pilot project. Both waste-to-energy and sanitary landfills will be further expanded to serve all parishes in Jamaica.

Waste-to-energy infrastructure will be further expanded by creating a market for waste-to-energy, locally and potentially with other Caribbean countries. Not only would using waste from industry and agricultural sectors create an internal market within the energy sector while providing mitigation benefits, but it would also have the potential to generate revenue which could be further invested in expanding

waste-to-energy or other mitigation actions, that could enable the waste sector to be on a trajectory for net-zero decarbonisation. For successful deep decarbonisation, improvements to the solid waste management infrastructure need to be monitored, maintained and where appropriate, expanded. Waste disposal means need to be strengthened to expand coverage and increase enforcement through regulations and potentially subsidies. This will be coupled with expanding and enhancing the safety of roadways, service areas and pick-ups to ensure increased accessibility to waste disposal services in the country. For the longevity and assurance of a resilient infrastructure, a network of transfer stations would also be built for greater accessibility and connectivity within parishes and landfill sites

Collecting biogas from agricultural waste will lead to emissions reductions, as outlined in the National Biofuels Policy 2010–2030, which is being expanded beyond 2030 (GOJ, 2010). Biogas will be collected and used to replace natural gas and aid the transition away from natural gas as a source of fuel in the country. Currently, 250 plants are in operation across the island using animal wastes in the agricultural sector, small manufacturing, educational and residential sectors. For this to expand for further emission mitigation, there needs to be increased social acceptance in the strategy's effectiveness which will involve public engagement, training, and awareness campaigns. Similarly, biodiesel is being produced from waste cooking oils, with a pilot project established at the Bodles

Research Station. Given the small scale of such efforts, they will be expanded to create a national system in place for collecting used cooking oil for biodiesel production.

Emissions from poor or mismanaged wastewater treatment come from runoff and storage of untreated wastewater. By establishing more wastewater treatment plants across the country to treat and reuse wastewater, emissions will be reduced. The USD 77 million contract signed in 2022 to establish a new wastewater treatment plant to service Portmore, Kingston and Spanish Town, sets a good precedent for future expansion (BNamericas, 2022). The treated wastewater can also be used as input for greywater systems in buildings, irrigation in agriculture and household level gardening, establishing a degree of circularity and avoiding unnecessary emissions.

As outlined in the Emissions Policy Framework, knowledge and awareness is a key part of emissions reductions in the waste sector, as it enables changing consumer behaviour (GOJ, 2021a). Especially since municipal waste production heavily relies on people's consumption patterns, attitudes and understanding of waste and its impacts on the environment, public awareness is key to changing waste generation in the country. The public will be sensitised about good practices in waste management, including the harmful effects of burning and incineration, as well as the benefits and opportunities of reducing, reusing and recycling countrywide.

4.8 Cooperation under Article 6 of the Paris Agreement

Carbon markets have been used by many countries as a tool to accelerate climate action: unlocking resources through increased revenue generation; driving an economy-wide transition towards a low-emissions future; all while boosting the local economy of Jamaica as a vehicle for foreign investment. By incentivising innovation and development of institutional frameworks for higher cost mitigation measures, Jamaica's participation in the global carbon market will enable the development of otherwise inaccessible technologies towards mainstream adoption, which can later be implemented for domestic efforts (Kachi et al., 2019). Jamaica's Climate Change Policy Framework recognises that participation in carbon markets has the potential to assist the country in meeting emissions reduction targets on a decarbonisation pathway to net-zero, but also moves towards achieving sustainable development (GOJ, 2021).

Market demand surrounding emissions reductions mitigation outcomes can come from various sources: decentralised cooperative approaches under Article 6.2 through the transfer of internationally transferred mitigation outcomes (ITMOs); the new centralised crediting mechanism under Article 6.4 being developed; voluntary carbon markets such as Verified Carbon Standard and Gold Standard; and international sectors such as in aviation under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) or in shipping through the International Maritime Organization (IMO).

Given how recently Article 6 and its rulebook were agreed upon, guidance on its modalities, especially for the new crediting mechanism, is limited. However, plenty of avenues of participation in carbon markets already exist under Article 6.2, as well as many emerging initiatives with Article 6 pilot projects. The Swedish Energy Agency, for example, is deeply engaged in the Article 6 market to support the development of mitigation activities. Japan's Joint Crediting Mechanism, Switzerland's KliK Foundation, Norway's Nordic Environment Finance Cooperation (NEFCO) and Nordic Initiative for Cooperative Agreements (NICA), and the Canada-Chile Agreement on Environmental Cooperation are existing mechanisms or framework agreements that are examples of successful carbon market participation.

While Jamaica has not been an active participant in carbon markets so far, they hold great potential in creating opportunities to further global emissions reductions while creating a source of revenue for future mitigation projects. While never approved for implementation, Jamaica's draft National Policy for Trading Carbon Credits 2010–2030 highlights various barriers that Jamaica will consider and evaluate before becoming an active participant in global carbon markets (MSET, 2010). There is currently limited regulatory framework to participate in the market, along with a lack of legal instruments to recognise mitigation outcomes as a tradable instrument in the regional market.

While mitigation projects have grown over the years, there is still low capacity to develop projects specifically to be considered as ITMOs, along with low levels of awareness regarding opportunities amongst public and private sector organisations. All these barriers will be further evaluated to develop a strategic framework for Jamaica's participation in carbon markets.

Jamaica will participate in international carbon market mechanisms to create a competitive, diversified, efficient and conducive market to trade mitigation outcomes that will foster socio-economic development and induce a low-carbon economy (MSET, 2010). This will take place through four main goals: a clear, flexible, legal and regulatory framework for carbon market participation that is responsive to changes in the global space; a well-developed governance and institutional framework that leads to the maximisation of opportunities; diverse initiatives implemented to reduce carbon emissions and generate mitigation outcomes through the regulatory and voluntary markets; and mitigation outcomes that successfully attract investment through a financial and economic system in which benefits and risks are distributed equitably.

The process for identifying mitigation outcomes is an important first step and can be summarised in the following steps (Greenhouse Gas Management Institute & Caribbean Cooperative MRV Hub, 2021):

- Identify all existing, planned, and potential mitigation activities;
- Determine the eligibility of mitigation activities under the various sources of market demand that the activities are eligible:

- a. Article 6.2: ITMOs or through bilateral framework agreements
- b. Article 6.4: new centralised mechanism when more guidance is available
- c. Article 6.8: voluntary carbon market mechanisms;

- Identify project development and implementation capacity needed and available;
- Identify project auditing capacity needed and available;
- Identify government capacity and institutional arrangements needed and available.

Jamaica has plenty of mitigation options that can be used for further emissions reductions beyond achieving the NDC, that are essential for the successful implementation of decarbonization strategies. Table 18 below provides a sectoral summary, as well as the expected impacts of each specific mitigation activity and thus its potential as a mitigation outcome to consider for the carbon markets (Greenhouse Gas Management Institute & Caribbean Cooperative MRV Hub, 2021). Following the identification of appropriate mitigation outcomes, Jamaica will create an enabling and approval framework for the authorisation of ITMOs, such that they are real, verified, and additional to mitigation outcomes in the country. This carefully considered approach to identifying eligible projects, and approving such activities, is essential for Jamaica's successful participation in carbon markets under Article 6.

Table 18*Potential Mitigation Outcomes for Article 6 Cooperation with Emissions Reductions Impacts*

Activity type	Mitigation Activity	Expected impacts in emissions reductions
 Energy	Intermittent renewables	High
	Battery storage	High
	Reduce transmission and distribution losses	High
	Demand-side response	Medium
	Low-carbon generation	Medium
	Hybrid mini-grids (PV +storage)	Low
 Buildings	Construction of low-carbon buildings	High
	Low-carbon cooling	High
	Energy-efficient appliance	Medium
	Energy efficiency in existing building	Medium
	Independent low-carbon generation	Medium
	Low-carbon cooking	Medium
 Transport—passenger transport	Low-carbon vehicles [Battery electric vehicles (BEV)]	High
	Modal shift from private to public transport and shared mobility	High
	Low-carbon public transport	High
	Fuel efficiency improvements	Medium
 Transport—freight and shipping	Fuel efficiency improvements	High
	Battery electric vehicles	High
 Industry	Energy efficiency improvements	High
	Fuel switching	High
	Clinker substitution	High
 Forestry	Improved forest management	Medium
	Wetlands and mangrove restoration	Medium
	Reforestation	Medium/Low
	Reduce use of non-sustainable forest products	Low
	Afforestation	Low
 Agriculture	Climate-smart agriculture	Medium
	Irrigation investments	Medium
	Agroforestry	Medium/Low
	Sustainable manure management	Medium/Low
	Livestock and agricultural productivity improvements	Medium/Low
	Reduction in food waste	Medium/Low
	Silvopasture	Medium/Low
	Nutrient management	Low
 Waste	Recycling and municipal solid waste management	Medium
	Tyre recycling/incineration	Medium/Low
	Methane capture	Medium/Low
	Composting	Medium
	Wastewater treatment	Low



5

Adaptation



5 | Adaptation

As a climate-sensitive country, Jamaica's social and economic sectors are highly susceptible to the impacts of climate change. Hydro-meteorological events often lead to the damage of infrastructure, the disruption of livelihoods, decreased economic output, loss of production systems and the disruption of social services such as access to water for sanitation and hygiene.

Since 2000, Jamaica has been affected by natural hazards on average every two years. Estimates of the economic impact from extreme events average to about 1.3% of GDP per year. The impact has been extensive on infrastructure, productive and social sectors; there has also been a toll on the natural environment though costing the impact has been challenging. Numerous persons have died or been injured, and hundreds of communities have been affected (GOJ, 2022b).

The impact of slow onset events such as sea level rise has been growing; Jamaica currently does not have the ability to cost this type of impact, but evidence shows a growing impact, with loss of territory, cultural and heritage sites, and repositories as well as consequent displacement (human mobility). Permanent displacement has occurred in several locations, where the coastline has eroded to render unliveable previously habitable areas (GOJ, 2022b).

A range of activities can strengthen Jamaica's response to climate risks. As an island nation, Jamaica faces climate risks such as floods, tropical storms, and heat stress. However, resilience activities can boost Jamaica's resilience to these threats while

protecting its natural assets and built environment now and in the future. This can be achieved with actions to protect and enhance critical public assets and services, helping the population and businesses in Jamaica manage residual risks and natural disasters with financial incentives to resilience building, and early warning systems in case of an extreme weather event just to mention some examples (Vivid Economics & WB, 2021a).

In an attempt to reduce the vulnerability of sectors, communities, and social and economic assets to climate impacts, Jamaica is focusing on enhancing its adaptation planning at the local, national, and sectoral levels, while facilitating the social and economic development essential to national growth and survival (GOJ, 2022b).

For adaptation measures to be implemented effectively, they need to be responsive to socio-economic impacts and should consider gendered differentiations that exist in the Jamaican society. The LTS approach to adaptation and resilience recognises women as a particularly vulnerable group, and therefore key stakeholders, due to historical and societal barriers, as well as the ways in which they are disproportionately impacted by the effects of climate change, more specifically, female-headed households and vulnerable groups and minorities.

Jamaica will pursue efforts to improve the resilience broadly across the economy and society. Particular areas of focus include tourism, human settlements, critical infrastructure, food security and agriculture, coastal areas, population and health, and culture and heritage.

While the goal of this strategy is to provide a long-term vision of key components of a resilient Jamaica, once the NAP is completed, it will provide clearer, more specific objectives for the immediate development of Jamaica's adaptation priorities.

Adaptation barriers

The GCF readiness proposal for the development of Jamaica's NAP identified several barriers in the country in terms of adaptation planning and implementation, these include (GCF, 2020):

- Insufficient technical and implementation capacities in adaptation planning and implementation among public, private, and civil society actors to meet the growing challenges brought on by climate change: formalised governance and institutional mechanisms for engagement include the Climate Change Focal Point Network, the Climate Change Advisory Board (CCAB) and the Hazard Risk Reduction and Adaptation to Climate Change (HRRACC) Thematic Working Group (TWG). However, there is greater engagement of the public sector across the various mechanisms, and there is largely a gap in specialised, targeted training and knowledge vis-à-vis climate change adaptation. The existing private sector mechanisms for adaptation planning and implementation need strengthening including institutional arrangements. In addition to this, technical capacities are needed to increase the understanding of the more extreme nature of climate change and the most appropriate responses. In November 2019, an adaptation stocktake exercise with civil society organisations across Jamaica revealed inadequate implementation capacity of civil society in adaptation planning.
- Inadequate enabling environment for adaptation action across priority sectors: Vision 2030 Jamaica and the MTF provide a high-level framework for development in the country, and climate change is among the key priorities. Although the NAP development process is in place, it has still not been completed and only few sectors have developed policies or strategies and action plans that mainstream climate change. Only the forest sector has completed its National Forest Management and Conservation Plan, 2016–2026. Others are advancing efforts through undertaking sector-specific vulnerability assessments or have developed plans that have yet to be promulgated.

- Inadequate structured approach to research, monitoring, evaluation, and learning: Basic socio-economic and environmental data for Jamaica are both available and accessible from entities such as the PIOJ, the Statistical Institute of Jamaica (STATIN), the Ministry responsible for agriculture, the Ministry of Finance and Public Service and NEPA. However, there are data gaps and needs to enable increased granular understanding of climate change impacts at the community and species level, more specifically issues impacting vulnerable groups (women, youth, persons with disabilities). Different agencies are developing data and information systems, but • there is a standardised system to integrate and track progress of climate change adaptation measures (aside from project-specific information). Currently, the Statistical Institute of Jamaica (which manages all government statistical information) collects and stores environmental data, but there is no structured collection of similar data for climate change.
- No formalised mechanism for private sector engagement in adaptation planning and implementation: Access and input into government actions by private sector are increasing but with limitations. Greater engagement will be required from the private sector to overcome limited knowledge and awareness on the potential impacts of climate change on business operations and value chains. There is limited regulatory support for integrating climate change measures to build climate resilience, insufficient mechanisms to encourage adaptation measures, and weak knowledge management structures to share good practice. The engagement with the private sector needs to progress from a project-based approach to a programmatic approach.
- Inadequate financing to support national adaptation planning and implementation of priority actions: As long as the NAP is under development, there is no comprehensive and cohesive plan identifying adaptation financing needs to facilitate more easily the development of an adaptation financing and implementation strategy. Financing for adaptation has taken place through GOJ support, external partners, development banks, and bilateral arrangements with other states. Many of these initiatives have been possible through country programmes or support programmes. The capacity to assess additional and incremental climate change costs for developing medium and long-term financial projections and resource allocation is also limited. There is an urgent need for short- and medium-term planning for adaptation actions and matchmaking these needs with donor funding.

5.1 Tourism

Jamaican tourism will be inclusive, world-class, distinctive, and highly competitive while serving as a significant driver of socio-economic and cultural development. The industry boasts a well-educated and highly skilled workforce capable of developing and implementing sustainable practices that revolve around the unique cultural heritage and natural assets of Jamaica, preserving and celebrating the country's rich cultural and environmental diversity.

Jamaica is known around the world as a Caribbean tourism destination. Each year, more than 1.5 million foreign visitors travel to Jamaica from all over the world to enjoy the country, climate, culture, music, people, and more (CTO, 2022).

Tourism is therefore a key component of the Jamaican economy. It is one of the country's most important foreign exchange earners. It contributes to around 18% of the country's labour employment (STATIN, 2022). The sector accounted for 31% of Jamaica's GDP in 2018. According to the Inter-American Development Bank's (IDB) Tourism Dependency Index, Jamaica ranks as the 13th most tourism-dependent economy in the world (GOJ, 2022b).

Tourism is also one of the most climate-sensitive sectors, particularly given the core role that sand and sun play in vacations to Jamaica, as well as the importance of natural and coastal resources to the vacation experience.

Jamaica's tourism activities are concentrated in coastal resort areas such as Montego Bay, Negril, and Ocho Rios, which together account for 75% of the visits (GOJ, 2022b; Vivid Economics & WB, 2021a). These coastal zones are, however, highly sensitive and vulnerable to climate-related hazards, such as hurricanes and storm surges, as well as slow onset effects such as sea level rise.

Considering that the island's coastline is densely populated with hotels and tourist facilities, it is estimated that a 1-metre rise in sea level will impact about 8% of major resorts in Jamaica, while a 2-metre rise will have an impact on 18% of infrastructure built on coastlines. These buildings and infrastructure are also highly exposed to the impacts of hydro-meteorological events such as tropical storms, and hurricanes, which are also projected to increase in frequency and intensity. All these events threaten tourist facilities and the wider sector through various physical, social, environmental, and economic impacts (GOJ, 2022b).

Adaptation Needs and Long-Term Sector Sustainability

Addressing the effects of climate change on tourism will require a multi-sectoral approach. Some adaptation options are diversifying the tourism product; using ecosystems-based adaptation strategies (e.g., beach restoration); collaborating with tourism interests; and improving communication on climate risks, among others. The development of the Ja-NAP will also include a vulnerability and adaptation assessment for the tourism sector with focus on the south and east coasts where possible (GCF, 2020).

There has been steady work in Jamaica's tourism sector for building resilience through various initiatives. These include vulnerability assessments of selected areas; drafting of plans and strategies for national and resort level action; workshops and training of key sector interests, including the private sector; and concrete activities to protect coastal resources (beaches and coral reefs, etc.). Nonetheless, these types of adaptation actions are and must remain iterative and must also be sustained and programmatic. Other needs include continued screening for climate risks; implementation of climate-proofing measures; and support to further identify and address risks to the tourism product including infrastructure and natural assets and value chains. There is an opportunity to strategically consolidate the data, information, and lessons that have been generated to date on adaptation action (GOJ, 2022b).

By 2025, the tourism sector will develop a tourism sector climate change adaptation strategy and implementation roadmap. The aim is to conserve or maintain the quality of the national tourism product and ensure its medium- to long-term viability.

Building resilience in the sector is also being done at the local level through plans relating to climate change and disaster risk management at the resort level. For example, a draft tourism specific disaster risk management plan was prepared for the Ocho Rios Resort Area which includes areas within the parishes of St. Ann and St. Mary. The sector is also advancing a Destination Assurance Framework which is expected to account for climate change in improving the tourism product of targeted geographic locations (GCF, 2020).

The long-term sustainability of the sector could be further supported through a mix of engineered and built environment, behavioural, and laws and regulation interventions such as (UWI, 2022):

- Diversify and invest in the touristic offering with a focus on Jamaica's strong
- cultural heritage and diverse natural environment;
- Invest in Nature-based Solutions (NbS) for coastal rehabilitation, beach nourishment, and artificial reefs projects;
- Introduce land management best practice standards and regulations to reduce runoff of polluting sediment and fertilizers;
- Prioritise, enhance, expand, and promote protected areas through the development of a comprehensive policy framework (including Marine Protected Areas or MPAs);
- Regulate, monitor, and enforce a reduction in overfishing and illegal fishing practices.

