St. Kitts and Nevis

TECHNOLOGY ACTION PLAN REPORT

ADAPTATION & MITIGATION

supported by UNOPS

TECHNOLOGY ACTION PLAN REPORT

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Acronyms and Abbreviations

ATGS	Agricultural Transformation and Growth Strategy
AWWA	American Water Works Association
BAEF	Barrier Analysis and Enabling Frameworks
CARDI	Caribbean Agricultural Research and Development Institute
CAWASA	Caribbean Water and Sewerage Association Inc.
DMA	District Metered Areas
EV	Electric Vehicle
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GOSKN	Government of St. Kitts and Nevis
GWP-C	Global Water Partnership - Caribbean
IPM	Integrated Pest Management
IWA	International Water Association
IWRM	Integrated Water Resources Management
NDC	Nationally Determined Contributions
NMT	Non-Motorised Transport
NRW	Non-Revenue Water
PRV	Pressure Reducing Valve
PV	Photovoltaic
PVC	Polyvinyl Chloride
SCADA	Supervisory Control and Data Acquisition System
SIDS	Small Island Developing States
SWG	Stakeholder Working Group
SWH	Solar Water Heating
TAP	Technology Action Plan
TNA	Technology Needs Assessment
TNC	Third National Communications Report to the UNFCCC
TNA	Technology Needs Assessment
UNEP-CCC	United Nations Environment Program – Copenhagen Climate Centre
UNFCCC	United Nations Framework Convention on Climate Change
5Cs	Caribbean Community Climate Change Centre

Executive Summary

Background

The Federation of St. Kitts and Nevis (SKN) is highly vulnerable to climate hazards, including hurricanes, storms, and droughts. Climate change is projected to increase mean temperatures, result in sea level rise, change rainfall patterns, and increase intensity and severity of storms. These projections and impacts are well documented, and the country needs to take decisive action on climate change adaptation. As such, climate change adaptation has been the primary focus of the Federation together with other SIDS worldwide.

While contributing very little to global GHG emissions, the Federation recognizes its commitments under the Paris Agreement and has taken actions to mitigate climate change. Mitigation efforts are mainly related to advancing the use of renewable energy, improving energy efficiency, and maintaining carbon sequestration potential. The twin-island federation is simultaneously encouraging increased sustainable mobility but recognises that improvements in the power generation sector are foremost important. In addition, St. Kitts and Nevis recognises that mitigation actions identified have many co-benefits associated with human health, energy security, biodiversity conservation, employment, and economic growth, among others (GOSKN, 2022a,b).

The National Climate Change Policy (2017) provides the mandate and policy framework for climate action in St. Kitts and Nevis (GOSKN, 2017). The National Climate Change Adaptation Strategy (2018) operationalizes the National Climate Change Policy and was developed using a participatory approach, gaining input and recommendations from diverse stakeholder groups through national consultations (GOSKN, 2018). The Strategy details specific adaptation objectives and measures across eight sectors (agriculture, coastal and marine ecosystems, forest and terrestrial ecosystems, finance and banking, human health, infrastructure and physical development, tourism and water) and five cross-cutting areas (stakeholder capacity building and engagement, information management, research and monitoring, integrated adaptation and disaster risk reduction and inter-sectoral coordination) for the time period of 2018-2030.

The most recent vulnerability assessment for the Federation was completed in 2021 during the development of the St. Kitts and Nevis Third National Communication (TNC) to the UNFCCC. Specifically, Chapter 3 of the report relates to vulnerability and adaptation assessment (GOSKN, 2021a). Climate change vulnerability was explored under two categories: hazard-based vulnerability and sectoral vulnerability. The most vulnerable sectors identified were human settlements and infrastructure, human health, gender, vulnerable groups and community-based adaptation, coastal, marine resources and fisheries, water, tourism, and agriculture.

Key challenges for adaptation planning that have emerged include the lack of data management systems to support adaptation planning, the lack of resources (funding, human resources, technology), the adaptation deficits and setbacks associated with the outbreak of diseases – such as the COVID-19 pandemic, droughts, as well as major natural disasters – such as hurricane Maria and Irma in 2017 (GOSKN, 2021a). Similarly, challenges to mitigation action include lack of adequate data for modelling and decision-making, high capital costs of renewable energy technologies, suitability and availability of appropriate technologies, land availability, natural disasters, and lack of political will (GOSKN, 2022b). An important process for overcoming challenges related to both adaptation and mitigation is technology needs assessment (TNA).

The Global Technology Needs Assessment project is funded by the Global Environment Facility (GEF) and executed by the United Nations Environment Programme (UNEP) through the UNEP-CCC (Copenhagen Climate Centre). The Global TNA is a strategic programme on technology transfer, designed to support developing countries to carry out Technology Needs Assessments within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) and under the Paris Agreement. Its main aim is to avert the risks and impacts of climate change and to reduce national greenhouse gas (GHG) emissions. The fourth phase of the TNA project was initiated in October 2020 and includes seventeen countries consisting of Small Island Developing States and Least Developed Countries in Africa, Asia, the Pacific, and Latin America and the Caribbean (including the Bahamas and St. Kitts and Nevis).

The Technology Action Plan (TAP) report for St. Kitts and Nevis represents the third deliverable of the three-step TNA process that seeks to identify and create climate technology pathways for implementation of the Paris Agreement. The first step of the process culminated in the TNA report for both adaptation and mitigation for prioritized sectors in St. Kitts and Nevis (Sahely, 2023). The sectors prioritized were the water and agriculture sector for adaptation and the energy and transport sector for mitigation. The prioritized technologies for each sector are summarized below.

Water Sector

1. Apparent loss management
2. Real loss management

Agriculture Sector

1. Integrated pest management
2. Soil moisture conservation monitoring and techniques

Energy Sector

1. Solar water heating
2. Residential scale grid-tied solar

Transport Sector

1. Hybrids and battery electric vehicles
2. Development and rehabilitation of sidewalks, cycle ways and lanes and safe cycle parking

The second deliverable (BAEF reports) identified preliminary targets for technology transfer and diffusion and barriers to the implementation of the prioritized technologies. Following prioritization of barriers, logical framework analysis (problem and objective trees) was used to decompose the barriers into their root causes. Finally, a set of enabling measures to enhance the diffusion of each technology was identified through analysis of objective trees and presented enabling frameworks to the development of the TAP which is the final step of the TNA process.

The TNA process for St. Kitts and Nevis is informed by the Second National Communication (GOSKN, 2015) and available chapters of the Third National Communication (TNC) (GOSKN, 2021a, 2022b) and the first Biennial Update Report (BUR1) (GOSKN, 2022a), the Nationally Determined Contributions (NDCs) (GOSKN, 2021c) and NDC Implementation Plan (GOSKN, 2022d), the SKN Water Utility Adaptation Plan (GOSKN, 2021b), the National Climate Change Policy (GOSKN, 2017) and Strategy (GOSKN, 2018), the St. Kitts and Nevis Agricultural Transformation and Growth Strategy (GOSKN, 2022e) and the St. Kitts and Nevis Energy Policy and Action Plan (GOSKN, 2014).

TAP Process

The national TNA team for St. Kitts and Nevis was trained through a capacity building workshop related to technology action plans in a workshop held in Basseterre, St. Kitts from March 26-27, 2024. The seven steps of preparing TAPs from ambitions to tracking and follow-up were highlighted. In addition, training on the implementation of the TAPs through project ideas was given.

The sector working groups (SWG), continuing from the first and second phases of the TNA, contributed throughout the TAP process. This involved a series of consultations which included interviews, online surveys and working group meetings. The names and contact information for the SWG are listed in Annex 1.

The first step of the TAP involves identification of the ambition of the TAP followed by the second step which outlines the actions and activities for the TAP. Steps 3 and 4 involve stakeholder mapping, determination of timelines, capacity needs and cost estimates. Steps 5 through 7 includes management planning, reporting and tracking the implementation status of the TAPs. Below is an overview of the TAP.

Overview of the TAPs

Actions	Target	Timeline (Years)	Costs (USD)
Water: Apparent Water Loss Management			
Action 1: Perform a detailed water audit on both islands to establish a baseline for water losses including detailed audits for top 100 large volume consumers. **Action 2:** Strengthen capacity and training for water loss prevention for water utility technicians. **Action 3:** Identify and remove or regularize illegal connections **Action 4:** Procure and install new (or upgraded) billing and customer information systems to improve data quality and facilitate accurate water loss tracking **Action 5:** Implement enhanced universal metering by replacing faulty meters and installing smart meters to monitor large volume users. **Action 6:** Develop public awareness and outreach campaigns focused on water conservation.	25% reduction in apparent losses over 5 years.	5	2,430,000
Water: Real Water Loss Management			
Action 1: Conduct feasibility studies and establish a program for real water loss management including leakage detection and pressure management including training for technicians **Action 2:** Procure and implement advanced leakage detection technologies **Action 3:** Establish district metered areas and enhanced pressure management **Action 4:** Install or upgrade remote monitoring systems (SCADA) **Action 5:** Monitor and evaluate real water loss management program and design long-term infrastructure upgrading plan	25% reduction in real losses over 5 years.	5	4,500,000
Agriculture: Integrated Pest Management			
Action 1: Comprehensive study of common agricultural pests in St. Kitts and Nevis and development of tailored IPM strategies **Action 2:** Develop and implement training programs for extension officers and set up dedicated IPM support team within the Ministry of Agriculture **Action 3:** Conduct laboratory needs assessment and upgrade facilities to support pest identification and management. **Action 4:** Develop and implement farmer field school to ensure in-depth knowledge of IPM among farmers. **Action 5:** Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of IPM inputs. **Action 6:** Create a certification program for IPM-compliant products and develop marketing campaigns that emphasize health and environmental benefits of IPM-compliant produce to consumers.	Diffusion of integrated pest management on half of the active farms in St. Kitts and Nevis by 2030.	5	2,225,000
Agriculture: Soil Moisture Conservation and Monitoring			
Action 1: Comprehensive study of soil moisture conservation practices in St. Kitts and Nevis and development of best practice guidelines.	Diffusion of soil moisture conservation and monitoring on	3	1,550,000

Action 2: Develop and implement training programs for extension officers and setting up demonstration plots on both islands. **Action 3:** Develop and implement farmer field school to ensure in-depth knowledge of soil moisture conservation among farmers. **Action 4:** Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of soil moisture monitoring equipment.	half of the active farms in St. Kitts and Nevis by 2028.		
Energy: Solar Water Heating			
Action 1: Comprehensive feasibility study on the use and penetration of solar water heating including economic assessments, design and roll-out of incentive regimes and guidelines to ensure safety and reliability **Action 2:** Expand and implement training programs for plumbers and electricians **Action 3:** Develop and implement pilot projects at critical government buildings **Action 4:** Design and roll-out public awareness campaign and community engagement	One comprehensive study including surveys, economic assessments, market research, incentive regime and technical standards, one public awareness campaign and installation of 30 SWHs at critical government infrastructure by 2028.	3	1,035,000
Energy: Residential Grid-Tied Solar			
Action 1: Comprehensive feasibility studies on the use and penetration of residential grid-tied solar PV system. **Action 2:** Expand and implement training programs for technicians **Action 3:** Develop and implement pilot projects at critical government buildings **Action 4:** Design and roll-out public awareness campaign and community engagement	One comprehensive study including surveys, economic assessments, market research, feed-in tariff, incentive regime and technical standards, one public awareness campaign and installation of 500 kW installed capacity at critical government buildings by 2028.	3	1,935,000
Transport: Hybrids and Battery Electric Vehicles			
Action 1: Develop and implement a pilot project to electrify the fleet of government school buses.	Deployment of 6 school buses and	5	4,080,000

Action 2: Conduct detailed electricity grid analysis and install charging stations (both conventional and solar) at strategic locations to facilitate pilot school bus project. **Action 3:** Conduct comprehensive economic and financial feasibility study including design of incentive regime necessary for transition to EVs and policies for vehicle replacement and procurement of new vehicles for the government fleet. **Action 4:** Conduct waste management study and policy for ICE vehicles and EV batteries reuse, repurpose, recycling and disposal. **Action 5:** Develop and implement training programme for school bus drivers, mechanics and first responders. **Action 6:** Develop and implement public awareness campaign related to long-term benefits of hybrids and EVs.	conventional charging stations (10) and solar chargers (5), training of a cadre of mechanics, bus drivers and first responders, demonstration of EV technology to the public, feasibility studies and rollout of incentive regime to promote the wider diffusion of hybrids and EVs and a wide-ranging public awareness campaign by 2030.		
Transport: Promotion of Non-Motorized Transport			
Action 1: Develop a comprehensive policy, strategy and action plan to promote NMT **Action 2:** Develop an infrastructure rehabilitation and development plan including site assessments and design of sidewalks, cycle lanes and cycle parking. **Action 3:** Rehabilitate existing and construct new sidewalks, cycle lanes and cycle parking including associated traffic calming measures. **Action 4:** Develop and implement public awareness campaign to promote NMT **Action 5:** Monitor and evaluate current and emerging use of NMT	Development of sidewalks, cycle lanes and safe cycle parking allows for a modal shift of 5% from personal vehicles by 2030.	5	1,812,500

Chapter 1 Technology Action Plan and Project Ideas for the Water Sector

1.1 TAP for the Water Sector

The first sector prioritized for the TNA process for climate change adaptation is the water sector. Two technologies were prioritized for the sector including: (1) apparent water loss management and (2) real water loss management.

Both the recent NDC (GOSKN, 2021c) and Chapter 3 of the Third National Communication (GOSKN, 2021a) assess progress towards adaptation measures identified in the National Climate Change Policy (GOSKN, 2017) and National Climate Change Adaptation Plan (GOSKN, 2018). Progress in the water sector included enhancing resilience of schools and health centres through installation of emergency water storage systems. There have also been advances in data collection with installation of hydro-met equipment at wells and tank level controls across both islands. Additionally, there has been the development of a drought risk monitoring tool funded by CTCN and water information systems funded by the GEF. The Water Utility Adaptation Plan of 2021 (GOSKN, 2021b) paves the way for future actions needed for this sector. The Plan is structured under six thematic programmes including water policy, legislation and capacity building, watershed management, climate resilient water supplies, water demand management, energy efficiency and renewable energy and disaster risk management.

1.1.1 Water Sector Overview

The water sector broadly encompasses activities related to the provision, treatment, management, distribution, and use of water. Potable water is retrieved from either surface sources (springs) or groundwater (wells). In 2019, in St. Kitts, 70% (3.37 MGD) of the water was derived from groundwater and the remaining 30% (1.49 MGD) was from springs. In Nevis, 99% (1.44 MGD) of water was derived from groundwater and remaining 1% (0.16 MGD) from springs. In 2012, the apparent losses on the island of St. Kitts were estimated to be about 34 million imperial gallons per month (GOSKN, 2013). The non-revenue water (NRW) (real + apparent losses) was estimated to represent 53% of total volume of water input. NRW for Nevis is estimated to be between 30-35%. This level of NRW coupled with more frequent drought and increase in water demand from all sectors have stressed water resources on the islands which is now in chronic deficit with water rationing becoming the norm.

In terms of water consumption by sector, in St. Kitts, about 60% of water supplies are consumed by the domestic sector, while the government, tourism and commercial sectors each use between 10 to 15% of the island's water resources. It is estimated that less than 5% of the supply goes to the agricultural sector. In Nevis, 52% goes to the domestic sector, 31% to government buildings and installations, while hotels and the commercial sector use about 8% each. As such, it is estimated that less than 1% of the supply goes to the agricultural sector. In recent times, after the closure of the sugar industry in the Federation, there has been a major focus on diversifying the agricultural sector. One of the main barriers to this is the availability

of water for irrigation especially during the dry season. Overall, the water supply on both islands can no longer keep up with the demand especially with the renewed effort to grow the tourism sector post COVID-19. It is clear additional water resources would have to be developed, and water demand control measures fully implemented to be able to supply sufficient water to all sectors. Enhancing the ability of stakeholders to understand climate change risks more fully will also greatly aid in management of water resources and ensure resiliency of the sector (GOSKN, 2021b).

1.1.2 Action plan for apparent loss management

1.1.2.1 Introduction

The first step in any water loss control program is a utility water balance (including water losses) as defined by the IWA/AWWA Water Audit methodology (GOSKN, 2013). The exercise of a top-down water audit allows a utility to identify weaknesses in terms of data quality and to take steps to improve data quality and ultimately to set performance indicators and monitor progress of any interventions taken to implement water loss control measures. The steps in a strategy to reduce apparent water losses include continuous water accounting, identification and removal of illegal connections, audits of large-volume users, ensuring the integrity of the billing and customer information system, universal metering and public awareness and outreach. Data collected can be tracked in a Management Information System (MIS) or Customer Relations Management System (CRM) or basic billing software. Universal metering includes activities such as installation of meters for all users (including public standpipes), retrofitting of old meters, fixed interval meter reading, meter accuracy analysis and meter testing, calibration, repair, or replacement. Public awareness and outreach programs can include activities such as water bill inserts, social media education programmes and workshops (GOSKN, 2013).

1.1.2.2 Ambition for the TAP

In alignment with the SKN Water Utility Adaptation Plan (GOSKN, 2021b) and the St. Kitts Water Conservation Plan of 2013 (GOSKN, 2013), the preliminary target is set at 25% reduction in apparent losses over 5 years. Table 1.2 outlines the key targets for greater diffusion of apparent loss management actions for this TAP.

Table 1.1: Key targets for diffusion of apparent loss management

Action	Target
Updated water audit to determine level of losses	One complete audit for St. Kitts and one complete audit for Nevis
Identification and removal of illegal connections	Removal of at least 100 illegal connections
Audit of large volume users	Audit of top 100 large volume users
Updated information system for billing and customer information	New billing system installed for each water utility

Universal metering with increased installation of smart meters	Replacement of faulty meters (at least 1000) and installation of smart meters for large volume users (at least 100)
Public awareness and outreach programs	Comprehensive national public awareness campaign

1.1.2.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, the SWG identified one (1) economic and financial and three (3) non-financial barriers for apparent water loss management including:

1. High capital costs
2. Limited management and organizational skills to implement apparent loss prevention program
3. Lack of political will to prioritize water demand management
4. Lack of specialized technicians and training

The main root causes to the core problem of high capital costs of advanced technologies for apparent loss reduction are not unique to St. Kitts and Nevis and would be encountered by most small island developing states that do not have local manufacturing of specialized equipment. In addition, since the equipment is only required by the water utility there are no local suppliers. The high cost of the equipment is further exacerbated by high importation costs mainly due to shipping of equipment from the USA or Europe to the Caribbean. Generally, the smaller islands would benefit from equipment manufactured in Trinidad and Tobago (or other larger islands) but in the case of conventional or smart meters, these are generally not manufactured anywhere in the Caribbean. Since the water utilities are owned by the government in St. Kitts and Nevis, most local taxes and tariffs are waived and so do not contribute directly to the high cost. The root causes to limited management skills are limited access to current knowledge and training for managers in best practices in water loss prevention along with inadequate budget and human resources allocated to water loss prevention. The root causes to lack of specialized technicians are lack of opportunities for training and professional development for technicians. As it relates to lack of political will, the root causes identified include limited public awareness of the benefit of effective water loss prevention, limited resources allocated to water loss prevention (where benefits are more long term and not as tangible) and even lobbying by influential stakeholders that may be negatively impacted by an effective water loss program (i.e. a new smart meter for a large user may reveal heavy water usage and increased water bill for the consumer). Table 1.2 identified key measures to overcome the barriers for greater diffusion of apparent loss management practices.

Table 1.2: Key measures to overcome barriers for diffusion of apparent loss management

Barriers	Measures
High capital costs of advanced technologies required for apparent loss reduction (smart meters, SCADA and other data management systems)	• Implement procurement best practices to ensure optimal bulk purchasing along economical shipping routes • Explore bulk purchasing with water utility in Nevis and other neighboring islands

Barriers	Measures
	• Private sector partnerships to encourage local suppliers to bring in specialized equipment on behalf of the utility • Pursue grants, loans, or investments from a wide range of source including the consideration of innovative instruments such as green bonds • Restructure water tariff to promote cost recovery and investment planning
Limited management and organizational skills to implement water loss prevention program	• Corporatization of the water utilities on both islands • Capacity building and greater access to professional development programs for managers on best practices in water loss prevention. • Short-term onboarding of consultants or experts to manage the implementation of any water loss prevention program. • Knowledge sharing and partnerships with other utilities that have successfully implemented similar programs.
Lack of political will to prioritize water loss reduction programs	• Public education and outreach including targeted public awareness campaigns to highlight the benefits of water loss prevention. • Meaningful engagement of stakeholders by allowing a variety of stakeholders to be involved in the planning process and implementation of water loss prevention strategies. • Showcasing of small-scale demonstration projects to demonstrate the effectiveness and benefits of water loss prevention, thus building political support.
Lack of specialized technicians and training for water loss reduction programs	• Provide access to technical training and certification programs (through established certification entities such as CAWASA) to provide technicians with credentials and ensure a standard level of competency. • Partner with other utilities in the Caribbean with successful water loss prevention programs to provide on-the-job training for local technicians. • Adjust renumeration of certified technicians to reflect upskilling.

