Jamaica's Climate Change Research Agenda 2021- 2030

Output 3. Analysis of R&TD sector's priorities vis a vis country climate priority (NDC, TNA, adaptation, national plans)

Solutions for environment and development
Soluciones para el ambiente y desarrollo

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This report was prepared for the Climate Change Division under the Climate Action Enhancement Package Program (CAEP). The CAEP is an offering of the NDC Partnership to support member countries to enhance quality, increase climate ambition and implement the NDC.

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Table of Contents

I. Country R&TD Priorities for the Water Sector

Jamaica's policy documents have been designed to capture pragmatic plans and strategies geared towards achieving economic growth and development. This report outlines the island's research and technology development (R&TD) priorities that are aligned with its development targets. The documents used for both the Water and Agriculture sectors include:

- National Water Sector Policy and Implementation Plan 2019
- Water Sector Plan- Vision 2009-2030
- Agriculture Sector Plan-Vision 2009-2030
- National Food and Nutrition Security Policy 2013
- Technology Needs Assessment (TNA) Water Sector 2020

Analysis of the country's R&TD priorities focused on policy measures that specifically mentioned "research" or any form of assessment. This approach was done to avoid any form of subjectivity where "research" may have been implied. With regards to technology, the analysis incorporated both hard and soft instruments outlined as policy measures and action plans. 'Hard' instruments are generally geared toward physical infrastructures, and engineered designs such as irrigation systems, piped water-supply networks, rainwater harvesting structures, storage facilities and treatment plants, weather instruments, etc. Alternatively, 'soft' technological development focuses on building the knowledge and capacity of stakeholders at various scales. This may include expanding knowledge, skills, and technical know-how within areas that will accelerate productivity. For example, building agricultural producers' knowledge capacity on efficient water and land management practices. Each research and technology priority were recorded under various themes or sector goals as detailed within the policy documents. There were some overlaps where a national indicator may have several action plans or outcomes related to both research and technology. For example, within the Agriculture Sector Plan-Vision 2009-2030, the national indicator "strengthen agricultural research institutions and programmes" has several research and technology priorities. These were recorded within their respective columns with the necessary notations.

Policy	Research Priorities	Technology Development Priorities
National Water Sector Policy and Implementation Plan 2019	**Theme 1: Climate Change Adaptation and Mitigation**	
		Technology 1: Rainwater harvesting, with adequate storage, is promoted for households in areas with adequate rainfall and where groundwater and surface sources are not available.

Policy	Research Priorities	Technology Development Priorities
		Technology 2: Sufficient investment in hydrological and water quality monitoring and adequate dissemination of information to stakeholders and decision-makers on the status of the island's water resources.
		Technology 3: Development of appropriate hydrological and water resources modelling tools in parallel with capacity building within key stakeholder organizations.
		Technology 4: Development of water protection zones, flood bank monitoring, water harvesting farms, reforestation of degraded water catchment areas and establish emergency water supply systems.
		Technology 5: Increased efficiency in water delivery systems.
	Theme 2: Energy Efficiency in the Water Sector	
	Research 1: Complete detailed Energy Audits of high energy consuming facilities that will guide the implementation of appropriate energy reduction strategies, and establish appropriate energy monitoring systems.	Technology 1: Rainwater harvesting systems—The GOJ promotes the use of rainwater harvesting in areas where piped water supply is not economical to meet the water demand.
		Technology 2: Piped gravity-fed water supply systems—Gravity-fed water systems are constructed where there are naturally occurring springs located in higher elevations than the communities. The community channels the water into a storage tank. The community builds a network of pipes that connect the households to the tank using gravity to deliver water from the tank to the households. Because they are gravity-fed, these systems can deliver reliable water supply to communities without any need for pumping.
		Technology 3: Renewable Energy Technology—Renewable energy technology, for example solar energy systems, will be utilized as a source for the delivery of water (either pumps or electro valves),

Policy	Research Priorities	Technology Development Priorities
		which can significantly decrease energy costs and greenhouse gas emissions.
		Technology 4: Weather stations—Local weather stations can provide rainfall and evaporation information. This data will allow land owners to irrigate using the exact amount of water needed for the crop, thereby reducing waste. These weather stations operate with solar panels.
		Technology 5: Other efficient irrigation technologies—Other technologies and methods to improve on farm water use efficiency, such as drip irrigation and fertigation, should be utilised.
	Theme 3: Private Participation in the Water Sector	
		Technology 1: Reduce NRW (non-revenue water) from 65% to 45% by 2030. This will be done by intensifying the programme of leak detection and repairs and undertaking capital intensive projects for efficiency improvement, inclusive of mains replacement and other NRW reduction activities.
		Technology 2: Utilize renewable energy technology as a source for service delivery in the water and agricultural sectors to significantly decrease high energy costs.
		Technology 3: Establish central sewerage in major towns and increase sewerage coverage in Kingston and St. Andrew from 30% to at least 45% by 2030.
	Theme 4: Standards for Access to Potable Water Supply and Improved Sanitation	
		Technology 1: Water supply will be delivered to the home, or as close as possible. Water supply should be no more than 500 metres from the home.

Policy	Research Priorities	Technology Development Priorities
	Theme 5: Water Supply in Utility and Non-Utility Service Areas	
		Technology 1: Piped water supply networks will reach all households in Utility Service Areas—about 85 percent of the population—by 2030.
		Technology 2: Various modalities will be used to provide water supply in Non-Utility Service Areas. The appropriate method will depend on the area being served, and be determined by the community or household that will benefit from the water supply system. Technologies used will include spring entombments, small piped gravity-fed or solar powered systems, and community or individual rainwater harvesting (catchment tanks) systems. The technology chosen for each community will depend on water resource availability. Where reliable springs are available in proximity to a community, they will be used. Elsewhere, rainwater harvesting will often be the most suitable option to access water.
	Theme 6: Drought Management	
	Research 1: Commitment to undertake research to improve storage and to implement long-term projects, for example Artificial Groundwater Recharge.	Technology 1: Use modelling approaches and tools to assess the impacts of climate change on crops.
	Research 2: Encourage research on alternative crops that can be grown in greenhouses.	Technology 2: Train farmers and other stakeholders in efficient water and land management practices (such as planting seeds in trays, instead of direct seeding, in order to use available water more efficiently, encouraging water reuse and recycling, where it is safe to do so); in efficient and economical irrigation systems, such as, drip irrigation systems. The use of small portable pumps and tanks for water storage will also be encouraged.
	Research 3: The GOJ will revise the National Drought Management Plan to mitigate against the impact of drought conditions. Components include:	Technology 3: Encourage farmers to plant drought-tolerant crops that are able to withstand increasing temperatures, such as cassava, pineapple, sweet potato, gungo peas and ginger.

Policy	Research Priorities	Technology Development Priorities
	I Projection–Climate studies, projection models and awareness of water storage levels and facilities to help in the formulation of prediction models. **II** Monitoring–The monitoring of rainfall patterns and weather conditions. Data collection will assist with planning for the severity and long term impact on the country by drought and other hazards. **III.** Impact Assessment–Impact assessments should be completed through the use of surveys on community vulnerability and the strength of the agricultural sector to withstand the impact of hazards. **IV.** Response–The response capability should provide for improved monitoring of water and crop management, and public education programmes to encourage water conservation and safe use practices.	
		Technology 4: Encourage the use of rainwater harvesting systems and other appropriate technologies on small farms.
		Technology 5: Explore the rehabilitation of existing permanent water tanks in communities across the island.
		Technology 6: Provide incentives to encourage home owners, businesses, institutions and private service providers to invest in water efficient technologies.
		Technology 7: Create a water efficiency criterion, using technologies such as showerheads, faucet aerators and toilets.
		Technology 8: Intensify the programme of leak detection and repairs, by strengthening the capability of the Regions and assuming a more proactive approach to leak repairs.

Policy	Research Priorities	Technology Development Priorities
		Technology Priority 9: Undertake capital intensive projects for efficiency improvement, inclusive of mains replacement and other NRW reduction activities.
		Technology 10: Introduce better monitoring and control systems to reduce overflow and other losses at storage facilities and treatment plants.
		Technology 11: Complete metering of production sources to ensure more accuracy in measuring NRW.
		Technology 12: Use private sector entities, under incentive based contracts, to provide the acceleration of NRW reduction, through cutting edge technologies and training.
		Technology 13: The GOJ will also bring more wells into operation and increase the treatment of water from wells for distribution.
		Technology 14: More artificial limestone aquifer recharge projects will be considered. The artificial recharge work comprises the establishment of facilities to increase the groundwater potential in the limestone aquifer, by treating and discharging surplus surface water into sinkholes and wells, in order to sustain abstraction from wells.
	Theme 7:Rainwater Harvesting	
	Research 1: The GOJ will develop Rainwater Harvesting Guidelines and strategies to encourage sufficient storage.	Technology 1: The GOJ will encourage and strengthen the capacity of households and entities to utilize rainwater harvesting systems to augment water supply. A special incentives regime will be developed to offset the cost of investment in rainwater harvesting systems for households and businesses requiring assistance. This incentive regime will be developed around water conservation and other demand side management approaches that would reward good practitioners and penalize abusers.