The combined threats of coastal erosion and dangers to coastal areas and ecosystems, particularly to coral reefs, threaten the future prosperity of the tourism industry. While Jamaica will work to ensure the resilience of the industry's operations, future development plans should also aim to diversify the economy to address the climate-related challenges the industry faces in order to foster growth.

5.2 Human Settlements

Jamaica's housing sector will be resilient to impacts, and responsive to the needs of people to reduce vulnerability relating to housing conditions across the country.

The formal housing sector is unable to meet the housing demand in the country, especially with the population growth trend. There is an annual domestic shortage of 6,200 units (PIOJ, 2022b), with around 20% of Jamaica's population living in informal settlements (Mycoo, 2022). Informal settlements are at high risk and tend to be located in disaster-prone areas in rural, urban, and coastal areas of Jamaica: 55% of informal settlements are in the floodplains and along the coast leading to a high probability of displacement of individuals due to isolation by landslide, floods and destruction of transportation, water, and waste infrastructures in the event of disasters (GOJ, 2022a).

The National Squatter Management Policy (NSMP) is currently being drafted with the aim to curtail squatting to reduce vulnerability of populations living in informal settlements. Beyond this policy, GOJ will create greater housing programmes targeted towards lower income groups to reduce the growth of the informal housing sector. GOJ will call for the private sector housing market to target these groups and provide subsidised housing programmes as well.

With the impacts of climate change worsening, and the frequency of hazards and disaster risk increasing, there is a need for funding to expedite the return to normal living and work conditions in the post-disaster. Jamaica will assist in the rolling out of parametric micro-insurance products for this purpose (Vivid Economics & WB, 2021a). Parametric insurance responds to disasters quicker than conventional insurances as they are predetermined amounts based on the size of hazards. Given that the associated residual risk is smaller and more easily managed

by these insurance products, they can reduce the demands on the government to be solely responsible for disaster relief needs of the population.

With a growing population, growing size of urban areas, and rising temperatures, urban heat stress will increasingly become an issue, with the demand for cooling technologies likely to increase. While also an effective mitigation measure, deploying low-carbon cooling is an essential tool to help populations in urban settlements adapt to the changing climate. Jamaica's National Cooling Strategy (JCNS) was developed as a part of the Jamaica - Caribbean Cooling Initiative (J-COOL), and outlines mechanisms to increase the efficiency of cooling equipment (United for Efficiency, 2021). In the long-term, cooling initiatives will also be rolled out to rural settlements, and wherever possible, informal settlements to help populations across the entire island adapt to rising temperatures.

While not directly an adaptation response, it is important to consider loss management responses in the event of both hazard events but also slow-onset effects of climate change. Given that 82% of the population lives within 5km of the coast (GOJ, 2014), there is a need for interventions where preventing coastal erosion is not possible, unsuccessful, or not monetarily feasible. The government thus will develop a countrywide management plan for coastal retreat to enable careful planning to ensure assets retreat inland in ways that provide the least possible disruption to livelihoods (MEGJC, 2018). This is a high risk of regret option given that coastal retreat is irreversible, and this might likely have high opportunity costs if not implemented.

5.3 Critical Infrastructure

Jamaica will have functional and climate resilient critical infrastructure that can cope with the risks and impacts of climate change and foster sustainable and equitable economic growth and development.

The critical infrastructure refers to the infrastructure related to the power, transport, water, and waste sectors. Although these sectors are mostly focused in mitigating the effects of climate change, the impact thereof will also affect critical public assets and services. For a climate resilient Jamaica, climate change issues need to be considered through the design, financing, and operation of long-lived critical assets.

The impacts to the critical infrastructure assets are not only physical, but also affect the services they provide such as healthcare and education. Resilient services require buildings that are physically resilient to disaster and changing climate as well as institutions and processes which can operate in crises and are robust to the evolving needs of the population (Vivid Economics & WB, 2021a).

The water sector infrastructure in Jamaica is expected to be significantly impacted by changing climatic conditions. The island has already been experiencing increased variable rainfall, prolonged drought conditions, increased evapotranspiration, and saline contamination of groundwater resources, all leading to a decline in the supply and distribution of water across rural and urban landscapes. Additionally, the sector is challenged by its old infrastructure which has contributed to leakage and frequent water supply disruptions. Hence, communities are even more affected by water lock-offs or the intermittent provision of water services due to increasingly frequent dry spells and drought conditions. In periods of heavy rainfall events, the sector has also been affected by high levels of siltation and damage to pipelines (GOJ, 2022b).

Water resources in the southern section of the island, including the country's capital, have been most affected by climate change over the years. In the Third National Communication (TNC), an analysis of future climate risks for Jamaican water resources determined that the three critical basins of Kingston, Rio Cobre, and Rio Minho would be in deficit by 2015. As of 2015, the Kingston Basin and the Rio Cobre Basin have been in deficit, with the Rio Cobre in deficit for several years now. The TNC further validated this observation, showing reduced aquifer recharge and extended drought periods in some areas (GOJ, 2022b).

The NAP should include considerations for increasing the water storage capacity in-country, and making the infrastructure more resilient to the various impacts of climate change.

The impacts of changing climatic conditions can adversely affect energy supply and distribution. The transmission and distribution of electricity across the island are dependent on the continued operation of the island's main electricity provider. However, most of the infrastructure including load centres, generating plants, service stations wind farms and power lines are mainly located along the coast, leaving them highly exposed to the impacts of extreme hydro-meteorological events. Likewise, an increase in temperatures will probably increase energy demand for cooling, and increase inefficiencies while sea-level rise is likely to affect coastal power stations. Furthermore, the ageing infrastructure of fossil fuel plants (some over 30 years old) is also threatened by the passage of intense storms and hurricanes.

Jamaica's transportation sector is already being affected by extreme weather events. Frequent damage to roads, bridges, drains and other infrastructure has become the norm during the passage of tropical cyclones and the occurrence of intense seasonal rainfall. According to PIOJ (2017), "since 2001, damage and loss related to infrastructure have cumulatively accounted for \$54.8 billion or 42.6% of the overall costs related to extreme weather events. Of this amount, damage to transportation infrastructure accounted for 87%" (GOJ, 2022b).

Adaptation Needs and Long-term Sustainability

Water is critical to every other sector. Therefore, the vulnerability of the sector to climate risks has far-reaching implications. Several adaptation initiatives are underway, spanning reduction in non-revenue water, awareness-raising programmes promoting household-level storage and conservation, and programmes targeting housing and other building construction developers to install water-saving devices, among others. Several rainwater harvesting systems have been installed across communities, schools, and agriculture networks, inter alia (GOJ, 2022b).

The policy landscape has also improved with the promulgation of the Water Sector Policy in 2019. Undergirding these activities are improvements in the collection, storage and analysis of hydro-meteorological data including real-time data collection stations across the island. Nonetheless, there is a "moving target" for making the sector resilient to the effects of climate change. This demands continuing the work already underway while also pursuing new and innovative options for adaptation (GOJ, 2022b).

The resilience and recovery capacity of the energy sector is central to national economic and social wellbeing. To establish an energy sector that is resilient in the face of climate change and climate variability, a comprehensive, data-driven, science-based approach to climate risk identification, reduction, recovery, and restoration must be adopted.

Progress has been made in assessing the levels of exposure, susceptibility, and risk of elements of the sector's energy generation, transmission, distribution, and storage infrastructure, to climate change and climate variability. This vulnerability and risk assessment are possible through the application of the Systemic Risk Assessment Tool (SRAT). The national electricity company also pursues training, capacity development, and emergency response and recovery (GOJ, 2022b).

Efficient and reliable transportation is dependent on sufficient, structurally sound, infrastructure (roads, bridges, and ports), that is protected by systems of secondary infrastructure (drains, culverts, retaining walls, etc.). The effectiveness of these protective systems is dependent on appropriate design, and the impacts of land use practices in surrounding areas. Regardless of the scale of a disaster, transportation is central to effective response, recovery, and restoration efforts. Effective adaptation in the transportation sector requires coordinated action across several sectors. Several vulnerability assessments and public infrastructure improvements have taken place. Infrastructure designs and ecosystem-based adaptation recommendations based on hazard and vulnerability assessment studies have been developed under different initiatives. However, as a capital-intensive sector, the mobilisation of financing has been constraining climate change adaptation

efforts (GOJ, 2022b). Focus should be made on enhancing the resilience of coastal area road infrastructure and major flood-prone corridors to enable the use of the infrastructure in the aftermath of an extreme weather event. However, the plans and targets for addressing these issues should be detailed as part of the NAP in the works.

Additional interventions that can enhance the long-term sustainability of critical assets are shown in Table 19 (UWI, 2022).



Table 19*Proposed Critical Infrastructure Adaptation Interventions*

Critical Infrastructure proposed Interventions for long-term Sustainability	
Electricity	● Adopt standards for resilient transmission and distribution infrastructure. ● Improve the location of electrical networks (production, transmission, distribution, and storage) and upgrade new and existing facilities against wind damage, storm surge and flooding (coastal and inland). ● Explore and implement the appropriate design of energy facilities located along the coastline and susceptible to extreme events and Sea Level Rise (SLR). ● Develop the methodological framework that will provide the enabling environment to facilitate adaptation projects and investment in the power sector. ● Explore the appropriate design of energy networks to enhance resilience through the incorporation of RE technology solutions, RE supported decentralisation, and diversification of energy supply and storage. ● Enhance the coordination of energy sector climate risk reduction initiatives with regional preparedness, response, and recovery mechanisms.
Transport	🚗 Adopt resilient road build standards and guidelines. 🚗 Conduct detailed, location-specific, climate vulnerability and risk assessments for each of Jamaica's main air and seaports, using the time-slices, and climate change projections employed in the State of the Climate Reporting process. 🚗 Use the findings of the climate change and vulnerability and risk assessment to develop, cost, select, and implement adaptation options. 🚗 Deploy the validated Jamaica Systemic Risk Assessment Tool (J-SRAT) as a shared platform for assessing and tracking, inter alia, transportation infrastructure exposure, and susceptibility to climate hazards.
Water	💧 Upgrade the water supply and sanitation facilities. 💧 Improve the design and expand locations for implementing water capture and storage facilities, including micro dams. 💧 Support the use of Nature-based Solutions (NbS) to adapt to climate change as they relate to water treatment, such as constructed wetlands. 💧 Invest in upgrades and enhancements for resilient water-related ecosystem services. 💧 Implement pilot projects or use of incentives to study the reuse of treated industrial effluent and other waste-water sources. 💧 Expand the implementation of artificial recharge systems in appropriate locations, including site identification, construction and incorporating the use of renewable energy. 💧 Support the need to increase the resilience of water intake works (infrastructures) located in sensitive watershed areas subjected to extreme weather conditions. 💧 Support the implementation of innovative methods/technologies such as early warning systems/probes to protect downstream assets from flooding.

Source: (GOJ, 2022b; Vivid Economics & WB, 2021a)

5.4 Food Security and Agriculture

Jamaica will have a climate-resilient agricultural economy that satisfies the needs of all Jamaicans to have access to a healthy, nutritious and balanced diet.

Some climate projections expect a decrease in the length of the rainy season by 7–8%, a 20% increase in the frequency of intense rains, and uncertainty of water availability with increasing temperatures by 2050 (JIS, 2020). Farmers in Jamaica are already struggling to cope with the impacts of climate change. With the agricultural sector being so reliant on the climate, and food security being entirely reliant on the agricultural sector in Jamaica, having food security is inexplicably linked to having a resilient agricultural sector (UNEP, 2022). Food poverty prevalence was 4% in 2019 in the country and is expected to increase due to climate change if resilient interventions are not implemented (PIOJ, 2022b). These interventions bring together changes in agricultural practices to better adapt to changing climatic conditions, while also encouraging means of coping with its implications on food systems. Improving food security in Jamaica means improving how the agricultural sector adapts and responds to climate change.

For long-term resilience within the agricultural sector, Jamaica will introduce the development and implementation of a policy framework for climate-smart agriculture (CSA). The aim of CSA is to shift goals of agricultural practices so that risks and future costs for current practices that might worsen are internalised. CSA also includes dynamic farm management tools to integrate climate change risks as mentioned in the Food and Nutrition Security Policy (MoAF & MoH, 2013).

With existing projects in St. Thomas, St. Mary and Portland, the CSA framework will be expanded and implemented across the island's agricultural sector (JIS, 2020). The Ministry of Agriculture and Fisheries (MoAF) will also further its "New Face of Food Strategy" beyond its current 2025 strategic plan, which focuses on implementing initiatives to respond to Food Security, Agribusiness Development, Climate-Smart Technologies, and Export Expansion (MoAF, 2021). Promoting agricultural resilience to water stress enables the agricultural sector to withstand the anticipated scarcity of water in the future. In order to achieve this goal, there is one key measure that Jamaica will implement, namely, the expansion of efficient irrigation methods. With drought conditions expected to increase, new techniques such as drip irrigation will enable farmers to adopt and maintain irrigation systems and conserve more water. This introduction of new techniques, and potentially technology, will be coupled with capacity building interventions amongst farming communities.

Therefore, with the expected shifts in seasonality, the country must be prepared to shift growing patterns to follow the new seasonality and optimise different climatic conditions for the most efficient and productive farming season. Jamaica thus proposes to support behavioural changes to adapt to these shifts in seasonality so that appropriate crops are resilient in the longer, hotter summers where there are expected to be more concentrated periods of intense precipitation.

The Government will work with the public to encourage behavioural changes and adapt to the new growing patterns of crops, while also providing the agricultural sector with information regarding seasonality and crop rotation. The Government will also aim to work with academic institutions on conducting research into the projected climatic changes and their implications on seasonal patterns of crop growth.

To further withstand changing conditions and ensure security within the food system, Jamaica will promote and facilitate crop substitution where necessary and appropriate. Pilot projects in transitioning to climate-resilient alternatives will be explored since various major crops might not be viable given the future climatic conditions. In particular, sugarcane, coconuts, bananas and coffee crops are seen to be vulnerable. Jamaica will actively work towards providing financial incentives to encourage the adoption of climate- resilient crops and

the replacement of vulnerable ones, with respective interventions for new commercial markets for these crops and public awareness campaigns. Attention will be given to the socio-cultural implications that this may have and its possible impact on Jamaica's food-based cultural identity.

Food security is a key sector that is necessary to make resilient before the impacts of climate change worsen. Given certain communities have reduced access to food and are already more vulnerable than other parts of society, it is going to be key to centre these measures for food security and accessibility around the most vulnerable in the country. By strengthening the existing food systems and making them more resilient, as well as introducing new practices, Jamaica's climate adaptation efforts in the agricultural and food security sector will be resilient and prepared for the impacts of climate change.

5.5 Terrestrial Ecosystems

Jamaica will have terrestrial ecosystems that are native, diverse and prioritise conservation actions and ensuring sustainable ecosystem services are available for all.

Terrestrial ecosystems are a valuable ecosystem service in Jamaica but are very susceptible to the impacts of climate change. The country is thus expecting further losses of biodiversity and ecosystem services. Jamaica's forests are the primary terrestrial ecosystem that we consider in the country. It is thus imperative to reduce deforestation—by preserving existing forests, they not only continue to act as carbon sinks, but also hold within a great deal of biodiversity and ecosystem services. Similarly, afforestation and reforestation increase forest coverage in the country.

Jamaica's Forestry Department, through initiatives in the National Forest Management and Conservation Plan (NFMCP) 2016–2026, has been undertaking a collaborative initiative to become REDD+ ready. Doing so enables the government to have access to Results-based Payments (RBPs). Jamaica's REDD+ strategy includes conservation redesign, sustainable forest management and forest restoration (Forestry Department, 2019). While Jamaica has historically implemented various adaptation and resilience projects for coastal ecosystems, the

REDD+ strategy enhances the scope of existing initiatives and introduces new conservation and reforestation projects, to also enable disaster resilience, using its Sustainable Fishery Conservation Areas (SFCA) network as a model for successful nature-based adaptation (Lee et al., 2022a).

The LTS is aligned with the National REDD+ Strategy, National Forest Management and Conservation Plan 2016–2026 and the Forest Policy for Jamaica 2017 with the goal of preserving and restoring a healthy ecosystem through sustainable forest management (Forestry Department,

2017a). Collaborative and interdisciplinary efforts will be implemented to engage with a wide range of stakeholders to ensure sustainable management and utilisation of forest resources to enhance social and economic development, while building resilience. The key focus areas of adaptation for Jamaica's forests include improved forest governance and conservation, sustainable forest management, including sustainable harvesting and use of ecosystem services, and multistakeholder participatory forest management practices (Forestry Department, 2017b).

5.6 Coastal Areas

Jamaica will protect its coastlines, build resilience along coastal settlements, and restore coastal ecosystems to reduce vulnerability of communities and ecosystem services. Coastal areas are at the forefront of experiencing the effects of climate change.

With high exposure to sea-level rise and tropical storms, and loss of coastal habitats, these areas are vulnerable to impacts from sea-level rise and coastal erosion. Various plans and policies are already underway; these will be expanded and new ones are being introduced. The Beach Control Act of 1956 will be expanded to include increased setbacks for construction near the shoreline beyond what is currently prescribed. The current Adaptation Fund project 'Enhancing the Resilience of the Agricultural Sector and Coastal Areas to Protect Livelihoods and Improve Food Security' covers seven of the 14 parishes. It uses shoreline protection and hard engineering structures, along with bioengineering solutions upstream to reduce coastal erosion along the north-eastern coast of the island (PIOJ & AF, 2018).

While this project is specifically targeting the protection of livelihoods, future

projects will build coastal resilience across all coastal areas for marine and coastal protection and conservation, and enhance resilience of livelihoods, with the aim to expand beyond the current seven parishes. These interventions will include installation of groynes, shoreline revetment and breakwaters to dissipate wave energy and impact of currents, and reduce the impacts of erosion on the beach and shoreline (Vivid Economics & WB, 2021a).

With Jamaica being one of the eight founding countries of the International Coral Reef Initiative (ICRI), the country currently has five marine-protected areas (MPAs) with a total of 1,764 reefs (ICRI, 2022). Jamaica's Action Plan for Corals and Reefs in Jamaica 2018–2023 creates a network of MPAs to ensure effective management of coastal areas and resources and undertakes reef restoration to combat degradation over time (NEPA, 2018).

With impacts of climate change worsening, this Action Plan will be expanded with further research being necessary before implementation of reef restoration practices, especially keeping in mind the tipping points for coral reef bleaching events. Artificial coral reefs will also be built and expanded to not only encourage biodiversity and conservation of marine life, but also because they are a beneficial adaptation measure in the event of storms.

The decline in extent and conditions of coastal habitats and ecosystems has also had a role to play in the increasing exposure and vulnerability of these areas to impacts of climate change—770 hectares of mangrove forest were lost between 1996 and 2006 (Castaño-Isaza et al., 2019). Past mangrove restoration projects in Jamaica specifically have seen to improve hydrological connections, and worldwide, have been successful in their functions in reducing impacts of storm surge and wave attenuation (Lee et al., 2022b). Jamaica's National Mangrove and Swamp Forest Management Plan 2023–2033 aims to conserve an additional 4340ha of GOJ-owned wetlands and 1300ha of privately-owned wetlands, and to restore at least 1000ha of the currently degraded mangroves and swamps (Forestry

Department, 2023). The government will build on these goals to further the conservation and restoration practices beyond 2033, as well as build capacity amongst communities as a viable alternative sustainable livelihood.