In determining the key actions and activities for the TAP, the SWG focused its consultations on comprehensive water auditing with emphasis on large users, updating billing systems, identifying and removing illegal connections and enhancing metering on both islands. Table 1.3 summarizes the key actions and associated activities (Table 1.4) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 1.3: Key actions for greater diffusion of apparent water loss management

Action	Description
Action 1	Perform a detailed water audit on both islands to establish a baseline for water losses including detailed audits for top 100 large volume consumers.
Action 2	Strengthen capacity and training for water loss prevention for water utility technicians.
Action 3	Identify and remove or regularize illegal connections
Action 4	Procure and install new (or upgraded) billing and customer information systems to improve data quality and facilitate accurate water loss tracking
Action 5	Implement enhanced universal metering by replacing faulty meters and installing smart meters to monitor large volume users.
Action 6	Develop public awareness and outreach campaigns focused on water conservation.

Table 1.4: Key activities for greater diffusion of apparent water loss management

Action 1: Perform a detailed water audit on both islands to establish a baseline for water losses including detailed audits for top 100 large volume consumers.
1.1 Conduct preliminary data collection on historical water usage.
1.2 Engage with key stakeholders to secure cooperation for data sharing and site access.
1.3 Implement water audit methodology including checks on meter accuracy, billing records, and system input data to identify discrepancies.
1.4 Perform on-site detailed audits for large volume users.
1.5 Compile audit results and prepare comprehensive report detailing water losses, sources of inefficiency and recommendations for improvement.
Action 2: Strengthen capacity and training for water loss prevention for water utility technicians.
2.1 Conduct training needs assessment related to water loss prevention and management
2.2 Identify existing or develop training program focused on apparent loss reduction.
2.3 Monitor training effectiveness through feedback, performance assessment and on-the-job evaluations.
Action 3: Identify and remove or regularize illegal connections
3.1 Based on audit results, conduct field surveys to identify any unmetered or unauthorized connections.
3.2 Develop a program to regularize illegal connections and disconnect any remaining illegal connections.
3.3 Monitor and update customer records and implement routine checks to prevent new illegal connections.
Action 4: Procure and install new (or upgraded) billing and customer information systems to improve data quality and facilitate accurate water loss tracking
4.1 Assess current billing systems and identify gaps.
4.2 Develop specifications for replacement or upgrading of billing systems.
4.3 Procure new or upgrade existing systems and install and configure new systems.
4.4 Provide training for utility staff on the use of the new billing system.
4.5 Launch and monitor system performance.
Action 5: Implement enhanced universal metering by replacing faulty meters and installing smart meters to monitor large volume users.
5.1 Based on audit results, prioritize meter replacement based on age, condition and reported inaccuracies.
5.2 Identify large volume users who benefit most from smart meter technology.
5.3 Procure and install meters.
5.4 Provide educational materials to inform consumers about the benefits of smart meters.
Action 6: Develop public awareness and outreach campaigns focused on water conservation.
6.1 Design public awareness strategy targeting various types of consumers explaining the benefits of water conservation and water loss management.
6.2 Launch campaign using various media channels to disseminate information.
6.3 Organize community events, school visits, seminars to educate the public about water conservation.

1.1.2.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater diffusion of apparent water loss management actions in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 1.5.

Table 1.5: Key stakeholders for greater diffusion of real water loss management

Stakeholder	Role
Water Utilities (St. Kitts Water Services Department and Nevis Water Department)	- Coordination and project management - Technical expertise in the installation, operation and maintenance of apparent loss management technologies - Establish guidelines and standard operating practices for the installation of apparent water loss management technologies such as smart meters and ensure compliance with safety standards. - Launch nationwide awareness campaigns to educate the public on the benefits of water loss reduction programmes
Ministry of Finance (MoF)	- Implement subsidies, and other financial mechanisms to lower the cost of equipment for apparent water loss management programme. - Allocate budget for long term investments in the water sector.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Ministry of Education (MoE)	- Develop and incorporate lessons about water conservation and climate change into the curriculum.
Private Sector (equipment suppliers)	- Import and supply specialized equipment to the local market and to the water utility. - Work with manufacturers to bring down the cost of equipment by negotiating bulk purchases.
Educational and Vocational Institutions (CFBC and AVEC)	- Develop and deliver training programs for technicians and operators for the water sector with focus on water loss reduction
Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of water conservation and water loss reduction strategies through various media channels. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of water conservation.
Local communities and consumers	- Participate in water audits and provide feedback on their effectiveness. - Consider the long-term benefits of water conservation when making decisions around the home. - Advocate for better infrastructure and policies that support water conservation. - Engage in community discussions and activities related to water conservation.

To ensure the successful implementation of the Technology Action Plan (TAP) for the application of real water loss management strategies and technologies in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. The nature of the plan requires at least a 5-year implementation period.

Action 1 requires primary research and data collection and will require at least one year of intensive research to prepare an in-depth water audit for both islands. Year 2 will highlight continuous training and upskilling for utility technicians. During Year 2-3, the focus will shift to replacing or upgrading billing systems to enable effective water loss management programs

and start of public awareness campaign. Starting in year 3 into year 4, activities will focus on regularizing or removing illegal connections and installing smart meter technology for large volume users. Year 5 will focus on full roll-out of public awareness and outreach campaigns.

1.1.2.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the transition to real water loss management.

The Water Utilities Departments require human resources (at least 3-4 new officers) with key technical skills related to water loss reduction and project management. In supporting roles, from the Ministry of Finance or Sustainable Development, at least one financial analyst or economist with expertise in financial modelling, cost-benefit analysis and design of subsidy regimes. From the Ministry of Education, technical instructor to help validate training programmes and to integrate lessons plans on water loss reduction into the curriculum at various levels.

Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 1.6 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the SKN Water Utility Adaptation Plan (GOSKN, 2021b) and the St. Kitts Water Conservation Plan of 2013 (GOSKN, 2013). In addition, the senior staff of both water utilities (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies. These estimates are robust and indicative in the absence of full feasibility studies, which would generally be required once concept notes are approved, and full detailed project designs are being finalized.

Table 1.6: Estimated costs per activity for greater diffusion of apparent water loss management

Action 1: Perform a detailed water audit on both islands to establish a baseline for water losses including detailed audits for top 100 large volume consumers.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
1.1 Conduct preliminary data collection on historical water usage.	100,000	
1.2 Engage with key stakeholders to secure cooperation for data sharing and site access.	20,000	
1.3 Implement water audit methodology including checks on meter accuracy, billing records, and system input data to identify discrepancies.	200,000	50,000
1.4 Perform on-site detailed audits for large volume users.	100,000	50,000
1.5 Compile audit results and prepare comprehensive report detailed water losses, sources of inefficiency and recommendations for improvement.	50,000	

Action 2: Strengthen capacity and training for water loss prevention for water utility technicians.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
2.1 Conduct training needs assessment related to water loss prevention and management	20,000	
2.2 Develop and implement training program focused on apparent loss reduction.	50,000	
2.3 Monitor training effectiveness through feedback, performance assessment and on-the-job evaluations.	20,000	
Action 3: Identify and remove or regularize illegal connections	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
3.1 Based on audit results, conduct field surveys to identify any unmetered or unauthorized connections.	100,000	50,000
3.2 Develop a program to regularize illegal connections and disconnect any remaining illegal connections.	50,000	50,000
3.3 Monitor and update customer records and implement routine checks to prevent new illegal connections.	50,000	
Action 4: Procure and install new (or upgraded) billing and customer information systems to improve data quality and facilitate accurate water loss tracking	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
4.1 Assess current billing systems and identify gaps.	50,000	
4.2 Develop specifications for replacement or upgrading of billing systems.	50,000	
4.3 Procure new or upgrade existing systems and install and configure new systems.		500,000
4.4 Provide training for utility staff on the use of the new billing system.	50,000	
4.5 Launch and monitor system performance.	50,000	
Action 5: Implement enhanced universal metering by replacing faulty meters and installing smart meters to monitor large volume users.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
5.1 Based on audit results, prioritize meter replacement based on age, condition and reported inaccuracies.	50,000	
5.2 Identify large volume users who benefit most from smart meter technology.	20,000	
5.3 Procure and install meters.		500,000
5.4 Provide educational materials to inform consumers about the benefits of smart meters.	50,000	
Action 6: Develop public awareness and outreach campaigns focused on water conservation.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**

6.1 Design public awareness strategy targeting various types of consumers explaining the benefits of water conservation and water loss management.	50,000	
6.2 Launch campaign using various media channels to disseminate information.	50,000	
6.3 Organize community events, school visits, seminars to educate the public about water conservation.	50,000	
TOTAL	1,230,000	1,200,000

1.1.2.6 Management planning

Table 1.7 summarizes some of the key risks and their associated contingency actions.

Table 1.7: Key risks and contingency actions for greater diffusion of apparent water loss management

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.
Delays in pilot project implementation	Delays in the implementation of pilot programs for apparent water loss management	Prioritize High-Demand Areas: Focus initial roll-out in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement of equipment for apparent water loss management.	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and Lack of Expertise	Technical issues related to the implementation of strategies for apparent water loss management.	Training and Capacity Building: Invest in comprehensive training programs for local technicians to build in-country expertise. Technical Partnerships: Partner with international experts or companies with experience in real water loss management technology to provide technical support and knowledge transfer. Regular Maintenance and Monitoring: Implement a robust monitoring system to identify and address technical issues early, minimizing disruptions.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty for investors and	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives.

	stakeholders, hindering progress.	Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.
Limited Consumer Acceptance	Resistance from the public due to a lack of awareness or trust in new technology especially as it relates to water audits and smart meters.	Enhanced Public Education Campaign: Intensify efforts to educate the public on the long-term benefits, cost savings, and environmental impacts of apparent water loss reduction. Incentivize Early Adopters: Provide additional incentives, such as tax breaks or rebates, to early participants in water audits to create a positive demonstration effect. Community Engagement: Engage community leaders and influencers to advocate for the adoption of strategies for apparent water loss reduction within their communities.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Water Utility Departments to effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.
2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

1.1.2.7 TAP overview

Table 1.8: TAP overview table for greater diffusion of apparent water loss management

Sector	Water							
Technology	Apparent water loss management							
Ambition	The overall target is set at 25% reduction in apparent losses over 5 years.							
Benefits	The main adaptation benefits related to water conservation and improved knowledge of water resources are overall improved water use efficiency, reduction in environmental impact and improved sustainability. Efficient use of water reduces the strain on water utilities thus making more water available to customers. It can also offset the need for supply side infrastructure upgrades by reducing demand growth and enhance the resiliency of water systems in the face of climate change.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Perform a detailed water audit on both islands to establish a baseline for water losses including detailed audits for top 100 large volume consumers.	1.1 Conduct preliminary data collection on historical water usage.	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise Lack of usable data	Complete preliminary research by middle of Year 1	Delivery of preliminary research study	100,000
	1.2 Engage with key stakeholders to secure cooperation for data sharing and site access.	Adaptation Fund GOSKN	WSD/ NWD	6	Limited Stakeholder Participation	Complete consultative process with 80% of key stakeholders by middle of Year 1	Delivery of consultation report	20,000
	1.3 Implement water audit methodology including checks on meter accuracy, billing records, and system input data to identify discrepancies.	Adaptation Fund	WSD/ NWD	18	Technical Challenges and Lack of Expertise	Complete data analysis for full audit by end of Year 1	Delivery of data analysis sections of the report	250,000
	1.4 Perform on-site detailed audits for large volume users.	Adaptation Fund	WSD/ NWD	12	Limited Stakeholder Participation	Complete audit of large volume users by end of Year 1	Delivery of large volume user audit report	150,000

	1.5 Compile audit results and prepare comprehensive report detailed water losses, sources of inefficiency and recommendations for improvement.	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete the full audit reports by middle of Year 2	Delivery of full audit reports	50,000
Action 2: Strengthen capacity and training for water loss prevention for water utility technicians.	2.1 Conduct training needs assessment related to water loss prevention and management	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete technical skills program by end of Year 1	Delivery of training programs	20,000
	2.2 Develop and implement training program focused on apparent loss reduction.	Adaptation Fund	WSD/ NWD	6	Supply Chain Disruptions	Train at least 20 technicians by end of Year 2	Number of individuals trained Percentage of trainees who pass certification assessments	50,000
	2.3 Monitor training effectiveness through feedback, performance assessment and on-the-job evaluations.	Adaptation Fund	WSD/ NWD	3	Technical Challenges and Lack of Expertise Low number of trainees	Achieve a satisfaction rate of 80% or higher among trainees	Survey results from trainees	20,000
Action 3: Identify and remove or regularize illegal connections	3.1 Based on audit results, conduct field surveys to identify any unmetered or unauthorized connections.	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete field surveys by end of Year 2	Delivery of field survey report	150,000
	3.2 Develop a program to regularize illegal connections and disconnect any remaining illegal connections.	Adaptation Fund	WSD/ NWD	12	Technical Challenges and Lack of Expertise	Complete regularization program by end of Year 3 Complete disconnection program by end of Year 3	Number of consumers regularized and disconnected	100,000

	3.3 Monitor and update customer records and implement routine checks to prevent new illegal connections.	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete update of records and design of regular program to check for illegal connections by end of Year 3	Delivery of maintenance program	50,000
Action 4: Procure and install new (or upgraded) billing and customer information systems to improve data quality and facilitate accurate water loss tracking	4.1 Assess current billing systems and identify gaps.	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete assessment and gap analysis by middle of Year 3	Delivery of gap analysis report	50,000
	4.2 Develop specifications for replacement or upgrading of billing systems.	Adaptation Fund	WSD/ NWD	6	Policy and Regulatory Uncertainty	Complete specifications for new billing systems by end of Year 3	Delivery of specifications report	50,000
	4.3 Procure new or upgrade existing systems and install and configure new systems.	Adaptation Fund	WSD/ NWD	12	Technical Challenges and Lack of Expertise	Installation and configuration of new billing systems by end of Year 4	New or upgraded billing systems	500,000
	4.4 Provide training for utility staff on the use of the new billing system.	Adaptation Fund	WSD/ NWD	3	Technical Challenges and Lack of Expertise	Complete training by end of Year 4	Number of utility staff trained	50,000
	4.5 Launch and monitor system performance.	Adaptation Fund GOSKN	WSD/ NWD	3	Policy and Regulatory Uncertainty	Launch new systems by middle of Year 5	New billing systems operational	50,000
Action 5: Implement enhanced universal	5.1 Based on audit results, prioritize meter replacement based on age, condition and reported inaccuracies.	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete meter replacement plan by end of Year 3	Delivery of meter replacement plan	50,000

metering by replacing faulty meters and installing smart meters to monitor large volume users.	5.2 Identify large volume users who benefit most from smart meter technology.	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete assessment of large volume users by end of Year 3	Delivery of assessment report	20,000
	5.3 Procure and install meters.	Adaptation Fund GOSKN	WSD/ NWD	12	Technical Challenges and Lack of Expertise	Procure and install replacement meters and smart meters by middle of Year 5	Number of faulty meters replaced Number of smart meters installed and operational	500,000
	5.4 Provide educational materials to inform consumers about the benefits of smart meters.	Adaptation Fund	WSD/ NWD	3	Policy and Regulatory Uncertainty	Design and disseminate educational materials for large volume users by middle Year 5	Number of large volume users informed of the benefits of smart meters	50,000
Action 6: Develop public awareness and outreach campaigns focused on water conservation.	6.1 Design public awareness strategy targeting various types of consumers explaining the benefits of water conservation and water loss management.	Adaptation Fund	WSD/ NWD	6	Limited Public Acceptance	Complete design of public awareness campaign by end of Year 4	Delivery of design report	50,000
	6.2 Launch campaign using various media channels to disseminate information.	Adaptation Fund	WSD/ NWD	12	Limited Public Acceptance	Achieve an engagement rate of 75% on social media platforms	Number of likes, shares, comments and other interactions on campaign-related content	50,000
	6.3 Organize community events, school visits, seminars to educate the public about water conservation.	Adaptation Fund GOSKN	WSD/ NWD	6	Limited Public Acceptance	Increase public awareness of the benefits of water conservation by end of Year 5	Survey results	50,000

1.1.3 Action plan for real loss management

1.1.3.1 Introduction

In 2012, the real losses on the island of St. Kitts were estimated to be over 37 million imperial gallons per month (GOSKN, 2013). There are two important types of interventions that can be taken to reduce real losses: (1) leakage detection and repair and (2) pressure management. Both were lumped into the same technology category during the prioritization of technologies for St. Kitts and Nevis (Sahely, 2023). Leak management methods can prevent or reduce leakage volume and leak detection technology can improve the ability of water utilities to respond quickly and repair leaks. The primary methods used for leak detection included acoustic, infrared thermography, chemical tracer, and mechanical methods. Among the acoustic methods were ground microphones, acoustic loggers on pipe fittings, and tethered in-line leak detectors. New and emerging technologies include ground penetrating radar (GPR), combined acoustic logger and leak noise correlators, digital correlators, and radio-frequency interferometers (Elliott et al. 2011). Acoustic methods have been used successfully for leak detection in metallic pipes for many years. However, their application in non-metallic piping is more challenging. The SK WSD has acoustic leakage detection equipment, but it is not widely used because of the predominance of PVC piping and the amount of time required to deploy the equipment. The Nevis Water Department does not currently have any leakage detection equipment. Repairs to pipes with holes generally involve either covering the hole from outside the pipe or inserting a smaller pipe inside the one that is leaking. The complexity and time for repairs varies widely but the knowledge and experience for repairs exists inside of both utilities in St. Kitts and Nevis. Leak detection and repair programs should include the following:

1. Update of water distribution system maps and record keeping of all inspection and repair works.
2. Use of leakage detection technology (including remote sensors) for ongoing monitoring and analysis of source, transmission, and distribution facilities. Remote sensors and monitoring software can alert operators to leaks, fluctuations in pressure, problems with equipment integrity, and other concerns; and
3. Regular inspection of pipes (and all elements of the distribution systems like meters, valves, and hydrants), and other maintenance efforts (cleaning, lubricating, exercising of valves) to improve the distribution system and prevent leaks and ruptures from occurring.

Water demand management initiatives like leakage detection and repair lead to overall improved water use efficiency, reduction in environmental impact and improved sustainability. Reducing leakages and inefficient water use reduces strain on operations, making more water available to more customers in the dry season and under drought conditions. It can also offset the need for supply side infrastructure upgrades by reducing demand growth and the impacts of climate change. As a specific example in St. Kitts, reducing leakages could bring significant energy savings (where the annual energy cost is estimated at 4.5 million XCD, 30% of

operating costs). A reduction in leakage by 30% could reduce total production by 10% and energy costs by 500,000 XCD per year (GOSKN, 2021b).

Pressure management can be defined as the practice of managing system pressures to the optimum levels of service while reducing unnecessary excess pressure and eliminating transients both of which cause distribution systems to leak (EU 2015). Years of research has shown leakage and pipe burst frequency increase with pressure thus wasting water (EU 2015, Fanner et al. 2007). The EU (2015) highlights three different levels of pressure management:

Basic

- Identify and reduce pressure transients and surges
- Achieve continuous supply (24/7 policy) even if at low pressure
- Strategic separation of transmission mains from distribution systems and zones
- Monitor pressures (inlet, critical, average), flows, bursts/leaks/repairs, complaints.
- Avoid overflows from service reservoirs; reduce outlet pressure whenever possible.

Intermediate

- Create sub-sectors (Pressure managed areas or zones)
- Reduce pressure using fixed outlet PRVs or intelligent pumping

Advanced

- Introduce time and/or flow modulation, or feedback loop from a critical node, or remote control, for valves and pumps.
- Introduce hydraulic flow modulation for valves

Both utilities in St. Kitts and Nevis practice basic level pressure management with some limited use of pressure-reducing valves (PRVs). Pressure management reduces leak flow rates and frequency of leaks thus extending infrastructure life, reducing pipe failures, conserving water, and saving money.

1.1.3.2 Ambition for the TAP

In alignment with the SKN Water Utility Adaptation Plan (GOSKN, 2021b) and the St. Kitts Water Conservation Plan of 2013 (GOSKN, 2013), the preliminary target is set at 25% reduction in real losses over 5 years. Table 1.9 outlines the key targets for greater diffusion of real loss management actions for this TAP.

Table 1.9: Key targets for diffusion of real loss management

Action	Target
Procurement and training for new and emerging technologies such as ground penetrating radar, digital leak noise correlators and radio-frequency interferometers	Feasibility study to determine most suitable options for St. Kitts and Nevis Procurement of at least one of these types of equipment for each water utility Comprehensive training
Remote sensors for ongoing monitoring and analysis of leaks and pressure data using supervisory control and data acquisition system (SCADA)	Installation of new full SCADA system for St. Kitts and upgrade of system in Nevis

Regular inspection of pipes, cleaning, lubricating and exercising valves	Establishment of one dedicated crew for leakage detection and repair for each island
Establishment of district metered areas (DMAs) and installation of bulk meters and pressure reducing valves (PRVs)	Establishment of at least 40 DMAs with bulk meters and PRVs as needed (for both islands)

1.1.3.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, the SWG identified one (1) economic and financial and two (2) non-financial barriers (technical) including:

1. Configuration of distribution systems make establishment of DMAs very difficult
2. High capital costs
3. Ability to detect and locate smaller leaks

The root cause to high capital costs is essential the same as presented in section 1.1.2.3 for apparent loss management. The root causes to the complicated configuration of distribution systems are lack of planning for future scalability, predominance of old systems that no longer meet current needs and standards and lack of upgrades due to inadequate funding and challenging terrain. Ad-hoc development of distribution systems over the years has made it progressively more difficult to manage these systems. Many years of developing and operating systems reactively instead of proactively, especially in an environment where investments have not kept up with the growing needs of water utilities, make it increasingly difficult to manage old systems. Attempts to modernize such systems require solid and long-term planning with sustained financing to effectively manage water losses both apparent and real.