Policy	Research Priorities	Technology Development Priorities
		Technology 2: The GOJ will also promote the rehabilitation and maintenance of community catchment tanks, where Municipal Corporations, Local Authorities, or communities themselves wish to take on the responsibility of maintaining these systems.
		Technology 3: Rainwater harvesting systems that are used as a primary source for household or community water supply will be designed to deliver the most optimal volumes of water.
		Technology 4: Incentivizing rainwater harvesting through value creation: To create value for harvested rainwater, the GOJ will implement and create a marketplace in which harvested rainwater can be bought and sold to enable revenue generation. This will be done by creating an accessible online marketplace to buy and sell excess rainwater harvested by users and providers, and utilizing water trucks managed by the Municipal Corporations for distribution.
	Theme 8: Wastewater Management in Utility and Non-Utility Service Areas	
		Technology 1: The GOJ will encourage the use of emerging technology such as, the adoption of nanotechnology and advanced microbiological processes, improvements in nutrient capture from wastewater, and likely improvements over time in energy efficiency and energy recovery.
		Technology 2: Non-Utility Service Areas are predominantly rural areas. In general, persons living in these areas will be best served by on-site sanitation facilities.
		Technology 3: In NUSAs, diverse on-site sanitation facilities will be used to meet the policy objectives, without contaminating groundwater sources. On-site sanitation facilities are built to safely treat effluent and human excreta at the point of use. Ideally, each household will have its own sanitation facility, and communal facilities may be necessary in some cases.

Policy	Research Priorities	Technology Development Priorities
	Theme 9: Irrigation Services	
		Technology 1: Drip irrigation – A technique that saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone. This technique can increase yields compared to traditional flood irrigation.
		Technology 2: Wastewater Re-use – Exploring opportunities for the reuse of waste water for irrigation purposes, especially for high water demand crops, within the bounds of sanitation, quality control and management, along with published guidelines and the requisite professionals for the management of these requirements. The precursor to this re-use is effective collaboration with other entities and a major education campaign for public and cultural acceptance by stakeholders, followed by investments in new infrastructure.
		Technology 3: Conservation & Storage – In an effort to capture seasonal flood run-off, which would normally go to the sea, storage of this and other short term surplus will assist in drought mitigation, reducing deficits during drought conditions, and reduce the dependency on energy-intensive groundwater. Existing storage capacities and storage sites contained in the NIDP should be explored and, where possible, improved or developed.
		Technology 4: Fertigation – Applying fertilizers through irrigation systems.
		Technology 5: Rainwater harvesting – Harvesting rainwater for use in irrigation. Consideration will be given to revitalizing the farm tank programme for irrigation purposes.
		Technology 6: Soil-moisture-based irrigation controls – This method involves measuring the amount of moisture in soil, allowing for irrigation only when plants need water.

Policy	Research Priorities	Technology Development Priorities
		Technology 7: Weather-based irrigation controls – This method uses historical and/or current weather information to allow irrigation only when plants need water.
		Technology 8: Public irrigation systems will consider renewable energy technology to reduce operating costs, thereby reducing dependence on GOJ subsidies, with a view to cost reduction for farmers.
		Technology 9: The National Irrigation Commission (NIC) will explore alternative conveyance methods in some areas for reduction of water loss and water quality deterioration.
	Theme 10: Flood Water Control and Drainage	
		Technology 1: The GOJ will encourage the following practices where they are economical: • Using natural features, such as floodplains and swales, to accommodate flood water runoff. • Construction of permeable rather than impermeable surfaces on commercial and residential plots. • Harvesting of flood waters through groundwater recharge and storage.
Policy	**Research Priorities**	**Technology Development Priorities**
Water Sector Plan- Vision 2009-2030	**Theme 1: All water and sanitation needs are met using modalities that are safe and sustainable**	
	Research 1: Implementation of IWRM in an established institutional framework anchored in the Dublin and other related principles and informed by regional and national research findings. • Improve timely access to and sharing of available data and research on water resources management and the dissemination & implementation of good practice guidelines for all water related projects.	Technology 1: Institute efficient water use for all sub-sectors- irrigation, domestic, hydropower, industry, environment and tourism. • Utilize extensions services and appropriate technology to improve water efficiency in the agricultural and domestic water sub-sectors. • Review existing wastewater technologies and infrastructure and recommend strategies for improvement and reuse.

Policy	Research Priorities	Technology Development Priorities
	• Establish mechanisms and guidelines for sex disaggregated data collection and maintenance of database on water and waste water management (capacity, standards, regulations and monitoring) to guide planning and investment in the sector.	
	Research 2: Ensure equitable allocation of water resources in each hydrological basin. • Review and implement guidelines for conducting water resources assessment and monitoring in each hydrological basin on a continuous basis to guide allocation.	
	Research 3: Institute efficient water use for all sub-sectors-irrigation, domestic, hydropower, industry, environment and tourism. • Conduct EIAs as an integral part of planning for development projects to ensure environmental values and objectives are properly considered.	
	Theme 2: Capabilities to address hazards and climate change improved	
	Research 1: Increase public awareness of the advantages of rainwater harvesting and introduce measures to implement this modality. • Analyze rainfall data and identify areas where rainwater harvesting is feasible.	Technology 1: Provide sufficient water for achieving food security. • Identify and upgrade water supply systems to support implementation of NIDP projects to increase agricultural production. • Increase investment in micro-irrigation systems and develop innovative mechanisms and give greater responsibility for the management of these systems to farmers and communities.
	Theme 3: Stakeholders participate in the planning and managing of the development and use of the island's water resources	
	Research and Technology 1: Foster the protection of the natural resources of the basin as a means of conserving water resources.	

Policy	Research Priorities	Technology Development Priorities
	• Adopt and implement measures that guarantee access to technology and research, in particular women, disadvantaged groups and people living in poverty in order to ensure sustainable use of land and water resources.	
	Theme 4: Capacity enhanced to effectively plan and manage the development and use of the island's water resources	
	Research 1: Strengthen national capacities to achieve effective integrated water resources management. • Design and use gender sensitive indicators to monitor impacts of water and sanitation policies and programmes.	
	Theme 5: The financial base for future water and sanitation needs strengthened	
	Research 1: Introduce mechanisms towards equitable water allocation and to encourage recycling of industrial effluent and domestic wastewater. • Develop national guidelines on best practice approaches to managing industrial effluent and domestic wastewater that incorporate tax incentives for compliance.	Technology 1: Introduce mechanisms towards equitable water allocation and to encourage recycling of industrial effluent and domestic wastewater. • Identify water pollution sources and review existing wastewater technologies and infrastructure and recommend strategies for improvement through incentive schemes.
Policy	**Research Priorities**	**Technology Development Priorities**
Technology Needs Assessment (TNA) Water Sector 2020	**Theme 1: Adaptation**	
		Technology 1: Rainwater Harvesting and Restoring of Barbeque Catchments- This may be done by collecting rainwater from rooftops (which act as the catchment area) and storing it in an appropriate container which may be fitted with a tap for daily usage.
		Technology 2: Creation and Restoration of Minor Tank Networks- Tanks which harvest water from surface water bodies, runoff and from direct rainfall, but have been damaged or silted. These can help to diversify water supply, control and capture storm water and aid in groundwater recharge.

II. Country R&TD Priorities for the Agriculture and Fisheries Sector

Policy	Research Priorities	Technology Development Priorities
Agriculture Sector Plan-Vision 2009-2030	**Theme 1: Efficient Competitive Diversified Value-Added Agricultural Production**	
	Research 1: Identify production systems that are appropriate to production zones and size of enterprise. • Apply comprehensive soil profile for agricultural lands to guide crop selection and care in respective production zones. • Establish system of crop zoning based on suitability of soil types and growing conditions, with regards to optimizing crop yields, production and productivity.	Technology 1: Encourage greater use of modern and appropriate equipment, tools and techniques among farmers. • Increase small farmers' production and productivity by the utilization of appropriate farm machinery, small tools and implements through acceleration of the small farm mechanization programme.
	Research 2: Utilize value chain approach • Analyze the value chain for agriculture including local and international links and identify strengths of Jamaican producers. • Undertake Value Chain Analysis of Jamaican dairy and beef cattle industry.	Technology 2: Develop modern, efficient farming systems through research and application of local and international best practices. • Promote the use of protected cultivation for specific crops (including greenhouse technology). • Strengthen Crop Care Programmes in Pest and Pesticide Surveillance, Technology Transfer, and Training in order to meet needs of local agriculture sector and international trade.
	Research 3: Strengthen agricultural research institutions and programmes. • Promote conservation of select root crop, vegetable and fruit tree germplasm. • Promote and strengthen conservation, research and export of genetic material including livestock and endemic species.	Technology 3: Increase application of information and communication technology (ICT) to agricultural production. • Implement electronic Extension Activity Reporting System (EARS). • Develop land use geo-spatial database. • Expand application of e-government to the agricultural sector, including approval of veterinary import permits.
	Research 4: Carry out research on new and high- value niche crops which may be added to the mix of crops being cultivated.	Technology 4: Strengthen agricultural research institutions and programmes. • Rehabilitate and modernize government agricultural research stations.