Under the 'Strengthen integrated and cohesive preparedness capacity at a regional, national and community level in the Caribbean' project, Jamaica has benefitted from investments in early-warning systems, especially when impacted by Hurricanes Irma and Maria in 2017 (Rahat, 2020). To ensure that Jamaica can improve risk preparedness and response measures, improvements will be made to these early warning systems. Coastal areas across the country will also be essential in partaking in the payment-for-ecosystem services scheme to be implemented across the country (Vivid Economics & WB, 2021a).

Given the high dependency of the country on tourism and its relation to the coastal ecosystems, more specifically coral reefs, Jamaica should consider examining potential options to diversify the tourism sector offerings in-country given the expectation for coral reef bleaching tipping points to happen by mid-century. This issue could be examined as part of the revision to Vision 2030 Jamaica.

5.7 Population and Health

By 2050, Jamaica will seek to ensure that its population is resilient and healthy, bolstered by equitable access to adequate, responsive, and safe healthcare services.

To achieve this, Jamaicans need resilience of healthcare facilities and supporting systems that respond to the vulnerabilities of the healthcare system in Jamaica to climate impacts, and population health vulnerabilities. This includes but is not limited to the increasing vulnerability to vector-borne diseases, heat stress-related illnesses, and malnourishment. It is

thus imperative to address the growing concerns surrounding the resilience of the population to health impacts from climate change, but also the resilience of healthcare services in the country. The government will bolster the health system through extensive measures responding directly to the needs of the population.

Ten per cent (10%) of Jamaica's groundwater resources have already been lost to water quality issues, due to seawater intrusion, under-metering, and leaks (PIOJ, 2021d). This is expected to worsen with an increase in drought incidence due to climate change. By expanding water and sanitation supply, the LTS aims to reduce the pollution of groundwater, providing strong co-benefits for public health through improved sanitation and environmental resources. The Water Sector Policy too highlights the impacts of climate change on water resources, and the development of a monitoring and planning programme would be beneficial to wider access to improved water quality.

Elderly persons (ages 60 and above) are the fastest growing age group in the country and it is anticipated that they will make up 21.8% of the population by 2050 (MEGJC, 2018). Given their vulnerability to chronic diseases and high risk to climate change impacts like high heat exposure and inability to adapt physiologically as well as other age groups, the government will create and implement a National Policy and Act on healthy aging, and outline avenues of support and measures implemented to better support the growing elderly population.

Across all four chronic diseases considered—obesity, diabetes, hypertension, and asthma—incidence of occurrence and direct cost are expected to increase between 2030 and 2050. Table 20 below indicates the expected changes in population affected by the various chronic diseases and mental health issues, and their respective direct cost projections in 2030 and 2050. To have a resilient Jamaican population, it is thus imperative to ensure proper financing and the full implementation of a National Strategic Action for the Prevention and Control of Non-Communicable Diseases. This will also be coupled with an effort to enable greater access and availability to green areas and park areas for physical activity and leisure, meeting WHO guidelines so that they are suitable for exercise. The government will also impose a 20% tax on junk food, and work towards eliminating the importation of Low Glycaemic Index and Load Foods and the application of the General Consumption Tax (GCT) to these items. Specific lly for asthma, the LTS will ensure the availability of asthma guidelines as well as capacity-building for training health staff on the most up-to-date asthma research and policy.

Table 20

Vulnerability from Health Issues for 2030 and 2050, and their Related Costs

Disease/ Issue	% of population		Direct cost in US\$	
	2030	2050	2030	2050
Obesity	64%	75%	\$2.87 billion	\$3.24 billion
Diabetes	18%	26%	\$205 million	\$291 million
Hypertension	64%	96%	\$681.8 million	\$999.6 million
Asthma	x3 2014 level	x4.6 2014 level	\$211 million	\$283 million
Mental health¹⁰	147,990 ppl	216,203	\$152 million	\$222 million

Source: (MEGJC, 2018)

¹⁰ It is important to note that the population estimate is for self-reported cases.

Vector-borne diseases, primarily dengue, are expected to worsen with rising temperatures across the country. This is normally exacerbated by poor housing and neighbourhood conditions, as well as inadequate waste collection. The LTS response is thus cross-sectoral to tackle waste, water and community: efficiency of garbage collection will be improved, the water deficit in water distribution systems will be eliminated, and community vector surveillance will be strengthened.

With the impacts of climate change, the frequency and intensity of disaster events are expected to increase. This requires our health system to be resilient and responsive. Thus, the LTS will develop a shock-responsive social safety net that aims to deliver fast, targeted, and appropriate support and response measures to households in the aftermath of a disaster event. By improving existing registries and methods of delivery and expanding the response measures, the government

will additionally explore contingency funding and determine the appropriate trigger for the Programme of Advancement Through Health and Education (PATH) cash transfers after a disaster (Beazley & Ciardi, 2020). Jamaica will also ensure that the 2017 National Financial Inclusion Strategy is delivered to enable greater financial inclusion. With benefits beyond disaster recovery, the strategy will allow households to manage finances sufficiently, improve livelihood generation opportunities, and reduce vulnerability to all climate hazards and shocks.

The government will build health sector capacity to manage direct health-related issues in Jamaica: aging population, and chronic and vector-borne diseases. The idea of investments in healthcare capacity to prepare for risks by providing insurance if critical infrastructure is unable to sufficiently respond to the needs of people is also being considered for implementation.

5.8 Culture and Heritage

Jamaica will work towards reducing the potential of climate-induced loss and damage of tangible and intangible culture, heritage and indigenous knowledges that are central to the Jamaica identity.

Building on Jamaica's National Culture Policy (Culture Division, 2008) and Vision 2030 Jamaica's Culture, Creative Industries and Values Sector Plan (PIOJ, 2009), the country will implement the following adaptation strategies:

- Conducting a comprehensive national inventory of cultural heritage sites and artefacts — This will be coupled with vulnerability assessments of heritage sites across the country, resulting in the development of risk management plans, mitigation and adaptive measures for these sites and artefacts. Where appropriate, a national inventory facility will also be built to ensure the resilient storage of cultural artefacts.
- Preserving traditional and indigenous knowledge systems through close collaborations between Ministry-support liaisons and specific indigenous communities—Increased collaboration between these communities and government agencies will enable the identification of traditional knowledge and practices, as well as their documentation and preservation. This will be further supported by providing education and training opportunities to help these communities adapt to climate change.
- Increasing public awareness of Jamaican history, values, and cultural practices, and engagement

with the public, especially youth, using technology as a tool to develop educational and capacity building training programmes and outreach activities — These will be targeted towards encouraging the protection, preservation, and development of Jamaica’s natural, cultural, and built heritage, as well as indigenous knowledge systems.





6

Loss and Damage



6 | Loss and Damage

As a small island developing nation, Jamaica is highly vulnerable to not just extreme weather events due to its geographic location in the Caribbean, but the country is vulnerable to the adverse impacts of climate change: increased frequency and intensity of rapid onset events; changes in precipitation patterns; prolonged drought periods; and slow-onset events like sea level rise. There are limits to our ability to cope with these impacts. As a result, loss and damage, as a standalone pillar in the global climate response, requires its own support, separate from adaptation and mitigation priorities. In this context, economic loss and damage refers to material losses and damages including the fiscal values of damage to infrastructure, loss of assets, destruction of property, loss of agricultural production and tourism productivity to name a few. Non-economic loss and damage refers to non-material losses and damages that are significantly harder to quantify such as damage to ecosystems, loss of territorial land, and also loss of culture, heritage identity, indigenous knowledge, and health (GermanWatch, 2021).

Jamaica's Mid-Term Socio-Economic Policy Framework 2018–2021 recognises that “no country can fully insulate itself against losses from adverse natural events” (PIOJ, 2018). Similarly, Jamaica's Climate Change Policy Framework (GOJ, 2021b) also explicitly refers to loss and damage as an important element of future climate action. The Adaptation Communication recognises the growing need to develop planning instruments for this area of concern especially in anticipation of the impact of slow-onset events that lead to permanent displacement of Jamaicans (GOJ, 2022b). Given the rate of impact of slow-onset events, there is a need to better understand and respond to them. While hazard risk reduction and risk recovery processes in Jamaica have long existed, they are not the same as loss and damage, especially to slow-onset events.

6.1 Key Loss and Damage Sectors

Based on 2015 data, losses and damages are anticipated to be the greatest in coastal areas where 82% of the Jamaican population lives within 5km of the coastline (GOJ, 2021b), and also in the agricultural sector which is vulnerable to the impacts of extreme events such as heatwaves, hurricanes and droughts. While there are significant overlaps with adaptation, specific and separate actions are necessary to address loss and damage complementing adaptation and mitigation efforts in the country. The following sections outlined are some of the important ones to consider for any loss and damage response strategy, beyond the limits of adaptation. GOJ will further undertake an in-depth prioritisation exercise to prioritise accurately loss and damage sectors in the country.

6.2 Economic Losses: Critical Infrastructure, Settlements

Increasing temperatures threaten the social and economic development through effects on worker productivity—higher temperatures reduce labour productivity across all sectors. Similarly, extreme weather events like heatwaves increase the emergence of vector-borne diseases, affecting local populations and their recovery time, and eventually leading to economic loss of productivity. With the increased frequency of hurricane events, flooding, coastal erosion and sea-level rise, important sectors like tourism, coastal sectors and critical infrastructure are severely affected. Coastal erosion and rising sea levels have grave economic losses as they affect ports, airports, road networks and tourism centres, especially since 90% of Jamaica's GDP is earned around the coastal zones (MEGJC, 2018). The inundation of coastal areas and settlements, coupled with the loss of property, are all expected impacts and predicted losses and damages that Jamaica anticipates in the near future.

Increasing temperatures lead to an escalation in the demand on energy for cooling of settlements and infrastructure. At the same time, sea-level rise, storm, and hurricane damage can affect energy production and infrastructure facilities that are located near the coastline (MEGJC, 2018). The same risk exists with storm and hurricane damage to energy infrastructure for renewable sources where present. Considering that 90% of the country's GDP is produced in the coastal zone (MEGJC, 2018), significant coastal property and infrastructure loss and damage from these slow onset events is anticipated. While adaptation measures play a significant role in avoiding such impacts, there may still be some unavoidable losses and damages that Jamaica will prepare for, prioritising resilience-building opportunities for its population.

6.3 Impacts on Agriculture and Food Security

The agricultural sector is extremely vulnerable to the impacts of climate change: changing weather and temperature conditions, extreme precipitation, floods and storm surges, and drought weather, all having a significant impact on agricultural productivity and food security.

Increasing temperatures and drier conditions bring with it an increase in weeds, pests and diseases resulting in reduced yields of agricultural outputs, along with a higher incidence of wildfires and bushfires. Drought conditions threaten local agricultural productivity, reducing food security in the country. With reduced access to water for agricultural use, as well as soil degradation and higher soil infertility, the losses and damages associated with the agricultural sector and resulting food security are of high concern to Jamaicans (PIOJ, 2021b). Sea-level rise increases sea water intrusion, and the resulting salinisation of the water supply affects certain aspects of the agriculture sector, resulting in wells having to be abandoned as they are no longer suitable for agricultural use (GOJ, 2022b).

6.4 Loss of Culture, Heritage, and Indigenous Knowledge

The erosion of Jamaica's cultural heritage is increasingly becoming a concern in the country with many calls to action to prevent cultural degeneration (Reckord, 2022). Jamaican culture and heritage are integral facets of the Jamaica identity. Largely due to the adoption of digital technology into non-western cultures, there has been erosion of local Jamaican cultural values and practices, as well as indigenous knowledge systems (Davidson, 2018), catalysed by climate-induced migration

from other Caribbean islands to Jamaica or vice versa. With the increasing onset of climate change, Jamaica expects to face an increase in loss and natural and culture and heritage, in the form of land, important artefacts and loss of indigenous vulnerable communities.

6.5 International Cooperation

Jamaica is an active participant in the international loss and damage landscape under UNFCCC. This continues to be essential, not only as a member of the Alliance of Small Island States (AOSIS), but also because the future of Jamaica's loss and damage response will rely heavily on the international response to loss and damage financing needs of SIDS. The country has consistently been an active participant in the international efforts to address loss and damage and disaster risk, including being a member of the Warsaw International Mechanism (WIM) for Loss and Damage associated with Climate Change Impacts, the Santiago Network, and the Sendai Framework for Disaster Risk Reduction.

Jamaica will follow guidance from the operationalisation of the loss and damage funding mechanism established at COP27 in Sharm el-Sheikh (Decisions [2/CP.27](#) and [2/CMA.4](#)), and the resulting Transitional Committee. Once progress is made on these fronts, Jamaica will create a loss and damage response, separate from disaster risk management to ensure that both are adequately addressed. Jamaica also joined the Alliance for Locally Led Approaches for Transformative Action on Loss and Damage (ALL ACT) in 2023 to work with researchers to provide better support for local communities, with the intention to help communities inform government responses using a bottom-up approach (IIED & ICCCAD, 2022).

6.6 Loss and Damage Finance

Jamaica's national discussions are largely shaped by the international landscape of loss and damage finance. Given that it is a new and emerging topic in the UNFCCC negotiation space now, Jamaica will follow on from discussions of the Transitional Committee in mainstreaming discussions in the Caribbean and in the national context. While Jamaica is relying on the operationalisation of this funding mechanism at the international scale, the country's Office of Disaster Preparedness and Emergency Management (ODPEM) actively works on disaster risk management by coordinating these management activities at national, community and parish scales, as well as developing early warning systems for climate hazards, working closely with the Caribbean Disaster Emergency Management Agency (CDEMA).

While loss and damage is understood as a separate issue from disaster management, loss and damage discussions in country have not yet become mainstreamed in financial discussions. As a result, loss and damage finance and disaster risk financing are not currently considered to be distinct. Additionally, as a small island state, it is challenging to mainstream loss and damage finance as being separate from disaster management financing. Hence, there is a need to make progress on discussions around allocations of funds for disaster risk reduction finance and loss and damage finance

To adequately address loss and damage finance in Jamaica, the country will expand its understanding on how to address slow-onset events in the long term. The vision is for PIOJ and ODPEM to coordinate in such a manner that

once the loss and damage funding mechanism under UNFCCC has been operationalised, Jamaica's multistakeholder group responsible for damage and loss assessments will create a national financing mechanism separate from disaster risk reduction finance. It is key for any loss and damage financing mechanism to respond to the economic and non-economic losses and damages highlighted in this section. Additionally, the two bodies will work towards creating an institutional framework to harmonise and institutionalise any pre-existing sector-specific loss and damage responses (GermanWatch, 2021). By ensuring that a harmonised financing mechanism and institutional framework exist and are implemented, Jamaica can be a regional leader in loss and damage responses in the Caribbean while also adequately and effectively building long-term climate resilience for its people.







LTS Implementation and Just Transition



7 | LTS Implementation and Just Transition

Jamaica's transition towards a low-emission greener economy will require significant changes in economic and policy structures and job markets. In this process, Jamaica is committed to effecting a "just transition" of the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities, and leaving no one behind (ILO, 2020).

The International Labour Organization (ILO) defines just transition as "a process of managing the economic and social changes required to achieve low-carbon development in a way that is fair and equitable" (ILO, 2015). Table 21 below highlights the four pillars of just transition: social dialogue, employment, skills development, and social protection. These pillars emphasise the importance of involving all stakeholders, including workers, employers, and governments, in the transition process (ILO, 2020).

Table 21

ILO's Four Pillars of just Transition and how they could be aligned to the Jamaican Context

Social dialogue	This pillar emphasises the importance of engaging workers, employers, and other stakeholders in a collaborative process to identify and address the challenges and opportunities associated with the transition to a low-carbon economy. Social dialogue can help to ensure that workers' rights and interests are protected, and that the benefits and costs of the transition are shared fairly. In Jamaica, the government has been and will continue to engage with workers, employers, and civil society organisations. The National Tripartite Advisory Committee (NTAC) in Jamaica is a forum for tripartite consultation and collaboration between the government, employers, and workers' representatives that can facilitate discussions on the impacts of the transition towards a greener economy on workers and communities, and how to address these impacts.
Decent work and employment	This pillar emphasizes the importance of creating new, decent jobs in the green economy to replace those that may be lost in the transition. Decent work includes fair wages, job security, and opportunities for training and career advancement. It also involves ensuring that workers have access to social protections, such as health care and retirement benefits. The transition towards a greener economy in Jamaica can create new job opportunities in the renewable energy sector. The government can promote the growth of the renewable energy sector by providing incentives, such as tax breaks, to investors. Additionally, the government can provide training programmes for workers in the renewable energy sector to ensure that they have the necessary skills to work in these sectors.
Skill development	The development of skills is critical for ensuring that workers are prepared for the transition towards a greener economy. The government can collaborate with training institutions to develop training programmes that meet the needs of the renewable energy and other relevant sectors. Additionally, the academic institutions can establish apprenticeship programmes to provide on-the-job training for workers.
Social protection	Social protection measures are essential for supporting workers and communities that are most affected by the transition towards a greener economy. In Jamaica, the government can establish a social protection scheme to provide income support for workers who lose their jobs due to the transition. The scheme can also provide support for communities that are dependent on industries affected by the transition.