As to the reliability of advanced technologies to detect small leaks, the root causes identified relate to challenges of maintenance and calibration of specialized equipment due to the different kinds of pipes utilized, and few suppliers of high precision leak detection equipment suitable for the conditions found in St. Kitts and Nevis. Water utilities managing aging systems with a variety of pipe types (asbestos cement, ductile iron and increasingly PVC) make it difficult to optimize leakage detection as different types of equipment could be needed for each type of pipe.

Table 1.10: Key measures to overcome barriers for diffusion of real loss management

Barriers	Measures
High capital costs of advanced technologies required for real loss reduction (pipes, leakage detection equipment and specialized meters and valves)	• Implement procurement best practices to ensure optimal bulk purchasing along economical shipping routes • Explore bulk purchasing with water utility in Nevis and other neighboring islands • Private sector partnerships to encourage local suppliers to bring in specialized equipment on behalf of the utility • Pursue grants, loans, or investments from a wide range of source consider innovative instruments such as green bonds • Restructure water tariff to promote cost recovery and investment planning

Barriers	Measures
Configuration of distribution systems make establishment of DMAs very difficult	• Modernizing infrastructure using a phased approach and best practices in planning and design: o Upgrade the current distribution systems to allow for better scalability and to meet current standards. o Implement modern piping and joining techniques that reduce the likelihood of leaks. o Engage in comprehensive planning for future expansion and scalability of water distribution networks. o Design distribution networks with DMAs in mind from the outset.
Ability to detect and locate smaller leaks	• Diversifying equipment suppliers: o Encourage the entrance of more suppliers into the market to increase the availability of suitable leak detection technology. o Consider public-private partnerships to facilitate the investment in necessary technologies (also noted in section 1.2.3.1) • Research and development: o Collaborate with manufacturers of advanced technologies for leakage detection institutions to optimize technologies and methods for leak detection and repair that are suitable for local conditions. o Monitor and evaluate the effectiveness of different strategies and technologies to continually improve the water loss reduction program.

In determining the key actions and activities for the TAP, the SWG focused its consultations training and implementation of new and emergency leak detection equipment, piloting district area meters and pressure zones and introducing SCADA into regular utility operations. Table 1.11 summarizes the key actions and associated activities (Table 1.12) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 1.11: Key actions for greater diffusion of real water loss management

Action	Description
Action 1	Conduct feasibility studies and establish a program for real water loss management including leakage detection and pressure management including training for technicians
Action 2	Procure and implement advanced leakage detection technologies
Action 3	Establish district metered areas and enhanced pressure management
Action 4	Install or upgrade remote monitoring systems (SCADA)
Action 5	Monitor and evaluate real water loss management program and design long-term infrastructure upgrading plan

Table 1.12: Key activities for greater diffusion of real water loss management

Action 1: Conduct feasibility studies and establish a program for real water loss management including leakage detection and pressure management including training for technicians
1.1 Conduct feasibility study of various leakage detection technologies suitable for local conditions
1.2 Conduct detailed analysis to identify and design district metered areas (DMAs)
1.3 Assess existing SCADA capabilities and determine specifications for new or upgraded systems
1.4 Develop comprehensive real water loss management plan and develop standard operating procedures (SOPs)
1.5 Conduct phased training workshops for technicians

Action 2: Procure and implement advanced leakage detection technologies 2.1 Procure and implement use of advanced leakage detection equipment 2.2 Establish maintenance and calibration schedule
Action 3: Establish district metered areas and enhanced pressure management 3.1 Procure and install bulk meters and PRVs in designated DMAs 3.2 Establish regular inspection protocols
Action 4: Install or upgrade remote monitoring systems (SCADA) 4.1 Procure and install SCADA systems 4.2 Establish dedicated team and set up centralized control room for efficient decision-making and incident management
Action 5: Monitor and evaluate real water loss management program and design long-term infrastructure upgrading plan 5.1 Develop monitoring and evaluation framework including KPIs 5.2 Conduct regular audits and assessments 5.3 Design long-term infrastructure development plan

1.1.3.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater diffusion of real water loss management actions in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 1.13.

Table 1.13: Key stakeholders for greater diffusion of real water loss management

Stakeholder	Role
Water Utilities (St. Kitts Water Services Department and Nevis Water Department)	- Coordination and project management - Technical expertise in the installation, operation and maintenance of real loss management technologies - Establish guidelines and standard operating practices for the installation of real water loss management technologies such as PRVs and ensure compliance with safety standards. - Launch nationwide awareness campaigns to educate the public on the benefits of water loss reduction programmes
Ministry of Finance (MoF)	- Implement subsidies, and other financial mechanisms to lower the cost of equipment for real water loss management programme. - Allocate budget for long term investments in the water sector.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Private Sector (equipment suppliers)	- Import and supply specialized equipment to the local market and to the water utility. - Work with manufacturers to bring down the cost of equipment by negotiating bulk purchases.

Educational and Vocational Institutions (CFBC and AVEC)	- Develop and deliver training programs for technicians and operators for the water sector with focus on water loss reduction
Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of water conservation and water loss reduction strategies through various media channels. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of water conservation.
Local communities and consumers	- Participate in water audits and provide feedback on their effectiveness. - Consider the long-term benefits of water conservation when making decisions around the home. - Advocate for better infrastructure and policies that support water conservation. - Engage in community discussions and activities related to water conservation.

To ensure the successful implementation of the Technology Action Plan (TAP) for the application of real water loss management strategies and technologies in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. The nature of the plan requires at least a 5-year implementation period.

Action 1 requires conducting a series of feasibility studies will require at least one year of intensive research. Year 2 (and throughout the implementation period) will highlight continuous, phased training and upskilling for utility technicians while rolling out various initiatives. During Year 2-3, the focus will shift to procurement of advanced leakage detection equipment and establishment of DMAs and enhanced pressure management. Starting in year 3 into year 4, activities will focus on implementation of SCADA. Year 5 will focus evaluating the program and charting the way forward.

1.1.3.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the transition to real water loss management.

The Water Utilities Departments require human resources (at least 3-4 new officers) with key technical skills related to water loss reduction and project management. Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 1.14 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the SKN Water Utility Adaptation Plan (GOSKN, 2021b) and the St. Kitts Water Conservation Plan of 2013 (GOSKN, 2013). In addition, the senior staff of both water utilities (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies. These estimates are robust and indicative in the absence of full feasibility studies, which would generally be required once concept notes are approved, and full detailed project designs are being finalized.

Table 1.14: Estimated costs per activity for greater diffusion of real water loss management

Action 1: Conduct feasibility studies and establish a program for real water loss management including leakage detection and pressure management including training for technicians	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
1.1 Conduct feasibility study of various leakage detection technologies suitable for local conditions	50,000	
1.2 Conduct detailed analysis to identify and design district metered areas (DMAs)	200,000	
1.3 Assess existing SCADA capabilities and determine specifications for new or upgraded systems	200,000	
1.4 Develop comprehensive real water loss management plan and develop standard operating procedures (SOPs)	100,000	
1.5 Conduct phased training workshops for technicians	50,000	
Action 2: Procure and implement advanced leakage detection technologies	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
2.1 Procure and implement use of advanced leakage detection equipment		500,000
2.2 Establish maintenance and calibration schedule	50,000	
Action 3: Establish district metered areas and enhanced pressure management	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
3.1 Procure and install bulk meters and PRVs in designated DMAs		1,000,000
3.2 Establish regular inspection protocols	50,000	
Action 4: Install or upgrade remote monitoring systems (SCADA)	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
4.1 Procure and install SCADA systems		2,000,000
4.2 Establish dedicated team and set up centralized control room for efficient decision-making and incident management	100,000	
Action 5: Monitor and evaluate real water loss management program and design long-term infrastructure upgrading plan	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
5.1 Develop monitoring and evaluation framework including KPIs	50,000	
5.2 Conduct regular audits and assessments	50,000	
5.3 Design long-term infrastructure development plan	100,000	
TOTAL	1,000,000	3,500,000

1.1.3.6 Management planning

Table 1.15 summarizes some of the key risks and their associated contingency actions

Table 1.15: Key risks and contingency actions for greater diffusion of real water loss management

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.
Delays in pilot project implementation	Delays in the implementation of pilot programs for real water loss management	Prioritize High-Demand Areas: Focus initial roll-out in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement of equipment for real water loss management.	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and Lack of Expertise	Technical issues related to the implementation of strategies for real water loss management.	Training and Capacity Building: Invest in comprehensive training programs for local technicians to build in-country expertise. Technical Partnerships: Partner with international experts or companies with experience in real water loss management technology to provide technical support and knowledge transfer. Regular Maintenance and Monitoring: Implement a robust monitoring system to identify and address technical issues early, minimizing disruptions.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty for investors and stakeholders, hindering progress.	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives. Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Water Utility Departments to effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.

2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

1.1.3.7 TAP overview

Table 1.16: TAP overview table for greater diffusion of real water loss management

Sector	Water							
Technology	Real water loss management							
Ambition	The overall target is set at 25% reduction in real losses over 5 years.							
Benefits	Water demand management initiatives like leakage detection and repair lead to overall improved water use efficiency, reduction in environmental impact and improved sustainability. Reducing leakages and inefficient water use reduces strain on operations, making more water available to more customers in the dry season and under drought conditions. It can also offset the need for supply side infrastructure upgrades by reducing demand growth and the impacts of climate change.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Conduct feasibility studies and establish a program for real water loss management including leakage detection and pressure management including training for technicians	1.1 Conduct feasibility study of various leakage detection technologies suitable for local conditions	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete feasibility study by middle of Year 1	Delivery of feasibility study	50,000
	1.2 Conduct detailed analysis to identify and design district metered areas (DMAs)	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete DMA design report by end of Year 1	Delivery of DMA design report	200,000
	1.3 Assess existing SCADA capabilities and determine specifications for new or upgraded systems	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete SCADA design report by end of Year 1	Delivery of SCADA design report	200,000
	1.4 Develop comprehensive real water loss management plan and develop standard operating procedures (SOPs)	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete management plan by end of Year 1	Delivery of real water loss management plan	100,000
	1.5 Conduct phased training workshops for technicians	Adaptation Fund GOSKN	WSD/ NWD	24	Technical Challenges and Lack of Expertise	Train at least 40 technicians by end of Year 4	Number of individuals trained	50,000

							Percentage of trainees who pass certification assessments	
Action 2: Procure and implement advanced leakage detection technologies	2.1 Procure and implement use of advanced leakage detection equipment	Adaptation Fund	WSD/ NWD	12	Supply Chain Disruptions Insufficient funding	Procure and implement at least one type of advanced leakage detection equipment for each island	Number of pieces of equipment procured and operational	500,000
	2.2 Establish maintenance and calibration schedule	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete schedule and O+M by end of Year 2	Delivery of schedule and O+M plan	50,000
Action 3: Establish district metered areas and enhanced pressure management	3.4 Procure and install bulk meters and PRVs in designated DMAs	Adaptation Fund	WSD/ NWD	24	Supply Chain Disruptions Insufficient funding	Procure and implement at least 20 DMAs across both islands by end of Year 3	Number of DMAs established and monitored	1,000,000
	3.5 Establish regular inspection protocols	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete schedule and O+M by end of Year 3	Delivery of schedule and O+M plan	50,000
Action 4: Install or upgrade remote monitoring systems (SCADA)	4.1 Procure and install SCADA systems	Adaptation Fund	WSD/ NWD	24	Supply Chain Disruptions Insufficient funding	Complete installation of SCADA by end of Year 4	Number of SCADA systems installed / upgraded	2,000,000
	4.2 Establish dedicated team and set up centralized control room for efficient decision-making and incident management	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Establish control centre by end of Year 4	One control centre on each island fully operational	100,000

Action 5: Monitor and evaluate real water loss management program and design long-term infrastructure upgrading plan	5.1 Develop monitoring and evaluation framework including KPIs	Adaptation Fund	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete M+V framework by end of Year 4	Delivery of M+V framework	50,000
	5.2 Conduct regular audits and assessments	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete regular audits by end of Year 5	Delivery of audit report	50,000
	5.3 Design long-term infrastructure development plan	Adaptation Fund GOSKN	WSD/ NWD	6	Technical Challenges and Lack of Expertise	Complete long-term infrastructure plan by end of Year 5	Delivery of plan	100,000

1.2 Project Ideas for the Water Sector

1.2.1 Summary of project ideas for the water sector

There are several concrete project ideas which can be extracted from the TAP to support phased actions towards the fulfilment of the overall goals for reducing apparent and real water losses outlined in sections 1.1.2.2 and 1.1.3.2. Several project ideas are outlined in Table 1.17.

Table 1.17: Project ideas for the water sector

Project Ideas	Overall TAP Target
Project Idea #1: Perform a detailed water audit on both islands to establish a baseline for water losses including detailed audits for top 100 large volume consumers. **Project Idea #2:** Establish district metered areas and pressure management zones for both islands including procurement and implementation of advanced leakage detection technologies and SCADA. **Project Idea #3:** Strengthen capacity and training for apparent and real water loss prevention for water utility technicians. **Project Idea #4:** Develop public awareness and outreach campaigns focused on water conservation.	25% reduction in apparent and real losses over 5 years.

1.2.2 Specific project idea

Project idea #2 related to the establishment of DMAs, pressure management zones and procurement and roll-out of advanced leakage detection technologies and SCADA is a priority for both water utilities and should be one of the first actions of the TAP for the water sector. Table 1.18 summarizes the key elements of a future project proposal for this project.

Table 1.18: Key project proposal elements for selected project idea

Section	Narrative
Introduction/ Background	This project focuses on establishing District Metered Areas (DMAs) and implementing pressure management zones across both islands. The goal is to reduce real losses using advanced leakage detection technologies and SCADA. This project is a response to the ongoing water losses (apparent and real) faced by St. Kitts and Nevis, as outlined in their Water Sector Action Plans. The initiative is part of a broader strategy to modernize the water distribution system, reduce water losses, and ensure efficient water management. The project emerged from a national assessment that highlighted significant water losses and the need for modernization of the water infrastructure.
Objectives	The primary objectives of the project are: • To reduce real water losses by 25% over the next 5 years. • Establish DMAs and pressure management zones to improve monitoring and control of water distribution. • Implement advanced leakage detection technologies and SCADA to quickly identify and repair leaks.
Outputs	1. Establishment of **40 District Metered Areas (DMAs)** with bulk meters and pressure-reducing valves (PRVs). 2. Procurement and installation of **advanced leakage detection equipment**.

	3. **SCADA system** installation and upgrade for real-time monitoring of the water network. 4. Training of at least **20 technicians** in advanced leakage detection and pressure management systems. 5. **Real water loss reduction** of 25% within 5 years.
Relationship to national priorities	This project aligns with St. Kitts and Nevis' climate resilience and sustainability goals, which focus on efficient water management and reducing non-revenue water (NRW). It supports the National Climate Change Adaptation Strategy (2018-2030), which prioritizes water resource management as a key area for adaptation. This project is not only a response to current challenges but also part of a long-term strategy to adapt to climate change, enhance water security, and promote sustainable development.
Project deliverables	**Water Conservation:** Reducing water losses will conserve water resources, especially critical in the face of increasing demand due to climate change and tourism growth. **Cost Savings:** Reducing water losses decreases operational costs for water utilities, including energy costs associated with pumping water. **Enhanced Infrastructure:** Modernizing water infrastructure extends its life, reduces maintenance costs, and improves service delivery to consumers. **Improved Climate Resilience:** Efficient water use ensures better preparedness for droughts and other climate-related impacts.
Project scope	The project will cover both St. Kitts and Nevis and will involve several components: leakage detection, pressure management, establishing DMAs, and upgrading the SCADA systems. This project is feasible given the government's ongoing focus on upgrading the water sector, previous initiatives in the area, and support from international climate funds. It builds on past water audits and previous efforts to reduce non-revenue water.
Project activities	1. Conduct feasibility studies to determine the best leak detection and pressure management technologies for the islands. 2. Procure and install advanced leakage detection technologies. 3. Establish DMAs and install PRVs across both islands. 4. Upgrade or install SCADA systems for real-time monitoring of water usage and pressures. 5. Train technicians in the use of new technologies and equipment. 6. Monitor and evaluate the system's performance through regular audits.
Timelines	The project will be implemented over a **5-year** period: **Year 1:** Feasibility studies and initial procurement of equipment. **Year 2-3:** Installation of equipment, establishment of DMAs, and training programs. **Year 4:** Full deployment of SCADA systems and further expansion of DMAs. **Year 5:** System performance evaluation, audits, and fine-tuning.
Budget	The estimated budget for this project is around **USD 4.5 million** over 5 years: - **USD 2 million** for procurement and installation of SCADA systems and advanced leakage detection technologies. - **USD 1 million** for DMAs and PRVs installation. - **USD 1.5 million** for feasibility studies, technician training, and project management. Funding will be sought from international climate funds (e.g., Green Climate Fund) and possibly through public-private partnerships.
Measurement and evaluation	The success of the project will be measured by: - Reduction in water losses by **25%** within 5 years. - Performance audits showing the impact of DMAs and pressure management zones on water use efficiency. - Reports from SCADA systems on real-time water usage and leak detection. - Number of trained technicians proficient in using advanced leakage detection equipment
Possible challenges	**High capital costs** of technologies and specialized equipment may pose a funding challenge. **Technical expertise** required for the maintenance and operation of new systems. **Supply chain delays** could affect the timely procurement of equipment.
Responsibilities / coordination	**Water Utilities Departments**: Lead on project implementation and maintenance of the systems. **Ministry of Sustainable Development**: Secure funding and oversee the project. **Consultants**: Conduct feasibility studies and provide technical training. **Local Technicians**: Trained to maintain and operate the equipment.

Chapter 2 Technology Action Plan and Project Ideas for the Agriculture Sector

2.1 TAP for the Agriculture Sector

The second sector prioritized for the TNA process for climate change adaptation is the agriculture sector. Two technologies were prioritized for the sector including: (1) Integrated pest management and (2) Soil moisture conservation monitoring and techniques.

Both the recent NDC (GOSKN, 2021c) and Chapter 3 of the Third National Communication (GOSKN, 2021a) document progress towards adaptation measures identified in the National Climate Change Policy (GOSKN, 2017) and National Climate Change Adaptation Plan (GOSKN, 2018). More recently, adaptation actions in the agriculture sector are in alignment with the St. Kitts and Nevis Agricultural Transformation and Growth Strategy (2022-2031) (GOSKN, 2022e) and the 25 by 2025 Agenda (Reduction of the food import bill by 25% by 2025) (GOSKN, 2024).

Progress in the agriculture sector has included vulnerability assessments (i.e. ongoing climate vulnerability assessment for Agriculture as of October 2024) and the development of measures to increase climate resilience (e.g., a livestock feed bank in Nevis). The DOE collaborated with the Ministry of Agriculture on three pilot projects, which included the use of organic mulch as an adaptive response to climate change, forage banking to provide feed for livestock during dry periods and the use of a shade house to intensify production (GOSKN, 2021c).

2.1.1 Agriculture Sector Overview

The agriculture sector represents a critical component of the St. Kitts and Nevis economy, especially for its national identity, its impact on rural development and its role in providing food and nutrition security (GOSKN, 2016). Although agriculture contributes less than 2% of the GDP, as much as 20% of the labor force may be engaged in agricultural activities, and approximately 24% of the total land area is used for agricultural purposes (63.4 km^2) (GOSKN, 2021a). The main crops grown are sweet potatoes, yams, vegetables, mangoes, limes, bananas, and coconuts (GOSKN, 2016). With about 1,000 hectares dedicated to pasture, livestock production is focused on beef, mutton, pork, and poultry (Sealy, 2015). The GOSKN has committed to supporting agricultural production as a national priority to bolster food security, reduce the food import bill and the cost of food, enhance rural livelihoods and job creation opportunities in agribusiness value chains, and promote more sustainable economic growth (GOSKN, 2020).

The overall decline in the contribution of agriculture to the overall economy is also due to numerous challenges of low on-farm productivity, high pest and disease incidence for crops and livestock, poor marketing arrangements, damage from tropical storms, droughts, and crop damage by monkeys. An example of how drought impacts this sector is evidenced by the major drought which occurred in 2015 which severely affected the rain-fed dominated agriculture.

Local crop production in St. Kitts reached 755 metric tonnes in 2015 compared to 1097 metric tonnes in 2014, a decrease in output of 31.2% (GOSKN, 2016).

2.1.2 Action plan for integrated pest management

2.1.2.1 Introduction

Integrated Pest Management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.

IPM is not widely practiced in St. Kitts and Nevis except for some work done by CARDI related to the sweet potato weevil in 2018 (CARDI, 2018) and more recent training for extension officers in IPM in 2023 with some field work at the Tabernacle Outreach Centre (DOA, 2024b) and small-scale trials in Nevis. The main pest of economic importance identified in the Director's Report for 2023 was the Cotton Leaf Hopper (DOA, 2024a). However, the report did not contain any data related to income loss due to pests for St. Kitts.