Policy	Research Priorities	Technology Development Priorities
	• Undertake market-driven research and development on crops and livestock. • Undertake research in support of development of organic farming and food.	• Establish a Centre of Excellence for advanced technology (CEATA) to drive research and technological dissemination in agriculture. • Strengthen capacity of CEATA to coordinate the research agenda and the development of agricultural education. • Increase the number of internationally accredited laboratories.
		Technology 5: Improve the delivery of research results to producers. • Encourage greater use of demonstration plots and farmer farm field schools. • Improve dissemination and use of annual report of research papers and findings. • Improve availability of improved planting material including from tissue culture labs and nurseries for seedlings.
		Technology 6: Carry out research on new and high- value niche crops which may be added to the mix of crops being cultivated. • Continue introduction of new technologies from other countries that have similar conditions as Jamaica.
		Technology 7: Develop a comprehensive agricultural information system. • Promote the Agricultural Business Information System (ABIS) as the premiere agricultural information system covering production, marketing and extension. • Expand use of agribusiness information systems. • Undertake integration of production and market information into ABIS to facilitate improved decision making. • Dev Apply GIS and GPS systems to the Agricultural Business Information System (ABIS) develop current registry of farmers and integrate into ABIS database.

Policy	Research Priorities	Technology Development Priorities
		Technology 8: Develop and implement strategic plans and programmes for fisheries. • Establish a communication system for fishers at sea. • Develop and apply GPS system for fishing vessels. • Establish a research station at Pedro Cays, as well as sanitary conveniences for fisheries on the north east and middle Cays. • Rehabilitate infrastructure on fishing beaches.
	Theme 2: Strong Marketing Systems for Domestic and Export Markets	
	Research 1: Establish comprehensive marketing database that is accessible, user friendly and constantly updated. • Compile and update local secondary data of market prices, production costs, input prices, market demand for specific commodities, etc. in accessible format for marketing and planning information. • Generate local primary data for marketing information as needed. • Undertake market research for the tourism and agro-processing sectors. • Undertake market research into local and ethnic markets abroad. • Carry out surveys and studies to determine market trends, consumption patterns and tastes and consumer preferences for a range of local and export market segments. • Use research findings to inform modifications in agricultural varieties and packaging.	Technology 1: Establish comprehensive marketing database that is accessible, user friendly and constantly updated. • Develop and implement the Jamaica Agricultural Marketing Information System (JAMIS) to automate and integrate the collection, storage and dissemination of marketing information. • Establish comprehensive database using internet sources, trade journals, foreign, public and private databases to include global commodity prices, market demand information by diaspora, regional and international markets. • Build capacity of MOAF and RADA staff to undertake market research, marketing information gathering and planning, market development and promotion. • Improve Aquaculture Data Collection System.
	Research 2: Undertake local and global promotion of Jamaican agricultural products. • Identify and assess value-added markets for agricultural products for local agro-processors,	Technology 2: Establish effective dissemination of information on marketing database, including stakeholder, institution and association and success stories.

Policy	Research Priorities	Technology Development Priorities
	agro-tourism, nutraceuticals and export markets.	• Explore options for setting up a network to provide distributed information via SMS and browser (existing cell phone operators or wi-fi distributors or autonomous cell phone operators).
	Research 3: Develop new and emerging markets. • Support research in pursuit of "fair trade" crops.	Technology 3: Develop reliable marketing distribution and communications network and infrastructure. • Undertake repair and upgrading of existing market infrastructure in major distribution centres including provision of modernized communication systems. • Strengthen communications network among agencies, organizations and associations involved in agricultural marketing.
		Technology 4: Strengthen capacity of current practitioners in the informal distribution system. • Facilitate upgrading of level of equipment and vehicles for higglers, truckers and purveyors.
		Technology 5: Strengthen linkages with other economic sectors including manufacturing and tourism. • Develop an industry purchasing planning platform to facilitate arranged purchasing between buyers and growers and enhance coordination of planting and reaping schedules with buyer requirements.
	Theme 3: Competent and Adequate Human Resources	
	Research 1: Strengthen long-term planning for agricultural labour force. • Carry out regular workforce audits to determine gaps in skills set within the agricultural sector. • Conduct audits of agricultural educational and training institutions to match programmes	Technology 1: Strengthen long-term planning for agricultural labour force. • Develop an Agricultural Skills Bank to quantify the level and types of skills present in the public and private sector and to determine the need for training and acquisition of scarce skills.

Policy	Research Priorities	Technology Development Priorities
	with long-term human resource needs of sector.	
	Theme 4: Enabling and Facilitating Framework, Infrastructure and Support Services	
	Research 1: Improve the capacity and effectiveness of the extension service. • Strengthen linkages between research and development and the extension services based on needs assessment of the sector.	Technology 1: Develop effective framework to reduce praedial larceny. • Establish and expand National Animal Identification System to undertake traceability of meats island-wide.
		Technology 2: Provide adequate water supply, irrigation and drainage to meet needs of sector. • Undertake expansion of irrigation services in major agricultural production areas • Promote acquisition and installation of on-farm irrigation systems.
	Theme 5: An Environmentally Sustainable Sector	
	Research 1: Facilitate access to and application of new and emerging information on environmental best practices and standards in the sector. • Strengthen partnerships between public and private sector and academic and research institutions in relevant research and fore-sighting on emerging environmental trends for agricultural sector.	Technology 1: Facilitate access to and application of new and emerging information on environmental best practices and standards in the sector. • Develop renewable energy from bio-fuel resources in sector.
	Research 2: Develop supporting environment and conditions for organic agriculture. • Develop and implement national organic research programme.	Technology 2: Strengthen compliance with environmental regulations, standards, conventions and agreements. • Develop and expand role of agricultural sector in system of carbon trading.
	Research 3: Develop comprehensive agricultural insurance system. • Develop a risk profile of Jamaica in order to identify the magnitude of losses that can	Technology 3: Increase utilization of conservation practices throughout the sector. • Integrate soil management, clean energy technology and watershed management with agricultural production.

Policy	Research Priorities	Technology Development Priorities
	occur based on the profile design risk management tools to manage the different risk layers (national, meso and micro level). • Identify the main sources of risks for specific crops and areas.	
	Research 4: Strengthen on-farm hazard mitigation measures. • Strengthen research into appropriate hazard mitigation measures for Jamaican agricultural enterprises.	Technology 4: Increase recycling of organic residue and waste. • Strengthen supply chain from aquaculture to farms. • Develop recycling of organic residue and waste from solid waste collection and sanitation sites to agricultural producers.
	Research 5: Strengthen disaster response and recovery mechanisms for the agricultural sector. • Research and improve hazard damage assessment methods for the agricultural sector. • Conduct agricultural livelihood assessments in pre-hurricane and post hurricane seasons.	Technology 5: Expand training of agricultural communities in organic farming practices. • Expand training programmes on organic technology for sector professionals and stakeholders.
		Technology 6: Strengthen on-farm hazard mitigation measures. • Encourage the design and construction of hurricane resistant structures for on-farm buildings and infrastructure. • Promote installation and provision of wind barriers to protect crops.
		Technology 7: Develop comprehensive hazard preparedness activities for the agricultural sector. • Strengthen early warning systems for natural disasters. • Encourage the establishment of a hemispheric network specialized in early warning and agro-meteorological monitoring for the mitigation of natural disasters through the joint efforts of public and private institutions in the hemisphere.

Policy	Research Priorities	Technology Development Priorities
		Technology 8: Strengthen disaster response and recovery mechanisms for the agricultural sector. • Develop mechanisms for communication with farmers after a disaster including through cell phone communication and mass-text messages to registered farmers.
	Theme 6: National Food Security	
	Research 1: Create supportive environment for healthy foods. • Support and strengthen relevant research on food and nutrition	Technology 1: Ensure safety of food supplies. • Strengthen the system for surveillance of food-borne disease and create a comprehensive database for food-borne related illnesses. • Establish effective traceability system for key agricultural crops and livestock "from farm to fork".
Policy	**Research Priorities**	**Technology Development Priorities**
National Food and Nutrition Security Policy 2013	**Theme 1: Food Availability- Promote the sustainable production of safe, affordable, nutritious, good quality Jamaican food commodities/products.**	
	Research 1: Include work on Genetically Modified Organisms (GMO) and Living Modified Organisms (LMO) in the National Food and Nutrition Research Agenda and to develop and implement, in consultation with relevant research institutions and national and regional tertiary institutions, a research programme on these organisms to provide evidence-based support for a national policy in respect of GMO's and LMO's.	Technology 1: Government shall encourage and facilitate the production and productivity of the identified food and livestock commodities/products by creating and fostering an enabling environment for: • Generation and transfer of appropriate technology through market driven research programmes at existing institutions (strengthened where appropriate) and cooperation with international development partners. • Facilitate the adoption of new and existing technologies in food crop cultivation and livestock management through the building of technical capabilities and capacities of producers through training and technology transfer in best practices. • Promotion of on-farm mechanization through greater use and improved access to modern and appropriate equipment/tools.