Source: (ILO, 2015; 2020)

To accomplish a just transition, Jamaica will develop critical climate change capacity- building and will seek to establish a just transition policy framework informed by consultations with relevant stakeholders as suggested by the ILO's guidelines on Just Transition, namely:

- 1. National and subnational governments** with the objective of establishing concrete commitments to implement just transition and green job measures;
- 2. Workers' and employers' organisations** advocating for and contributing to a just transition and green jobs at local and national levels;
- 3. Academia and think tanks** delivering a substantive contribution to knowledge generation and innovation, including The University of West Indies (UWI), the University of Technology, Jamaica (UTech, Ja.), and other relevant institutions in Jamaica;
- 4. Multilateral and regional institutions** through technical assistance or potential sources of funding;
- 5. Businesses** implementing measures for just transition and green jobs;
- 6. Civil society organisations**

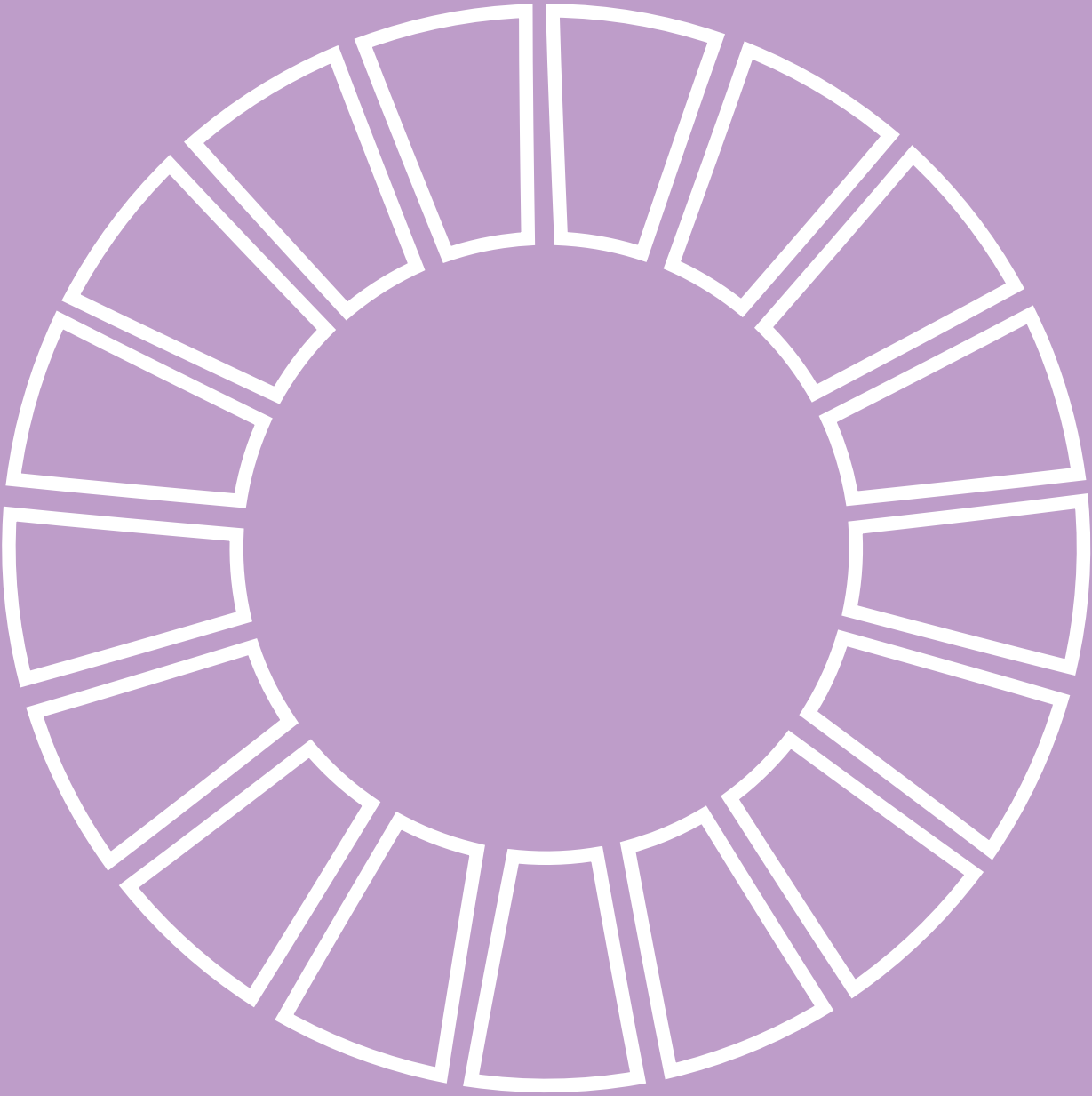








Co-benefits and Sustainable Development Goals



8 | Co-benefits and Sustainable Development Goals

This strategy aims put Jamaica on a pathway toward low-carbon and resilient development while also creating opportunities for economic growth, a resilient environment, and a healthy population, in alignment with Jamaica’s future Vision 2050, and the Sustainable Development Goals. Since the LTS will be established prior to Jamaica Vision 2050, there is plenty of opportunity to ensure that these co-benefits and synergies are maximised for the best possible future for Jamaica. Table 22 below summarises the mentioned co-benefits, along with how they map on to the Sustainable Development Goals as well as the National Goals and Outcomes from Vision 2030 (PIOJ, 2021a).

Reduced combustion of fossil fuels in electricity generation, transport, and within buildings will provide a range of benefits. At an economic level, the Jamaican economy will additionally become less reliant on importing fuel, on which the country currently spends 7.4% of its GDP, which will have positive macroeconomic implications and reduced risk of supply shocks on the global markets (ETI & DOE, 2020).

Less fossil fuel combustion across these sectors should likewise mean improvements in air and water quality, with corresponding improvements in human health. Nine per cent (9%) of deaths from respiratory diseases can be attributed to household air pollution, the biggest source of which is the burning of fuels for cooking (WHO, 2017).

Traffic congestion is a serious challenge in Jamaica’s urban areas, particularly around Kingston, leading to dangerous traffic accidents as well as loss of time to commuting—in 2016, there were 379 reported fatalities and an estimated 5,865 injuries relating to road crashes in the country (GRSF, 2018). In 2021, this increased to 487 road fatalities (OPM, 2022). For some commuters, up to 30–40% of their person-hours are lost daily in long commutes into and out of the capital (Salmon, 2021). Modal shifts, such as greater public transit use, can help address these problems. Encouraging cycling and walking can also reduce congestion and traffic safety, while promoting an active and healthy lifestyle.

Table 22 illustrates alignment with various SDGs, highlighting the importance and need for safety in Jamaica’s transport mobility.

Actions in land use and forestry can provide a range of co-benefits. In addition to sequestering carbon, forest systems provide habitat for critical species. Mangrove forests provide both habitat for critical ecosystems as well as storm surge protection measures.

A resilient agricultural system not only enables emissions reduction, but also increases food security, lowers consumer costs, and becomes an increasingly reliable source of income among rural populations. Agroforestry and manure and grazing management to reduce emissions will improve soil nutrients and reduce erosion, which will, in turn, reduce the risk of leaching, landslides, and runoff in the event of storm surges. Low-emissions fertilizer usage improves soil fertility. These factors can all result in increased food security, which can improve human nutrition and reduce risk of nutrition-related illnesses.

A robust and resilient waste management infrastructure reduces the health implications of pollutants entering water streams. Efforts to divert waste from landfills – through composting, recycling, and waste-to-energy – not only abate methane emissions but also reduce the amount of valuable land needed for landfills/dumps. Well-managed waste-to-energy efforts can further contribute to energy security.

Table 22

Co-benefits of the LTS mapped on to SDGs and Vision 2030

Sustainable Development Goals		Vision 2030	
LOWER RELIANCE ON IMPORTING FUELS, AND INCREASED PRODUCTION OF RENEWABLE ENERGY FOR ENERGY INDEPENDENCE			
Sectors:  Energy  Transport  Buildings			
SDG 7 Affordable and clean energy - Universal access to affordable, reliable, and modern energy services - Increased share of renewable energy in the global energy mix - Improved rate of energy efficiency		National Goal 3: Jamaica’s economy is prosperous - <i>National Outcome 10:</i> Energy security and efficiency National Goal 4: Jamaica has a healthy natural environment - National Outcome 14: Hazard Risk Reduction and Adaptation to Climate Change	
IMPROVED AIR QUALITY FROM LESS FOSSIL FUEL COMBUSTION			
Sectors:  Energy  Buildings  Human health			
SDG 3 Good health and wellbeing - Reduce premature mortality from non- communicable diseases through prevention and treatment - Reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination		National Goal 1: Jamaicans are empowered to achieve their fullest potential - <i>National Outcome 1:</i> A healthy and stable population National Goal 4: Jamaica has a healthy natural environment - <i>National Outcome 13:</i> Sustainable management and use of environmental natural resources	
SDG 12: Responsible consumption and production - Environmentally sound management of chemicals and all wastes throughout their life cycle, and reduce their release to air, water, and soil			

Table 22 continued*Co-benefits of the LTS mapped onto SDGs and Vision 2030*

Sustainable Development Goals		Vision 2030
REDUCED TRAFFIC CONGESTION TO PROMOTE ROAD SAFETY AND AN ACTIVE AND HEALTHY LIFESTYLE		
Sectors:  Transport  Built Environment  Human health		
SDG 3: Good health and well-being - Reduce the number of deaths and injuries from road traffic accident	National Goal 2: The Jamaican society is secure, cohesive, and just - <i>National Outcome 5:</i> Security and safety National Goal 3: Internationally competitive industry structures - <i>National Outcome 9:</i> Strong economic infrastructure	
SDG 11: Sustainable cities and communities - Access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety by expanding public transport		
SDG 16: Peace, justice, and strong institutions - Significantly reduce all forms of violence and related death rates everywhere		
RESILIENT AGRICULTURAL SYSTEM INCREASES FOOD SECURITY AND IMPROVES HUMAN NUTRITION		
Sectors:  Agriculture  Human health		
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture - End hunger and ensure access by all people to safe, nutritious, and sufficient food all year round - Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production	National Goal 1: Jamaicans are empowered to achieve their fullest potential - <i>National Outcome 1:</i> A healthy and stable population National Goal 3: Jamaica’s economy is prosperous - <i>National Outcome 12:</i> Internationally competitive industry structures – agriculture	

Table 22 continued*Co-benefits of the LTS mapped onto SDGs and Vision 2030*

Sustainable Development Goals		Vision 2030
ROBUST AND RESILIENT WASTE MANAGEMENT INFRASTRUCTURE TO REDUCE HEALTH IMPLICATIONS, AND INCREASE ENERGY SECURITY		
Sectors:  Waste  Energy  Human health		
SDG 3: Good health and well-being - Reduce the number of deaths and illnesses from hazardous chemicals and water pollution and contamination	National Goal 3: Internationally competitive industry structures - <i>National outcome 9:</i> Strong economic infrastructure	
SDG 6: Clean water and sanitation - Improve water quality by reducing pollution, eliminating dumping, and minimizing release of hazardous chemicals and materials, reducing untreated wastewater and increasing recycling and safe reuse	National Goal 4: Jamaica has a healthy natural environment - <i>National outcome 13:</i> Sustainable management and use of environmental natural resources	
SDG 12: Responsible consumption and production - Environmentally sound management of chemicals and all wastes throughout their life cycle, and significantly reduce their released to water to minimise adverse impacts on human health - Reduce waste generation through prevention, reduction, recycling, and reuse		

Table 22 continued*Co-benefits of the LTS mapped onto SDGs and Vision 2030*

Sustainable Development Goals		Vision 2030
BIODIVERSITY AND CONSERVATION FOR CARBON SEQUESTRATION, STORM PROTECTION, AND PROTECTION OF CRITICAL SPECIES		
Sectors: 🌿 Terrestrial and coastal ecosystems		
SDG 6: Clean water and sanitation - Protect and restore water-related ecosystems	National Goal 4: Jamaica has a healthy natural environment - <i>National Outcome 13:</i> Sustainable management and use of environmental natural resources	
SDG 12: Responsible consumption and production - Achieve sustainable management and efficient use of natural resources		
SDG 14: Conserve and sustainable use oceans, seas, and marine resources for sustainable development - Sustainably manage and protect marine and coastal ecosystems and take action for their restoration to achieve healthy and productive oceans - Effectively regulate harvesting and end overfishing, illegal, unreported, and unregulated fishing and destructive fishing practices and implement science-based management plans - Increase the economic benefits from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture, and tourism		
SDG 15: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss - Ensure conservation, restoration and sustainable use of terrestrial ecosystems and their services - Promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally - Significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, protect and prevent the extinction of threatened species - Action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products		

Source: (PIOJ, 2021a)



9

Key requirements for implementation



9 | Key requirements for implementation

The Jamaica of today does not yet have all the tools and resources needed to develop into the low-emissions, climate-resilient Jamaica of 2050. Appropriate technologies for reducing emissions and/or improving resilience must be developed or brought into the country; institutions and processes must be able to coordinate and implement the necessary actions; the private sector must be involved and ready to take an active role in the country's efforts; and adequate funding must be secured from a range of sources. These factors will help Jamaica to build a more sustainable and resilient future.

Transitioning towards a low-carbon economy is imperative for countries in the global context, especially with the global target of achieving net-zero emissions by 2050. The increasing concerns over climate change have led to the need for urgent action, and many developed and developing countries are taking the lead in this transition. By June 2023, 63 parties have submitted their LTS to the UNFCCC which represents more than 30% of the total ratifying parties of the PA (UNFCCC, 2022). These indicate the global direction developed and developing countries are advocating for and following.

By mid-century, many of the world's largest economies would have phased out from fossil fuel markets, given their advancement in the low-carbon transition. With some of the largest competitors in the fossil fuel market and with dwindling demand for these products, international prices are expected to be higher with a lot more of volatility arising from fewer market actors. As the largest actors are out of the market, vehicle manufacturers will follow the trend moving away from fossil fuels and are already looking to scale-up their research on electric vehicle technologies. This trend is only going to grow year-on-year as the technology is more broadly adopted.

Reducing the reliance on imported fossil fuels for the energy needs of Jamaica will be an advantage in the

long-term perspective. Understanding the benefits and advantages of taking early steps towards the transition can hugely impact future economic growth and competitiveness of a low-carbon and sustainable future. By successfully implementing its LTS, Jamaica is contributing its share in the global transition, while procuring the well-being and sustainable development of its economy, communities, and residents. It can also show the country's leading role in the region in terms of climate ambition, so other countries in the region can follow.

9.1 Technology Development and Transfer Needs

As climate ambition rises worldwide, mitigation and adaptation climate technologies must be readily available for deployment at scale. The transfer of state-of-the-art technology from developed countries to developing countries can help accelerate the development process and enhance the capacity of the developing countries to implement new or upgrade existing technologies effectively. It can lead to the development of new industries, products, and services, and improve the efficiency and effectiveness of existing ones. However, the technicalities of transferring technological breakthroughs can be challenging, and several factors must be considered, including intellectual

property rights, the commercial viability of the technologies, availability of skilled and trained personnel for construction and operation, and having appropriate supporting infrastructure in place.

Jamaica's TNC identified various gaps, needs and constraints using questionnaires and face-to-face interviews with stakeholders; the gaps identified included technology needs for mitigation, adaptation and modelling and data as cross-cutting.

In 2020, the United Nations Environment Programme (UNEP) conducted a Technology Needs Assessment (TNA) for Jamaica to identify and prioritise technology needs that can contribute to the country's mitigation and adaptation climate ambition under the Paris Agreement. The process also includes identifying the technology barriers for deployment and the development of Technology Action Plans (TAPs) for the implementation of the prioritised technologies (UNEP, 2020).

The process was participatory, and country-driven for a selected number of priority sectors. The sectors chosen from Jamaica's TNA exercise were Energy, Water, Agriculture and Coastal Resources given their vulnerability to climate change impacts and their contribution to the country's GDP (UNEP, 2020).

Each sector developed a long- and short-list of technologies was using available data from previous TNAs and technology factsheets. The short-listed technologies for each sector were then prioritised using a Multi-Criteria Analysis (MCA) based on capital, economic, social, environmental and climate indicators. The two highest scoring technologies based on the results from the MCA are shown in Table 23.

Table 23*Mitigation, Adaptation and Cross-cutting Technology Needs*

Mitigation technology needs		Source¹¹
Energy	☀ Technology for energy storage to fulfil Jamaica's NDC climate ambition	TNC
	☀ Refuse Derived Fuel Production	TNA
	☀ Biogas	
Agriculture	🐄 Concentrating Solar Power (CSP) Systems	TNA
	🐄 Aerobic Biological Treatment	
Adaptation technology needs		Source
Agriculture	🐄 Research and development of adaptation methods for	TNC
	🐄 Agricultural production to adapt to dryer climates and to combat saline intrusion from SLR	
	🐄 Sprinkler and Drip Irrigation for crop farmers	TNA
	🐄 Rainwater Harvesting and Water Storage systems	
Coastal Resources	🕒 Research and development of technologies to combat beach erosion, which is already occurring at many places in Jamaica	TNC
	🕒 Wetland Restoration (Mangroves)	TNA
	🕒 Artificial Coastal Reef and Reef Ecosystem Restoration	
Water Resources	💧 Research and development of technologies and methods to enhance water resource management for domestic and agricultural uses	TNC
	💧 Rainwater Harvesting and Restoration of Barbeque Catchments	TNA
	💧 Creation and Restoration of Minor Tank Networks	
Cross-Cutting technology needs		Source
Monitoring and Data Analysis	• Methods and technical assistance for climate change impact modelling at various sectoral levels	TNC
	• Research and technical assistance for meteorological real-time monitoring through adequate geographically located meteorological stations	
	• Technical assistance for long time series data analysis	

Source: (MEGJC, 2018; UNEP, 2020)

¹¹ TNC – Third National Communication; TNA – Technology Needs Assessment

Although Energy, Agriculture, Water and Coastal Resources were the chosen sectors as part of the TNA exercise, to achieve low-carbon and resilient long-term development, investment in research and development for technologies in other sectors of the economy will be needed. Support for technological transfer and deployment through international cooperation and partnerships will also be crucial to help accelerate the adoption of these technologies.

Implementing the TAPs can support Jamaica's climate ambition under the Paris Agreement in the short- and medium-terms, but the implementation of the LTS will be carried out over various decades. It is expected that during this process, improvements to current technologies will occur. It can also be that new technological needs will arise as technology advances. Future iterations of the TNA will be needed to support the integration of newer technologies, especially for sectors which are most difficult to decarbonise.

9.2 Institutional Capacity Needs

Jamaica has been building its national climate-related institutional framework since the creation of the Vision 2030 Secretariat and with the subsequent establishment of the CCD and the CCAB with the adoption of the Climate Change Policy Framework in 2015. The roles and responsibilities are clearly allocated and regulated, so that no overlap occurs among the entities involved. CCD, through its role coordinating climate action, ensures consistency and cooperation among the entities involved (CCAB and Vision Secretariat) and with the line Ministries, through the CCFPN

(UWI, 2022). The PIOJ also contributes to climate action by strategically coordinating policy development planning and implementation for Jamaica's sustainable development (GOJ, 2022b).

Therefore, in principle, the climate change institutional arrangements as identified through formal requirements (i.e., legislation establishing the entities and regulating their roles and responsibilities) are in place, and the current institutional state of art (CCD, CCAB, Vision 2030 Secretariat, PIOJ) provides comprehensive and coordinated arrangements. This would suggest that there is no need to establish additional bodies, but rather, to provide existing ones with improved staff and continuous training (UWI, 2022).

Despite the formal requirements listed above as being in place, concrete capacities of the responsible bodies are lacking in terms of human resources and updated technical capacity and skills. Under the Climate Action Enhancement Package (CAEP), an institutional capacity assessment was conducted to determine the institutional needs for the implementation of an LTS in Jamaica (GHGMI, 2021).

The greatest need for capacity building lies in the CCD. The CCD was originally envisioned to have a staff of at least 22, but it currently only has four (4) full-time staff members, and it appears there is no mechanism in place embedded into the CCD to ensure continuous training for improvement of existing skills and the acquisition of new areas of competence.

The same is true for Climate Change Focal Points (CCFPs). Due to limited resources within the line Ministries that appoint CCFPs, the CCFPs are typically overburdened and can face

difficulties in actively participating in the CCD meetings to which they are invited. Further, the CCFPs are asked to represent multiple topic areas (e.g., energy efficiency and renewable electricity), which require a staff member with broad knowledge of all necessary topic areas to be selected as the CCFP, instead of multiple experts with targeted thematic knowledge (UWI, 2022).