IPM contributes to climate change adaptation by providing a healthy and balanced ecosystem in which the vulnerability of plants to pests and diseases is decreased. By promoting a diversified farming system, the practice of IPM builds farmers' resilience to potential risks posed by climate change, such as damage to crop yields caused by newly emerging pests and diseases (Clements et al. 2011).

2.1.2.2 Ambition for the TAP

In alignment with the St. Kitts and Nevis Agricultural Transformation and Growth Strategy (2022-2031) (GOSKN, 2022e) and the 25 by 2025 Agenda (Reduction of the food import bill by 25% by 2025) (GOSKN, 2024), the preliminary target is set at diffusion of integrated pest management on half of the active farms in St. Kitts and Nevis by 2030. Table 2.1 presents targets for the scale of diffusion for IPM.

Table 2.1: Key targets for greater diffusion of IPM

Action	Target
Installation of pest traps / pheromone traps	Recommendations in the literature vary widely and depend on the crop being planted. For general monitoring, recommendations range up to 5-10 traps per acre for high-value crops like fruits and vegetables.
Use of selective biological control agents (such as insects, microbial agents, nematodes, and viruses)	Varies greatly on the target pest, the crop type, and environmental conditions
Pest resistant cultivars	Varies on crop types and farm acreage

Organic manures	Varies on crop type, nutrient content of the manure, soil health, environmental concerns, and local regulations. Average amount per acre in IPM ranges from 2-20 tons per acre.
Farmer field school focused on IPM including traditional practices related to pest management	4-6 months farmer field school for all eligible farms in St. Kitts and Nevis depending on the average length of crop cycle.

2.1.2.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, the SWG identified two (2) economic and financial and two (2) non-financial barriers (technical and socio-cultural) including:

1. Low market demand or premium for IPM-compliant products
2. Difficulty in monitoring and managing a diverse range of pests
3. High implementation costs for IPM strategies
4. Low awareness among farmers about the benefits of IPM

The root causes to low market demand for IPM-compliant products are high cost of specialized inputs required for IPM, lack of policies and extension support and no targeted marketing and public awareness campaigns. As it relates further to the overall high implementation costs of IPM, this was deconstructed even more, and root causes were found to be high importation costs and logistics related to specialized inputs required for IPM and lack of access to these tools by farmers as a result. Furthermore, lack of training programs focused on IPM lead to limited awareness about its benefits. The root causes to the technical issue related to the difficulty and complexity in monitoring and managing a diverse range of pests were found to be lack of laboratory facilities able to test for various pests, lack of specialized extension staff to aid in monitoring and lack of access to specialized inputs required for effective IPM. As it relates to low awareness among farmers about IPM, the root causes identified relate to lack of extensions services and training related to IPM, limited communications and networking amongst farmers and resistance to change and adopting new techniques. Table 2.2 identified key measures to overcome the barriers for greater diffusion of IPM.

Table 2.2: Key measures to overcome barriers for greater diffusion of IPM

Barriers	Measures
Low market demand or premium for IPM-compliant products	• Develop certification programs for IPM-compliant products to promote best practices and standards and stimulate demand. Certified farmers would then be able to access branding and labelling strategies to showcase their products. • Partner with hotels, restaurants, and supermarkets to promote locally grown, IPM-compliant produce. • Strategies to promote healthy diets to help create demand for IPM-compliant produce.
Difficulty in monitoring and managing a diverse range of pests	• Invest in local laboratory facilities for pest identification and management. • Train specialized extension staff who can assist farmers with IPM strategies.
High implementation costs for IPM	• Offer subsidies, low-interest loans, or grants for the initial investment

Barriers	Measures
	• Encourage and incentivize established farmers cooperatives to cooperate to actualize bulk purchasing and cost-sharing were applicable
Low awareness among farmers about the benefits of IPM	• Implement comprehensive education and training programs through farmer field schools including modules on financial planning and analysis to help farmers understand the long-term cost savings and yield benefits. • Create demonstration farms where farmers can observe and learn first-hand • Use success stories and case studies to highlight the long-term benefits of IPM • Launch targeted marketing and public awareness campaigns to educate farmers and the public about the benefits of IPM • Utilize local community meetings, farmer field days, and agricultural shows to spread awareness and demonstrate techniques.

In determining the key actions and activities for the TAP, the SWG focused its consultations on strengthening of extension services, implementation of farmer field schools, facilitating access to affordable IPM tools and inputs and certification of IPM-compliant produce. Table 2.3 summarizes the key actions and associated activities (Table 2.4) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 2.3: Key actions for greater diffusion of IPM

Action	Description
Action 1	Comprehensive study of common agricultural pests in St. Kitts and Nevis and development of tailored IPM strategies
Action 2	Develop and implement training programs for extension officers and set up dedicated IPM support team within the Ministry of Agriculture
Action 3	Conduct laboratory needs assessment and upgrade facilities to support pest identification and management.
Action 4	Develop and implement farmer field school to ensure in-depth knowledge of IPM among farmers.
Action 5	Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of IPM inputs.
Action 6	Create a certification program for IPM-compliant products and develop marketing campaigns that emphasize health and environmental benefits of IPM-compliant produce to consumers.

Table 2.4: Key activities for greater diffusion of IPM

Action 1: Comprehensive study of common agricultural pests in St. Kitts and Nevis and development of tailored IPM strategies
1.1 Conduct baseline surveys to identify the most common and economically significant agricultural pests in different areas of St. Kitts and Nevis.
1.2 Develop context-specific IPM strategies for different crops, focusing on prevention, monitoring, and control measures.
1.3 Publish comprehensive manual outlining findings and recommended IPM strategies and distribute to key stakeholders.
Action 2: Develop and implement training programs for extension officers and set up dedicated IPM support team within the Ministry of Agriculture
2.1 Create a detailed IPM training curriculum based on results of baseline surveys (Task 1.1).

2.2 Conduct intensive workshops for extension officers, equipping them with the knowledge and skills needed to train farmers in IPM. 2.3 Setting up a demonstration plot (at one on each island) where extension officers can receive hands-on experience and continue field research on IPM strategies. 2.4 Form a dedicated IPM support team with both Ministries of Agriculture and develop workplan for sustained assistance to farmers.
Action 3: Conduct laboratory needs assessment and upgrade facilities to support pest identification and management. 3.1 Conduct needs assessment to identify gaps in existing lab facilities, equipment and staff skills related to pest identification and potentially other needs such as water and soil testing. 3.2 Develop detailed plan to upgrade lab infrastructure. 3.3 Procure necessary equipment and implement planned upgrades. 3.4 Develop and implement standard operating procedures for pest identification and management, ensure consistency and accuracy in lab operations.
Action 4: Develop and implement farmer field school to ensure in-depth knowledge of IPM among farmers. 4.1 Create a comprehensive curriculum for the farmer field school, covering all aspects of IPM. 4.2 Conduct farmer field school sessions in various locations, ensuring accessibility for farmers across St. Kitts and Nevis. 4.3 Assess the effectiveness of the field school program through feedback and outcomes and make necessary adjustments.
Action 5: Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of IPM inputs. 5.1 Conduct market research to identify reliable local and regional suppliers of IPM inputs. 5.2 Engage with suppliers to negotiate favourable terms for bulk purchasing and long-term supply agreements. 5.3 Develop and implement financial incentives, such as subsidies or tax breaks, to encourage local suppliers to import and stock IPM inputs.
Action 6: Create a certification program for IPM-compliant products and develop marketing campaigns that emphasize health and environmental benefits of IPM-compliant produce to consumers. 6.1 Develop standards and criteria for IPM certification that reflects best practices and local conditions. 6.2 Implement certification program, including development of verification process, training for inspectors and issuing of certification marks. 6.3 Design marketing and public awareness plan and products such as brochures, posters, and social media content highlighting health and environmental benefits of IPM-compliant produce. 6.4 Partner with local supermarkets, hotels and restaurants to promote IPM-certified products.

2.1.2.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater diffusion of IPM in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 2.5.

Table 2.5: Key stakeholders for greater diffusion of IPM

Stakeholder	Role
Ministry of Agriculture	- Coordination and project management - Develop and enforce policies and regulations that support the adoption of IPM - Launch nationwide awareness campaigns to educate the public on the benefits of IPM compliant products. - Engage with farmers and co-ops to promote the adoption of IPM.

Ministry of Finance (MoF)	- Implement tax incentives, subsidies, and other financial mechanisms to lower the cost of inputs for IPM. - Allocate budget for long term investments in agriculture.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Bureau of Standards	- Develop certification / standards for IPM-compliant produce
Ministry of Justice and Legal Affairs	- Legal drafting of regulations
Ministry of Education (MoE)	- Develop and incorporate lessons about IPM and climate change into the curriculum.
Private Sector (IPM input suppliers)	- Import and supply IPM inputs to the local market. - Work with manufacturers to bring down the cost of IPM inputs by negotiating bulk purchases. - Partner with the government to offer favourable loan conditions for farmers wanting to adopt IPM practices.
Educational and Vocational Institutions (CFBC and AVEC)	- Develop and deliver training programs for farmers on the use of IPM. - Incorporate IPM concepts into the school curriculum to educate future generations.
Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of IPM compliant products through various media channels. - Highlight success stories, case studies, and interviews with early adopters of IPM on farms. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of IPM compliant products.
Local co-ops and farmers	- Participate in pilot projects and farmer field school and provide feedback on their effectiveness. - Consider the long-term benefits of IPM when making decisions on the farm. - Advocate for better infrastructure and policies that support regenerative agriculture. - Engage in community discussions and activities related to use of IPM.

To ensure the successful implementation of the Technology Action Plan (TAP) for the transition to IPM in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. The nature of the plan requires at least a 5-year implementation period.

Action 1 requires primary research and data collection and will require at least one year of intensive research to fully study common agricultural pests and develop IMP related strategies. During Year 2-3, the focus will shift to comprehensive training of extension officers, setting up an IPM support team within the Ministries of Agriculture and laboratory expansion and upgrading to fully support pest identification and management. Year 4-5 will see full roll-out of farmer field schools for farmers on both islands to fully impart in-depth knowledge of IPM

strategies along with hands-on training on demonstration plots and development of partnerships and incentive regimes to stimulate bulk imports of IPM inputs. Year 5 will focus on roll-out of certification program and public awareness and outreach.

2.1.2.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the transition to soil moisture conservation

The Ministry of Agriculture requires human resources (at least 4-6 new officers across both islands) with key technical skills related to IPM and project management. In supporting roles, from the Ministry of Finance or Sustainable Development, at least one financial analyst or economist with expertise in financial modelling, cost-benefit analysis and design of incentive regimes. From the Bureau of Standards, an officer to head up the certification program and train inspectors.

Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 2.6 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the St. Kitts and Nevis Agricultural Transformation and Growth Strategy (2022-2031) (GOSKN, 2022e) and the 25 by 2025 Agenda (Reduction of the food import bill by 25% by 2025) (GOSKN, 2024). In addition, the senior staff of both departments of agriculture (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies. These estimates are robust and indicative in the absence of full feasibility studies, which would generally be required once concept notes are approved, and full detailed project designs are being finalized.

Table 2.6: Estimated costs per activity for greater diffusion of IPM

Action 1: Comprehensive study of common agricultural pests in St. Kitts and Nevis and development of tailored IPM strategies	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
1.1 Conduct baseline surveys to identify the most common and economically significant agricultural pests in different areas of St. Kitts and Nevis.	350,000	100,000
1.2 Develop context-specific IPM strategies for different crops, focusing on prevention, monitoring, and control measures.	50,000	
1.3 Publish comprehensive manual outlining findings and recommended IPM strategies and distribute to key stakeholders.	50,000	
Action 2: Develop and implement training programs for extension officers and set up dedicated IPM support team within the Ministry of Agriculture	**Consultancies (including expertise,**	**Equipment costs (USD)**

	logistics, materials etc) (USD)	
2.1 Create a detailed IPM training curriculum based on baseline surveys.	75,000	
2.2 Conduct intensive workshops for extension officers, equipping them with the knowledge and skills needed to train farmers in IPM.	100,000	
2.3 Setting up a demonstration plot (at one on each island) where extension officers can receive hands-on experience and continue field research on IPM strategies.		200,000
2.4 Form a dedicated IPM support team with both Ministries of Agriculture and develop workplan for sustained assistance to farmers.	100,000	
Action 3: Conduct laboratory needs assessment and upgrade facilities to support pest identification and management.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
3.1 Conduct needs assessment to identify gaps in existing lab facilities, equipment and staff skills related to pest identification and potentially other needs such as water and soil testing.	50,000	
3.2 Develop detailed plan to upgrade lab infrastructure.	50,000	
3.3 Procure necessary equipment and implement planned upgrades.		200,000
3.4 Develop and implement standard operating procedures for pest identification and management, ensure consistency and accuracy in lab operations.	50,000	
Action 4: Develop and implement farmer field school to ensure in-depth knowledge of IPM among farmers.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
4.1 Create a comprehensive curriculum for the farmer field school, covering all aspects of IPM.	50,000	
4.2 Conduct farmer field school sessions in various locations, ensuring accessibility for farmers across St. Kitts and Nevis.		200,000
4.3 Assess the effectiveness of the field school program through feedback and outcomes and make necessary adjustments.	50,000	
Action 5: Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of IPM inputs.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
5.1 Conduct market research to identify reliable local and regional suppliers of IPM inputs.	50,000	
5.2 Engage with suppliers to negotiate favourable terms for bulk purchasing and long-term supply agreements.	50,000	

5.3 Develop and implement financial incentives, such as subsidies or tax breaks, to encourage local suppliers to import and stock IPM inputs.	50,000	
Action 6: Create a certification program for IPM-compliant products and develop marketing campaigns that emphasize health and environmental benefits of IPM-compliant produce to consumers.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
6.1 Develop standards and criteria for IPM certification that reflects best practices and local conditions.	50,000	
6.2 Implement certification program, including development of verification process, training for inspectors and issuing of certification marks.		200,000
6.3 Design marketing and public awareness plan and products such as brochures, posters, and social media content highlighting health and environmental benefits of IPM-compliant produce.	100,000	
6.4 Partner with local supermarkets, hotels and restaurants to promote IPM-certified products.	50,000	
TOTAL	1,325,000	900,000

2.1.2.6 Management planning

Table 2.7 summarizes some of the key risks and their associated contingency actions.

Table 2.7: Key risks and contingency actions for greater diffusion of IPM

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.
Delays in pilot project implementation	Delays in the implementation of farmer field schools and pilot programs for IPM	Prioritize High-Need Areas: Focus initial roll-out in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement of IPM equipment.	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and	Technical issues related to the	Training and Capacity Building: Invest in comprehensive training programs for local technicians to build in-country expertise.

Lack of Expertise	implementation of IPM practices.	Technical Partnerships: Partner with international experts or companies with experience in IPM technology to provide technical support and knowledge transfer. Regular Maintenance and Monitoring: Implement a robust monitoring system to identify and address technical issues early, minimizing disruptions.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty for investors and stakeholders, hindering progress.	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives. Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.
Limited Farmer Acceptance and Adoption of IPM	Resistance from the public due to a lack of awareness or trust in new technology	Enhanced Public Education Campaign: Intensify efforts to educate the public on the long-term benefits, cost savings, and environmental impacts of IPM. Incentivize Early Adopters: Provide additional incentives, such as tax breaks or rebates, to early adopters of IPM to create a positive demonstration effect. Community Engagement: Engage community leaders and influencers to advocate for the adoption of IPM within their communities.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Departments of Agriculture to effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.
2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

2.1.2.7 TAP overview

Table 2.8: TAP overview table for greater diffusion of IPM

Sector	Agriculture							
Technology	Integrated Pest Management							
Ambition	The overall target is set at diffusion of integrated pest management on half of the active farms in St. Kitts and Nevis by 2030.							
Benefits	IPM contributes to climate change adaptation by providing a balanced ecosystem in which the vulnerability of plants to pests and diseases is decreased and farmers' resilience to potential risks posed by climate change, such as damage to crop yields caused by newly emerging pests and diseases is enhanced.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Comprehensive study of common agricultural pests in St. Kitts and Nevis and development of tailored IPM strategies	1.1 Conduct baseline surveys to identify the most common and economically significant agricultural pests in different areas of St. Kitts and Nevis.	Adaptation Fund GOSKN	MOA	12	Technical Challenges and Lack of Expertise	Complete survey and baseline study by end of Year 1	Delivery of survey and baseline results	450,000
	1.2 Develop context-specific IPM strategies for different crops, focusing on prevention, monitoring, and control measures.	Adaptation Fund	MOA	12	Technical Challenges and Lack of Expertise	Complete IPM strategy and action plan by middle of Year 2	Delivery of IPM strategy and action plan	50,000
	1.3 Publish comprehensive manual outlining findings and recommended IPM strategies and distribute to key stakeholders.	Adaptation Fund	MOA	12	Technical Challenges and Lack of Expertise	Complete IPM guidance manual by middle of Year 2	Delivery of IPM guidance manual	50,000
Action 2: Develop and implement training programs for	2.1 Create a detailed IPM training curriculum based on baseline surveys.	Adaptation Fund	MOA	6	Technical Challenges and Lack of Expertise	Complete IPM technical skills program by middle of Year 2	Delivery of training programs	75,000

extension officers and set up dedicated IPM support team within the Ministry of Agriculture	2.2 Conduct intensive workshops for extension officers, equipping them with the knowledge and skills needed to train farmers in IPM.	Adaptation Fund GOSKN	MOA	12	Technical Challenges and Lack of Expertise	Train at least 20 extension officers by end of Year 3	Number of individuals trained	100,000
	2.3 Setting up a demonstration plot (at one on each island) where extension officers can receive hands-on experience and continue field research on IPM strategies.	Adaptation Fund	MOA	12	Technical Challenges and Lack of Expertise Insufficient Funding and Financial Support	Complete 2 demonstration plots (one of each island) by end of Year 2	Number of demonstration plots initiated	200,000
	2.4 Form a dedicated IPM support team with both Ministries of Agriculture and develop workplan for sustained assistance to farmers.	Adaptation Fund GOSKN	MOA	12	Insufficient Funding and Financial Support Policy and Regulatory Uncertainty	Set up IPM support unit by end of Year 3	Fully functional IPM support unit	100,000
Action 3: Conduct laboratory needs assessment and upgrade facilities to support pest identification and management.	3.1 Conduct needs assessment to identify gaps in existing lab facilities, equipment and staff skills related to pest identification and potentially other needs such as water and soil testing.	Adaptation Fund GOSKN	MOA	6	Technical Challenges and Lack of Expertise	Complete needs assessment by middle of Year 2	Delivery of needs assessment study	50,000
	3.2 Develop detailed plan to upgrade lab infrastructure.	Adaptation Fund	MOA Bureau of Standards	6	Technical Challenges and Lack of Expertise	Complete lab infrastructure upgrade plan by end of Year 2	Delivery of lab infrastructure plan	50,000
	3.3 Procure necessary equipment and implement planned upgrades.	Adaptation Fund	MOA	6	Insufficient Funding and Financial Support	Complete procurement of lab equipment by end of Year 3	Delivery of lab equipment	200,000

	3.4 Develop and implement standard operating procedures for pest identification and management, ensure consistency and accuracy in lab operations.	Adaptation Fund	MOA Bureau of Standards	6	Technical Challenges and Lack of Expertise	Complete lab SOPs by end of Year 3	Delivery of SOPs	50,000
Action 4: Develop and implement farmer field school to ensure in-depth knowledge of IPM among farmers.	4.1 Create a comprehensive curriculum for the farmer field school, covering all aspects of IPM.	Adaptation Fund	MOA	6	Technical Challenges and Lack of Expertise	Complete IPM farmer field school program by middle of Year 3	Delivery of farmer field school training programs	50,000
	4.2 Conduct farmer field school sessions in various locations, ensuring accessibility for farmers across St. Kitts and Nevis.	Adaptation Fund GOSKN	MOA	18	Technical Challenges and Lack of Expertise Lack of Farmer Acceptance	Train at least 100 farmers by end of Year 4	Number of farmers trained	200,000
	4.3 Assess the effectiveness of the field school program through feedback and outcomes and make necessary adjustments.	Adaptation Fund GOSKN	MOA	3	Technical Challenges and Lack of Expertise	Achieve a satisfaction rate of 80% or higher among trainees	Survey results from trainees	50,000
Action 5: Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of IPM inputs.	5.1 Conduct market research to identify reliable local and regional suppliers of IPM inputs.	Adaptation Fund GOSKN	MoF	6	Technical Challenges and Lack of Expertise	Complete market research study by middle of Year 4	Delivery of market research report	50,000
	5.2 Engage with suppliers to negotiate favourable terms for bulk purchasing and long-term supply agreements.	Adaptation Fund	MOA MoF	6	Technical Challenges and Lack of Expertise Lack on Supplier Interest	Complete consultative process with suppliers by end of Year 4	Delivery of consultation report	50,000
	5.3 Develop and implement financial incentives, such as	Adaptation Fund	MoF	6	Technical Challenges	Complete incentive	Delivery of incentive regime	50,000

	subsidies or tax breaks, to encourage local suppliers to import and stock IPM inputs.	GOSKN			and Lack of Expertise	package by end of Year 4		
Action 6: Create a certification program for IPM-compliant products and develop marketing campaigns that emphasize health and environmental benefits of IPM-compliant produce to consumers.	6.1 Develop standards and criteria for IPM certification that reflects best practices and local conditions.	Adaptation Fund GOSKN	Bureau of standards MOA	12	Technical Challenges and Lack of Expertise	Complete IPM certification program design by end of Year 4	Delivery of design report	50,000
	6.2 Implement certification program, including development of verification process, training for inspectors and issuing of certification marks.	Adaptation Fund GOSKN	Bureau of standards MOA	12	Technical Challenges and Lack of Expertise Insufficient Funding and Financial Support	Roll-out of certification program by end of Year 5	Number of products certified / applicants to the program	200,000
	6.3 Design marketing and public awareness plan and products such as brochures, posters, and social media content highlighting health and environmental benefits of IPM-compliant produce.	Adaptation Fund	MOA	6	Limited Public Acceptance	Achieve an engagement rate of 75% on social media platforms	Number of likes, shares, comments and other interactions on campaign-related content	100,000
	6.4 Partner with local supermarkets, hotels and restaurants to promote IPM-certified products.	Adaptation Fund GOSKN	MOA	12	Limited Public / Private Sector Acceptance	Increase private sector and public awareness of the benefits of IPM products by 50% by end of Year 5	Survey results Number of likes, shares, comments and other interactions on campaign-related content	50,000

2.1.3 Action plan for soil moisture conservation monitoring and techniques

2.1.3.1 Introduction

The main objective of soil moisture conservation is to minimize the amount of water lost from the soils through evaporation (water loss directly from the soil) and transpiration (water loss occurring through the plants) – or combined, the evapotranspiration. Preserving soil moisture is an important means to maintain the necessary water for agricultural production and helps minimize irrigation needs of the crops. This is especially important in areas where rainwater and/or groundwater resources for irrigation are scarce or decreasing due to climate change or other causes (CTCN 2022). Even in areas where irrigation is widely practiced, soil moisture monitoring is important to ensure irrigation water is utilized efficiently.