Policy	Research Priorities	Technology Development Priorities
	Research 2: Government shall encourage and facilitate the production and productivity of the identified food and livestock commodities/products by creating and fostering an enabling environment for: • Documentation and dissemination of best practices for identified food crops/livestock and other food commodities, including sustainable production practices.	Technology 2: Improve the National Food Distribution System through: • Facilitation of greater linkages between buyers and sellers and reduction of information asymmetries through the implementation of a national market intelligence system. • Development of wholesale and retail market facilities and packaging centres as public goods to facilitate efficient markets, which will improve availability and lower market prices. • Transportation - fostering greater use of refrigerated trucks to implement food safety standards. (Envisage granting of duty concession on refrigerated trucks). Appropriate packaging and transportation material, maintenance of cold chains for crops and livestock for quality assurance and food safety. • Developing an information system to assess and monitor food access throughout the island, and specifically in the interior of parishes.
		Technology 3: Government shall create an enabling environment to facilitate increased production and productivity in the agricultural/food production sector by : • Strengthening the institutional and technical capacities for research and development (placing emphasis on the integration of existing and new research institutions to realize greater synergies and efficiencies), so that it is demand driven and responsive to the needs of producers through the development, adaptation and adoption of appropriate technologies and methods to improve agricultural productivity and cooperation with data collection and research institutions such as the UWI. • Fostering greater synergies between extension and research and development to ensure the effective dissemination of new and existing technologies to stakeholders.

Policy	Research Priorities	Technology Development Priorities
		• Expanding and strengthening the institutional and technical capacity of extension services to provide better support and more rapid and extensive transfer of new and innovative technologies to primary producers and other actors along the value chain as well as for linking producers to markets. • Continuing to provide institutional and technical assistance to public (and private) research institutions in support of product development for the agro processing sector. • Government will also facilitate the accessibility and affordability of credit to agro processors to enable them to invest in new agro-business ventures and technologies. • Reducing the incidence of praedial larceny through the implementation of a holistic approach involving improved traceability systems, legislation, monitoring, surveillance, enforcement and public awareness. • Encouraging the adoption and promotion of new/improved technologies in livestock breeding, and production to ensure the preservation of existing and where necessary, the improvement of genetic stock.
		Technology 4: Government shall seek to increase the cost efficiency of value added production for locally produced and imported semi-processed foods and livestock products through: • Construction and operation of critical infrastructure such as post-harvest facilities, abattoirs, cold storage, packing houses through strategic public/private sector partnerships. • Food safety- traceability, residue testing, standards and grades.
		Technology 5: Government shall formulate and implement land and water resource management plans and strategies. • Ensure more efficient use of existing irrigated lands and the expansion of the area of agricultural land under irrigation and promotion of greater use of on-farm water harvesting and management systems.

Policy	Research Priorities	Technology Development Priorities
		Technology 6: Promote sustainable exploitation of Jamaica's fisheries resources and greater investment in aquaculture to increase the availability of fish and fish products.
	Theme 2: Stability of Food Supply- To improve the food and nutrition security resilience of the national community to natural and socio-economic shocks and climate change.	
	Research 1: The policy will emphasize the implementation of adaptation and resilience building strategies as a means of enhancing the stability of food security. • Promote the creation of an Information System for Food and Nutrition Security (ISFNS) for food security development as well as food crisis prevention and risk management and the construction of adequate risk profiles for the main crops.	Technology 1: The policy will emphasize the implementation of adaptation and resilience building strategies as a means of enhancing the stability of food security. • Encourage capacity enhancement within relevant ministries and public entities, research institutions and the hydro-meteorological departments and foster links with UWI and the Caribbean Community Climate Change Centre (CCCCC) so that they can provide accurate and timely climate information to the farming community. In this area, within the framework of the ISFNS, Government of Jamaica and CARICOM will seek technical and financial assistance for institution building and capacity development at regional and national levels from bilateral and multilateral partners and the International Finance Institutions. • Facilitate reduction in tariffs on 'green' and cleaner technologies, and related material and equipment or capital goods that could assist in the reduction of Greenhouse Gas emissions by the agricultural and agro-processing industries. For example, liberalization of environmental goods, solar panels, etc.; since with the drive to increase agricultural production and agro-processing, there is the threat that carbon emission will also increase. Special attention will also be paid to technologies for the reduction of carbon emissions and the use of crops/livestock/food waste as an input to biogas production. • Promote the inclusion of adaptation and mitigation strategies in the curricula of all training institutions and

Policy	Research Priorities	Technology Development Priorities
		extension training mechanisms for farmers and other producers e.g. farmer field schools.
	Research 2: Utilization of vulnerability analysis and mapping to provide timely nutrition and socio-economic information on vulnerable population groups to decision-makers to enable the design of more effective emergency and relief responses.	Technology 2: In order to reduce the impact of climate change on food production, incomes and livelihoods, Government shall enhance the stability of food supply by: • Retraining and retooling of farmers in appropriate production practices (e.g. conservation farming, zero tillage etc.) to adapt to the changing environment Zoning of agricultural production as necessary to reduce vulnerability. • Investment in new or existing water management and control infrastructure. • Promote cost-effective alternatives to fossil fuels that improve energy efficiency in agriculture. • Support the improvement of national monitoring and forecasting systems for weather and natural phenomena and endorse the development of a Regional monitoring and forecasting system for the same.
	Research 3: Harmonize and coordinate the collection and collation of information inter alia on markets, production-type and level, income sources and reliability, policies affecting trade and distribution of food products, baseline information on food availability, access, utilization, population numbers and distribution, infrastructure, rainfall information, crop and livestock diseases, monthly state of crops in the fields, security conditions-extent of praedial larceny, etc.	Technology 3: Develop a preparedness strategy and an early warning system (short-medium-long term) dealing with climate change parameters.
	Research 4: Construct resilience indicators and develop comprehensive risk profiles for the main economic and food crops.	Technology 4: Improve the systems for the collection of agro-meteorological data (for key climate variables such as rainfall, river flow/levels, temperature, sea level rise and the incidence of extreme weather events (e.g.. hurricane, flood, drought) at the national and parish levels.

Policy	Research Priorities	Technology Development Priorities
		Technology 5: Maintain a functional national germplasm bank and subscription to a regional germplasm bank.
	Theme 3: Food Access-To ensure access of households and individuals to sufficient, safe, nutritious and affordable food at all times.	
	Research 1: Government shall ensure that the population has economic and physical access to food at all times by: • Identification and mapping of vulnerable groups (taking a gender-sensitive approach) that are prone to chronic or transitory food insecurity and establishment of a national database of this information, recognizing that each group may require a different intervention, to ensure their access to livelihoods based on self-sufficiency and sustainable income earning activities. This will be effected through collaboration among its agencies, and with external partners and extensive and continued consultation with vulnerable groups, to provide timely socio-economic and nutrition information on vulnerable population groups; this will further enable the design of more effective and targeted interventions. • Improved measurement and identification methodologies to improve the design and targeting of programmes and interventions for the poor. • Enhanced data collection methodologies. • Evidence-based research as a basis for poverty measurement and monitoring. • Setting nutrition standards and guidelines for schools, training and other community based	Technology 2: Strengthening national laboratory capacity to monitor/verify labelling requirements and nutrients of concern.

Policy	Research Priorities	Technology Development Priorities
	institutions such as orphanages, hospitals, nursing homes, prisons and others.	
	Theme 4: Food Utilization/Consumption/Nutritional Adequacy- To promote nutritionally adequate, safe, affordable dietary intakes and other positive lifestyle behaviours throughout the life course.	
	Research 1: Strengthen national nutrition surveillance systems in accordance with WHO standards, so as to monitor the nutritional status of the population and identify those at risk of nutrition-related disorders: • Implement a strategy of universal assessment for all children (0 to 18 years old) to identify those at risk of malnutrition (deficiency diseases, overweight, obesity and non-communicable diseases).	
	Research 2: Implement policies and programmes to detect, prevent and manage micronutrient deficiency: • Conduct systematic reviews of available evidence on effective approaches to food fortification of staple products. • Pilot fortification of commonly used staple foods based on available evidence and best practices.	
	Research 3: Develop and implement, in consultation with relevant national and regional tertiary institutions, a National Research Agenda for Nutrition, to provide evidence-based support for policies and programmes, in support of food and nutrition security, to mitigate the impact of nutrition-related disorders: • New and existing national health surveys including nutrition and physical activity components. • Surveillance studies inter alia on the trans-fat content and other nutrients of interest in the	

Policy	Research Priorities	Technology Development Priorities
	national food supply as well as the concentration of contaminants in food products and the extent of iron deficiency anaemia in the country. • Research on more effective approaches to food fortification of staple products. • Five-yearly food consumption and special surveys, as necessary. • Research on the ecological suitability and nutrient content of GMOs and LMOs. • Studies to investigate the levels of genetically modified organisms (GMOs) and living modified organisms (LMOs) in the food supply and their impact on the health of the population.	
Policy	**Research Priorities**	**Technology Development Priorities**
Technology Needs Assessment (TNA) Agriculture and Fisheries Sector 2020	**Theme 1: Adaptation**	
		Technology 1: Sprinkler and Drip Irrigation Systems- Drip irrigation involves constant application of a specific and calculated quantity of water to soil crops (localised area). This significantly reduces water runoff through deep percolation or evaporation. Barriers to implement both systems include lack of access to finance for the purchase of equipment, lack of local skills for design, installation and maintenance of the system, and lack of nationally/locally available component parts. May be solar-powered for efficiency.
		Technology 2: Rainwater Harvesting Systems- Ideal for adaptation to restricted water supply in areas where there is no surface water, or where groundwater is deep or inaccessible due to hard ground conditions, or where it is too salty or acidic. Rainwater harvesters induce, collect, store and conserve local surface runoff for agriculture. Implementation is often at the household level.
	Theme 2: Mitigation	

Policy	Research Priorities	Technology Development Priorities
		Technology 1: Concentrating Solar Power- Concentrates the energy from the sun for electricity production by heating fluid which is then used to raise steam to a conventional turbine for on and off-grid electricity provision. This reduces carbon emissions and helps farmers save against high electricity costs.
		Technology 2: Aerobic Biological Treatment (Composting)- The biological degradation under controlled aerobic conditions The waste is decomposed into carbon, water and the soil amendment or mulch which is integrated back into the soil. Carbon storage also occurs in the residual compost.