At the local level, capacity building is valuable to ensure coordination between the GOJ and local communities. Local capacity building would also ensure that communities are considered in the decision-making process for low-emissions and resilience building interventions. Community level coordination can assist in more effective implementation of national policies at the local level. At present, engagement at the community level could benefit from further institutional arrangements and institutional capacity. To overcome these barriers, it would be beneficial to prioritize the creation of the Municipal

Corporations Focal Point Network. Further, institutional structures and institutional capacity could be added to engage stakeholders more locally than at the municipal level. In particular, institutional arrangements that target the engagement of marginalized communities would greatly benefit the ultimate success of outcomes from adaptation interventions (UWI, 2022).

The institutional arrangements within the structure of Vision 2030 also have the potential to extend to the local level through the Thematic Working Groups (TWGs). The purpose of TWGs is to ensure a stakeholder-led consultative mechanism and assist with the implementation and improvement of the MTF priorities at the National, Parish, and Municipal Corporation levels. Local authorities currently do not participate in TWGs although there is the expectation to engage Municipal Corporations actively in the Vision 2030 TWG consultative processes (UWI, 2022).

Institutional Capacity Building Recommendations

The creation of a mechanism to facilitate coordination among groups such as the CCAB, CCFPN, and Vision 2030 TWGs (and other coordinating bodies) could support the implementation of the LTS. Provided that human resources are increased and that technical capacity needs are developed, the responsible entities will have the skills to cope with climate change, and to propel Jamaica towards low-carbon development (UWI, 2022).

Institutional coordination between CCD and PIOJ is needed to evaluate the cost of impacts, the feasibility of climate change action, the value added by climate change action, and the economic cost of inaction, and also to work with sectors and national focal points to determine the amount of financing needed for climate change actions, the options for insurance, as well as other economic considerations for the implementation of the project concepts (MEGJC, 2018).

To increase manpower available to the CCD and to add required expertise, **a merger of the CCD and the Meteorological Service is suggested** to improve data collection capacities and relieve some administrative capacity constraints which are already in place in the operational structure of the Meteorological Service (MEGJC, 2018).

The CCFPN is so important that the CCD should have a staff member working with the CCFPs to help facilitate the work they need to do. Such a person could be a “Partnership Development Specialist” because the CCD needs to develop partnerships so that agencies and ministries will have the information to integrate climate change into everyday activities without making it feel like irrelevant intrusion or too much extra work (MEGJC, 2018).

It would be **ideal that the designated CCFPs are senior officers who have influence on a department and on policy or who hold a policymaking position**. Ideally, there would be **a team within each department rather than one person**. Since CCFPs need to have more than a basic understanding of climate change to appreciate climate change as a national and development issue, and since most are not specially trained, there is **the need to develop a training programme for them** (MEGJC, 2018).

The strengthening of the role of the Ministry of Finance and the Public Service entails aligning fiscal policies, budgeting procedures, and economic planning with climate change mitigation measures and adaptation plans. It is crucial to implement capacity building programmes aimed at enhancing the technical expertise of key stakeholders within these ministries. These initiatives will enable informed decision-making when integrating climate considerations into budgetary procedures and financial decisions. By equipping relevant stakeholders with enhanced technical experience, they will be better equipped to navigate the complexities of climate-related challenges and contribute effectively to sustainable development goals.

Future iterations of the institutional capacity and training assessment needs should be carried out on a systematic, periodic basis in parallel to the implementation of the LTS to understand unfulfilled or new gaps in the current capacities.

9.3 Funding requirements

Funding is essential to ensure the successful implementation of an LTS, as it procures the necessary investments and provides a stable and predictable financial flow for businesses and governments during the implementation process.

Funding can come from a variety of sources which can be domestic, international, public, and private. Some examples of funding sources include bilateral donors, multilateral development banks, and international organisations. These funds can be used to finance mitigation or adaptation through new or improved infrastructure, research and development, funding for pilot projects, readiness support, among several other interventions.

Additionally, through adequate funding, the economy can be stimulated to help create new jobs, while supporting climate ambition and contributing to a more sustainable development. Without adequate sources and sufficient funding, implementing an LTS would be extremely challenging given the large amounts of financing needed for mitigation and adaptation interventions.

As part of the Climate Action Enhancement Package (CAEP) programme, estimates for the costs of implementing low-emission pathways and specific mitigation and adaptation actions were calculated by the Rocky

Mountain Institute, based on previous work led by the World Bank and Vivid Economics. The estimates are shown in Table 24 and include estimates for feasibility assessments, and capital and operating costs in the calculation of total costs.¹² The total cost of low-emission mitigation options alone add up to USD 5 billion, while for adaptation, the estimates almost add up to USD 1 billion (RMI, 2021).

Table 24

Cost of Mitigation and Adaptation Activities by Sector

Sector	Estimated total cost (million USD)
Mitigation	
⚙️ Electricity Generation	2,812.2
🚗 Transport	1,282.3
🏠 Buildings (residential, commercial and services)	63.8
🏭 Industry (alumina, bauxite, cement, and lime)	636.1
🌳 Land use change and Forestry	113.0
🐄 Agriculture	11.4
♻️ Waste	34.6
💧 Commercial Water Supply	64.2
TOTAL COST MITIGATION	5,017.6
Adaptation	
Cost of Adaptation Interventions	Estimated total cost (million USD)
Tourism	95.6
Built Environment	84.6
Critical Infrastructure (transport, water, waste, and power)	71.4
AFOLU Agriculture, Forestry and other Land Use)	165.8
Population and Health	566.7
TOTAL COST ADAPTATION	984.0

Source: (RMI, 2021)

The costs estimated under the CAEP programme provide a good starting point to match the necessary financial needs and sources for each intervention. However, further work will be needed to update and better disaggregate the costs, as the implementation progresses. It can also be that in the next decades, new technologies will require additional costing analyses.

¹² Operating and maintenance costs are assessed based on similar project or as a flat 5% of capital costs. Potential revenues generated are not considered in the analysis.

Sources of funding

The funding for implementing the mitigation and adaptation actions will need to be channelled from various sources as already mentioned.

Domestic sources will be vital. Jamaica is actively looking to build the proper enabling environment to support finance and implement climate action. In addition to investing USD 400 million in climate change interventions, Jamaica has also integrated climate change issues into national policies and development activities through Vision 2030 and the updated Climate Change Policy Framework (CCD, 2017). However, there is no set budget for climate change aligned investments, though there may be sections of the overall budget that deal with climate change issues (MEGJC, 2018).

To be able to source domestic funds for the LTS implementation in Jamaica, the government will need to adapt revenue structures to new realities to ensure that the public sector has sufficient resources available to provide necessary public services. The current fiscal structure of the country relies heavily on the taxation of fossil fuels to raise revenues. In 2020, approximately 56% of the total revenues raised in Jamaica came from general and specific taxes on goods and services (including excise taxes and environmental levies on imported fuels) (OECD, 2023). The Tax-to-GDP ratio for the same year was almost 28% (OECD, 2022).

International public finance is another option for channelling climate finance. Jamaica has previously accessed a wide range of international public climate finance options, including from bilateral sources, multilateral funds, regional and national funds. For example, Jamaica has received funding from UNFCCC mechanisms such as the Global Environment Facility (GEF) (total USD 36.6 million), the Adaptation Fund (AF) (USD 9.7 million), and the GCF (USD 31.4 million between readiness and full project funding support). Given that the cap for the AF sources

has increased to USD 20 million, there is potential for Jamaica to access more from these resources (RMI, 2021).

Jamaica has also previously accessed non-UNFCCC funding mechanisms including the Pilot Programme for Climate Resilience (PPCR), which has invested USD 31 million into four different projects. Additionally, RMI finds that there are several opportunities for Jamaica to fund the current list of options identified by Vivid Economics through the GCF, which can facilitate more direct access and may provide more opportunity for country ownership through the GCF's Enhanced Direct Access (EDA) mechanism (RMI, 2021).

There are other international development partners working with projects specifically for Jamaica, but also in the region and that could support the implementation of the LTS. Partners include multilateral climate and environmental funds, the UN and other multilateral development institutions, regional and global development banks, other international financial institutions, and bilateral development and climate aid from individual developed countries and regional entities.

In 2023, the IMF approved an arrangement under the Resilience and Sustainability Facility (RSF) for USD 764 million to strengthen the country's physical and fiscal resilience to climate change, advance the decarbonisation of the economy, manage transition risks, and catalyse multilateral support and private financing through reforms in specific areas, which were identified in collaboration with the WB and other international agencies. Measures supported by the RSF were categorized under three (3) pillars: Pillar 1 — Building fiscal and resilience to natural disasters and climate change; Pillar 2 — Strengthening mitigation and promoting renewable energies; and Pillar 3 — Greening the financial sector (IMF, 2023b).

With support from the Resilience and Sustainability Facility under the IMF Agreement, the GOJ agreed to a series of reform measures including. These include the following:

By the end of 2023:

- The Ministry of Finance and Public Service (MoF&PS), which has adopted a National Natural Disaster Risk Financing (DRF) policy, will establish a National Natural Disaster Reserve Fund (NDRF), and has supported the Development Bank of Jamaica in modifying the Policy and Institutional Framework for Public-Private Partnership (PPP) to include climate requirements.
- The Ministry of Science, Energy and Telecommunications (formerly named Ministry of Science, Energy and Technology) has submitted the Electric Vehicle Policy to Parliament. The policy was promulgated in June 2023 and has approved guidelines to reduce energy use in schools, hospitals, and public buildings for existing and new infrastructure.
- The Public Investment Appraisal Branch (PIAB) will define a methodology to conduct climate impact assessments at the project appraisal stage and incorporate the methodology in the Public Investment Management System (PIMS).
- The Planning Institute of Jamaica (PIOJ) will define and publish project selection criteria including climate change considerations.
- The Bank of Jamaica (BOJ) will publish a climate risk assessment and define a timeline to embed these risks in supervisory activities for development of climate risk assessments.

By the end of 2024:

- The MoF&PS will conduct and publish in the Fiscal Risk Statement a quantitative analysis of the fiscal risks generated by climate change and will submit to Parliament a bill to incentivise investment in renewable energies through fiscal measures
- The GOJ will adopt a monitoring framework to implement Climate-related Financial Risks stress testing and establish a regulatory framework for green-bond issuance and trading.

Finally, private investment sources also present an opportunity to fund large renewable projects (for example, large-scale grids), energy efficiency programmes, and climate proofing of existing infrastructure. Leveraging private interests to fund activities within the energy (mitigation), built environment (adaptation), and critical infrastructure (adaptation) sectors can enable the long-term, low-carbon and resilient transition. Domestically, several local commercial banks (for example, National Commercial Bank Jamaica, JN Bank) as well as development banks (for example, Development Bank of Jamaica) have previously participated in co-financing larger-scale projects in Jamaica and may have interests to finance local initiatives at preferential rates in the future (RMI, 2021):

- Lack of financial and technical capacity for implementation (for example, inadequate access to affordable finance, access to insurance, skills for investment evaluation, research, and development capacity);
- Lack of awareness and knowledge of climate risks and implications for financing (for example, access to information on climate risks, its effect on business operations, and adaptation and mitigation options and financing mechanisms);
- Lack of intra-governmental cooperation and capacity constraints within the government agencies to prepare and submit proposals for funding procurement;
- Policies and regulations that hinder mitigation and adaptation (for example, non-climate-related agriculture policies, less than attractive enabling environments, no regulation on market access, taxation to fossil fuels);
- Social attitudes towards mitigation and adaptation (for example, lack of options awareness, lack of interest, beliefs about uncertainty, limited support from member organisations).

Enabling actions for climate finance mobilisation

In addition to the measures identified in the engagement with the IMF, Jamaica will set out to enhance its ability to ensure the financing of critical adaptation and mitigation actions, through a range of efforts aimed at enhancing the alignment of its fiscal and tributary systems with a low-carbon and resilient future.

While high taxes on fossil fuels can encourage more sustainable alternatives, achievement of low-emission development will require a major decrease in the import of these fuels, leading to a loss of tax receipts, if no action is taken.

Jamaica will explore options for reform to align the tax structure with the country's long-term climate objectives without undercutting the country's ability to provide necessary public services.

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Having specific national budgetary allocations for mitigation and adaptation by using a standardized taxonomy can also support the implementation of climate ambitious interventions, while easing the process of monitoring and analysing climate finance flows and determining performance indicators. **Jamaica will pursue efforts to track budgetary allocations toward climate change-related actions.**

A high debt burden leads Jamaica to spend significant sums of public resources on debt service each year. These payments represent resources that cannot be allocated to climate action. **Jamaica will continue to explore the possibility of arranging Debt-for-Climate Swaps, which could reduce the country's debt burden and free up financial resources for disaster risk management, climate preparedness, and low-carbon and resilient development** (MEGJC, 2018).

To mobilize private climate finance, it is vital for the GOJ to create the proper regulatory and financial environment that simultaneously attracts, encourages, and enables private investment in mitigation and adaptation activities, for example, including climate-related requirements in the country's Public-Private Partnership (PPP) Framework or by establishing regulatory frameworks for sustainable investments (RMI, 2021). **Jamaica will continue to reform its regulatory and financial environment to help spur private investment in climate change mitigation and adaptation.**

9.4 Private Sector Engagement

The private sector will play many roles during the implementation process of Jamaica's LTS. It will not only enable the transition with financial resources for mitigation and adaptation, but also through technical capacity, creation of employment opportunities, technology transfer, and innovation.

There are also initiatives to support the private sector such as the preparation of the fully funded proposal for a regional project being prepared through the GCF Project Preparation Facility by the Caribbean Development Bank for "Transforming Finance to Unlock Climate Action in the Caribbean". This project aims to enhance awareness, strengthen capacities and provide funding to support the local private sector in Jamaica, Belize, and Saint Lucia. Other international public organisations could also support engaging and integrating the private sector in the implementation of Jamaica's LTS through national and regional projects and initiatives.

Jamaica will seek to benefit from engaging with the private sector by:

- **Creating an enabling framework where the private sector actively engages and participates** in the planning and implementation processes of the LTS;
- **Developing awareness raising campaigns for the private sector to sensitise in regard to how climate change will affect their businesses and how to participate in the decision-making processes** so as to create a fruitful forum, to better inform and support climate change policy making and implementation;

- **Investing in staff dedicated to only engage with the private sector**, as it creates a platform where the synergies, interests, opportunities, and alignment of national priorities with the private sector needs can be identified;
- **Developing a private sector stakeholder mapping and engagement strategy** to have more clarity on the various organisations within Jamaica and internationally that should be involved in the LTS implementation process.

The development and implementation of Jamaica's NAP should include a clear strategy and roles for engaging the various private sector actors that will be critical to improving the country's resilience.







10

Gender Mainstreaming



10 | Gender Mainstreaming

The impacts of climate change are not gender neutral, and disproportionately affect women more. These gendered impacts of climate change, as well as unequal access to benefit of climate action present the need to ensure that the LTS is gender responsive, inclusive, and equitable for all Jamaicans.

In Jamaica, women are particularly vulnerable to issues arising from access to clean water, sanitation issues, and also to affordable and sustainable fuels (PIOJ, 2010b). Jamaican women's participation in the labour force is significantly lower than men's: in 2021, the female labour participation rate for women of working age was 57.0% compared to 69.7% for men (DataBank, 2021). Women in the country also have lower access to paid labour compared to men, especially when part of a multigenerational household. Women entrepreneurs face more challenges relating to gender roles, social norms, and business environments due to a lack in the enabling environment, limited access to gender-sensitive financial resources, and limited time to participate due to family obligations. While Jamaican women are better represented in decision-making in the private sector compared to other Caribbean countries, there is still underrepresentation. These socio-economic factors are what exacerbate women's vulnerability to the impacts of climate change (World Bank Group, 2021).

Women and children make up the group most affected by natural disasters, and often face increased risks of diseases, illnesses, and injuries due to their disproportionate vulnerability. Women play a crucial role within the agricultural sector in the country—they are primarily responsible for water collection, and with the impacts of climate change increasing droughts and water shortages, they are put under additional pressure. Women, especially from rural areas, due to limited access to formal work, land ownership and finances, are particularly insecure in the face of climate hazards, and face more challenges when looking to migrate (World Bank Group, 2021).

While progress has been made and is ongoing, Jamaica's commitment towards gender equality, as outlined in the National Policy for Gender Equality (Gender Affairs, 2011), is further reaffirmed in by Vision 2030 Gender Sector Plan (PIOJ, 2010b). The LTS builds on the two to create enabling environments through its principles to ensure that the goal of fairness and socio-economic justice for women and men is achieved. Given the gendered and climate justice implications of the effects of climate change, it is necessary to ensure that the LTS responds to the threats and vulnerabilities.

These key principles are central to ensuring gender inclusion and equity in the LTS to enable women to recognise their full potential as active participants in society, while creating avenues for positive change to mitigate emissions and adapt to climate change in the country.

10.1 Principles

Gender is a cross-cutting issue that presents unique challenges but also opportunities in tackling the effects of climate change. The LTS strongly supports and incorporates gender equitable approaches and activities, and outlines principles to guide all relevant stakeholders in ensuring that climate policies and measures are effective, equitable and inclusive: this includes strategies to encourage women empowerment, and also increases male participation in areas where they are underrepresented.

In 2021, Jamaica undertook a national gender and climate change assessment which resulted in Jamaica's Gender and Climate Change Strategy and Action Plan (GCCSAP) 2022–2025 (GOJ, 2022a). Continuing the country's efforts to mainstream gender in all relevant sectors, the following principles aim to build on current efforts to ensure long-term effectiveness, equity, and inclusion. Altogether, these principles outlined in the GCCSAP ensure that gender is being mainstreamed into climate initiatives across all climate-related processes: data collection, analysis, decision-making, implementation, financing, and monitoring and evaluation.

Principle 1

Vulnerability and needs assessments, and capacity-building for climate action will be gender responsive.

By having gender-sensitive vulnerability and needs assessments, gaps are more easily identified and gendered norms and power dynamics can more effectively be targeted. Additionally, this enables appropriate response strategies, capacity building exercises, and frameworks.

Gender-disaggregated data, analysis and monitoring and evaluation frameworks are established to identify gender-based inequalities and needs such that they can be adequately responded to. This is particularly relevant for monitoring and evaluation processes for the LTS broadly, but also for more granular climate initiatives. By ensuring that monitoring and evaluation frameworks are gender disaggregated, the LTS ensures that all current and future actions sufficiently consider gender where necessary, and adequately respond to the gaps and needs that arise.

Specific capacity-building initiatives will be undertaken to empower women in leadership—this is especially relevant in the agricultural sector that is currently dominated by male participation. Similarly, women will be encouraged to participate within the private sector, given the growing role of private sector actions to enable positive climate action. Capacity-building for men regarding gender-based violence is also a key initiative, especially given its lack of consideration in disaster settings, and the underrepresentation of men in such discussions and conversations (World Bank Group, 2021).

Capacity-building also includes network and coalition building across communities and sectors for equitable participation. This will include and enable greater flexibility and appreciation for equitable access to opportunity, to ensure that cultural norms and stereotypes that are archaic, and any existing discriminatory practices are abandoned.

Principle 2

There will be gender-equitable inclusion and participation in climate-related decision-making.