Soil moisture conservation measures can be categorized as biological (agroforestry and agricultural) and mechanical measures (terracing, bunding, trenching, check dams, etc.). Generally, most methods used for soil quality improvement and conservation (and even for IPM), will also yield benefits to soil moisture conservation. It is important for the effectiveness of these techniques to be evaluated and measured in the field. Such data provide real-time information and the ability to adjust the irrigation regime to increase soil moisture. Various tools are available to measure soil moisture including tensiometers, electrical resistance blocks, granular matrix sensors and time domain reflectometry (Kujawski 2011).

2.1.3.2 Ambition for the TAP

In alignment with the St. Kitts and Nevis Agricultural Transformation and Growth Strategy (2022-2031) (GOSKN, 2022e) and the 25 by 2025 Agenda (Reduction of the food import bill by 25% by 2025) (GOSKN, 2024), the preliminary target is set at diffusion of soil moisture conservation on half of the active farms in St. Kitts and Nevis by 2028. Table 2.9 presents targets for the scale of diffusion for soil moisture conservation monitoring.

Table 2.9: Key targets for diffusion of soil moisture conservation monitoring

Action	Target
Soil moisture monitoring sensors (such as tensiometers, electrical resistance blocks, granular matrix sensors and time domain reflectometry)	For enhanced water management, especially in fields with greater variability or high-value crops, 2-3 sensors per acre.
Comprehensive training for farmers on soil moisture conservation measures can be categorized as biological (agroforestry and agricultural) and mechanical measures (terracing, bunding, trenching, check dams, etc.).	4-6 months farmer field school for all eligible farms in St. Kitts and Nevis depending on the average length of crop cycle.

2.1.3.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, the SWG identified one (1) economic and financial and two (2) non-financial barriers (institutional capacity and socio-cultural) to the widespread diffusion of soil moisture conservation including:

1. High implementation costs for soil moisture conservation strategies

2. Short term planning horizons that overlook long-term benefits of soil moisture conservation
3. Low awareness among farmers about the benefits of soil moisture conservation

The root causes to the overall high implementation costs of soil moisture conservation are all inter-related and were found to be high importation costs and logistics related to specialized inputs required, lack of local suppliers and lack of training programs focused on soil moisture conservation monitoring and techniques. Effective soil moisture conservation is a combination of activities that require a long-term outlook, much longer than a typical crop cycle, with a 3-to-5-year timeframe needed to realize the benefits. As it relates to low awareness among farmers about soil moisture conservation, the root causes identified relate to lack of extensions services and training, limited communications and networking amongst farmers and resistance to change and adopting new techniques. Table 2.10 identified key measures to overcome the barriers for greater diffusion of soil moisture conservation.

Table 2.10: Key measures to overcome barriers for greater diffusion of soil moisture conservation

Barriers	Measures
High implementation costs soil moisture conservation strategies	• Offer subsidies, low-interest loans, or grants for the initial investment • Encourage and incentivize established farmers cooperatives to cooperate to actualize bulk purchasing and cost-sharing were applicable
Low awareness among farmers about the benefits of soil moisture conservation	• Implement comprehensive education and training programs through farmer field schools including modules on financial planning and analysis to help farmers understand the long-term cost savings and yield benefits. • Create demonstration farms where farmers can observe and learn first-hand • Use success stories and case studies to highlight the long-term benefits of soil moisture conservation • Launch targeted marketing and public awareness campaigns to educate farmers and the public about the benefits of soil moisture conservation. • Utilize local community meetings, farmer field days, and agricultural shows to spread awareness and demonstrate techniques.
Short term planning horizons that overlook long-term benefits of soil moisture conservation	• Strengthen extension services to provide ongoing support and guidance on long-term planning using soil moisture conservation techniques. • Promote farmer-to-farmer learning and mentorship programs to facilitate the exchange of knowledge and experiences

In determining the key actions and activities for the TAP, the SWG focused its consultations on setting up demonstration plots, comprehensive training of extension officers and farmers through farmer field schools and incentives to bring down the cost of monitoring equipment. Table 2.11 summarizes the key actions and associated activities (Table 2.12) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 2.11: Key actions for greater diffusion of soil moisture conservation

Action	Description
Action 1	Comprehensive study of soil moisture conservation practices in St. Kitts and Nevis and development of best practice guidelines.
Action 2	Develop and implement training programs for extension officers and setting up demonstration plots on both islands.
Action 3	Develop and implement farmer field school to ensure in-depth knowledge of IPM among farmers.
Action 4	Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of soil moisture monitoring equipment.

Table 2.12: Key activities for greater diffusion of soil moisture conservation

Action 1: Comprehensive study of soil moisture conservation practices in St. Kitts and Nevis and development of best practice guidelines.
1.1 Perform detailed survey of current soil moisture conservation practices among farmers
1.2 Develop and disseminate best practices guidelines tailored to the conditions in St. Kitts and Nevis.
Action 2: Develop and implement training programs for extension officers and setting up demonstration plots on both islands.
2.1 Develop and implement detailed training program covering best practices for soil moisture conservation.
2.2 Procure soil moisture monitoring sensors for use on demonstration plots and for distribution to farms.
2.3 Set up demonstration plots on both islands to showcase effective soil moisture conservation techniques including a variety of crops and soil types.
Action 3: Develop and implement farmer field school to ensure in-depth knowledge of soil moisture conservation among farmers.
3.1 Create comprehensive curriculum for farmer field school including participatory teaching methods.
3.2 Implement farmer field school.
3.3 Establish support network for farmers to facilitate farmer-to-farmer knowledge exchange and learning.
Action 4: Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of soil moisture monitoring equipment.
4.1 Conduct market research to identify reliable local and regional suppliers of soil moisture monitoring equipment.
4.2 Engage with suppliers to negotiate favourable terms for bulk purchasing and long-term supply agreements.
4.3 Develop and implement financial incentives, such as subsidies or tax breaks, to encourage local suppliers to import and stock soil moisture sensors.

2.1.3.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater diffusion of soil moisture conservation practices in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 2.13.

Table 2.13: Key stakeholders for greater diffusion of soil moisture conservation

Stakeholder	Role
Ministry of Agriculture	- Coordination and project management - Develop and enforce policies and regulations that support the adoption of soil moisture conservation practices

	- Launch nationwide awareness campaigns to educate the public on the benefits of products from farms that practice soil moisture conservation. - Engage with farmers and co-ops to promote the adoption of soil moisture conservation.
Ministry of Finance (MoF)	- Implement tax incentives, subsidies, and other financial mechanisms to lower the cost of inputs for soil moisture conservation especially sensors and meters. - Allocate budget for long term investments in agriculture.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Ministry of Justice and Legal Affairs	- Legal drafting of regulations
Ministry of Education (MoE)	- Develop and incorporate lessons about soil moisture conservation and climate change into the curriculum.
Private Sector (soil sensor suppliers)	- Import and supply soil moisture conservation inputs to the local market. - Work with manufacturers to bring down the cost of soil moisture conservation inputs by negotiating bulk purchases. - Partner with the government to offer favourable loan conditions for farmers wanting to adopt soil moisture conservation practices.
Educational and Vocational Institutions (CFBC and AVEC)	- Develop and deliver training programs for farmers on the use of soil moisture conservation practices. - Incorporate soil moisture conservation concepts into the school curriculum to educate future generations.
Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of products from farms using soil moisture conservation practices through various media channels. - Highlight success stories, case studies, and interviews with early adopters of soil moisture conservation on farms. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of products from farms using soil moisture conservation practices.
Local co-ops and farmers	- Participate in pilot projects and farmer field school and provide feedback on their effectiveness. - Consider the long-term benefits of soil moisture conservation when making decisions on the farm. - Advocate for better infrastructure and policies that support regenerative agriculture. - Engage in community discussions and activities related to use of soil moisture conservation practices.

To ensure the successful implementation of the Technology Action Plan (TAP) for the transition to soil moisture conservation in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. The nature of the plan requires at least a 3-year implementation period.

Action 1 requires primary research and data collection and will require about one year. During Year 2-3, the focus will shift to comprehensive training of extension officers, full roll-out of farmer field schools for farmers on both islands to fully impart in-depth knowledge of soil moisture conservation strategies along with hands-on training on demonstration plots. Year 3 will see the development of partnerships and incentive regimes to stimulate bulk imports of soil moisture monitoring equipment and inputs.

2.1.3.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the transition to soil moisture conservation

The Ministry of Agriculture requires human resources (at least 2-3 new officers across both islands) with key technical skills related to soil moisture conservation and project management. In supporting roles, from the Ministry of Finance or Sustainable Development, at least one financial analyst or economist with expertise in financial modelling, cost-benefit analysis and design of incentive regimes.

Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 2.14 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the St. Kitts and Nevis Agricultural Transformation and Growth Strategy (2022-2031) (GOSKN, 2022e) and the 25 by 2025 Agenda (Reduction of the food import bill by 25% by 2025) (GOSKN, 2024). In addition, the senior staff of both departments of agriculture (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies. These estimates are robust and indicative in the absence of full feasibility studies, which would generally be required once concept notes are approved, and full detailed project designs are being finalized.

Table 2.14: Estimated costs per activity for greater diffusion of soil moisture conservation

Action 1: Comprehensive study of soil moisture conservation practices in St. Kitts and Nevis and development of best practice guidelines.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
1.1 Perform detailed survey of current soil moisture conservation practices among farmers	50,000	
1.2 Develop and disseminate best practices guidelines tailored to the conditions in St. Kitts and Nevis.	50,000	
Action 2: Develop and implement training programs for extension officers and setting up demonstration plots on both islands.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**

2.1 Develop and implement detailed training program covering best practices for soil moisture conservation.	50,000	
2.2 Procure soil moisture monitoring sensors for use on demonstration plots and for distribution to farms.		7500 acres[1] X 2 sensors / acre X 50USD = 750,000
2.3 Set up demonstration plots on both islands to showcase effective soil moisture conservation techniques including a variety of crops and soil types.	200,000	
Action 3: Develop and implement farmer field school to ensure in-depth knowledge of soil moisture conservation among farmers.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
3.1 Create comprehensive curriculum for farmer field school including participatory teaching methods.	50,000	
3.2 Implement farmer field school.		200,000
3.3 Establish support network for farmers to facilitate farmer-to-farmer knowledge exchange and learning.	50,000	
Action 4: Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of soil moisture monitoring equipment.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
4.1 Conduct market research to identify reliable local and regional suppliers of soil moisture monitoring equipment.	50,000	
4.2 Engage with suppliers to negotiate favourable terms for bulk purchasing and long-term supply agreements.	50,000	
4.3 Develop and implement financial incentives, such as subsidies or tax breaks, to encourage local suppliers to import and stock soil moisture sensors.	50,000	
TOTAL	600,000	950,000
Notes: We assume approximately 24% of lands in SKN are agricultural (approx. 15,000 acres). Thus, if we target 50% of agricultural lands = 7,500 acres.		

2.1.3.6 Management planning

Table 2.15 summarizes some of the key risks and their associated contingency actions.

Table 2.15: Key risks and contingency actions for greater diffusion of soil moisture conservation

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.

Delays in pilot project implementation	Delays in the implementation of farmer field schools and pilot programs for soil moisture conservation equipment	Prioritize High-Demand Areas: Focus initial roll-out in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement of soil moisture conservation equipment.	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and Lack of Expertise	Technical issues related to the implementation of soil moisture conservation practices.	Training and Capacity Building: Invest in comprehensive training programs for local technicians to build in-country expertise. Technical Partnerships: Partner with international experts or companies with experience in soil moisture conservation technology to provide technical support and knowledge transfer. Regular Maintenance and Monitoring: Implement a robust monitoring system to identify and address technical issues early, minimizing disruptions.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty for investors and stakeholders, hindering progress.	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives. Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.
Limited Farmer Acceptance and Adoption of soil moisture conservation practices	Resistance from the public due to a lack of awareness or trust in new technology	Enhanced Public Education Campaign: Intensify efforts to educate the public on the long-term benefits, cost savings, and environmental impacts of soil moisture conservation. Incentivize Early Adopters: Provide additional incentives, such as tax breaks or rebates, to early adopters of soil moisture conservation practices to create a positive demonstration effect. Community Engagement: Engage community leaders and influencers to advocate for the adoption of soil moisture conservation practices within their communities.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Departments of Agriculture to effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.

2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

2.1.3.7 TAP overview

Table 2.16: TAP overview table for greater diffusion of soil moisture conservation

Sector	Agriculture							
Technology	Soil moisture conservation							
Ambition	The overall target is set at diffusion of soil moisture conservation and monitoring on half of the active farms in St. Kitts and Nevis by 2028.							
Benefits	Preserving soil moisture is important means to maintain the necessary water for agricultural production and helps minimize irrigation needs of the crops. This is especially important in St. Kitts and Nevis where rainwater and/or groundwater resources for irrigation are scarce and decreasing due to climate change.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Comprehensive study of soil moisture conservation practices in St. Kitts and Nevis and development of best practice guidelines.	1.1 Perform detailed survey of current soil moisture conservation practices among farmers	Adaptation Fund GOSKN	MOA	6	Technical Challenges and Lack of Expertise	Complete survey and baseline study by end of Year 1	Delivery of survey and baseline results	50,000
	1.2 Develop and disseminate best practices guidelines tailored to the conditions in St. Kitts and Nevis.	Adaptation Fund	MOA	6	Technical Challenges and Lack of Expertise	Complete best practice guidelines by end of Year 1	Delivery of best practice guidelines	50,000
Action 2: Develop and implement training programs for extension officers and setting up demonstration plots on both islands.	2.1 Develop and implement detailed training program for covering best practices for soil moisture conservation.	Adaptation Fund	MOA	6	Technical Challenges and Lack of Expertise	Complete soil moisture conservation technical skills program by middle of Year 2 Train at least 20 extension officers by end of Year 2	Delivery of training programs Number of individuals trained	50,000

	2.2 Procure soil moisture monitoring sensors for use on demonstration plots and for distribution to farms.	Adaptation Fund GOSKN	MOA	12	Supply Chain Disruptions Insufficient Funding and Financial Support	Procure sensors by end of Year 2	Number of sensors procured and distributed to participating farms	750,000
	2.3 Set up demonstration plots on both islands to showcase effective soil moisture conservation techniques including a variety of crops and soil types.	Adaptation Fund	MOA	12	Technical Challenges and Lack of Expertise Insufficient Funding and Financial Support	Complete 2 demonstration plots (one of each island) by end of Year 2	Number of demonstration plots initiated and operational	200,000
Action 3: Develop and implement farmer field school to ensure in-depth knowledge of soil moisture conservation among farmers.	3.1 Create comprehensive curriculum for farmer field school including participatory teaching methods.	Adaptation Fund	MOA	6	Technical Challenges and Lack of Expertise	Complete soil moisture conservation farmer field school program by end of Year 2	Delivery of farmer field school training programs	50,000
	3.2 Implement farmer field school.	Adaptation Fund GOSKN	MOA	18	Technical Challenges and Lack of Expertise Lack of Farmer Acceptance	Train at least 100 farmers by end of Year 3 Achieve a satisfaction rate of 80% or higher among trainees	Number of farmers trained Survey results from trainees	200,000
	3.3 Establish support network for farmers to facilitate farmer-to-farmer knowledge exchange and learning.	Adaptation Fund GOSKN	MOA	3	Technical Challenges and Lack of Expertise	Establish support network by end of Year 3	Network initiated and functional	50,000

Action 4: Develop partnerships with local suppliers and develop incentive regime to stimulate bulk imports of soil moisture monitoring equipment.	4.1 Conduct market research to identify reliable local and regional suppliers of soil moisture monitoring equipment.	Adaptation Fund GOSKN	MoF	6	Technical Challenges and Lack of Expertise	Complete market research study by end of Year 2	Delivery of market research report	50,000
	4.2 Engage with suppliers to negotiate favourable terms for bulk purchasing and long-term supply agreements.	Adaptation Fund	MOA MoF	6	Technical Challenges and Lack of Expertise Lack on Supplier Interest	Complete consultative process with suppliers by end of Year 2	Delivery of consultation report	50,000
	4.3 Develop and implement financial incentives, such as subsidies or tax breaks, to encourage local suppliers to import and stock soil moisture sensors.	Adaptation Fund GOSKN	MoF	6	Technical Challenges and Lack of Expertise	Complete incentive package by middle of Year 3.	Delivery of incentive regime	50,000

2.2 Project Ideas for the Agriculture Sector

2.2.1 Summary of project ideas for the agriculture sector

There are several concrete project ideas which can be extracted from the TAP to support phased actions towards the fulfilment of the overall goals for diffusion of IPM and soil moisture conservation and monitoring outlined in sections 2.1.2.2 and 2.1.3.2. Several project ideas are outlined in Table 2.17.

Table 2.17: Project ideas for the agriculture sector

Project Ideas	Overall TAP Target
Project Idea #1: Develop and implement training for both IPM and soil moisture conservation monitoring programs for extension officers and set up dedicated support teams within both departments of Agriculture. **Project Idea #2:** Develop and implement farmer field school to ensure in-depth knowledge of IPM and soil moisture conservation and monitoring among farmers including baseline surveys and demonstration plots on both islands. **Project Idea #3:** Conduct laboratory needs assessment and upgrade facilities to support pest identification and management, soil and water testing. **Project Idea #4:** Create a certification program for IPM-compliant products and develop marketing campaigns that emphasize health and environmental benefits of IPM-compliant produce to consumers.	Diffusion of IPM and soil moisture conservation on half of the active farms in St. Kitts and Nevis by 2030.

2.2.2 Specific project idea

Project idea #2 related to the development and implementation of farmer field schools for knowledge transfer related to IMP and soil moisture conservation is a priority for both departments of Agriculture and should be one of the first actions of the TAP for the agriculture sector. Table 2.18 summarizes the key elements of a future project proposal for this project.

Table 2.18: Key project proposal elements for selected project idea

Section	Narrative
Introduction/ Background	This project seeks to establish a Farmer Field School (FFS) focused on Integrated Pest Management (IPM) and soil moisture conservation techniques in St. Kitts and Nevis. The FFS will provide farmers with practical, hands-on training to enhance agricultural sustainability and resilience to climate change. The project idea was developed as part of the Technology Needs Assessment (TNA) for the agriculture sector in St. Kitts and Nevis, recognizing the critical role that knowledge transfer plays in climate change adaptation and food security. Baseline surveys, training programs, and demonstration plots on both islands will facilitate knowledge dissemination.
Objectives	The primary objectives of the project are: • Equip farmers with in-depth knowledge of IPM techniques to minimize pest damage and reduce pesticide use. • Train farmers in soil moisture conservation practices to improve water use efficiency and mitigate drought impacts.