III. Country R&TD Priorities for Energy

The key fundamental objective of Vision 2030 Jamaica is to secure sustained and widespread improvement in the living standards of the people that will change Jamaica into "the place of choice to live, work, raise families and do business." The goals are systemic in their approach and encourage the integration of resources and outcomes. The national development plan is broken out into targeted sector plans that integrate the guiding principles of equity, sustainable urban and rural development, and partnership, among others.

As an implementation of the national development plan, several policy documents, plans and programmes have been designed and executed. The Vision 2030 Energy Sector plan outlines responsibilities for the implementation of the prioritizations and goals in the National Energy Policy 2009-2030. While stemming from the larger energy policy sub-sectors such as renewable energy, biofuels, and waste from energy also have draft policies. These energy policies and other documents will be broken down in chapter two to identify the specific research and technology development priorities that the country has embedded in its plans and policies.

Policy	Research	Technology Development priorities
Jamaica's National Energy Policy 2009 – 2030	Theme: Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency.	
	Research 1: Undertake studies and conduct consultations with stakeholders on taxation levels for petroleum fuels (such as gasoline, diesel, kerosene, natural gas) with a view to instituting a system designed to enhance efficiency and conservation. This system will be consistent with regional and international trends and best practices.	
	Theme: Jamaica has a modernized and expanded energy infrastructure that enhances energy generation capacity and ensures that energy supplies are safely, reliably, and affordably transported to homes, communities, and the productive sectors on a sustainable basis	
		Technology 1: Establish a combined cycle capacity to replace old and inefficient units/plants with more fuel-efficient and cost-efficient technologies and plants.

Policy	Research	Technology Development priorities
		Technology 2: Upgrade the petroleum refinery (PETROJAM) to increase capacity utilization and output of lighter and higher-value refined petroleum products to replace imports and compensate. Technology 3: Implement appropriate energy distribution and transmission systems
	Theme: Jamaica realizes its energy resource potential through the development of renewable energy sources and enhances its international competitiveness, energy security whilst reducing its carbon footprint.	
	Research 1: Research and develop alternate fuels for the transportation sector (e.g liquid fuels from organic matter and CNG) Research 2: Encourage research, development, and implementation of qualified renewable energy projects	
	Theme: Jamaica's energy supply is secure and sufficient to support long-term economic and social development.	
		Technology 1: Construct new energy-efficient generating facilities on a phased basis to meet increasing demand. Technology 2: Identify and develop indigenous non-renewable sources of energy and necessary enabling environment to encourage private sector participation
Renewable Energy Policy 2010-2030	Theme: The economic, infrastructural, and planning conditions conducive to the sustainable development of all of Jamaica's renewable energy resources	
	Research 1: Promote research, development, and implementation of qualified renewable energy projects through the provision of resources and appropriate incentives.	Technology 1: Develop diversification priorities based on cost, efficiency, environmental considerations, appropriate technologies, and competitiveness.

Policy	Research	Technology Development priorities
	Research 2: Compile renewable-energy resources assessments for wind, biomass, geothermal, hydro, and solar energy, and conduct assessments where needed.	Technology 2: Develop the institutional framework to ensure the continuous review of new and emerging technologies that facilitate the improved delivery and efficiency of technology as well as policy alignment to ensure their seamless introduction into both the production and consumption processes. Technology 3: Create mechanisms to introduce modern renewable energy in rural areas—for example, link this policy with other policies that promote rural development, recognizing that renewable energy can play an important role in rural income-generation activities.
	Theme: An enabling environment that facilitates the introduction of key policy instruments (financial and fiscal) for the promotion of renewable energy (by redirecting national resources and investments to RETs)	
	Research 1: Analyse and explore the main financial and non-financial instruments for the direct stimulation of renewable energy deployment into type and position in the development chain. Choice of the instrument will ultimately be based on factors such as effectiveness; cost-effectiveness; market efficiency (static and dynamic); transaction cost and administrative capacity; equity (fair distribution of benefits); and market conformity.	Technology 1: Capitalize on the use of the Global Environment Facility (GEF) and other facilities such as the Clean Development Mechanism (CDM) which encourages investments in renewable technologies by covering the incremental costs of such projects. Certified Emission Reductions (CERs), which have derived from the CDM, are another option for attracting international capital flows.
	Theme: Sustained R & D and innovation in existing and emerging RETs.	
	Research 1: Facilitate and promote research, development, and demonstration of new energy technologies by strengthening institutional capacity, improving R&D infrastructure, attracting and retaining quality expertise and creating long-term funding mechanisms.	

Policy	Research	Technology Development priorities
	Research 2: Conduct feasibility studies for wider use of solar technologies such as solar manufacturing facility and the use of solar PV for homes and in use in rural electrification. Research 3: Undertake research and development (R&D) through cooperation with public and private research institutions and private businesses for strengthening and advancing the renewable energy technologies, business models, and policies are necessary for determining the optimal applications for renewables in market environments. Research 4: Engage in a process to continuously develop "best practices" and benchmarking while furthering R&D to replicate and scale up such experiences	
	Theme: A dynamic legislative and regulatory environment, responsive to growth and development in the renewable energy sector	
		Technology 1: Establish net metering strategies that value renewable energy production at the point of end-use and allow public utility networks to provide "energy storage" for small users. Technology 2: Develop transmission and distribution grid infrastructure, intelligent networks, storage facilities and the electricity system, to allow the secure operation of the electricity system as it accommodates the further development of electricity production from renewable energy sources.
Energy from Waste 2010-2030	Theme: Jamaica creates economic infrastructure and planning conductions conducing to the development of the energy from waste sector.	

Policy	Research	Technology Development priorities
	Research 1: Conduct economic assessments of energy-from-waste facilities to determine the costs and benefits of investment in the sector. Research 2: Conduct assessments of non-price-sensitive barriers to the take up of energy recovery including planning approval and supply chain limitations.	Technology 1: Create a system for the measurement, verification, and marketing of greenhouse gas (carbon dioxide) credits that will result from reducing methane generation potential. Technology 2: Establish dedicated substations and the protection systems required for interconnection with the electricity grid.
	Theme: Jamaica builds its energy from the waste sector on the most appropriate technologies that are environmentally friendly, producing a clean reliable renewable source of energy.	
	Research 1: Develop a research agenda that would facilitate research to analyse different EFW options – in terms of waste type and technologies – within the Jamaican context. Research 2: Undertake research to determine options available at a small scale for EFW initiatives in rural parishes and other areas. Research 3: Require environmental impact assessments as well health impact assessments and other relevant impact assessments (social impact assessments, trade impact assessments etc.) for any energy-from-waste facility before development approval. The assessments should include a life-cycle analysis of all associated environmental and energy impacts that will result from each option. Research 4: Conduct a feasibility study for producing fuel from wastewater sludge.	Technology 1: Establish training, lab testing and plant control facilities, which will be used to ensure the air quality, process quality, fuel and power quality specifications are met. The air pollution control equipment should include but not be limited to dry scrubbers for acid gas control, filter fabric baghouses for particulates, nitrogen oxide (NOX) controls, continuous emission monitoring and an activated carbon injection system for mercury and dioxin control. Technology 2: Expand the system of generating biogas from wastes. Technology 3: Explore and develop systems for the capture of landfill gas

Policy	Research	Technology Development priorities
	Research 5: Undertake research to determine the potential of the long-term use of commercial and industrial solid waste within EFW initiatives	
Technology Needs Assessment (2020)	Theme: Prioritised Mitigation technology for the Energy sector.	
	Research 1: Investigate alternative energy sources: • Biogas • Natural Refrigerants • Refuse-derived fuel production	Technology 1: Mitigation initiatives and technology needs: • Biogas • Natural Refrigerants • Refuse-derived fuel production
National Biofuels Policy 2010-2030 Draft	Theme: Innovative and clean technologies facilitating a secure supply of biofuels into local and national distribution systems.	
		Technology 1: Adopt precision agriculture and real-time yield monitoring on mechanical sugar cane harvesters. Technology 2: Facilitate the expansion of current agricultural producers to convert their biowaste/biomass into biofuels either for cogeneration or for selling to the grid. Technology 3: Develop biofuel "packages" - including the use of biodigesters that can provide energy in the medium term - that can be implemented at the household level using biomass that avoids pollution concerns
Updated NDC (2020)	Theme: Developing a technology strategy to support low carbon and climate-resilient growth.	
		Technology 1: The need for innovations is embedded in the need to be more efficient and to produce from cleaner technologies. The availability and transfer of technologies that are environmentally sound and which support low carbon and climate-resilient development are paramount.