Women's participation in climate policy development, planning and decision-making processes is a crucial measure to ensure that their needs, perspectives, and experiences are considered. Climate measures and responses outlined in the LTS will also champion leadership by women wherever appropriate to build social and financial resilience to climate change impacts. Efforts will additionally be made to encourage men's participation in female-dominated issues and spaces to ensure gender-equity.

Meaningful and equitable participation in climate decision-making processes is vital for achieving long-term climate goals by integrating gender considerations into actions. Striving for a gender balance in participatory and multistakeholder decision-making processes is necessary. Additionally, participation of gender focal points and/or experts, or having decisions heavily informed by guidance is important to guarantee availability of access to technical expertise in the mainstreaming of gender in decision making. Ensuring that there is equitable inclusion and participation in decision-making processes also ensures that all members of society have equitable access and ownership over climate actions that directly affect them.

Principle 3

Access to climate finance and benefits will be gender-responsive.

As with any other activity, gender-responsive interventions require budgetary support. For effective implementation and ensuring appropriate financing for activities, the LTS will incorporate a gender perspective to support gender activity implementation wherever appropriate. The design and implementation of specific initiatives will build on a gender analysis to ensure that processes are gender empowering, while enabling active participation, and balanced representation. The design will furthermore aim to lift barriers created by discrimination and stereotypes within the society to enable equitable access to opportunities and benefits of gender-responsive climate action.

Allocation of financial resources will include gender considerations to ensure gender-responsive climate actions are being implemented. Furthermore, efforts will be made for future funding and budget proposals to embed gender-based flexibility to address financial needs and ensure that gender-related activities are adequately resourced. This also includes increased consideration and access to gender-responsive budget training at all levels, from national to community level.



11

Action for Climate Empowerment



11 | Action for Climate Empowerment

Engaging and empowering all members of society is essential in tackling the climate crisis. Action for Climate Empowerment (ACE) is a key component of creating enabling environments for them to become active participants and stakeholders in climate action. ACE, under Article 12 of the Paris Agreement and Article 6 of the UNFCCC, encourages the cooperation to enhance climate change education, training, public awareness, participation, and access to information to enhance climate action. It highlights the importance of respecting, promoting, and considering the obligations of climate action on human rights, gender equality and empowerment of women, as well as upholding intergenerational equity (Plush et al., 2022). Jamaica will thus have an active, engaged, and skilled society that is involved in climate action, has equitable access to information, training, and capacity-building, and makes meaningful contributions to creating a sustainable and low-carbon future.

Public awareness and understanding of how climate trajectories will affect risk and climate futures are important as these factors enable and make the alignment and ownership of climate actions more effective—it is important to align these interests with broader resilience goals while also encouraging behaviour change, cooperation, and collaboration. Jamaica’s Climate Change Policy Framework outlines the country’s goal to increase public awareness and education of climate change impacts, actions, and responses at the national and local levels, while at the same time promoting behavioural change (GOJ, 2021b). The following section builds on this framework through strategies centred around building a resilient, inclusive, and sustainable future by empowering all members of society to stimulate and reinforce the understanding of climate change, and actively participate to better mitigate and adapt (UNESCO & UNFCCC, 2016).

11.1 Climate Education and Awareness

Sensitising the public on decarbonisation mitigation strategies, and adaptation and resilience-building strategies is fundamental to having a climate-literate population. Through targeted awareness-raising campaigns, the public will be informed, sensitised, and enabled to facilitate understanding and accepting the various duties in citizens’ contributions to accelerating climate action and LTS implementation. Jamaica will ensure that citizens at all levels of education, of all age groups, genders and vulnerability levels will have access to accurate information and will be equipped with the necessary knowledge to further engage (UNESCO

& UNFCCC, 2016). The use of digital tools and platforms to establish and expand awareness campaigns will enable reaching a wider audience, while promoting public access to information on climate change.

Education in schools will involve climate-specific curriculum through integration of climate education in the national curriculum for a deeper understanding of climate change, policy actions, and the just transition while enabling them to develop skills and knowledge to become responsible environmental stewards (Ingaruca et al., 2022). By encouraging people to be more knowledgeable about the impacts of climate change, and actions

that are being taken by the country, the hope is for the Jamaican population to become actively engaged on climate change in all parts of society. This is also a necessary strategy to encourage behavioural change in consumption patterns where necessary.

11.2 Public Engagement and Cooperation

Jamaica will foster a culture whereby citizens are encouraged to be active participants and engage in climate action at all scales. This will include providing citizens with the opportunity to voice concerns, exchange views, contribute ideas, provide feedback, and take ownership of climate action projects being implemented. GOJ will further public participation and discourse by establishing platforms for public dialogues, consultations, and invest in community-led initiatives while incentivising through recognition, leading climate champions in the Jamaican community. There will be a special focus on engagement with marginalised groups and vulnerable communities, especially in public participation and any decision-making processes. Multistakeholder workshops and events will be conducted to bring together civil society, non-governmental organisations, businesses, and local governments to harmonise efforts, practices, and decisions, to enhance cross-sectoral collaboration (UNESCO & UNFCCC, 2016). Together, this will also encourage the Jamaican society to be more attentive to policymaking and take ownership over climate action.

Youth are still largely considered beneficiaries of climate action instead of effective stakeholders themselves. To combat this understanding and encourage greater public engagement

and cooperation, a special youth focus is necessary to empower them (Ingaruca et al., 2022). The government will provide relevant climate youth groups with the necessary tools and platforms for such engagement. Jamaica will support and empower youth-led initiatives that promote climate and sustainability by providing funding and technical support to plan and implement local initiatives, promoting youth leadership, and creating mentorship opportunities. Such opportunities will work to bring together youth with policymakers and stakeholders already working in this space. The government will provide them with the necessary tools and platforms for such engagement. Jamaica will support and empower youth-led initiatives that promote climate and sustainability by providing funding and technical support to plan and implement local initiatives, promoting youth leadership, and creating mentorship opportunities. Such opportunities will work to bring together youth with policymakers and stakeholders already working in this space.

Youth participation will be encouraged and enabled in deliberative processes and will be embedded in formal decision-making procedures such as through citizen assemblies or appointment of youth representatives in decision-making bodies wherever possible (Ingaruca et al., 2022). The government will also work closely with Climate Change Youth Ambassadors across all sectors, and the Jamaica Climate Change Youth Council. This will ensure positive outcomes for youth development and consider the youth narrative, while also embedding youth participation in all dimensions, cycles, and levels of governance for systemic empowerment in climate action.

11.3 Training and Capacity Building

With the economy-wide just transition, low-carbon technologies and green jobs, there will be an increased need for the Jamaican population to adapt to these socio-economic changes. The government will collaborate with civil society organisations, private sector entities and academic institutions to leverage networks and platforms to share knowledge, best practices and provide training and capacity-building opportunities to the population. This will not only enable the adoption of climate mitigation and adaptation strategies, but also provide citizens with the opportunity to take ownership of climate solutions.

Skill-based training for economic sectors is key for effective implementation of the LTS to ensure that members of society are not left behind in the transition. Sector-specific programmes will be offered to train the relevant workforces in new technologies, and to sensitise them to alternative and integrated livelihoods.

Capacity-building training programmes will also be offered, especially to vulnerable populations to ensure that the transition to a low-emission pathway is just and inclusive. This includes capacity-building programmes to empower women in male-dominated sectors and engaging more rural populations in farm innovation and agricultural resilience (UNESCO & UNFCCC, 2016). Youth-targeted skill-based training programmes will also be provided to create stronger links between educational institutions and workplaces to encourage a smoother school-to-work transition in a green economy.

Here, it is also necessary to deepen private sector engagement, not just for decision-making processes, but also to enable the private sector in supporting the creation of green jobs, skills-training programmes to the workforce, and mentorship schemes for youth. The private sector has a unique opportunity to empower vulnerable and marginalised communities to build capacity and receive the training required to be mobilised in the workforce.



A close-up photograph of a light-colored wooden block with rounded ends. The word "GOVERNANCE" is carved into the front face of the block in a bold, dark blue, distressed font. The background is a blurred office setting with rows of desks and chairs.

GOVERNANCE

12

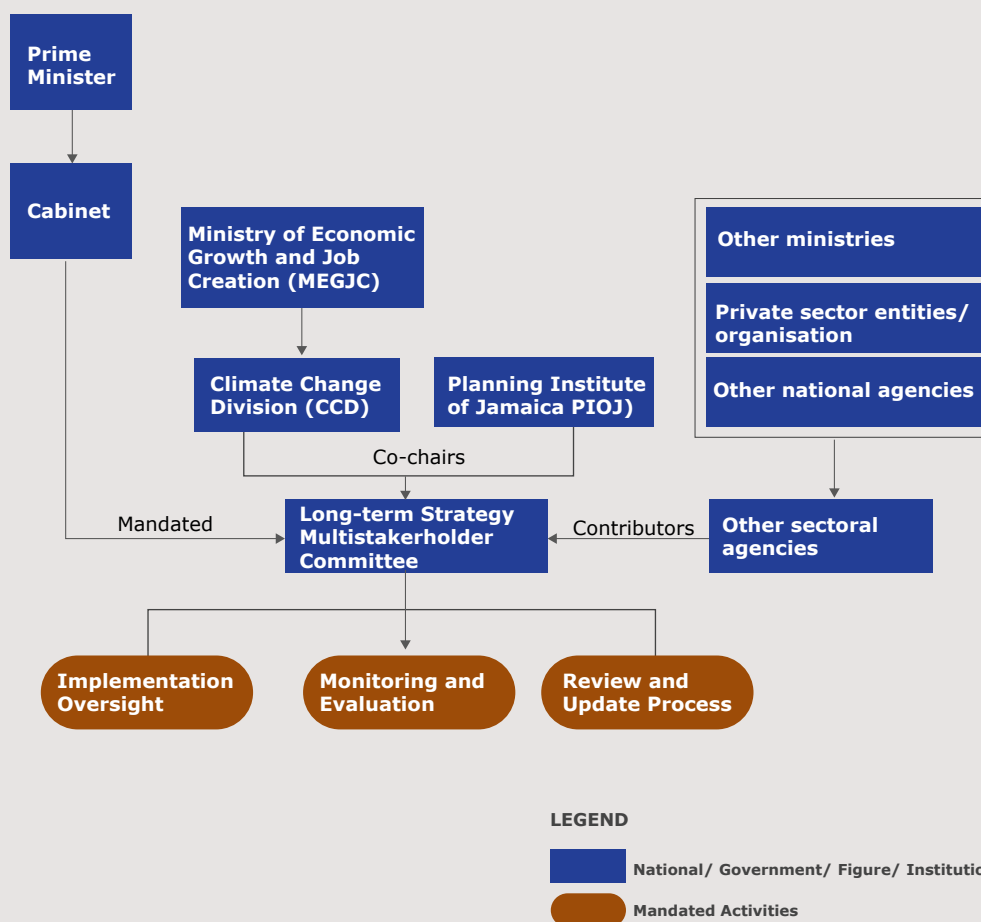
Jamaica's LTS Governance Structure



12 | Jamaica's LTS Governance Structure

Jamaica's LTS governance structure is shown in Box 5. It comprises the cabinet mandated LTS Committee, which is co-chaired by the Climate Change Division (CCD) and the Planning Institute of Jamaica (PIOJ). Other stakeholders are considered as contributors to the activities of the LTS Committee. *The LTS Committee was originally only mandated to provide oversight of the course of the development of the LTS. The GOJ may seek to extend this mandate for the full LTS implementation period and expand its role to include implementation oversight functions as seen in the box below.*

Box 5 | LTS Governance Structure



The CCD which sits under the Ministry of Economic Growth and Job Creation (MEGJC) oversees climate change initiatives and fulfils obligations under the UNFCCC and the PA, including the updated CCPF. The CCD also serves as the National Designated Authority (NDA) to the Green Climate Fund (GCF), acts as the Secretariat for the CCAB, and is responsible for preparing National Greenhouse Gas (GHG) Inventories and any other reporting requirements for the UNFCCC (GOJ, 2021b).

The LTS Committee will oversee the operationalisation of the LTS and will play a key role in the update process of future LTS iterations by organising and interacting with the contributing stakeholders to support its activities and accommodate for any new breakthroughs in terms of technological innovation and best practices in future iterations of the LTS.







13

Monitoring and Evaluation



13 | Monitoring and Evaluation

Jamaica will integrate a Monitoring and Evaluation (M&E) framework into the LTS planning process to ensure that LTS objectives and targets are met. The LTS M&E framework will be established in the LTS Operationalization Plan. The LTS M&E framework will integrate previous M&E efforts in the country. This integration will facilitate the collection of relevant data and information, warranting that the M&E framework is responsive to changing sectoral priorities and contexts.

Jamaica's main previous M&E efforts include Vision 2030 that integrates a National Monitoring and Evaluation Plan (NMEP) developed to monitor and evaluate the performance of each sector's policies by 2030. The NMEP consists of a framework of indicators, data sources and methodologies to monitor progress towards sectoral targets. Additional efforts include the Performance, Monitoring, Evaluation and Reporting System (PMERS) for NEPA, which provides details on the establishment of baselines, targets and monitoring and evaluation of twelve strategic Key Performance Indicators (KPIs) related to environmental and climate policies and activities. Other efforts in data generation and monitoring and evaluation activities have been undertaken by the Ministry of Science, Energy and Technology, which collects statistics and produces assessments of science, energy and the Information and Communications Technology (ICT) Policy outcomes, and the Statistical Institute of Jamaica, which produces environmental and multimodal statistics including gender-disaggregated information.

The LTS M&E framework will contain an LTS updating process. Jamaica will continually update its LTS to reflect changes in policy, technology, and the global context. Jamaica's LTS updating process will follow the UNFCCC's recommended steps. These steps are intended to keep LTS relevant and effective over time. The steps are as follows:

1. Conducting an assessment of existing LTS: Before updating its LTS, Jamaica will assess current plans and actions to identify strengths, weaknesses, and opportunities for improvement. This review will include an evaluation of progress toward emission reduction targets as well as an examination of changes in the policy and technological landscape.
2. Stakeholder engagement: The LTS updating process will be developed in collaboration with a diverse range of stakeholders, including government agencies, civil society organizations, and the private sector. Stakeholder engagement can help ensure that LTS is aligned with national priorities and take into account the needs of vulnerable groups and populations.
3. Assessing the costs and benefits of new strategies: When updating its LTS, considerations about the costs and benefits of emission reduction and adaptation strategies. This analysis will take into account both the economic and social costs of various approaches, as well as the potential benefits of lower emissions and other co-benefit

4. Establishing new targets and timelines: The LTS updating process will establish new emission reduction targets and timelines based on a review of the existing LTS performance and an assessment of new strategies. These goals will be ambitious but attainable and they will reflect the most recent scientific understanding of climate change

The LTS M&E framework will include indicators based on the setting of specific, measurable, achievable, relevant, and time-bound (SMART) methodology to track each of the sectoral policies and measures under a low-emission pathway by 2050. The M&E framework will track the proposed sectoral and economy-wide targets, staggered by 5-year intervals which align with existing government monitoring frameworks. The list of sectoral and economy-wide indicators will be established in the Operationalisation Plan.

The cabinet-mandated LTS Committee in collaboration with the CCD and the PIOJ will coordinate efforts among government agencies, civil society organisations, academia and the private sector.

The involvement of sub-national governments and local communities will be a crucial element for effective M&E. Subnational governments such as cities, parishes and states have jurisdiction over a wide range of policy areas including local economic development; spatial and urban planning; housing; transport infrastructure development; waste collection and management; agriculture; local resources, environment, and biodiversity management; and tourism.

Jamaica will invest in building the capacity of relevant stakeholders in data management, analysis, and reporting. The Academia, including The University of Technology, Jamaica (UTech, Ja.) and The University of the West Indies (UWI) will help with building M&E capacities of relevant stakeholders. The PIOJ and CCD can collaborate with Academia to develop customised training programmes for different stakeholders, taking into account their level of expertise and existing resources.

Jamaica will explore the use of emerging technologies, such as artificial intelligence, blockchain, and satellite imagery, to enhance data collection, analysis, and reporting. The National Spatial Data Management Branch (NSDMB) is responsible for managing Jamaica's geospatial data and can lead the use of satellite imagery for Monitoring and Evaluation (M&E). Jamaica will continue to encourage innovation to improve the effectiveness and efficiency of M&E



References

- Beazley, R., & Ciardi, F. (2020). *Shock-Responsive Social Protection in the Caribbean: Jamaica Case Study*. <https://docs.wfp.org/api/documents/WFP-0000115072/download/>
- BNamericas. (2022). Jamaica advances US\$77mn water treatment plant – BNamericas. *BN Americas*. <https://www.bnamericas.com/en/news/jamaica-advances-us77mn-water-treatment-plant>
- Building Act 2018. (2018).
- Bureau of Standards (BSJ). (2019). *Energy Efficiency Building Codes for Jamaica*.
- Carbon Leadership Forum. (2020). *1 - Embodied Carbon 101 - Carbon Leadership Forum*. <https://carbonleadershipforum.org/embodied-carbon-101/>
- Caribbean Centre for Renewable Energy and Energy Efficiency (CCREEE). (2020). *2020 Energy Report Card*. www.ccreee.org
- Caribbean Tourism Organization (CTO). (2022). *Jamaica's Visitor Arrivals and Spend Beat Projections*. Caribbean Tourism Organization. <https://www.onecaribbean.org/jamaicas-visitor-arrivals-and-spend-beat-projections/#:~:text=Visitor%20arrivals%20and%20spend%20for,1%2C46%204%2C399%20were%20air%20stopover%20arrivals>.
- Castaño-Isaza, J., Saurabh, S. L., Authors, D., Beck, M. W., Narayan, S., Losada, I. J., Espejo, A., Saul, H., Ortega, T., Herrero, S. A., Mandal, A., Smith, R. A., Edwards, T., Kinlocke, R., Mitchell, S., Webber, M., Trench, C., Francis, P., Spence, A., & Edwards, P. E. T. (2019). Forces of Nature: Assessment and Economic Valuation of Coastal Protection Services Provided by Mangroves in Jamaica. In *World Bank*. www.worldbank.org
- Clayton, A. (2021). Jamaica in 2050 – Part 3: Energy and the built environment. *The Jamaica Gleaner*. <https://jamaica-gleaner.com/article/focus/20211107/anthony-clayton-jamaica-2050-part-3-energy-and-built-environment>
- Climate Analytics (CA). (2022). *Long term strategies: low carbon growth, resilience and prosperity for Least Developed Countries*.
- Climate Change Division (CCD). (2017). *Understanding the Climate Finance Landscape in Jamaica (Briefing Paper #1)*.
- Climate Watch Data. (2022a, March). *Jamaica ClimateWatch Emissions*. https://www.climatewatchdata.org/countries/JAM?end_year=2019&start_year=1990#ghg-emissions
- Climate Watch Data. (2022b, March). *Jamaica ClimateWatch Emissions*. https://www.climatewatchdata.org/countries/JAM?end_year=2019&start_year=1990#ghg-emissions
- Ministry of Culture, Gender, Entertainment and Sport . (2008). *National Cultural Policy of Jamaica*. <https://www.nlj.gov.jm/files/u8/national-cultural-policy.pdf>
- DataBank. (2021). *World Development Indicators*. The World Bank. <https://databank.worldbank.org/source/world-development-indicators>
- Davidson, A. (2018). *Jamaica Urged to Step Up Efforts to Protect Cultural Heritage*. Jamaica Information Service (JIS). <https://jis.gov.jm/jamaica-urged-to-step-up-efforts-to-protect-cultural-heritage/>