	• Establish demonstration plots on both St. Kitts and Nevis for farmers to observe and practice the technologies. • Promote sustainable agricultural practices that increase resilience to climate change.
Outputs	**Baseline Surveys:** Comprehensive survey of farm pest issues and soil moisture management practices on 100 farms. **Training Programs:** 10 training sessions conducted annually, reaching at least 50 farmers in St. Kitts and Nevis. **Demonstration Plots:** 4 demonstration plots (2 on each island) showcasing IPM and soil moisture conservation practices. **Farmer Participation:** 100 farmers participating in field schools and adopting IPM and soil moisture techniques within 3 years.
Relationship to national priorities	This project supports St. Kitts and Nevis' sustainable development goals by: • Aligning with the **St. Kitts and Nevis Agricultural Transformation and Growth Strategy**, which prioritizes climate-resilient agriculture. • Contributing to the National Climate Change Adaptation Strategy by promoting sustainable farming practices. • Enhancing food security and reducing dependency on chemical pesticides and water-intensive practices.
Project deliverables	**Value/Benefits:** Improved crop yields, reduced reliance on chemical inputs, and increased resilience to climate change. **Messages:** Adoption of IPM and soil moisture conservation is critical for sustainable, profitable farming and national food security. The project is necessary to combat the increasing threats of pest infestations and drought conditions exacerbated by climate change.
Project scope	The project targets small and medium-scale farmers in St. Kitts and Nevis. It will focus on capacity building, knowledge transfer, and practical demonstrations.
Project activities	1. **Baseline Survey:** Conduct a comprehensive study to assess pest challenges and soil moisture management practices. 2. **Curriculum Development:** Develop a practical curriculum for IPM and soil moisture conservation field schools. 3. **Demonstration Plots:** Establish four demonstration plots showcasing IPM strategies and soil moisture conservation. 4. **Training Sessions:** Implement farmer field schools on both islands, focusing on hands-on learning. 5. **Knowledge Sharing Network:** Create a network for ongoing farmer-to-farmer knowledge exchange. 6. **Monitoring and Evaluation:** Regularly assess farmer adoption of IPM and soil moisture techniques.
Timelines	The project will be implemented over a 3-**year** period: **Year 1:** Baseline surveys, establishment of demonstration plots, and initial training sessions. **Year 2:** Full implementation of the Farmer Field School, ongoing training, and monitoring. **Year 3:** Evaluation of project outcomes and transition to long-term knowledge sharing networks.
Budget	**Total Budget:** USD 1,550,000 **Key Budget Items:** - Baseline surveys and data collection: USD 100,000 - Establishment of demonstration plots: USD 400,000 - Training programs and materials: USD 200,000 - Procurement of soil moisture sensors: USD 750,000 - Monitoring and evaluation: $50,000 - Administrative costs and coordination: $ 50,000
Measurement and evaluation	**Key Performance Indicators:** - Number of farmers trained and actively using IPM and soil moisture conservation techniques. - Percentage reduction in pesticide use on participating farms. - Increase in crop yields and water use efficiency as measured by farm surveys. Evaluations will be conducted annually to measure progress toward these targets

Possible challenges	**Farmer Resistance:** Farmers may be slow to adopt new practices. This will be mitigated through targeted awareness campaigns and showing tangible benefits through demonstration plots. **Climate Variability:** Unpredictable weather patterns could affect demonstration plots, but this risk will be minimized by selecting diverse locations and crops. **Funding Delays:** Delays in securing project funding may affect timelines; contingency plans include phased implementation.
Responsibilities / coordination	**Departments of Agriculture:** Lead coordination, oversee project management, and liaise with local farmers. **Agricultural Extension Officers:** Conduct training and manage demonstration plots. **Consultants:** Provide expertise in IPM and soil moisture techniques. **Farmers:** Actively participate in training and implement learned techniques on their farms. **Local Suppliers:** Provide necessary tools and inputs for IPM and moisture monitoring.

Chapter 3 Technology Action Plan and Project Ideas for the Energy Sector

3.1 TAP for the Energy Sector

The first sector prioritized for the TNA process for climate change mitigation is the transport sector. Two technologies were prioritized for the sector including: (1) Solar water heating and (2) Residential grid-tied solar.

Both the recent NDC (GOSKN, 2021c) and mitigation analysis chapters in the BUR1 and TNC (GOSKN, 2022a,b) assess progress towards mitigation actions identified in the National Climate Change Policy (GOSKN, 2017) and National Energy Policy and Action Plan (GOSKN, 2014). These important policy tools and action plans provide the roadmap for climate change mitigation in the Federation.

3.1.1 Energy Sector Overview

The St. Kitts Electricity Company Ltd. (SKELEC) was formed in 2011 (formerly the St. Kitts Electricity Department) and serves all of St. Kitts. Nevis Electricity Company Ltd. (NEVLEC) was formed in 2000 as a subsidiary of the Nevis Island Administration and serves all of Nevis Island. Both utilities provide electricity powered by diesel generators. Total installed capacity is 66 MW with 45.4 MW in St. Kitts and 20.6 MW in Nevis (NREL and CCREEE, 2020). Renewable energy including both solar (1.5 MW) and wind (2.2 MW) represents about 5.6% of installed capacity. Transmission and distribution losses are approximated at 20%.

GHG emissions in 2018 reached 182 ktCO_2-eq, which is an increase of 13.4% from 2014 (shown in Figure 3.1) (GOSKN 2022c). Further investments in renewable sources such as geothermal and photovoltaics have been announced and will be contributing to the future emission reductions in this sector.

Saint Kitts and Nevis' energy mix is currently dominated by fossil fuels. Saint Kitts and Nevis has declared a 61% CO2 emission reduction target by 2030, based on 2010 levels. Transitioning to 100% renewable energy in power generation by 2030 can help the islands achieve their overall targets. Recently, a study named the “Transmission and Distribution (T&D) Efficiency and Vulnerability Assessment Report for St. Kitts and Nevis" (TTPV, 2024a) evaluated the power systems on both islands, focusing on configurations, efficiency, resilience, vulnerabilities, and potential improvements. The key findings included:

Efficiency and Resilience:

- Power flow analysis indicates that shorter feeders can maintain voltage stability through 2044, but longer feeders (e.g., Cotton Ground and Gingerland in Nevis) need additional reactive compensation.
- **Vulnerabilities** include overhead infrastructure prone to weather-related disruptions, limited system redundancy, and manual operations. The absence of SCADA systems exacerbates reliability issues.

Electrical Losses:

- **Technical Losses** arise from conductor inefficiencies, transformer losses, and imbalances in power demand.
- **Non-technical Losses** include metering inaccuracies, billing issues, and energy theft. Advanced metering infrastructure (AMI) could help address these challenges.

Renewable Energy Integration:

- Large-scale PV installations will strain feeder capacities and voltage stability, with the proposed SKELEC 35.7 MW PV facility requiring a high-voltage transmission system.
- At the prosumer level, clear standards are needed for PV integration and energy storage solutions.

Interconnection Feasibility:

- Connecting St. Kitts and Nevis at 33 kV could improve thermal efficiency and reduce fuel consumption by 1.03 million liters annually, although high capital costs may delay implementation.

The main recommendations of the report include:

System Upgrades:

- Reconductoring weak feeder sections with higher capacity conductors.
- Implementing SCADA for better system monitoring and control.
- Replacing outdated switchboards with double busbar configurations to enhance operational flexibility.

Regulatory Enhancements:

- Formalize the Public Utilities Commission to regulate tariffs, efficiency, and service standards.
- Increase staffing in the Energy Unit for data collection and analysis.

Renewable Energy Incentives:

- Finalize and implement a net billing feed-in tariff to encourage prosumer participation in renewable energy generation.

As a follow-up to this study, a further assessment of the barriers to grid and tariff upgrades was conducted (TTPV, 2024b) which provides a comprehensive evaluation of the challenges and opportunities in modernizing the energy infrastructure of St. Kitts and Nevis. The report identifies significant barriers to grid modernization, including:

- **Technical barriers**: Aging infrastructure, challenges in integrating renewable energy, and lack of technical expertise.
- **Regulatory barriers**: Different frameworks in St. Kitts and Nevis, with no independent regulatory body to set consistent tariffs and ensure oversight.
- **Financial barriers**: High costs for grid upgrades and low collection rates from public institutions. For example, grid upgrades are estimated at USD 5.1 million for St. Kitts and USD 3 million for Nevis.

- **Environmental barriers**: The region's vulnerability to natural disasters and geographical isolation, leading to logistical challenges and higher costs.
- **Social and political barriers**: Public resistance to grid upgrades, coordination difficulties among stakeholders, and the complexities of integrating utilities under a unified system.

The report assesses the current tariff structures and recommends modernizing tariffs to enhance efficiency and encourage investments. Proposed changes include the introduction of Time-of-Use (TOU) pricing, penalties for excessive consumption, and a Renewable Energy Feed-In Tariff (FiT) to promote decentralized renewable generation. A five-year roadmap was provided, with the aim to improve grid resilience and sustainability through strategic planning, pilot projects, and phased upgrades. The GOSKN is in the advanced stages of development of a FiT (GOSKN, 2024c).

In the Nationally Determined Contributions (NDCs) (GOSKN, 2021c) and NDC Implementation Plan (GOSKN, 2022d), the twin-island Federation has set a goal to reach 100% renewable energy (RE) generation through the following renewable energy projects:

1. 35.7 MW utility-scale solar PV capacity with 44.2 MWh lithium-ion battery storage facility by 2025
2. 10 MW geothermal power in Nevis by 2030
3. 6.6 MW wind power in St. Kitts by 2030
4. 15 MW geothermal power capacity in St. Kitts by 2035

In the years since the development of the NDC, priorities have shifted with more focus on geothermal (new goal of 30MW in Nevis by 2030) and less focus on wind power (no project in the pipeline to realize this goal) (personal communication, Energy Unit, 2024). Also, utility-scale PV still has the same target but will not be completed in 2025.

The estimated GHG emission reduction related to the implementation of RE in the Federation as outlined above (when implemented alone with the original NDC targets) is 129.15 ktCO2-eq compared to the baseline. Successful implementation of the RE in SKN would increase the proportion of clean renewable energy in the national energy mix; lower and stabilize energy prices; reduce reliance on imported fossil fuels; reduce carbon emissions; increase energy independence; and promote economic development.

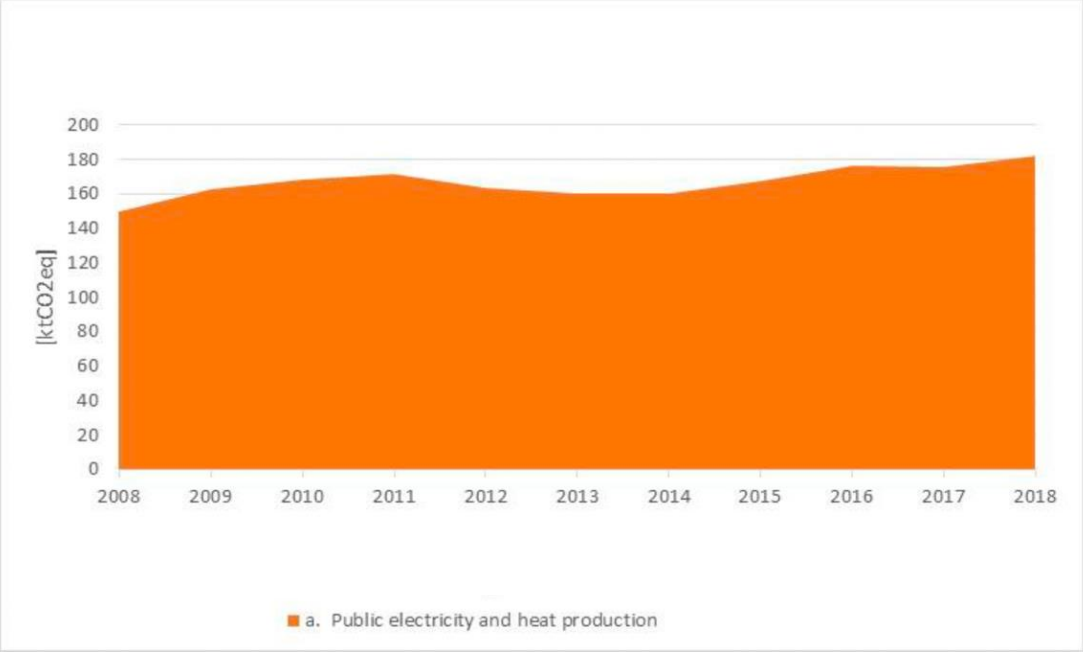

Figure 3.1: GHG emissions for the Energy Sector for St. Kitts and Nevis (2018)

3.1.2 Action plan for solar water heating

3.1.2.1 Introduction

Solar water heating (SWH) was included in the TNA as a mitigation technology due to its potential to reduce energy costs for heating water and imports of fossil fuels, to improve consumer welfare and to reduce GHG emissions.

Energy efficient solar water heating is an affordable practice to mitigate climate change, prevent excess demand of electricity, avoid electricity rationing (blackouts), reduce the investment in power generation, and reduce the cost of energy subsidies. Further, solar water heating provides savings at country and citizen levels, in financial, environmental and energy terms. These reduce the value of electricity bills as well as imports of fossil fuels, improve consumer welfare and reduce carbon dioxide emissions (UNEP / CLASP 2015).

Solar water heaters are commonplace in many SIDS such as Barbados and Bermuda. There are several examples in St. Kitts and Nevis at the residential level and local suppliers are available.

3.1.2.2 Ambition for the TAP

In alignment with the mitigation chapters of the Third National Communication (TNC) (GOSKN, 2021a, 2022b) and the first Biennial Update Report (BUR1) (GOSKN, 2022a), the Nationally Determined Contributions (NDCs) (GOSKN, 2021c), NDC Implementation Plan (GOSKN, 2022d) and the SKN Energy Policy and Action Plan (GOSKN, 2014), the long-term target for solar water heaters (residential and commercial) is 40% by 2040 of all households (total number of households approximately 25,000 in 2040). The estimated GHG emission reduction related to the implementation of solar water heaters is 5.54 $ktCO_2$-eq compared to

the baseline (GOSKN, 2021c). Given the time that has already elapsed since the NDCs, the SWG adjusted the target timeline to 2040. The investment required for this diffusion target including feasibility studies, incentives plans, and solar water heating units was approximated at 20 M USD (GOSKN, 2021c) (15 M USD for St. Kitts and 5 M USD for Nevis). The key targets chosen by the SWG for the diffusion of SWH in St. Kitts and Nevis are outlined in Table 3.1. The activities outlined in this TAP provide the foundation to achieve this long-term target. The shorter-term TAP target is one comprehensive study including surveys, economic assessments, market research, incentive regime and technical standards, one public awareness campaign and installation of 30 SWHs at critical government infrastructure (health centres, schools etc.) by 2028.

Table 3.1: Key targets for diffusion of SWH

Action	Target
Total number of solar water heaters installed by 2040	10,000 units across both islands
Survey on use and penetration of solar water heating and economic feasibility and design of incentive regime	One comprehensive study
Public education and outreach campaign	One comprehensive campaign for both islands

3.1.2.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, the SWG identified two (2) economic and financial and one (1) non-financial barrier to the adoption of solar water heaters including:

1. High capital costs
2. Lack of funding and financial incentives such as subsidies or low-interest loans
3. Limited access to training and technical expertise in installation of solar water heaters

The root causes to the high capital costs of solar water heaters (and residential solar PV systems) are the lack of financing options, few local suppliers and overall limited awareness of the benefits of solar technologies. In looking more closely at the lack of funding and financial incentives, lack of specific policies promoting solar water heating, limited government resources and restricted fiscal space and limited overall awareness of the benefits of solar water heating are root causes which are inter-related and mutually reinforcing. As it relates to limited access to training / expertise in installation of SWH, the root causes which are tied with overall lack of awareness of the important benefits of solar water heating and more specifically to the need for skilled installation and maintenance. Furthermore, the absence of government mandate for skill development in renewable energy further reinforces this problem. Recently, there has been some work on the ground to create an enabling environment for the upskilling of technicians in St. Kitts and Nevis as they seek to enter the fields of renewable energy especially regarding solar technologies. The Clarence Fitzroy Bryant College (CFBC) in St. Kitts has partnered with Green Solutions International (GSI) to create more opportunities for upskilling (SKNIS, 2024). They have received a grant from the GEF UNDP Small Grant Program to design, implement, and operate a centre for research, innovation, and workforce training for solar and electric vehicle technologies. The initiative seeks to address the energy gap but also

aims to empower local communities by providing opportunities for workforce development, job creation, and entrepreneurship in the green technology sector.

Table 3.2 identified key measures to overcome the barriers for greater diffusion of SWH.

Table 3.2: Key measures to overcome barriers for greater diffusion of SWH

Barriers	Measures
High capital costs and lack of funding and financial incentives such as subsidies or low-interest loans (for both solar water heaters and residential grid-tied solar PV systems)	• The government can offer subsidies that reduce the upfront cost of solar water heaters and solar PV systems, making them more affordable for the average consumer. • Encouraging bulk purchasing and offering incentives for suppliers could increase competition and supply, potentially reducing costs. • Financial institutions, possibly with government backing or through public private partnerships, could provide low-interest loans specifically for solar energy investments. • Establishing green energy bonds or other innovative financing mechanisms to provide capital for residential solar projects. • Creating economies of scale by supporting community solar programs to reduce installation and equipment costs.
Limited access to training and technical expertise in installation of solar technologies	• Developing and funding training programs at local educational institutions to increase the number of qualified installers and maintenance personnel. • Establish certification programs for solar technology installers to ensure quality control and customer confidence. • Increase awareness of the benefits of solar water heating and residential grid-tied solar PV systems through campaigns, workshops, and showcasing successful installations.

In determining the key actions and activities for the TAP, the SWG focused its consultations on developing partnerships with SWH suppliers and local businesses, enhancing supply chains and pilot projects to demonstrate the benefits of the technology. Table 3.3 summarizes the key actions and associated activities (Table 3.4) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 3.3: Key actions for greater diffusion of SWH

Action	Description
Action 1	Comprehensive feasibility study on the use and penetration of solar water heating including economic assessments, design and roll-out of incentive regimes and guidelines to ensure safety and reliability
Action 2	Expand and implement training programs for plumbers and electricians
Action 3	Develop and implement pilot projects at critical government buildings
Action 4	Design and roll-out public awareness campaign and community engagement

Table 3.4: Key activities for greater diffusion of SWH

Action 1: Comprehensive feasibility study on the use and penetration of solar water heating including economic assessments, design and roll-out of incentive regimes and guidelines to ensure safety and reliability
1.1 Conduct household and business surveys to understand current water heating practices and energy consumption patterns.
1.2 Conduct market analysis to identify potential suppliers and manufacturers of SWH systems and to analyze the supply chain to understand availability and cost of components needed.
1.3 Assess the financial feasibility of various incentive regimes, such as tax credits, rebates, and subsidies.
1.4 Design and roll-out incentive regime to local businesses to facilitate bulk imports.
1.5 Develop and establish technical guidelines and standards for the safe and efficient installation of SWH systems.
Action 2: Expand and implement training programs for plumbers and electricians
2.1 Develop and enhance comprehensive training curriculum.
2.2 Partner with AVEC / CFBC and Nevis Sixth Form College to integrate SWH training into their programs.
2.3 Conduct training of trainers.
2.4 Launch new revamped programs.
Action 3: Develop and implement pilot projects at critical government buildings
3.1 Site assessment and selection focusing on critical buildings such as emergency shelters, health centres or schools.
3.2 Develop detailed pilot project plans, including design specifications, timelines and budgets.
3.3 Install and commission SWH systems at selected sites.
3.4 Monitor and evaluate systems to track energy savings, cost reduction and system performance and assess the impact of the pilot projects.
Action 4: Design and roll-out public awareness campaign and community engagement
4.1 Develop educational materials explaining the benefits of SWH.
4.2 Launch campaign using various media channels to disseminate information
4.3 Organize community events and open house events at pilot project sites to showcase SWH systems.

3.1.2.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater diffusion of SWH in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 3.5.

Table 3.5: Key stakeholders for greater diffusion of SWH

Stakeholder	Role
Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport (MPI), Energy Unit	- Coordination and project management - Develop and enforce policies and regulations that support the adoption of SWH - Launch nationwide awareness campaigns to educate the public on the benefits of SWH. - Engage with communities and stakeholders to promote the adoption of SWH.
Ministry of Finance (MoF)	- Implement tax incentives, subsidies, and other financial mechanisms to lower the cost of SWH. - Allocate budget for infrastructure development, such as grid upgrades.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Bureau of Standards	- Establish guidelines for the installation of SWH and ensure compliance with safety standards.
Ministry of Justice and Legal Affairs	- Legal drafting of regulations
Ministry of Education (MoE)	- Develop and incorporate lessons about SWH, renewable energy, and climate change into the curriculum. - Develop training curriculum in collaboration with CFBC / AVEC / vocational schools
Private Sector (SWH suppliers)	- Import and supply SWH to the local market. - Work with manufacturers to bring down the cost of SWH by negotiating bulk purchases. - Partner with the government to offer favourable loan conditions or leasing options for SWH buyers. - Provide financial products that make purchasing SWH more accessible to consumers.
Utility companies (SKELEC and NEVLEC)	- Collaborate with the government and private sector to ensure the stability of the grid. - Promote the integration of renewable energy sources (such as solar power) into the grid. - Provide technical expertise and support in the development and maintenance of SWH.
Educational and Vocational Institutions (CFBC and AVEC)	- Develop and deliver training programs for mechanics on the maintenance and repair of SWH. - Incorporate SWH technology and renewable energy concepts into the school curriculum to educate future generations.

Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of SWH through various media channels. - Highlight success stories, case studies, and interviews with early adopters of SWH technology. - Provide accurate and timely information about government policies, incentives, and available financial options for SWH. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of SWH.
Local communities and consumers	- Participate in pilot projects and provide feedback on their effectiveness. - Consider the long-term benefits of SWH when making vehicle purchasing decisions. - Advocate for better infrastructure and policies that support cleaner energy options. - Engage in community discussions and activities related to use of solar technologies.