IV. Country R&TD Priorities for Human Settlements and Infrastructure

As Party to the United Nations Framework Convention on Climate Change and the Paris Agreement, Jamaica is committed to promoting adaptation to the effects of climate change and reducing Greenhouse Gases emissions. With this objective, R&TD priorities in the Human Settlements and Infrastructure sector contribute to achieving the national policies related to climate change. The table below presents the knowledge gaps included for this sector in Jamaica's Climate Change Research Agenda 2021-2030 listed along with the following policies:

- National Energy Policy (Ministry of Energy and Mining 2009)
- National Renewable Energy Policy (Ministry of Energy and Mining 2010)
- Update of Nationally Determined Contribution (NDC) of Jamaica (Government of Jamaica 2020)
- Intended Nationally Determined Contribution of Jamaica Communicated to the UNFCCC (Government of Jamaica 2015b)
- Climate Change Policy Framework for Jamaica (Government of Jamaica 2015a)
- Vision 2030, Jamaica. Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030 (Government of Jamaica 2009b)
- Vision 2030, Jamaica. Housing Sector Plan 2009-2030 (Government of Jamaica 2009a)
- Vision 2030, Jamaica. Urban Planning and Regional Development Sector Plan 2009-2030 (Government of Jamaica 2010)
- Vision 2030, Jamaica. Construction Sector Plan 2009-2030 (Government of Jamaica 2009c)

Theme	Research gaps	Country Climate Priority
Theme 1: Enhancing the adaptive capacity of the sector to climate change effects.	**Outcome 1.1: Understanding climate change impacts on infrastructure.**	**Climate Change Policy Framework for Jamaica:** The strategies will address: "Assessment of technological needs for adaptation and mitigation strategies."
	Further study on the vulnerability of housing and infrastructure to negative impacts of slow onset events (e.g., sea-level rise). Get further knowledge of who and what is affected (e.g., infrastructure,	**Climate Change Policy Framework for Jamaica:** The strategies will address: "Improvement of assessment tools for observing and researching the impacts of climate change at the sector and community levels." Also, actions include: "Identifying and delineating vulnerable areas (including marine areas) in the formulation of a National Spatial Strategy which will utilize hazard mapping."

Theme	Research gaps	Country Climate Priority
	neighborhoods, human cohorts, coupled human-environment systems, among others).	**Housing Sector Plan 2009-2030**: Goal 1, "Safe, sanitary and affordable shelter for all citizens," includes the outcome: "Housing settlements are not vulnerable to hazards."
	Further research on methods (e.g., modeling approaches, monitoring systems, decision support systems) for risk assessment and resilience of infrastructure in urban and peri-urban zones towards extreme weather events.	**Climate Change Policy Framework for Jamaica:** The principles of the Climate Change Policy Framework include: "Best science. The Government will apply sound technical and scientific analysis and principles and new scientific findings consistent with the precautionary approach. Traditional knowledge is recognized and will be utilized as an important complement to scientific information." Also, the strategies will address: "Improvement of the national systems for climate change impact modelling." **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 4 include: "Develop mechanisms that integrate disaster risk reduction in development planning" and "Implement best practices for hazard risk management."
	Participatory studies with a community-based approach to evaluate the capacity and condition of infrastructure under climate variability and develop adaptation strategies.	**Climate Change Policy Framework for Jamaica:** The principles of the Climate Change Policy Framework include: "Public Participation and Collaboration. The Government will employ a consultative and collaborative approach to respond to climate change. Information on the impacts of climate change and proposed response measures will be provided to the public to ensure awareness and understanding and also to encourage changes in attitudes and practices. The Government, in the development of strategies and approaches to address climate change, will engage interested and relevant stakeholders which include local communities, media, academia, research institutions, public and private sectors, NGOs, and CBOs as well as those most vulnerable to climate change impacts, including women, children and the poor." Actions include: "Design and implementation of public consultation procedures in climate change-related projects and programmes" and "Engagement of communities in vulnerability assessments and adaptation planning programmes that are self-orientated and self-sustaining." **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 4 include: "Build awareness of natural hazards among all stakeholders" and "Support community-based approach to hazard risk reduction."
	Research on the vulnerabilities of domestic water services infrastructure and sanitation	**Climate Change Policy Framework for Jamaica:** The adaptation's strategies to address Climate Change include: "The draft National Water Sector Adaptation Strategy to address climate change in Jamaica. This was prepared under the

Theme	Research gaps	Country Climate Priority
	to climate change effects and actions to reduce risk.	Mainstreaming Adaptation to Climate Change Project led by the Caribbean Community Climate Change Centre (CCCCC). The strategy provides an assessment of the water sector's vulnerability to climate change and outlines the duties of the Government and other key stakeholder groups in helping to build the resilience of the sector against climate change and other potential hazardous impacts."
	Analyse the link between the effects of climate change on infrastructure and the health impact (e.g., indoor air quality and overheating risk in dwellings and buildings).	**Climate Change Policy Framework for Jamaica:** The strategies will address: "Improvement of assessment tools for observing and researching the impacts of climate change at the sector and community levels." **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 3 include: "Mainstream environmental concerns in the decision-making process to ensure the use of impact assessments for development projects – BIA/SEA/HIA" and specific actions include: "Develop framework for the introduction of health impact assessments, and biodiversity impact assessments in policy development."
	Evaluation of sustainability and resilience of existing buildings exposed to weather effects (e.g., material degradation, corrosion, carbonation, etc.). Study of weather factors (e.g., rain and wind) and their effects on buildings and infrastructure (e.g., moisture presence, runoff, biological growths, etc.).	**Climate Change Policy Framework for Jamaica:** The principles of the Climate Change Policy Framework include: "Best science. The Government will apply sound technical and scientific analysis and principles and new scientific findings consistent with the precautionary approach."
	Continuous research to quantify the contributions of urban areas to climate change in terms of anthropogenic GHG emissions, aerosols, ground-level air pollution, and surface reflectivity (National Research Council 2010), including the consequences imposed on surrounding areas and the effects of heat island and urban vegetation-evapotranspiration feedbacks on climate.	**Update of Nationally Determined Contribution (NDC) of Jamaica:** In the Scope and Coverage, how the Party has taken into consideration paragraphs 31(c) and (d) of decision 1/CP.21: "Jamaica is committed over time to extending the scope of the coverage of its NDC to all categories of anthropogenic emissions in line with paragraph 31(c)… Jamaica conducted a detailed assessments to determine whether other sources and sinks of emissions could be included within its updated NDC but concluded that the data needed to rigorously assess the impact of policies and actions on emissions in other sectors was not available. Efforts will be made to address these data gaps over time with the support of national, regional and international partners." **Climate Change Policy Framework for Jamaica:**

Theme	Research gaps	Country Climate Priority
		The principles of the Climate Change Policy Framework include: "Best science. The Government will apply sound technical and scientific analysis and principles and new scientific findings consistent with the precautionary approach. Traditional knowledge is recognized and will be utilized as an important complement to scientific information."
	Outcome 1.2: Developing appropriate adaptation response measures.	**Intended Nationally Determined Contribution of Jamaica Communicated to the UNFCCC:** Human settlement is included in the sectors to implement high-priority adaptation programmes/projects with cross-cutting and national impact. **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 4 include: "Adopt best practices for climate change adaptation." **Construction Sector Plan 2009-2030:** Goal 3, "Development of sector in environmentally sustainable manner," has the strategies: "Ensure that building code addresses requirements for hazard mitigation and climate change."
	Research to identify alternatives to address informal housing developments that contribute to environmental degradation, unplanned development, squatting, and occupation of unsafe areas.	**Housing Sector Plan 2009-2030:** Goal 1, "Safe, sanitary and affordable shelter for all citizens," includes the strategy: "Create mechanisms to relocate informal settlers occupying danger or unsafe zones/unsuitable lands in a just and humane manner." The actions include: "Implement housing strategies to reduce the numbers of persons in squatter settlements" and "Monitor and combat squatting." **Climate Change Policy Framework for Jamaica:** Strategies include: "Develop Research, Technology, Training and Knowledge Management." A key policy implementation action is: "Undertake assessment of technological needs for adaptation and mitigation strategies."
	Options to increase and protect the provision of basic amenities for housing under climatic variabilities.	**Housing Sector Plan 2009-2030**: Goal 1, "Safe, sanitary and affordable shelter for all citizens," includes the outcome: "All communities have access to minimum standard of support services and amenities." **Climate Change Policy Framework for Jamaica:** Key policy implementation actions include: "Undertake assessment of technological needs for adaptation and mitigation strategies."
	Further research on the feasibility of new housing options (for instance, floating and	**Climate Change Policy Framework for Jamaica:** Key policy implementation actions include: "Undertake assessment of technological needs for adaptation and mitigation strategies."