- Development Bank of Jamaica (DBJ). (2022). *Integrated Solid Waste Management PPP – Development Bank of Jamaica*. <https://dbankjm.com/waste-management-reform-programme/>
- Economic Commission for Latin America and the Caribbean (ECLAC). (2022). *Preliminary Overview of the Economies of Latin America and the Caribbean*.
- Economic Programme Oversight Committee (EPOC). (2023). *About the Economic Programme Oversight Committee*. Economic Programme Oversight Committee. <http://epocjamaica.com/about/>
- Energy Transitions Initiative and U.S. Department of Energy (ETI, & DOE). (2020). *Jamaica Energy Snapshot*. <https://solarheadofstate.org/press-releases/2018/jamaicasolar>
- Food and Agriculture Organization (FAO). (2016). *Country Programming Framework Jamaica 2016–2019*.
- Food and Agriculture Organization (FAO). (2020).
- Food and Agriculture Organization (FAO), 2021
- Forestry Department. (2013). *Jamaica’s Land Use Cover Assessment 2013*.
- Forestry Department. (2017a). *Forest Policy for Jamaica*. https://www.forestry.gov.jm/resourcedocs/forest_policy_of_jamaica_2017.pdf
- Forestry Department. (2017b). *National Forest Management and Conservation Plan 2016–2026*. https://www.forestry.gov.jm/resourcedocs/NFMCP_Final_010917_FINAL_S EP2017.pdf
- Forestry Department. (2019, February 8). *Jamaica’s REDD+ Journey Gets Financial Boost*. Forestry Department. <https://www.forestry.gov.jm/newsDetails?newsID=23>
- Forestry Department. (2023). *National Mangrove and Swamp Forest Management Plan 2023–2033*.
- Gender Affairs. (2011). *Jamaica National Policy for Gender Equality*. https://japarliament.gov.jm/attachments/461_National%20Policy%20for%20Gender%20Equality%20%28NPGE%29.pdf
- GermanWatch. (2021). *National and International Approaches to Address Loss and Damage from Slow-onset Processes*. https://www.germanwatch.org/sites/default/files/art%20%20-%20National%20and%20international%20approaches%20to%20address%20loss%20and%20damage%20from%20slow-onset%20processes_1.pdf
- Government of Jamaica (GOJ). (2009). *Vision 2030 Jamaica - Mining & Quarrying Sectoral Plan*. <https://www.vision2030.gov.jm/wp-content/uploads/sites/2/2020/12/Microsoft-Word-Vision-2030-Jamaica-Final-Draft-Mining-and-Quarrying-Sec%E2%80%A6.pdf>
- Government of Jamaica (GOJ). (2009). *Transport Sector Plan 2009–2030. Vision2030. Jamaica*.
- Government of Jamaica (GOJ). (2009a). *Vision 2030 Jamaica – Mining & Quarrying Sectoral Plan*. <https://www.vision2030.gov.jm/wp-content/uploads/sites/2/2020/12/Microsoft-Word-Vision-2030-Jamaica-Final-Draft-Mining-and-Quarrying-Sec%E2%80%A6.pdf>
- Government of Jamaica (GOJ). (2009b). *Vision 2030 Jamaica Construction Sectoral Plan*.

- Government of Jamaica (GOJ). (2009c). *Vision 2030 Jamaica Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change Sectoral Plan 2009- 2030*. <https://www.vision2030.gov.jm/wp-content/uploads/sites/2/2020/12/Microsoft-Word-Natural-Resources-and-Environmental-Management-June-2009.pdf>
- Government of Jamaica (GOJ). (2010). *National Biofuels Policy 2010-2030*. https://www.mset.gov.jm/wp-content/uploads/2019/07/Draft-Biofuels-Policy_0.pdf
- Government of Jamaica (GOJ). (2014). *Jamaica Country Report Third United Nations Conference on Housing and Sustainable Urban Development (Habitat III)* . <https://habitat3.org/wp-content/uploads/Habitat-III-Jamaica-Report.pdf>
- Government of Jamaica (2017).
- Government of Jamaica (GOJ). (2017). *Jamaica's Third National Communication under the United Nations Framework Convention on Climate Change*.
- Government of Jamaica (GOJ). (2020). *Jamaica Updated Nationally Determined Contribution (NDC)*. https://unfccc.int/sites/default/files/N_C/2022-06/Updated%20NDC%20Jamaica%20-%20ICTU%20Guidance.pdf
- Government of Jamaica (GOJ). 2021.
- Government of Jamaica (GOJ). (2021a). *The Emissions Policy Framework for Jamaica*. <https://japarliament.gov.jm/attachments/article/2450/2021-Ministry-Paper-61.pdf>
- Government of Jamaica (GOJ). (2021b). *Updated Climate Change Policy Framework for Jamaica*.
- Government of Jamaica (GOJ). (2022a). *Jamaica Gender and Climate Change Strategy and Action Plan 2022-2025*.
- Government of Jamaica (GOJ). (2022b). *Jamaica's Adaptation Communication to the UNFCCC* <https://unfccc.int/sites/default/files/CR/2022-12/Adaptation%20Communication%20for%20Jamaica.pdf>
- Government of Jamaica (GOJ). (2023). *Sectoral Presentation 2023 by the Minister of Science, Energy and Technology, Hon. Daryl Vaz, MP*. https://jis.gov.jm/media/2023/05/Sectorial-Presentation-_-PRINT-Final-1.pdf
- Global Road Safety Facility (GRSF). (2018). *Road Safety in Jamaica: Traffic accidents, crash, fatalities & injury statistics*. Road Safety Country Profile <https://www.roadsafetyfacility.org/country/jamaica>
- Green Climate Fund (GCF). (2020). *GCF Readiness: Towards a comprehensive national adaptation planning process in Jamaica (Ja-NAP)*. <https://www.greenclimate.fund/document/towards-comprehensive-national-adaptation-planning-process-jamaica-ja-nap>
- Greenhouse Gas Management Institute (GHGMI). (2021). *NDC Partnership CAEP Activity 397: Assessing Institutional Capacity in Jamaica to Implement the Long-term Low Emissions and Climate Resilience Strategy*.
- Greenhouse Gas Management Institute (GHGMI) & Caribbean Cooperative MRV Hub, 2021).
- Ingaruca, M., Richard, N., Carman, R., Savarala, S., Jacovella, G., & Baumgartner, L. (2022). Elevating Meaningful Youth Engagement for Climate Action. In *Office of United Nations Secretary-General's Envoy on Youth (OSGEY)*. https://www.undp.org/sites/g/files/zskg_e326/files/2022-05/UNDP-Elevating-Meaningful-Youth-Engagement-for-Climate-Action-2.pdf

- International Coral Reef Initiative (ICRI). (2022,February). *Jamaica |ICRI Membership*. <https://icriforum.org/members/jamaica/>
- Inter-American Development Bank (IDB). (2016).
- Inter-American Development Bank (IDB). (2020). *Strategic Framework for Electric Mobility in Jamaica*.
- International Institute for Environment and Development (IIED), & International Centre for Climate Change and Development (ICCCAD). (2022). *ALL ACT now! Progressing locally led action on loss and damage*. https://www.iied.org/sites/default/files/pdfs/2022_12/21291iied.pdf
- International Labour Organization (ILO). (2015). *Guidelines for a just transition towards environmentally sustainable economies and societies for all*.
- International Labour Organization (ILO). (2020). *Just transition: Towards environmentally sustainable economies and societies for all*.
- International Monetary Fund (IMF). (2023a). *Jamaica 2022 Article IV Consultation — Press Release; Staff Report; and Staff Statement*.
- International Monetary Fund (IMF). (2023b). *Jamaica: Request for an Arrangement Under the Precautionary Liquidity Line and Request for an Arrangement Under the Resilience and Sustainability Facility-Press Release; Staff Report; Staff Statement; and Statement by the Executive Director for Jamaica*. <https://www.imf.org/en/Publications/CR/Issues/2023/03/07/Jamaica-Request-for-an-Arrangement-Under-the-Precautionary-Liquidity-Line-and-Request-for-530707>
- International Road Federation. (2019). *World Road Statistics 2019*.
- Jamaica Agricultural Society (JAS). (2019). *JAS Annual Report 2018–2019*.
- Jamaica Forestry Department. (2020). *Jamaica Land-use and Forest Estates (2020)*. Jamaica Forestry Department. <https://www.forestry.gov.jm/publiccontent>
- Jamaica Information Service (JIS). (2020, January 7). *Climate-Smart Farming Practices*. Jamaica Information Service. <https://jis.gov.jm/information/get-the-facts/get-the-facts-climate-smart-farming-practices/>
- Kachi et al., 2019
- Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. <https://doi.org/10.1596/978-1-4648-1329-0>.
- Lee, S., Hall, G., & Trench, C. (2022a). The role of Nature-based Solutions in disaster resilience in coastal Jamaica: current and potential applications for 'building back better.' *Disasters*, 46(Suppl 1), S78. <https://doi.org/10.1111/DISA.12539>
- Lee, S., Hall, G., & Trench, C. (2022b). The role of Nature-based Solutions in disaster resilience in coastal Jamaica: current and potential applications for 'building back better.' *Disasters*, 46(S1), S78–S100. <https://doi.org/10.1111/DISA.12539>
- Ministry of Economic Growth and Job Creation (MEGJC). (2012). *Biennial Update Report of Jamaica*. https://unfccc.int/files/national_reports/non-annex_i_parties/biennial_update_reports/application/pdf/jambur1.pdf
- Ministry of Economic Growth and Job Creation (MEGJC). (2018). *Third National Communication of Jamaica to the United Nations Framework Convention on Climate Change*. https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/578491_Jamaica-NC3-1-TNC_Final_December132018.pdf

- Ministry of Science, Energy and Technology (MSET) of Jamaica. (2022). *Strategic Framework for Electric Mobility in Jamaica*.
- Ministry of Agriculture and Fisheries (MoAF), & Ministry of Health (MoH). (2013). *Jamaica – National Food and Nutrition Security Policy*. <https://extranet.who.int/nutrition/gina/sites/default/filesstore/AM%202013%20Food%20and%20nutrition%20security%20policy.pdf>
- Ministry of Agriculture and Fisheries (MoAF). (2021). *Ministry of Agriculture and Fisheries, Quarterly Performance Review Report (April – June, 2021)*. <https://www.moa.gov.jm/sites/default/files/pdfs/MOAF-1s-quarter-finalrevised1.pdf>
- Ministry of Finance and the Public Service (MoF&PS). (2023). *Economic Reform Programme*. Ministry of Finance and the Public Service. [https://www.mof.gov.jm/fiscal-operations/economic-reform/#:~:text=The%20Economic%20Reform%20Programme%20\(ERP,lo ng%2Dterm%20development%20of%20Jamaica.\)](https://www.mof.gov.jm/fiscal-operations/economic-reform/#:~:text=The%20Economic%20Reform%20Programme%20(ERP,lo ng%2Dterm%20development%20of%20Jamaica.))
- Ministry of Health and Wellness (MoHW). (2008). *Rapid Assessment of Squatting Report 2008*. <https://www.yumpu.com/en/document/read/17074439/rapid-assessment-of-squatting-report-note-large-file>
- Morrison, H. W. & L. D. (2016). Public Transport in Jamaica: Meeting the Needs of the Urban Poor. *The Journal of Transport and Land Use*.
- Ministry of Science, Energy and Technology (MSET). (2009). *Jamaica's National Energy Policy 2009–2030*.
- Ministry of Science, Energy and Technology (MSET). (2010). *National Renewable Energy Policy 2009–2030*.
- Ministry of Science, Energy and Technology (MSET). (2022). *Jamaica Energy Statistics 2021*. <https://www.mset.gov.jm/wp-content/uploads/2021/07/Jamaica-Energy-Statistics-2021.pdf>
- Mycoo, M. (2022, June 29). *Building Urban Resilience in the Caribbean: Policies, Practices and Prospects*. SDG Knowledge Hub. <https://sdg.iisd.org/commentary/guest-articles/building-urban-resilience-in-the-caribbean-policies-practices-and-prospects/>
- National Environment and Planning Agency (NEPA). (2018). *Action Plan for Corals and Reefs in Jamaica 2018–2023*. https://websitearchive2020.nepa.gov.jm/new/services_products/publications/docs/Action_plan_for_corals_and%20reefs_APCAR_Sept2019.pdf
- New Energy Events. (2018). *Jamaica announces goal for 50% renewable energy by 2030*. <https://newenergyevents.com/jamaica-announces-goal-for-50-renewable-energy-by-2030/#>
- Office of the Prime Minister (OPM). (2022, December 15). Jamaica facing a National Road Traffic Crisis, Prime Minister Convenes Meeting of National Road Safety Council to Address Concerning Number of Road Deaths. *News from the Office of the Prime Minister*. <https://opm.gov.jm/news/jamaica-facing-a-national-road-traffic-crisis-prime-minister-convenes-meeting-of-national-road-safety-council-to-address-concerning-number-of-road-deaths/>
- Organisation for Economic Cooperation and Development (OECD). (2022). *Revenue Statistics in Latin America and the Caribbean 2022 – Jamaica*.

- Organisation for Economic Cooperation and Development (OECD). (2023). *OECD Statistics*. <https://stats.oecd.org/Index.aspx?DataSetCode=REVJAM>
- Planning Institute of Jamaica (PIOJ). (2004). *Damage and Loss Assessments: 2004 PIOJ Report Hurricane Ivan*.
- Planning Institute of Jamaica (PIOJ). (2008). *Damage and Loss Assessments: 2008 PIOJ Report Storm Gustav*.
- Planning Institute of Jamaica (PIOJ). (2009). *Vision 2030 Jamaica: Culture, Creative Industries and Values Sector Plan*. <https://www.vision2030.gov.jm/wp-content/uploads/sites/2/2022/11/Culture-Creative-Industries-and-Values- Sector-Plan-1.pdf>
- Planning Institute of Jamaica (PIOJ). (2010a). *Damage and Loss Assessments: 2010 PIOJ Report Storm Nicole*.
- Planning Institute of Jamaica (PIOJ). (2010b). *Vision 2030 Jamaica Gender Sector Plan*. <https://www.vision2030.gov.jm/wp-content/uploads/sites/2/2020/12/Microsoft-Word-Gender.pdf>
- Planning Institute of Jamaica (PIOJ). (2017).
- Planning Institute of Jamaica (PIOJ). (2018). *Medium Term Socio-Economic Policy Framework 2018–2021*. <https://www.pioj.gov.jm/wp-content/uploads/2019/08/MTF-2018-2021- March-2019.pdf>
- Planning Institute of Jamaica (PIOJ). (2019).
- Planning Institute of Jamaica (PIOJ). (2021a). *Alignment of Vision 2030 Jamaica MTF 2018–2021 National Strategies to the Sustainable Development Goals (SDGs) Indicators and Targets*. <https://www.vision2030.gov.jm/wp-content/uploads/sites/2/2021/05/Alignment-of-the-Vision-2030-Jamaica- MTF-2018-2021-National-Strategies-to-the-Sustainable-Development- Goals-SDGs- Indicators-and-Targets.pdf>
- Planning Institute of Jamaica (PIOJ). (2021b). *Economic and Social Survey Jamaica 2021: Selected Indicators & Overview*. <https://www.pioj.gov.jm/product/economic-and-social-survey-jamaica-2021-selected-indicators-overview/>
- Planning Institute of Jamaica (PIOJ). (2021c). *Economic and Social Survey Jamaica 2021: Selected Indicators & Overview*. <https://www.pioj.gov.jm/product/economic-and-social-survey- jamaica-2021-selected-indicators-overview/>
- Planning Institute of Jamaica (PIOJ). (2021d). *The State of the Jamaican Climate 2019: Historical and Future Climate Changes for Jamaica*. <https://www.pioj.gov.jm/product/the-state-of-the-jamaican-climate-2019-historical-and-future-climate-changes-for-jamaica/>
- Planning Institute of Jamaica (PIOJ). (2022a). *Medium Term Socio-Economic Policy Framework (MTF) 2021–2024*.
- Planning Institute of Jamaica (PIOJ). (2022b). *Voluntary National Review Report on the 2030 Agenda and the Sustainable Development Goals*. <https://hlpf.un.org/sites/default/files/vnrs/2022/VNR%202022%20Jamaica%20 report.pdf>
- Planning Institute of Jamaica (PIOJ) & Adaptation Fund (AF). (2018). *Proposal: Enhancing the Resilience of the Agriculture Sector and Coastal Areas to Protect Livelihoods and Improve Food Security*. <https://www.adaptation-fund.org/projects-document- view/?URL=https://pubdocs/en/546661591148120117/63-Jamaica- Proposal-AF-revised-Feb2018-clean.pdf>

- Plush, T., Cohen, Z., & Nyamadzawo, L. (2022). *Child-sensitive climate policies for every child*. https://www.unicef.org/media/129976/file/Child_sensitive%20climate%20policies%20for%20every%20child.pdf
- Rahat, S. (2020). *Desk Review of Early Warning Systems (EWS) in the Caribbean: An Examination of the Level of Investment Established to Strengthen the 4 Pillars of EWS at the Regional, National and Community Levels*. <https://dipecholac.net/docs/xfiles/1054-DESK%20REVIE-OF-EARLY-WARNING-SYSTEMS-EWS-IN-THE-CARIBBEAN.pdf>
- Reckord, M. (2022, December 23). Gov't offers help in preserving Jamaica's heritage. *The Jamaica Gleaner*. <https://jamaica-gleaner.com/article/entertainment/20221223/govt-offers-help-preserving-jamaicas-heritage>
- Rocky Mountain Institute (RMI). (2021). *Costing and Financing Option Analysis for Jamaica's Updated NDC Implementation*.
- Salmon, D. (2021, June 28). Urban traffic crisis. *The Jamaica Gleaner*. <https://jamaica-gleaner.com/article/lead-stories/20210628/urban-traffic-crisis>
- Statistical Institute of Jamaica (STATIN). (2022, July). *Labour Force Indicators*. The Statistical Institute of Jamaica. <https://statinja.gov.jm/LabourForce/NewLFS.aspx>
- Strain, L. (2023). *10 steps to reducing embodied carbon*. <https://www.aia.org/articles/70446-ten-steps-to-reducing-embodied-carbon>
- United for Efficiency. (2021, March). *Jamaica's National Cooling Strategy Prepared for Cabinet Submission*. United for Efficiency. <https://united4efficiency.org/jamaicas-national-cooling-strategy-prepared-for-cabinet-submission/>
- United Nations Development Programme (UNDP). (2015).
- United Nations Educational, Scientific and Cultural Organization (UNESCO) & United Nations Framework Convention on Climate Change (UNFCCC). (2016). *Action for climate empowerment: guidelines for accelerating solutions through education, training and public awareness*. <https://unesdoc.unesco.org/ark:/48223/pf0000246435>
- United Nations Environment Programme (UNEP). (2020). *Technology Needs Assessment Report*.
- United Nations Environment Programme (UNEP). (2022, May 27). *In Jamaica, farmers struggle to contend with a changing climate*. UN Environment Programme. <https://www.unep.org/news-and-stories/story/jamaica-farmers-struggle-contend-changing-climate>
- United Nations Framework Convention on Climate Change (UNFCCC) (2015). *Paris Agreement*. https://unfccc.int/sites/default/files/english_paris_agreement.pdf
- United Nations Framework Convention on Climate Change (UNFCCC). (2017). *Jamaica's Third National Communication to the UNFCCC, 2017*.
- United Nations Framework Convention on Climate Change (UNFCCC). (2022). *Long-term low-emission development strategies: Synthesis report by the secretariat*. <https://unfccc.int/documents/619179>
- United Nations International Children's Emergency Fund (UNICEF) & World Health Organization (WHO). (2019). *Progress on household drinking water, sanitation and hygiene (2000-2017)*. <https://www.unicef.org/media/55276/file/Progress%20on%20drinking%20water,%20sanitation%20and%20hygiene%202019%20.pdf>
- United States Agency for International Development (USAID). (2018). *Vulnerability Assessment of Jamaica's Transport Sector*. <https://www.climatelinks.org/projects/atlas>