To ensure the successful implementation of the Technology Action Plan (TAP) for the transition to SWH in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. Below is a summary of the sequence and timing for the specific activities:

Year 1: Initial Research and Planning

1. Conduct Household and Business Surveys
- Nature and scale: Data collection through surveys to understand water heating practices and energy consumption. Involving a significant number of households and businesses across St. Kitts and Nevis.
- Timing: Months 1-3

2. Conduct Market Analysis
- Nature and scale: Research to identify potential suppliers, manufacturers, and analyze the supply chain. Medium-scale; involves coordination with local and international suppliers and manufacturers.
- Timing: Months 2-6

3. Site Assessment and Selection for Pilot Projects
- Nature and scale: Technical evaluation of government buildings (e.g., emergency shelters, health centres, schools) for SWH installation. Small-scale; focused on a select number of critical government buildings.
- Timing: Months 6-9

4. Enhance Comprehensive Training Curriculum and Partner with AVEC/CFBC/Nevis Sixth Form College to Integrate SWH Training
- Nature and scale: Curriculum development for plumbers and electricians on SWH systems. Medium-scale; involves educational institutions and industry experts.
- Timing: Months 6-12

5. Develop Educational Materials for Public Awareness Campaign

- Nature and scale: Creation of informational content highlighting the benefits of SWH. Medium-scale; to be distributed across various media channels.
- Timing: Months 3-12

Year 2: Implementation and Initial Training

6. Assess Financial Feasibility of Incentive Regimes and Design and Roll-out Incentive Regime

- Nature and scale: Economic assessment, design and roll-out of incentives like tax credits, rebates, and subsidies. Medium-scale; involves financial modelling and consultation with stakeholders.
- Timing: Months 12-24

7. Develop Technical Guidelines and Standards

- Nature and scale: Establishment of installation and safety standards for SWH systems. Large-scale; involves industry-wide application.
- Timing: Months 12-18

8. Install and Commission SWH Systems at Selected Sites

- Nature and scale: Installation of SWH systems in selected government buildings. Small-scale; pilot projects limited to a few sites.
- Timing: Months 18-24

9. Launch Public Awareness Campaign

- Nature and scale: Public campaign using media channels to promote SWH benefits. Large-scale; reaching the public across St. Kitts and Nevis.
- Timing: Months 20-24

Year 3: Expansion and Monitoring

10. Conduct Training of Trainers and Launch Revamped Training Programs

- Nature and scale: Specialized training for individuals who will train plumbers and electricians. Medium-scale; involves select groups of trainers.
- Timing: Months 24-30

11. Monitor and Evaluate Pilot SWH Systems

- Nature and scale: Continuous monitoring of SWH systems installed in pilot sites to assess energy savings and performance. Small-scale; focused on the pilot sites.
- Timing: 24-36

12. Organize Community Events and Open House Events

- Nature and scale Community engagement through events at pilot sites to showcase SWH systems. Medium-scale; several events targeting different communities.
- Timing: Months 30-36

13. Conduct Comprehensive Evaluation of SWH Adoption and Performance

- Nature: Final evaluation of SWH diffusion, energy savings, cost benefits, and overall program success. Large-scale; involving all installations and stakeholder feedback.
- Timing: Months 31-36.

This three-year timeline provides a phased approach, starting with research and planning, moving to initial implementation and training, expanding through pilot projects, and culminating in a comprehensive evaluation of the SWH program.

3.1.2.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the transition to residential grid-tied solar.

The Energy Unit within the Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport requires human resources (at least 2-3 new officers) with key technical skills related to SWH systems notably at least one mechanical / electrical engineer and one project manager (with some thought to additional staffing for public education and awareness). In supporting roles, from the Ministry of Finance or Sustainable Development, at least one financial analyst or economist with expertise in financial modelling, cost-benefit analysis and design of incentive regimes. From the Ministry of Education, technical instructor to help validate training programmes and to integrate lessons plans on solar technologies into the curriculum at various levels. From the Ministry of Legal Affairs, a legal draftsperson with expertise in environmental law, regulatory frameworks and contract law.

Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 3.6 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the Nationally Determined Contributions (NDCs) (GOSKN, 2021c), NDC Implementation Plan (GOSKN, 2022d) and the SKN Energy Policy and Action Plan (GOSKN, 2014). In addition, the senior staff the Energy Unit and both electrical utilities (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies. These estimates are robust and indicative in the absence of full feasibility studies, which would generally be required once concept notes are approved, and full detailed project designs are being finalized.

Table 3.6: Estimated costs per activity for greater diffusion of SWH

Action 1: Comprehensive feasibility study on the use and penetration of solar water heating including economic assessments, design and roll-out of incentive regimes and guidelines to ensure safety and reliability	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
1.1 Conduct household and business surveys to understand current water heating practices and energy consumption patterns.	100,000	
1.2 Conduct market analysis to identify potential suppliers and manufacturers of SWH systems and to analyze the supply chain to understand availability and cost of components needed.	50,000	
1.3 Assess the financial feasibility of various incentive regimes, such as tax credits, rebates, and subsidies.	50,000	
1.4 Design and roll-out incentive regime to local businesses to facilitate bulk imports.	100,000	
1.5 Develop and establish technical guidelines and standards for the safe and efficient installation of SWH systems.	50,000	
Action 2: Expand and implement training programs for plumbers and electricians	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
2.1 Enhance comprehensive training curriculum.	50,000	
2.2 Partner with AVEC / CFBC/Nevis Sixth Form College to integrate SWH training into their programs.	100,000	50,000
2.3 Conduct training of trainers.	20,000	
2.4 Launch new revamped programs.	20,000	
Action 3: Develop and implement pilot projects at critical government buildings	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
3.1 Site assessment and selection focusing on critical buildings such as emergency shelters, health centres or schools.	50,000	
3.2 Develop detailed pilot project plans, including design specifications, timelines and budgets.	75,000	
3.3 Install and commission SWH systems at selected sites.		30 units X 5,000 USD = 150,000 USD
3.4 Monitor and evaluate systems to track energy savings, cost reduction and system performance and assess the impact of the pilot projects.	20,000	
Action 4: Design and roll-out public awareness campaign and community engagement	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
4.1 Develop educational materials explaining the benefits of SWH.	50,000	
4.2 Launch campaign using various media channels to disseminate information	50,000	

4.3 Organize community events and open house events at pilot project sites to showcase SWH systems.	50,000	
TOTAL	835,000	200,000

3.1.2.6 Management planning

Table 3.7 summarizes some of the key risks and their associated contingency actions.

Table 3.7: Key risks and contingency actions for greater diffusion of SWH

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.
Delays in SWH installation	Delays in the installation of SWH units	Prioritize High-Demand Areas: Focus initial infrastructure development in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement of SWH and associated equipment.	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and Lack of Expertise	Technical issues related to the installation, maintenance, and operation of SWH.	Training and Capacity Building: Invest in comprehensive training programs for local technicians to build in-country expertise. Technical Partnerships: Partner with international experts or companies with experience in SWH technology to provide technical support and knowledge transfer. Regular Maintenance and Monitoring: Implement a robust monitoring system to identify and address technical issues early, minimizing disruptions.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty for investors and stakeholders, hindering progress.	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives. Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.
Limited Public Acceptance and Adoption of SWH	Resistance from the public due to a lack of awareness or trust in new technology	Enhanced Public Education Campaign: Intensify efforts to educate the public on the long-term benefits, cost savings, and environmental impacts of SWH. Incentivize Early Adopters: Provide additional incentives, such as tax breaks or rebates, to early adopters of SWH to create a positive demonstration effect.

		Community Engagement: Engage community leaders and influencers to advocate for the adoption of SWH within their communities.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Energy Unit of the Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport is critical to ensure the Unit can effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.
2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

3.1.2.7 TAP overview

Table 3.8: TAP overview table for greater diffusion of SWH

Sector	Energy							
Technology	Solar water heating							
Ambition	The long-term target for solar water heaters (residential and commercial) is 40% by 2040 of all households. By the end of Year 3 of this TAP, one comprehensive study including surveys, economic assessments, market research, incentive regime and technical standards, one public awareness campaign and installation of 30 SWHs at critical government infrastructure (health centres, schools etc.) by 2028.							
Benefits	Energy efficient solar water heating is an affordable practice to mitigate climate change, prevent excess demand of electricity, avoid electricity rationing (blackouts), reduce the investment in power generation, and reduce the cost of energy subsidies.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Comprehensive feasibility study on the use and penetration of solar water heating including economic assessments, design and roll-out of incentive regimes and guidelines to ensure safety and reliability	1.1 Conduct household and business surveys to understand current water heating practices and energy consumption patterns.	GCF GOSKN	MPI	6	Insufficient Funding and Financial Support	Complete survey by end of Year 1	Survey results	100,000
	1.2 Conduct market analysis to identify potential suppliers and manufacturers of SWH systems and to analyze the supply chain to understand availability and cost of components needed.	GCF	MPI / MoF	4	Insufficient Funding and Financial Support	Complete market analysis by end of Year 1	Delivery of market analysis report	50,000
	1.3 Assess the financial feasibility of various incentive regimes, such as tax credits, rebates, and subsidies.	GCF	MPI / MoF	3	Technical Challenges and Lack of Expertise	Complete economic assessment by end of Year 1	Delivery of economic assessment report	50,000
	1.4 Design and roll-out incentive regime to local businesses to facilitate bulk imports.	GCF GOSKN	MoF	9	Policy and Regulatory Uncertainty Insufficient Funding and	Complete design of incentive regime by end of Year 1 Achieve 20% of local hardware	Delivery and roll-out of incentive regime Number of applicants	100,000

					Financial Support	businesses applying for incentives for bulk import		
	1.5 Develop and establish technical guidelines and standards for the safe and efficient installation of SWH systems.	GCF GOSKN	MPI / Bureau of Standards	6	Technical Challenges and Lack of Expertise	Complete technical guidelines and standards by middle of Year 2	Delivery of technical guidelines	50,000
Action 2: Expand and implement training programs for plumbers and electricians	2.1 Enhance comprehensive training curriculum.	GCF	MoE	6	Technical Challenges and Lack of Expertise	Complete technical skills program by end of Year 2	Delivery of training programs	50,000
	2.2 Partner with AVEC / CFBC / Nevis Sixth Form College to integrate SWH training into their programs.	GCF	MoE	3	Technical Challenges and Lack of Expertise	Complete consultative process with CFBC / AVEC by end of Year 2	Delivery of consultation report	150,000
	2.3 Conduct training of trainers.	GCF	MoE	6	Technical Challenges and Lack of Expertise	Train at least 10 trainers by end of Year 3	Number of individuals trained Percentage of trainees who pass certification assessments	20,000
	2.4 Launch new revamped programs.	GCF GOSKN	MoE	3	Insufficient Funding and Financial Support	Achieve a satisfaction rate of 80% or higher among trainees	Survey results from trainees	20,000
Action 3: Develop and implement pilot projects at	3.1 Site assessment and selection focusing on critical buildings such as emergency shelters, health centres or schools.	GCF GOSKN	MPI	3	Technical Challenges and Lack of Expertise	Complete site assessment and selection by end of Year 1	Delivery of site assessment study	50,000

critical government buildings	3.2 Develop detailed pilot project plans, including design specifications, timelines and budgets.	GCF	MPI	6	Technical Challenges and Lack of Expertise	Complete design reports by end of Year 1	Delivery of design report	75,000
	3.3 Install and commission SWH systems at selected sites.	GCF	MPI	6	Insufficient Funding and Financial Support Supply Chain Disruptions	Complete installation of 30 SWH systems by end of Year 2	Number of SWH installed and operational	150,000
	3.4 Monitor and evaluate systems to track energy savings, cost reduction and system performance and assess the impact of the pilot projects.	GCF GOSKN	MPI	12	Technical Challenges and Lack of Expertise	Achieve at least 50% energy savings and cost reductions	Analysis results	20,000
Action 4: Design and roll-out public awareness campaign and community engagement	4.1 Develop educational materials explaining the benefits of SWH.	GCF	MPI	9	Insufficient Funding and Financial Support	Complete design of public awareness campaign by middle of Year 1	Delivery of design report	50,000
	4.2 Launch campaign using various media channels to disseminate information	GCF	MPI	4	Limited Public Acceptance	Achieve an engagement rate of 75% on social media platforms	Number of likes, shares, comments and other interactions on campaign-related content	50,000
	4.3 Organize community events and open house events at pilot project sites to showcase SWH systems.	GCF	MPI	3	Limited Public Acceptance	Increase public awareness of the benefits of SWH by 50% by end of Year 3	Survey results	50,000

3.1.3 Action plan for residential grid-tied solar

3.1.3.1 Introduction

Solar photovoltaic refers to the technology of using solar cells to convert solar radiation directly into electricity. A solar cell works based on the photovoltaic effect which can be briefly summarized as sunlight striking a semiconductor and causing electrons to be excited due to energy in the sunlight (photons). Grid-connected PV systems do not require energy storage but instead use an inverter to convert electricity from direct current (DC) to alternating current (AC) and the generated electricity is then fed into the grid distribution network to consumers. Grid-connected distributed PV systems are installed on residential, commercial, or public buildings and generate electricity which is consumed by the customer and the excess is sent/sold to the grid to be consumed by other users. Most distributed systems range between 1-5 kW in power generation. Grid-tied systems are equipped with a bi-directional meter that can measure electricity flow in both directions – to and from the grid. This is essential for net metering, a billing mechanism that credits solar energy system owners for the electricity they add to the grid. The main benefits of household PV systems including enhanced energy savings, reduced dependence on fossil fuels for electricity and increased energy security.

In St. Kitts and Nevis, there are residential and commercial PV systems that have been installed but in the absence of net metering and the high initial capital investment, the diffusion of the technology has been slow.

3.1.3.2 Ambition for the TAP

As it relates to residential scale grid-tied PV systems, this technology was not included as part of the mitigation actions in the NDCs as the focus was utility scale PV as the Federation aims to transition to 100% renewable energy. However, the diffusion of distributed solar technologies was still included as an activity in the NDC Implementation Plan but without a definite target (GOSKN, 2022d). As such, the SWG chose a diffusion capacity of residential scale grid-tied PV of 5 MW for St. Kitts and 2 MW for Nevis and extended the timeline to 2040. Table 3.9 presents targets for the scale of diffusion for residential grid tied solar PV systems. The activities outlined in this TAP provide the foundation to achieve this long-term target. The shorter-term TAP target is one comprehensive study including surveys, economic assessments, market research, feed-in tariff, incentive regime and technical standards, one public awareness campaign and installation of 500 kW installed capacity at critical government buildings by 2028.

Table 3.9: Key targets for diffusion of residential grid-tied solar PV systems

Action	Target
Total capacity of residential grid-tied PV systems by 2040	Various unit sizes (max. 100 kw) for a total of 5 MW for St. Kitts and 2 MW for Nevis.
Net metering tariff study, regulations, and incentive regime for rooftop solar developed	Net metering and incentive regime in place

Public education and outreach campaign	One comprehensive campaign for both islands

3.1.3.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, the SWG identified one (1) economic and financial and two (2) non-financial barriers (legal and regulatory and technical) to the diffusion of grid-tied residential solar systems including:

1. Inadequate legal frameworks especially absence of feed in tariffs to support adoption of residential PV systems
2. High capital costs
3. Grid infrastructure may not be able to handle variable output of solar PV systems

The root causes to the high capital costs of residential solar PV systems are the lack of financing options, few local suppliers and overall limited awareness of the benefits of solar technologies. As it related to the inadequate legal frameworks especially lack of feed-in tariffs, the main root causes were found to be limited government resource allocation to incentives related to renewables and limited exposure to successful models of feed-in tariff implementation leading to the absence of a government mandate for supporting residential grid-tied PV systems. Closely related is the insufficient grid infrastructure to support feed-in systems, which has as its root cause a dependence on external expertise for grid improvements, inadequate planning for integration of variable renewable energy sources and lack of advanced grid management and storage technologies. Table 3.10 identified the key measures to overcome the barriers to greater diffusion of residential grid tied solar.

Table 3.10: Key measures to overcome barriers for greater diffusion of residential grid tied solar

Barriers	Measures
High capital costs and lack of funding and financial incentives such as subsidies or low-interest loans (for both solar water heaters and residential grid-tied solar PV systems)	• The government can offer subsidies that reduce the upfront cost of solar water heaters and solar PV systems, making them more affordable for the average consumer. • Encouraging bulk purchasing and offering incentives for suppliers could increase competition and supply, potentially reducing costs. • Financial institutions, possibly with government backing or through public private partnerships, could provide low-interest loans specifically for solar energy investments. • Establishing green energy bonds or other innovative financing mechanisms to provide capital for residential solar projects. • Creating economies of scale by supporting community solar programs to reduce installation and equipment costs.
Inadequate legal frameworks especially absence of feed in tariffs to support adoption of residential PV systems	• Introduction of feed-in tariffs to provide long-term security and financial returns for solar PV system owners.
Grid infrastructure may not be able to handle variable output of solar PV systems	• Comprehensive modernization of the grid and associated investment is needed to make it more resilient and adaptable to distributed generation sources along with • Research and development into energy storage solutions

In determining the key actions and activities for the TAP, the SWG focused its consultations on setting the foundation for effective diffusion of residential PV by focusing on a properly structured feed-in tariff and incentive regime along with demonstration of the technology. Table 3.11 summarizes the key actions and associated activities (Table 3.12) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 3.11: Key actions for greater diffusion of residential grid-tied solar

Action	Description
Action 1	Comprehensive feasibility studies on the use and penetration of residential grid-tied solar PV system including economic assessments, feed-in tariff and incentive design study and roll-out and guidelines to ensure safety and reliability.
Action 2	Expand and implement training programs for technicians.
Action 3	Develop and implement pilot projects at critical government buildings.
Action 4	Design and roll-out public awareness campaign and community engagement.

Table 3.12: Key activities for greater diffusion of residential grid-tied solar

Action 1: Comprehensive feasibility studies on the use and penetration of residential grid-tied solar PV system including economic assessments, feed-in tariff and incentive design study and roll-out and guidelines to ensure safety and reliability.
1.1 Conduct household and business surveys to understand current energy consumption patterns.
1.2 Conduct market analysis to identify potential suppliers and manufacturers of home solar PV systems and to analyze the supply chain to understand availability and cost of components needed.
1.3 Upgrade current feed-in tariffs studies and roll-out feed-in tariff to encourage purchase of home solar PV systems.
1.4 Assess the financial feasibility of various incentive regimes, such as tax credits, rebates, and subsidies.
1.5 Design and roll-out incentive regime to local businesses to facilitate bulk imports.
1.6 Develop and establish technical guidelines and standards for the safe and efficient installation of home solar PV systems.
Action 2: Expand and implement training programs for technicians.
2.1 Enhance comprehensive training curriculum.
2.2 Partner with AVEC / CFBC / Nevis Sixth Form College to integrate SWH training into their programs.
2.3 Conduct training of trainers.
2.4 Launch new revamped programs.
Action 3: Develop and implement pilot projects at critical government buildings
3.1 Site assessment and selection focusing on critical buildings such as emergency shelters, health centres or schools.
3.2 Develop detailed pilot project plans, including design specifications, timelines and budgets.
3.3 Install and commission solar PV systems at selected sites.
3.4 Monitor and evaluate systems to track energy savings, cost reduction and system performance and assess the impact of the pilot projects.
Action 4: Design and roll-out public awareness campaign and community engagement
4.1 Develop educational materials explaining the benefits of residential grid-tied solar PV systems.
4.2 Launch campaign using various media channels to disseminate information
4.3 Organize community events and open house events at pilot project sites to showcase solar PV systems.

3.1.3.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater diffusion of residential grid-tied solar PV systems in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 3.12.

Table 3.12: Key stakeholders for greater diffusion of residential grid tied solar

Stakeholder	Role
Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport (MPI), Energy Unit	- Coordination and project management - Develop and enforce policies and regulations that support the adoption of solar PV systems - Establish guidelines for the installation of solar PV systems and ensure compliance with safety standards. - Launch nationwide awareness campaigns to educate the public on the benefits of solar PV systems. - Engage with communities and stakeholders to promote the adoption of solar PV systems.
Ministry of Finance (MoF)	- Implement tax incentives, subsidies, and other financial mechanisms to lower the cost of solar PV systems. - Allocate budget for infrastructure development, such as grid upgrades.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Bureau of standards	- Establish guidelines for the installation of solar PV systems and ensure compliance with safety standards.
Ministry of Justice and Legal Affairs	- Legal drafting of regulations
Ministry of Education (MoE)	- Develop and incorporate lessons about solar PV systems, renewable energy, and climate change into the curriculum.
Private Sector (solar PV system suppliers)	- Import and supply solar PV systems to the local market. - Work with manufacturers to bring down the cost of solar PV systems by negotiating bulk purchases. - Partner with the government to offer favourable loan conditions or leasing options for solar PV system buyers. - Provide financial products that make purchasing of solar PV systems more accessible to consumers.
Utility companies (SKELEC and NEVLEC)	- Collaborate with the government and private sector to ensure the stability of the grid. - Promote the integration of renewable energy sources (such as solar power) into the grid. - Provide technical expertise and support in the development and maintenance of solar PV systems.