Theme	Research gaps	Country Climate Priority
	amphibious housing) according to the populations' needs.	**Housing Sector Plan 2009-2030**: Goal 1, "Safe, sanitary and affordable shelter for all citizens," includes the strategy: "Provide flexibility for innovative housing design" and the action: "Create a housing research unit to facilitate research and design in housing development/communities in collaboration with research institutions."
	Further development of scenario planning for the social and sustainable use of space in less exposed areas.	**Climate Change Policy Framework for Jamaica:** Strategies include: "Develop and incorporate mechanisms and tools to mainstream climate change into ecosystem protection and land-use and physical planning." An action is: "Reform zoning plans including 'no-build' zones." **Housing Sector Plan 2009-2030:** Goal 1, "Safe, sanitary and affordable shelter for all citizens," includes the strategy: "Promote construction and rehabilitation techniques that enhance the long term usability and affordability of housing," and the actions include: "Use hazard maps for different areas in guiding housing development decisions" and "housing schemes not built in hazard prone areas." **Urban Planning and Regional Development Sector Plan 2009-2030:** Goal 1, "Comprehensive, efficient and effective planning system," includes the strategy "Ensure that the planning framework is able to cope with current and future challenges brought about by globalization, urbanization, demographic changes, natural hazards and climate change". Some specific actions are: "Ensure the integration of hazard mapping in the planning process" and "Ensure that new developments through their location and design are resilient to the consequences of climate change."
	Further knowledge on the efficacy, sociological and socioeconomic factors, and political linkages related to the implementation of adaptation strategies (e.g., eco-design alternatives, smart growth, green roofs, landscape architecture).	**Climate Change Policy Framework for Jamaica:** Strategies include: "Develop and incorporate mechanisms and tools to mainstream climate change into ecosystem protection and land-use and physical planning." **Update of Nationally Determined Contribution (NDC) of Jamaica:** In the Planning process, in other contextual aspirations and priorities acknowledged when joining the Paris Agreement: "The availability and transfer of technologies that are environmentally sound and which support low carbon and climate-resilient development is paramount." **Housing Sector Plan 2009-2030:**

Theme	Research gaps	Country Climate Priority
		Goal 3, "Strong, supportive communities which promote harmony and opportunities," includes the strategy: "Use a sustainable livelihoods (SL) approach in housing developments." An action is: "Use the highest feasible green building and site design."
	Improve knowledge of urban governance capacity and effective decision-making under uncertainty to face climate change. Research on the comparison of city action plans for climate variability and the features that cause or break path dependencies or more flexible adaptive responses.	**Climate Change Policy Framework for Jamaica:** The objectives of the Policy Framework include: "II. To support the institutions responsible for research, data collection, analysis and projections at the national level on climate change, its impacts, and appropriate adaptation and mitigation measures, to facilitate informed decision-making and strategic actions at all levels. IV. To improve communication at all levels on climate change impacts and also adaptation and mitigation related opportunities so that decision makers and the general public will be better informed." Also, the principles include: "Multi-sectoral approach to climate change." **National Renewable Energy Policy**: "Goal 4: Enhanced technical capacity and Public awareness of renewable energy through effective support of training programmes, information dissemination strategies and ongoing government communication". Key strategies of Goal 4 include the exchange of best practices on renewable energy sources. "Goal 5: Sustained R & D and innovation in existing and emerging RETs". Key strategies of Goal 5 include R&D through the cooperation with public and private research institutions and private businesses for determining the optimal applications for renewables in market environments and the involvement in a process to develop "best practices" and benchmarking while furthering R&D to replicate and scale-up such experiences. **National Energy Policy:** "Goal 1: Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency". Strategies of Goal 1 include reviewing demand-side energy management programmes for performance, strengths, weakness and lessons learned. **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 4 include: "Create mechanisms to enable all government policies and plans fully consider the implementation of climate change" and "Adopt best practices for climate change adaptation."
	Further research on enhancing construction techniques, including stronger connections,	**Climate Change Policy Framework for Jamaica:** The adaptation's strategies to address Climate Change include: "A National Building Code has been developed which establishes new guidelines for the construction of hurricane resistant buildings

Theme	Research gaps	Country Climate Priority
	low screws/nails, hurricane straps and strong roofing materials, among others.	across the island, including the use of hurricane straps and water tanks. The code outlines the building standards for construction within the coastal zone, and takes into consideration physical planning standards, such as coastal setbacks."
	Further research on structural engineering options against extreme storms and ocean water (seawalls, sea dikes, storm surge barriers and closure dams, groynes, among others).	**Climate Change Policy Framework for Jamaica:** The adaptation's strategies to address Climate Change include: "A National Building Code has been developed which establishes new guidelines for the construction of hurricane resistant buildings across the island, including the use of hurricane straps and water tanks. The code outlines the building standards for construction within the coastal zone, and takes into consideration physical planning standards, such as coastal setbacks."
	Research on action plans to reduce impact on critical infrastructure and disruption of basic public services, including health and educational infrastructure.	**Construction Sector Plan 2009-2030:** Goal 3, "Development of sector in environmentally sustainable manner," has the strategies: "Ensure that building code addresses requirements for hazard mitigation and climate change." **Climate Change Policy Framework for Jamaica:** National plans that address climate change, include: "The National Disaster Plan."
	Further research on protection and accommodation strategies of existing infrastructure for air and seaports.	**Climate Change Policy Framework for Jamaica:** The adaptation's strategies to address Climate Change include: "A National Building Code has been developed which establishes new guidelines for the construction of hurricane resistant buildings across the island, including the use of hurricane straps and water tanks. The code outlines the building standards for construction within the coastal zone, and takes into consideration physical planning standards, such as coastal setbacks."
	Research on stormwater management in urban areas and flood control.	**Climate Change Policy Framework for Jamaica:** The adaptation's strategies to address Climate Change include: "A National Building Code has been developed which establishes new guidelines for the construction of hurricane resistant buildings across the island, including the use of hurricane straps and water tanks. The code outlines the building standards for construction within the coastal zone, and takes into consideration physical planning standards, such as coastal setbacks." **Urban Planning and Regional Development Sector Plan 2009-2030:** Goal 3, "Liveable, equitable and ecologically sensitive communities," includes the strategy: "Plan safer, fairer cities," and specific action is to "Plan and implement drainage and flood control measures."
	Research on further improvement and protection of infrastructures for electricity	**National Energy Policy:**

Theme	Research gaps	Country Climate Priority
	transmission and distribution against extreme weather events.	"Goal 2: Jamaica has a modernized and expanded energy infrastructure that enhances energy generation capacity and ensures that energy supplies are safely, reliably, and affordably transported to homes, communities and the productive sectors on a sustainable basis".
	Continue efforts to improve physical planning and urban design approaches that will advance climate change adaptation while protecting landscapes and most valued townscapes.	**Climate Change Policy Framework for Jamaica:** The principles of the Climate Change Policy Framework include: "…the response to the climate change challenge must be linked to the sustainable use of natural resources, the maintenance and restoration of ecosystems and an ecosystem based approach to disaster risk management." Strategies include: "Develop and incorporate mechanisms and tools to mainstream climate change into ecosystem protection and land-use and physical planning." **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 2 include: "Establish linkages between environmental and urban planning, regional development and sectoral strategies." **Housing Sector Plan 2009-2030:** Goal 3, "Strong, supportive communities which promote harmony and opportunities," includes the strategy: "Use a sustainable livelihoods (SL) approach in housing developments." Some actions are: "Integrate urban designs, parks, land use and transportation with environmental improvements" and "create an urban form that promotes the functions of healthy natural resources." **Urban Planning and Regional Development Sector Plan 2009-2030:** Goal 3, "Liveable, equitable and ecologically sensitive communities," includes the strategy: "Design policies to minimize sprawl and encourage compact development, infill and urban regeneration" and a specific action is to "Provide a high level of protection to our most valued townscapes and landscapes, wildlife habitats and natural resources."
	Further research on the relationship between climate change and air quality in major cities of Jamaica and continue efforts to develop strategies of urban planning and design alternatives that contribute to reducing air pollution.	**Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Specific actions of Goal 2, "Sustainable Management & Utilization of Natural Resources," include: "Develop a national air monitoring system" and "Include an air protection component in the energy sector and other sectoral strategies." **Update of Nationally Determined Contribution (NDC) of Jamaica:**

Theme	Research gaps	Country Climate Priority
		"A shift to cleaner energy in the energy sector will reduce local air pollution and therefore benefit human health."
Theme 2: Contributing to the mitigation of climate change impact.	**Outcome 2.1: Improving energy efficiency**	**Climate Change Policy Framework for Jamaica:** The strategies will address: "Assessment of technological needs for adaptation and mitigation strategies." **Construction Sector Plan 2009-2030:** Goal 3, "Development of sector in environmentally sustainable manner," has the strategies: "Reduce the carbon footprint of the construction sector through energy efficiency and other measures."
	Evaluation of design strategies for thermal comfort and energy consumption under climate scenarios. Further research to identify alternatives to reduce energy demand by buildings and decrease the urban heat island, such as the development of housing types and construction techniques for energy conserving and energy-efficient housing designs, including active and passive adaptation measures that improve thermal comfort (e.g., cool painting, solar screens, evaporative cooling, ventilation, among others).	**National Renewable Energy Policy**: "Goal 1: The economic, infrastructural and planning conditions conducive to the sustainable development of all of Jamaica's renewable energy resources." Key strategies of Goal 1 include integrating renewable energy in building designs and planning, such as applying the National Building Code and using renewable energy into policies relating to land-use planning. "Goal 5: Sustained R & D and innovation in existing and emerging RETs". Key strategies of Goal 5 include conducting feasibility studies for wider use of solar technologies, such as solar PV for homes. **National Energy Policy:** "Goal 1: Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency". Strategies of Goal 1 include employing energy-saving approaches in building design and construction, updating, applying and enforcing the Energy Efficiency Building Codes to support efficient energy use in buildings. "Goal 3: Jamaica realizes its energy resource potential through the development of renewable energy sources and enhances its international competitiveness, energy security whilst reducing its carbon footprint". Key strategies of Goal 3 include prioritizing renewable energy sources by economic feasibility criteria, environmental considerations including carbon abatement **Climate Change Policy Framework for Jamaica:** Actions include: "Reviewing and enforcing building codes, setback limits, standards and guidelines for developments assist in addressing challenges such as the urban heat island effect, among others."