- University of the West Indies (UWI). (2021). *The State of the Jamaican Climate 2019: Historical and Future Climate Changes for Jamaica*.
- University of the West Indies (UWI). (2022). *Jamaica's CAEP Programme Synthesis Report*.
- Vision 2030 Jamaica. National Development Plan
- Vivid Economics. (2022).
- Vivid Economics, & World Bank (WB). (2019). *Assessment of Jamaica's Climate Change Mitigation Potential and Implications for its Updated NDC-Sectoral Review*. www.worldbank.org
- Vivid Economics, & World Bank (WB). (2021a). *Jamaica's Long-Term Climate Change Strategy Recommendations*.
- Vivid Economics, & World Bank (WB). (2021b). *Jamaica's Long-Term Climate Change Strategy Recommendations*.
- World Bank (WB). (2023, March). *The World Bank Open Data*. The World Bank.
- World Health Organization (WHO). (2017). *Climate and Health Country Profile – 2017 Jamaica Demographic Estimates*. <https://apps.who.int/iris/bitstream/handle/10665/260410/WHO-FWC-PHE-EPE-15.57-eng.pdf?sequence=1&isAllowed=y>
- World Bank Group. (2021). *Jamaica Gender Assessment*. <https://documents1.worldbank.org/curated/en/09915450222328619/pdf/P175282042506702e0a7d100b3087a5be64.pdf>
- Worldometer. (2023). *Jamaica Population*. <https://www.worldometers.info/world-population/jamaica-population/>

Annex 1: Mitigation Modelling Approach

The modelling approach followed by Vivid Economics for the mitigation results presented in Jamaica's Long-Term Strategy Recommendations is presented in the following annex (Vivid Economics & WB, 2021a).

The modelling approach combines outputs from an energy systems model with a bespoke land use model. This enables interaction effects within the energy sectors to be captured, along with the interactions between activities in the agriculture and forestry sectors. This section outlines the modelling approach used for each sector.

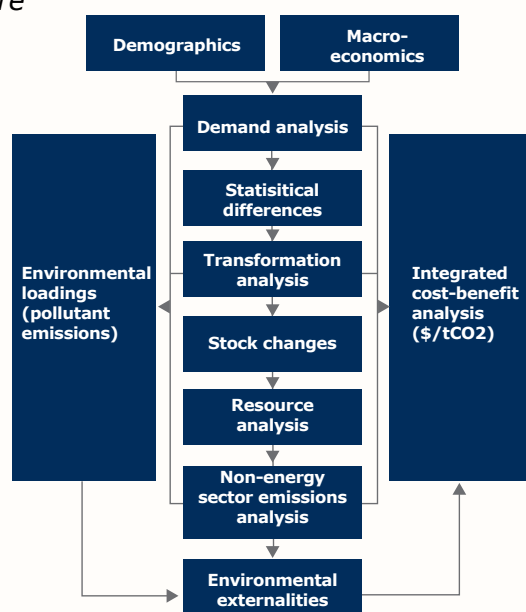
Energy Sector

The climate mitigation impact of policies in the energy sector is estimated using the Long-range Energy Alternatives Planning system (LEAP) model. The LEAP model is an integrated energy-environment tool used to conduct energy policy analysis and

climate change mitigation assessment developed by the Stockholm Environment Institute (SEI). This framework is used to model policy scenarios (based on the agreed policy packages) against a baseline to determine the emissions and other energy sector impacts (for example, the change in energy mix) of the policies. The model is highly flexible and therefore suitable for developing countries where the availability of data can be limited. The model scope covers energy demand, energy supply, resources, environmental loadings, cost-benefit analysis and non-energy sector emissions. Figure 11 shows the flow of calculations through the LEAP model.

Figure 11

LEAP Model Structure



Source: Vivid Economics based on Stockholm Environment Institute. LEAP.
 Available from: <https://www.sei.org/projects-and-tools/tools/leap-long-range-energy-alternatives-planning-system/>
 Accessed 24/08/2021

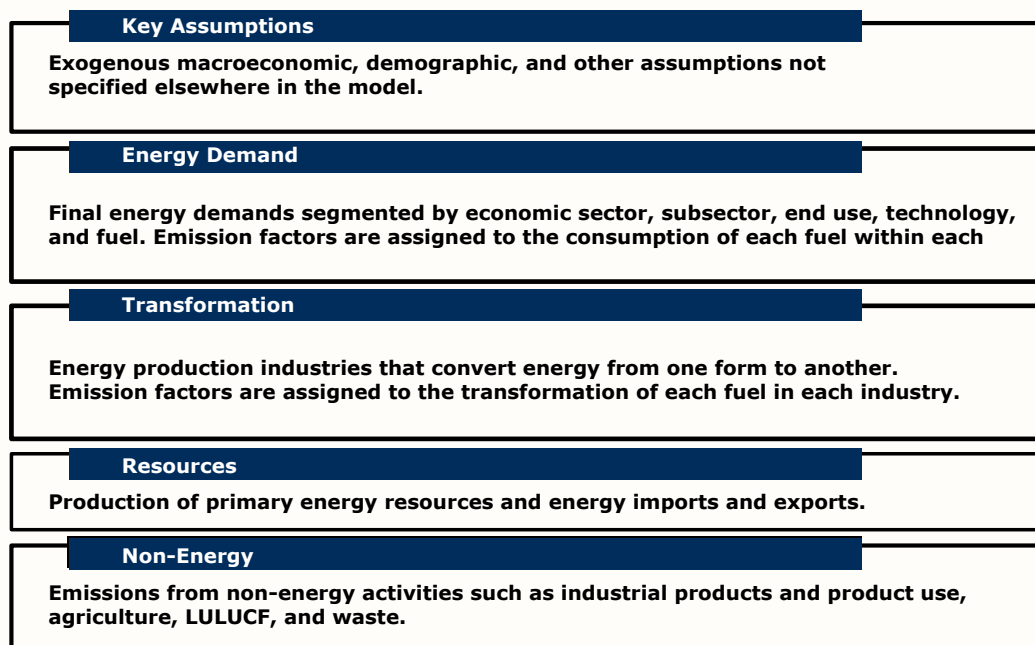
The LEAP model can capture the effects of several policy changes at once within a particular scenario, and therefore the emissions impact of commitment packages. The team developed commitment packages based on the standard ambition and deep decarbonisation scenarios identified earlier in the analysis. Using a 'package' approach to model the emissions impact of mitigation actions ensures the model accounts for the interaction between policies and therefore provides a more accurate view of the abatement potential in the energy sector. For example, when modelling multiple policies which improve the efficiency of electricity use, the modelled reduction in emissions takes account of other policies that are also changing the carbon intensity of the grid over time.

The LEAP model is an energy-systems model and only accounts for system costs and not economic impacts. Also, as an energy-systems model, the LEAP model only considers the direct impact of the policies known as the system costs. The wider economic impacts of these changes in the energy sector, for example, the macroeconomic impacts of higher or lower energy prices or lower air pollution impacts are not captured in the model.

The LEAP model is built with a branch structure as shown in Figure 12 where associated variables are stored within each branch.

Figure 12

Variable Branches of the LEAP Model

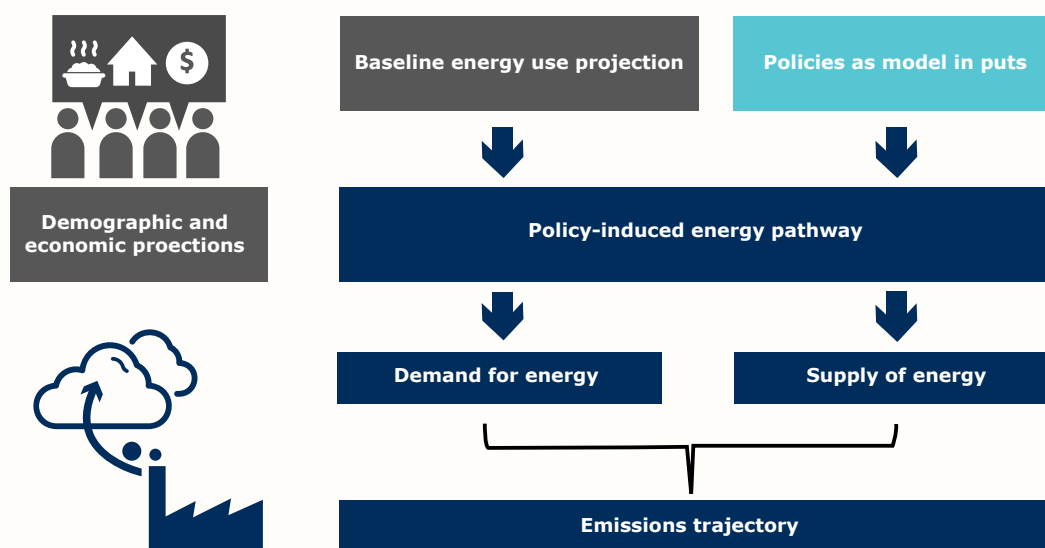


Source: (Vivid Economics & WB, 2021a)

The mitigation actions were represented as inputs in the LEAP model by setting levels of uptake, energy efficiency improvements and target years. This was then combined with underpinning baseline trends to estimate the policy impact on energy use and GHGs emissions. The schematic description of the energy policy modelling is shown in Figure 13.

Figure 13

Schematic Description of Energy Policy Modelling

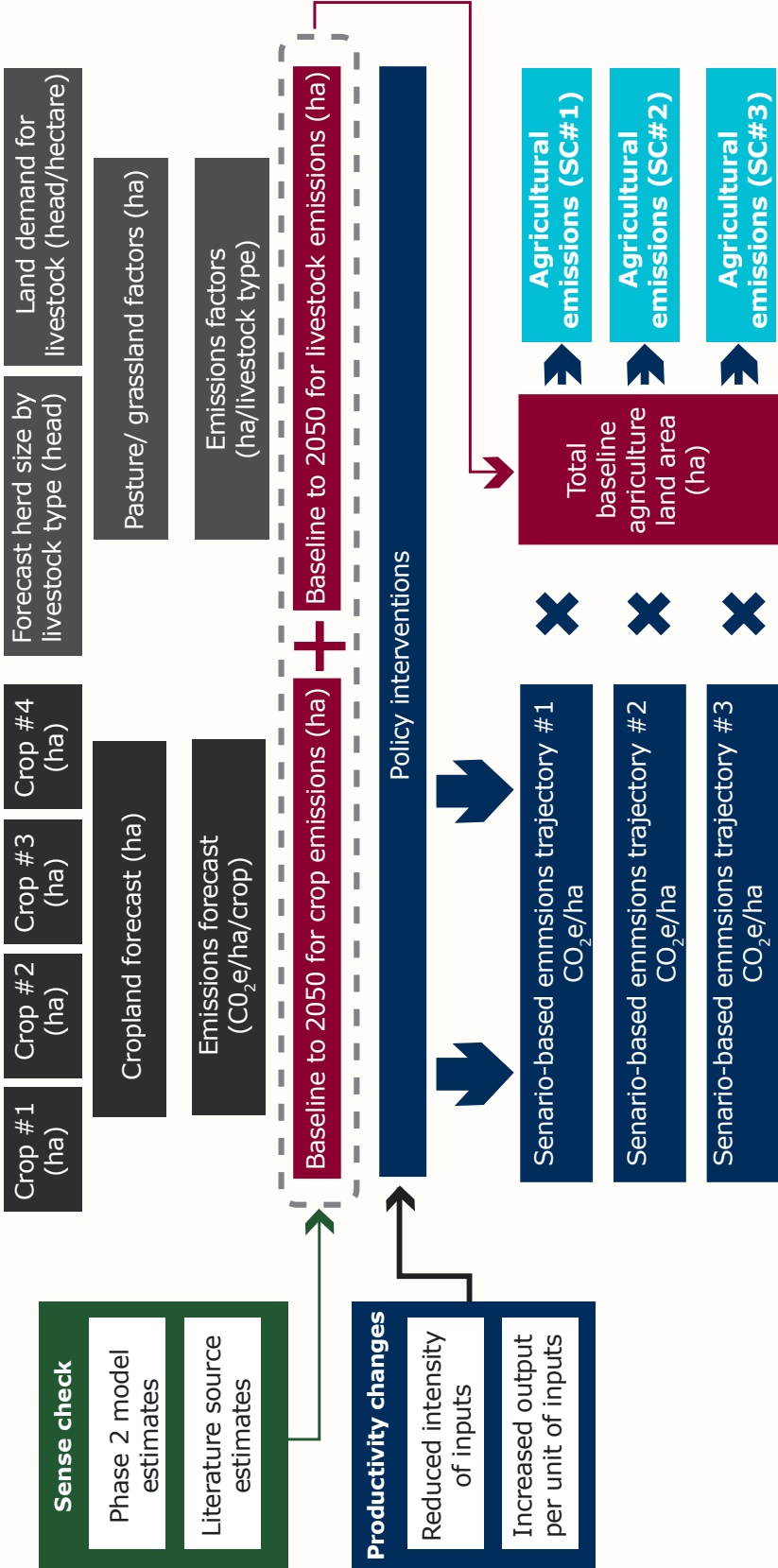


Source: (Vivid Economics & WB, 2021a)

Land use modelling

The analysis draws on a Python model that quantifies the emissions impact of these commitments. The model establishes a baseline for forest cover, agricultural output and associated emissions by drawing on historic land use data, agricultural and settlement growth projections, and international data on the carbon density of Jamaica's existing and newly planted forests, using emissions factors by crop and livestock category. The model then combines these factors with assumptions on the impact of mitigation actions on land use change and emissions intensity of agricultural outputs to generate emissions projections for the standard ambition and deep decarbonisation scenarios. Figure 14 sets out the modelling process.

Figure 14
Land-use Sector Modelling Approach



Source: (Vivid Economics & WB, 2021a)

Annex 2: LTS Multistakeholder Committee Composition

Title	First Name	Last Name	Title	Entity	Expert Area
Mr.	Omar	Alcock	Acting Principal Director	Ministry of Economic Growth and Job Creation (Co-Chair)	Climate Change
Ms.	Larytha	Fletcher	Urban and Regional Planner	Planning Institute of Jamaica (Co-Chair)*	Urban Planning
Ms.	Farrah	Hansel-Murray	Science and Technology Development Planner	Planning Institute of Jamaica (Alternate Co-Chair)*	Science Technology and Innovation
Mr.	Jerome	Smith	Principal Director	Forestry Department	Forestry
Ms.	Debra-Kay	Palmer	Director	Ministry of Culture, Gender, Entertainment and Sports	World Heritage and Culture Conventions
Mr.	Brian	Richardson	Chief Technical Director	Ministry of Science, Energy, Telecommunications and Technology	Energy
Mr.	Osbourne	Chin	Director	Ministry of Tourism	Tourism Facilitation
Ms.	Jody-Ann	Marston-Minott	Acting Manager	National Environment and Planning Agency	Environmental Management and Conservation
Mr.	Garfiel	Murray	Senior Planning and Research Office	National Solid Waste Management Authority	Waste Research and Management
Ms.	Monifa	Blake	Environmental Office	Ministry of Science, Energy, Telecommunications and Technology	Environment and Transport Policy
Ms.	Phillipa	Rickettes-Edmund	Disaster Coordinator	Ministry of Local Government and Community Development	Disaster Risk Reduction and Management
Dr.	David	Smith	Lecturer	Jamaica National Commission for United National Education, Scientific and Cultural Organization	Culture
Mr.	Winston	Shaw	Senior Director	Rural Agriculture Development Authority	Technology, Training & Technical Information
Ms.	Eleanor	Jones	Chairman and Chief Executive	Private Sector Organization of Jamaica	Energy, Environment, and Climate Change

Note: *Miss Fletcher demitted office and was replaced by Mrs. Hansel-Murray during the tenure of the Committee.

Annex 3: Stakeholder Consultations

Consultations were conducted in all phases to inform the process and outcome of the development of the LTS. Bilateral consultations were conducted with representatives from the key sectors for mitigation, adaptation and loss and damage.

Following the development of a draft LTS document and its review by the LTS committee, public in-person validation sessions were held in Kingston, Mandeville, and Montego Bay, and one virtually via a webinar. Additionally, the draft document was circulated electronically, and a Google Form set up so that interested parties could provide their inputs, even if unable to attend any of the sessions

No.	Stakeholder	Date 1	Date 2
1	LTS Committee	January 31 2023	February 28 2023
2	Rural Agricultural Development Authority	February 28 2023	N/A
3	Local Government Authority	February 28 2023	N/A
4	National Solid Waste Management Authority	February 28 2023	N/A
5	Ministry of Science, Energy, Telecommunications and Transport	March 1 2023	June 27 2023
6	Ministry of Culture, Gender, Entertainment and Sport	March 1 2023	N/A
7	National Environmental Planning Agency	March 1 2023	June 27 2023
8	Vision 2030 Secretariat	March 1 2023	June 27 2023
9	University of Technology Jamaica	March 1 2023	N/A
10	Jamaica Bauxite Institute	March 1 2023	June 27 2023
11	Jamaican Forestry Department	April 13 2023	N/A
12	Private Sector Organisation of Jamaica	April 18 2023	N/A
13	Bureau of Gender Affairs	April 19 2023	N/A
14	Jamaican Institution of Engineers	April 21 2023	N/A
15	Validation Consultation Kingston	June 26 2023	N/A
16	Validation Consultation Mandeville	June 28 2023	N/A
17	Validation Consultation Montego Bay	June 29 2023	N/A
18	Validation Consultation Online	July 6 2023	N/A
19	International Development Partners	July 18 2023	N/A



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