Theme	Research gaps	Country Climate Priority
	Research, evaluation, and implementation monitoring of clean cooking alternatives in houses.	**National Renewable Energy Policy**: "Goal 1: The economic, infrastructural and planning conditions conducive to the sustainable development of all of Jamaica's renewable energy resources." Key strategies of Goal 1 consider the use of renewable energy in building designs. **National Energy Policy:** "Goal 1: Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency". Strategies of Goal 1 include employing energy-saving approaches in building design and construction. **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 2 include: "Promote the use of new and clean technologies."
	Research on options to displace electric and LPG water heating to implement solar water heaters in newly constructed and existing houses.	**National Renewable Energy Policy**: "Goal 1: The economic, infrastructural and planning conditions conducive to the sustainable development of all of Jamaica's renewable energy resources." Key strategies of Goal 1 include establishing "early win" investments/projects, including the application of solar water heating and a focus on building. "Goal 3: A dynamic legislative and regulatory environment, responsive to growth and development in the renewable energy sector". Key strategies of Goal 3 include establishing standards that require all new construction in the public and private sectors to incorporate the use of solar water heating. "Goal 5: Sustained R & D and innovation in existing and emerging RETs". Key strategies of Goal 5 include conducting feasibility studies for wider use of solar technologies, such as solar PV for homes. **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 2 include: "Promote the use of new and clean technologies." Actions include: "Introduce cleaner technologies to replace old equipment and old industry technology."
	Analyse the development and implementation of tools for measuring energy performance and management in building operations. Study of energy demand and consumption due to climate change, including estimation methods in energy consumption (electricity	**National Energy Policy:** "Goal 1: Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency". Strategies of Goal 1 include employing energy-saving approaches in building design and construction. **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:**

Theme	Research gaps	Country Climate Priority
	consumption, cooling energy requirements, heating, costs, and financial implications) for present and future scenarios.	Strategies of goal 2 include: "Promote the use of new and clean technologies." An action is: "Develop regulations for the energy performance of buildings."
	Research on options to decrease costs and promote residential and public/commercial LED or fluorescent lighting to reduce electricity demand and related emissions due to electricity production.	**National Renewable Energy Policy**: "Goal 1: The economic, infrastructural and planning conditions conducive to the sustainable development of all of Jamaica's renewable energy resources." Key strategies of Goal 1 consider using renewable energy in building designs and integrating the planning process for renewable energy infrastructure with the national spatial plan and regional development strategy. **National Energy Policy:** "Goal 1: Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency." Strategies of Goal 1 include facilitating the introduction of energy-saving devices and developing programmes to influence market behaviour toward and promote efficient use of energy, including energy-efficient appliances, equipment, and building designs.
	Analyse the development of decarbonization strategies for refurbishment and retrofit in existing buildings. Assessment of retrofitting measures and new designs to achieve net-zero emissions or net-zero energy.	**Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 2 include: "Promote the use of new and clean technologies." Actions are: "Develop regulations for the energy performance of buildings" and "Introduce cleaner technologies to replace old equipment and old industry technology." **Housing Sector Plan 2009-2030:** Goal 3, "Strong, supportive communities which promote harmony and opportunities," includes the strategy: "Use a sustainable livelihoods (SL) approach in housing developments." Actions include: "Introduce energy efficiency programmes to encourage and support energy retrofit."
	Further research on environmental effects and implementation of reflective and green roof mitigation technologies. Impact of greening on energy savings and study of the use of different vegetation, plant morphology, and physiology, substrate, among others.	**Update of Nationally Determined Contribution (NDC) of Jamaica:** In the Planning process, in other contextual aspirations and priorities acknowledged when joining the Paris Agreement: "The availability and transfer of technologies that are environmentally sound and which support low carbon and climate-resilient development is paramount." **National Energy Policy:** "Goal 1: Jamaicans use energy wisely and aggressively pursue opportunities for conservation and efficiency." Strategies of Goal 1 include facilitating the introduction of energy-saving devices and developing programmes to influence market behaviour toward and promote efficient use of energy, including energy-efficient appliances, equipment, and building designs.

Theme	Research gaps	Country Climate Priority
	Cost-benefit analysis of ecological design implementation and carbon footprint analysis of materials for having environmentally friendly buildings and infrastructure.	**Climate Change Policy Framework for Jamaica:** The strategies will address: "Assessment of the most appropriate mitigation actions per sector taking into account mitigation potential, cost, sector "buy-in," co-benefits and alignment with sectoral and national development priorities." **Update of Nationally Determined Contribution (NDC) of Jamaica:** In the Planning process, in other contextual aspirations and priorities acknowledged when joining the Paris Agreement: "The availability and transfer of technologies that are environmentally sound and which support low carbon and climate-resilient development is paramount."
	Outcome 2.2: Enhance efficient use of soil-sediment-water resources through a closing of urban material loops	**Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies include: "Create an integrated framework for the management of all type of waste."
	Analyse the quantification of impact of major potential sources of pollution from construction processes (e.g., waste materials, contaminants in the atmosphere, emissions from construction vehicles and equipment) and the assessment of GHG emissions associated with different infrastructure types and construction operations. Further knowledge of the life-cycle of GHG emissions generated in the construction sector.	**Update of Nationally Determined Contribution (NDC) of Jamaica:** In the Scope and Coverage, how the Party has taken into consideration paragraphs 31(c) and (d) of decision 1/CP.21: "Jamaica is committed over time to extending the scope of the coverage of its NDC to all categories of anthropogenic emissions in line with paragraph 31(c)… Jamaica conducted a detailed assessments to determine whether other sources and sinks of emissions could be included within its updated NDC but concluded that the data needed to rigorously assess the impact of policies and actions on emissions in other sectors was not available. Efforts will be made to address these data gaps over time with the support of national, regional and international partners."
	Alternative technologies for material production and management (e.g., CHP for alumina production, switch from fuel oil to LNG) targeted to construction. Research on strategies for promoting the use of low carbon materials in construction and continue efforts to improve new construction materials and selection of building products to decrease the carbon footprint.	**National Energy Policy:** "Goal 2: Jamaica has a modernized and expanded energy infrastructure that enhances energy generation capacity and ensures that energy supplies are safely, reliably, and affordably transported to homes, communities and the productive sectors on a sustainable basis". Strategies of Goal 2 include facilitating greater energy efficiency and lower energy costs in the bauxite and alumina industry and the manufacturing sector. "Goal 4: Jamaica's energy supply is secure and sufficient to support long-term economic and social development and environmental sustainability". A flagship project includes developing capacity and infrastructure to use alternative fuels such as LNG, petcoke, and biofuels as part of the national efforts to reduce its dependence on oil. **Update of Nationally Determined Contribution (NDC) of Jamaica:**

Theme	Research gaps	Country Climate Priority
		In the Planning process, in other contextual aspirations and priorities acknowledged when joining the Paris Agreement: "The availability and transfer of technologies that are environmentally sound and which support low carbon and climate-resilient development is paramount." Also, in How the Party's preparation of its NDC has been informed by the outcomes of the global stocktake: "By 2030, emissions covered by the NDC will be 1.8 to 2.0 MtCO2e lower than under a BAU scenario. These reductions relative to business-as-usual (BAU) in 2030 compare with a range of 1.1 to 1.5 MtCO2e in Jamaica's previous NDC." **Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change. Sector Plan 2009-2030:** Strategies of goal 2 include: "Promote the use of new and clean technologies." An action is: "Prepare guidelines for using ecological materials during construction works."
	Further research to construction and demolition waste tracing and quantity and quality estimation. Research on options for waste reduction and disposal to reduce pollution from construction activities. Improvement of reuse and recycling processes as well as development of efficient strategies for construction and demolition waste management to reduce related carbon emissions and decrease the rate of non-renewables depletion.	**Climate Change Policy Framework for Jamaica:** The strategies will address: "Assessment of the most appropriate mitigation actions per sector taking into account mitigation potential, cost, sector "buy-in", co-benefits and alignment with sectoral and national development priorities." **Update of Nationally Determined Contribution (NDC) of Jamaica:** In the Planning process, in How the Party's preparation of its NDC has been informed by the outcomes of the global stocktake: "By 2030, emissions covered by the NDC will be 1.8 to 2.0 MtCO2e lower than under a BAU scenario. These reductions relative to business-as-usual (BAU) in 2030 compare with a range of 1.1 to 1.5 MtCO2e in Jamaica's previous NDC." **Construction Sector Plan 2009-2030:** Goal 3, "Development of sector in environmentally sustainable manner," has the strategies: "Encourage reduction and elimination of waste in construction through improved design and procurement," "encourage reduction and elimination of waste on construction sites" and "develop greater reuse and recycling of construction materials."

V. Country R&TD Priorities for the Waste Sector

VI. References

Government of Jamaica. 2009a. “Vision 2030 Jamaica. Housing Sector Plan 2009-2030.”

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Ministry of Energy and Mining. 2009. “Jamaica’s National Energy Policy 2009-2030.”

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