Educational and Vocational Institutions (CFBC and AVEC)	- Develop and deliver training programs for mechanics on the maintenance and repair of solar PV systems. - Incorporate solar PV systems technology and renewable energy concepts into the school curriculum to educate future generations.
Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of solar PV systems through various media channels. - Highlight success stories, case studies, and interviews with early adopters of solar PV systems technology. - Provide accurate and timely information about government policies, incentives, and available financial options for solar PV systems. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of solar PV systems.
Local communities and consumers	- Participate in pilot projects and provide feedback on their effectiveness. - Consider the long-term benefits of solar PV systems when making vehicle purchasing decisions. - Advocate for better infrastructure and policies that support cleaner energy options. - Engage in community discussions and activities related to use of solar technologies.

To ensure the successful implementation of the Technology Action Plan (TAP) for the transition to residential grid-tied solar PV systems in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. Below is a summary of the sequence and timing for the specific activities:

Year 1: Initial Research and Planning

1. Conduct Household and Business Surveys
- Nature and scale: Data collection through surveys to understand water heating practices and energy consumption. Involving a significant number of households and businesses across St. Kitts and Nevis.
- Timing: Months 1-3

2. Conduct Market Analysis
- Nature and scale: Research to identify potential suppliers, manufacturers, and analyze the supply chain. Medium-scale; involves coordination with local and international suppliers and manufacturers.
- Timing: Months 2-6

3. Site Assessment and Selection for Pilot Projects
- Nature and scale: Technical evaluation of government buildings (e.g., emergency shelters, health centres, schools) for solar PV system installation. Small-scale; focused on a select number of critical government buildings.
- Timing: Months 6-9

4. Enhance Comprehensive Training Curriculum and Partner with AVEC/CFBC/Nevis Sixth Form College to Integrate solar PV systems
- Nature and scale: Curriculum development for technicians focused on solar PV systems. Medium-scale; involves educational institutions and industry experts.

- Timing: Months 6-12

5. Develop Educational Materials for Public Awareness Campaign
- Nature and scale: Creation of informational content highlighting the benefits of solar PV systems. Medium-scale; to be distributed across various media channels.
- Timing: Months 3-12

Year 2: Implementation and Initial Training

6. Assess Financial Feasibility of Incentive Regimes and Feed-In Tariffs and Design and Roll-out Both.
- Nature and scale: Economic assessment, design and roll-out of a feed-in tariffs and incentives like tax credits, rebates, and subsidies. Medium-scale; involves financial modelling and consultation with stakeholders.
- Timing: Months 12-24

7. Develop Technical Guidelines and Standards
- Nature and scale: Establishment of installation and safety standards for solar PV systems. Large-scale; involves industry-wide application.
- Timing: Months 12-18

8. Install and Commission Solar PV Systems at Selected Sites
- Nature and scale: Installation of solar PV systems in selected government buildings. Small-scale; pilot projects limited to a few sites.
- Timing: Months 18-24

9. Launch Public Awareness Campaign
- Nature and scale: Public campaign using media channels to promote solar PV benefits. Large-scale; reaching the public across St. Kitts and Nevis.
- Timing: Months 20-24

Year 3: Expansion and Monitoring

10. Conduct Training of Trainers and Launch Revamped Training Programs
- Nature and scale: Specialized training for individuals who will train technicians. Medium-scale; involves select groups of trainers.
- Timing: Months 24-30

11. Monitor and Evaluate Pilot Solar PV Systems
- Nature and scale: Continuous monitoring of solar PV systems installed in pilot sites to assess energy savings and performance. Small-scale; focused on the pilot sites.
- Timing: 24-36

12. Organize Community Events and Open House Events
- Nature and scale Community engagement through events at pilot sites to showcase solar PV systems. Medium-scale; several events targeting different communities.
- Timing: Months 30-36

13. Conduct Comprehensive Evaluation of Solar PV Adoption and Performance

- Nature: Final evaluation of solar PV systems diffusion, energy savings, cost benefits, and overall program success. Large-scale; involving all installations and stakeholder feedback.
- Timing: Months 31-36.

This three-year timeline provides a phased approach, starting with research and planning, moving to initial implementation and training, expanding through pilot projects, and culminating in a comprehensive evaluation of the solar PV program.

3.1.3.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the transition to residential grid-tied solar.

The Energy Unit within the Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport requires human resources (at least 2-3 new officers) with key technical skills related to solar PV systems notably at least one mechanical / electrical engineer, one project manager, and one communications expert (to aid with comprehensive public awareness campaigns). In supporting roles, from the Ministry of Finance or Sustainable Development, at least one financial analyst or economist with expertise in financial modelling, cost-benefit analysis and design of incentive regimes. From the Ministry of Education, technical instructor to help validate training programmes and to integrate lessons plans on solar technologies into the curriculum at various levels. From the Ministry of Legal Affairs, a legal draftsperson with expertise in environmental law, regulatory frameworks and contract law.

Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 3.14 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the Nationally Determined Contributions (NDCs) (GOSKN, 2021c), NDC Implementation Plan (GOSKN, 2022d) and the SKN Energy Policy and Action Plan (GOSKN, 2014). In addition, the senior staff the Energy Unit and both electrical utilities (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies. These estimates are robust and indicative in the absence of full feasibility studies, which would generally be required once concept notes are approved, and full detailed project designs are being finalized.

Table 3.14: Estimated costs per activity for greater diffusion of residential grid-tied solar

Action 1: Comprehensive feasibility studies on the use and penetration of residential grid-tied solar PV system including economic assessments, feed-in tariff and incentive design study and roll-out and guidelines to ensure safety and reliability.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**

1.1 Conduct household and business surveys to understand current energy consumption patterns.	100,000	
1.2 Conduct market analysis to identify potential suppliers and manufacturers of home solar PV systems and to analyze the supply chain to understand availability and cost of components needed.	50,000	
1.3 Upgrade current feed-in tariffs studies and roll-out feed-in tariff to incentive purchase of home solar PV systems.	50,000	
1.4 Assess the financial feasibility of various incentive regimes, such as tax credits, rebates, and subsidies.	50,000	
1.5 Design and roll-out incentive regime to local businesses to facilitate bulk imports.	100,000	
1.6 Develop and establish technical guidelines and standards for the safe and efficient installation of home solar PV systems.	50,000	
Action 2: Expand and implement training programs for technicians	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
2.1 Enhance comprehensive training curriculum.	50,000	
2.2 Partner with AVEC / CFBC / Nevis Sixth Form College to integrate solar PV system training into their programs.	100,000	50,000
2.3 Conduct training of trainers.	20,000	
2.4 Launch new revamped programs.	20,000	
Action 3: Develop and implement pilot projects at critical government buildings	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
3.1 Site assessment and selection focusing on critical buildings such as emergency shelters, health centres or schools.	50,000	
3.2 Develop detailed pilot project plans, including design specifications, timelines and budgets.	75,000	
3.3 Install and commission solar PV systems at selected sites.		Total installed capacity of 500 kW at 2000 USD per kw = 1,000,000 USD
3.4 Monitor and evaluate systems to track energy savings, cost reduction and system performance and assess the impact of the pilot projects.	20,000	
Action 4: Design and roll-out public awareness campaign and community engagement	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
4.1 Develop educational materials explaining the benefits of solar PV systems	50,000	
4.2 Launch campaign using various media channels to disseminate information	50,000	

4.3 Organize community events and open house events at pilot project sites to showcase solar PV systems.	50,000	
TOTAL	855,000	1,050,000

3.1.3.6 Management planning

Table 3.15 summarizes some of the key risks and their associated contingency actions.

Table 3.15: Key risks and contingency actions for greater diffusion of residential grid-tied solar

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.
Delays in solar PV installation	Delays in the installation of solar PV units	Prioritize High-Demand Areas: Focus initial infrastructure development in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement of solar PV systems and associated equipment.	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and Lack of Expertise	Technical issues related to the installation, maintenance, and operation of solar PV systems.	Training and Capacity Building: Invest in comprehensive training programs for local technicians to build in-country expertise. Technical Partnerships: Partner with international experts or companies with experience in solar PV technology to provide technical support and knowledge transfer. Regular Maintenance and Monitoring: Implement a robust monitoring system to identify and address technical issues early, minimizing disruptions.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty for investors and stakeholders, hindering progress.	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives. Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.
Limited Public Acceptance and Adoption of solar PV systems	Resistance from the public due to a lack of awareness or trust in new technology	Enhanced Public Education Campaign: Intensify efforts to educate the public on the long-term benefits, cost savings, and environmental impacts of solar PV systems. Incentivize Early Adopters: Provide additional incentives, such as tax breaks or rebates, to early adopters of solar PV systems to create a positive demonstration effect.

		Community Engagement: Engage community leaders and influencers to advocate for the adoption of solar PV systems within their communities.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Energy Unit of the Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport is critical to ensure the Unit can effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.
2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

3.1.3.7 TAP overview

Table 3.16: TAP overview table for greater diffusion of residential grid-tied solar

Sector	Energy							
Technology	Residential grid-tied solar PV systems							
Ambition	The long-term target for solar PV systems at the residential level is 7 MW installed capacity by 2040 of all households in SKN. By the end of Year 3 of this TAP, one comprehensive study including surveys, economic assessments, market research, feed-in tariff, incentive regime and technical standards, one public awareness campaign and installation of 500 kW installed capacity at critical government buildings by 2028.							
Benefits	Energy efficient residential grid-tied solar PV systems is an affordable practice to mitigate climate change, prevent excess demand of electricity, avoid electricity rationing (blackouts), reduce the investment in power generation, and reduce the cost of energy subsidies.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Comprehensive feasibility studies on the use and penetration of residential grid-tied solar PV system including economic assessments, feed-in tariff and incentive design study and roll-out and guidelines to ensure safety and reliability.	1.1 Conduct household and business surveys to understand current energy consumption patterns.	GCF GOSKN	MPI	6	Insufficient Funding and Financial Support	Complete survey by end of Year 1	Survey results	100,000
	1.2 Conduct market analysis to identify potential suppliers and manufacturers of home solar PV systems and to analyze the supply chain to understand availability and cost of components needed.	GCF	MPI / MoF	4	Insufficient Funding and Financial Support	Complete market analysis by end of Year 1	Delivery of market analysis report	50,000
	1.3 Upgrade current feed-in tariffs studies and roll-out feed-in tariff to incentive purchase of home solar PV systems.	GCF	MPI / MoF	3	Technical Challenges and Lack of Expertise	Complete economic assessment by end of Year 1	Delivery of economic assessment report	100,000
	1.4 Assess the financial feasibility of various incentive regimes, such as tax credits, rebates, and subsidies.	GCF	MoF	9	Policy and Regulatory Uncertainty	Complete design of incentive regime by end of Year 1	Delivery and roll-out of incentive regime	50,000

	1.5 Design and roll-out incentive regime to local businesses to facilitate bulk imports.	GOSKN	MoF	9	Insufficient Funding and Financial Support	Achieve 20% of local hardware businesses applying for incentives for bulk import	Number of applicants	100,000
	1.6 Develop and establish technical guidelines and standards for the safe and efficient installation of home solar PV systems.	GCF GOSKN	MPI / Bureau of Standards	6	Technical Challenges and Lack of Expertise	Complete technical guidelines and standards by middle of Year 2	Delivery of technical guidelines	50,000
Action 2: Expand and implement training programs for technicians	2.1 Enhance comprehensive training curriculum.	GCF	MoE	6	Technical Challenges and Lack of Expertise	Complete technical skills program by end of Year 2	Delivery of training programs	50,000
	2.2 Partner with AVEC / CFBC / Nevis Sixth Form College to integrate solar PV system training into their programs.	GCF GOSKN	MoE	3	Technical Challenges and Lack of Expertise	Complete consultative process with CFBC / AVEC by end of Year 2	Delivery of consultation report	150,000
	2.3 Conduct training of trainers.	GCF	MoE	6	Technical Challenges and Lack of Expertise	Train at least 10 trainers by end of Year 3	Number of individuals trained and % of trainees who pass certification assessments	20,000
	2.4 Launch new revamped programs.	GCF GOSKN	MoE	3	Insufficient Funding and Financial Support	Achieve a satisfaction rate of 80% or higher among trainees	Survey results from trainees	20,000
Action 3: Develop and implement pilot projects	3.1 Site assessment and selection focusing on critical buildings such as emergency shelters, health centres or schools.	GCF GOSKN	MPI	3	Technical Challenges and Lack of Expertise	Complete site assessment and selection	Delivery of site assessment study	50,000

at critical government buildings						by end of Year 1		
	3.2 Develop detailed pilot project plans, including design specifications, timelines and budgets.	GCF	MPI	6	Technical Challenges and Lack of Expertise	Complete design report by end of Year 1	Delivery of consultation report	75,000
	3.3 Install and commission solar PV systems at selected sites (4-5 sites)	GCF	MPI	6	Insufficient Funding and Financial Support and Supply Chain Disruptions	Complete installation of 4-5 systems (approx. 500 kW total) by end of Year 2	Number of PV systems installed and operational	1,000,000
	3.4 Monitor and evaluate systems to track energy savings, cost reduction and system performance and assess the impact of the pilot projects.	GCF GOSKN	MPI	12	Technical Challenges and Lack of Expertise	Achieve at least 50% energy savings and cost reductions	Analysis results	20,000
Action 4: Design and roll-out public awareness campaign and community engagement	4.1 Develop educational materials explaining the benefits of solar PV systems.	GCF	MPI	9	Insufficient Funding and Financial Support	Complete design of public awareness campaign by middle of Year 1	Delivery of design report	50,000
	4.2 Launch campaign using various media channels to disseminate information	GCF	MPI	4	Limited Public Acceptance	Achieve an engagement rate of 75% on social media platforms	Number of likes, shares, comments and other interactions on campaign-related content	50,000
	4.3 Organize community events and open house events at pilot project sites to showcase solar PV systems.	GCF	MPI	3	Limited Public Acceptance	Increase public awareness of the benefits of solar PV by 50% by end of Year 3.	Survey results	50,000

3.2 Project Ideas for the Energy Sector

3.2.1 Summary of project ideas for the energy sector

There are several concrete project ideas which can be extracted from the TAP to support phased actions towards the fulfilment of the overall goals for diffusion of solar water heating and PV systems outlined in sections 3.1.2.2 and 3.1.3.2. Several project ideas are outlined in Table 3.17.

Table 3.17: Project ideas for the energy sector

Project Ideas	Overall TAP Target
Project Idea #1: Comprehensive feasibility studies on the use and penetration of residential solar water heating systems and grid-tied solar PV systems. Roll-out of pilot demonstration projects at critical government buildings. **Project Idea #2:** Develop and implement training programs for technicians for solar technologies such as solar water heating, solar PV systems and others. **Project Idea #3:** Design and roll-out comprehensive public awareness campaign and community engagement related to residential solar power.	comprehensive studies including surveys, economic assessments, market research, feed-in tariff, incentive regime and technical standards, public awareness campaigns and installation SWHs and grid-tied solar PV systems at critical government buildings by 2030.

3.2.2 Specific project idea

Project idea #1 related comprehensive feasibility studies and roll-out of pilot solar projects at government buildings such as emergency shelters and health centres should be one of the first actions of the TAP for the energy sector. Table 3.18 summarizes the key elements of a future project proposal for this project.

Table 3.18: Key project proposal elements for selected project idea

Section	Narrative
Introduction/ Background	This project aims to conduct comprehensive feasibility studies on the use and penetration of residential solar water heating systems and grid-tied solar photovoltaic (PV) systems in St. Kitts and Nevis. The project will also roll out pilot demonstration projects at critical government buildings to showcase the viability and benefits of solar energy. The initiative aligns with the country's commitment to renewable energy adoption and reducing its carbon footprint, as highlighted in its National Energy Policy and Climate Change Adaptation Strategy. This project was developed in response to growing energy demands and the government's recognition of the need to transition to renewable sources to enhance energy security and sustainability.
Objectives	The primary objectives of the project are: • **Conduct feasibility studies**: Assess the technical, financial, and environmental viability of residential solar water heating and grid-tied solar PV systems. • **Demonstrate the benefits**: Implement pilot projects at government buildings to demonstrate the performance and cost savings of these technologies.
Outputs	**Feasibility Study Report**: Completed reports detailing the potential for solar water heating and grid-tied PV system adoption. **Pilot Projects**: Installation of solar water heating at 30 buildings and PV systems at 4-5 government buildings (approx. 500 kW installed capacity).

Relationship to national priorities	This project supports St. Kitts and Nevis' sustainable development priorities, specifically its Nationally Determined Contributions (NDC) under the Paris Agreement, which emphasize the reduction of greenhouse gas (GHG) emissions through increased use of renewable energy. The project also aligns with the country's National Energy Policy, which seeks to diversify energy sources and promote the use of clean energy. The project is not entirely new but builds on prior efforts to promote renewable energy, such as smaller-scale solar installations and public sector energy efficiency initiatives.
Project deliverables	The key deliverables include: • **Reduction in Energy Costs**: Government buildings using solar energy will experience reduced energy costs, setting an example for residential and commercial sectors. • **Reduction in GHG Emissions**: The transition to solar energy contributes directly to the country's emission reduction goals.
Project scope	The project will be implemented across both islands, starting with government buildings as pilot sites before expanding to residential and commercial sectors based on feasibility study results. This project builds on existing renewable energy initiatives and aims to scale up efforts by incorporating lessons learned from past projects, such as the introduction of small-scale PV systems.
Project activities	1. Conduct detailed feasibility studies (technical, economic, and environmental assessments). 2. Identify and install pilot solar water heating and grid-tied PV systems at three key government buildings. 3. Monitor and evaluate pilot project performance.
Timelines	The project will be implemented over a **3-year** period: **Year 1**: Feasibility studies and site selection for pilot projects. **Year 2:** Installation of pilot systems. **Year 3**: Final evaluation and preparation of recommendations for scaling up.
Budget	The total budget for the project is estimated at **USD 1.6 million**, broken down as follows: **Feasibility Studies**: USD 400,000 **Pilot Installations**: USD 1,150,000 **Monitoring and Evaluation**: USD 50,000
Measurement and evaluation	Success will be measured through: • **Energy Savings**: Reduction in energy consumption in pilot government buildings by at least 30%. • **Adoption Rate**: A measurable increase in the number of households and businesses installing solar systems, with a target of 500 new installations within five years.
Possible challenges	**Technical Barriers**: Ensuring adequate grid integration of solar PV systems may present challenges, especially during peak load times. **Financing**: Securing sufficient funding for scaling up the project may face delays or limitations. **Public Acceptance**: There may be resistance to adopting new technologies due to perceived high upfront costs.
Responsibilities / coordination	**Project Management**: The Ministry of Public Infrastructure will oversee project coordination. **Technical Partners**: Local utilities and contractors will provide technical expertise for the installation and grid integration of solar systems.

Chapter 4 Technology Action Plan and Project Ideas for the Transport sector

4.1 TAP for the Transport Sector

The second sector prioritized for the TNA process for climate change mitigation is the transport sector. Two technologies were prioritized for the sector including: (1) Hybrids and battery electric vehicles (EVs) and (2) Development and rehabilitation of sidewalks, cycle lanes and safe cycle parking to promote non-motorised transport (NMT).

Both the recent NDC (GOSKN, 2021c) and mitigation analysis chapters in the BUR1 and TNC (GOSKN, 2022a,b) assess progress towards mitigation actions identified in the National Climate Change Policy (GOSKN, 2017), National Energy Policy and Action Plan (GOSKN, 2014) and Draft St. Kitts and Nevis Electric Vehicle Transition Policy and Action Plan (GOSKN, 2024b). These important policy tools and action plans provide the roadmap for climate change mitigation in the transport sector in the Federation.

4.1.1 Transport Sector Overview

Almost all GHG emissions from the transport sector in St. Kitts and Nevis are coming from road transport. Emissions from railways are very small and limited to St. Kitts Scenic Railway (29km long narrow-gauge railway) which is exclusively transporting tourists along the coastline of the St. Kitts. GHG Emissions from road transport sector has in 2018 (approximately 100 $ktCO_2$-eq) increased by 28.1% compared to 2014 and 48.6% compared to year 2008.

Within the transport sector in 2018, emissions from cars represent 63.3% of the overall emissions. Second largest share goes to heavy duty vehicles (HDV) and busses with 24.0% of emissions (down from 26.9% in 2008). The biggest increase in share is observed for light duty vehicles (LDV) where the share in emissions increased from 8.4% in 2008 to 12.6% in 2018 (shown in Figure 4.1) (GOSKN, 2022c). Evolution of the emissions from passenger car transport is closely linked to macroeconomic environment, growth of GDP and with increased purchasing power of St. Kitts and Nevis residents. Number of vehicles per capita has increased from 365 cars per thousand inhabitants in 2008 to 404 cars per thousand inhabitants in 2018.

SKN total GHG emissions increased by 19.7% or approximately 60 ktCO2eq in 2018 compared to the 2010 levels (excluding emissions/removals from LULUCF) according to the latest National Inventory Report. This increase corresponds to an increase in GHG emissions of 26% in the energy sector over the same period, mainly attributed to the transport sector, with an increase of approximately 91% in 2018 from 2010 levels. The energy sector represented 77% and 81% of total GHG emissions in 2010 and 2018, respectively (GOSKN 2022a). The transport sector is the second largest emitter in the Federation of St. Kitts and Nevis.

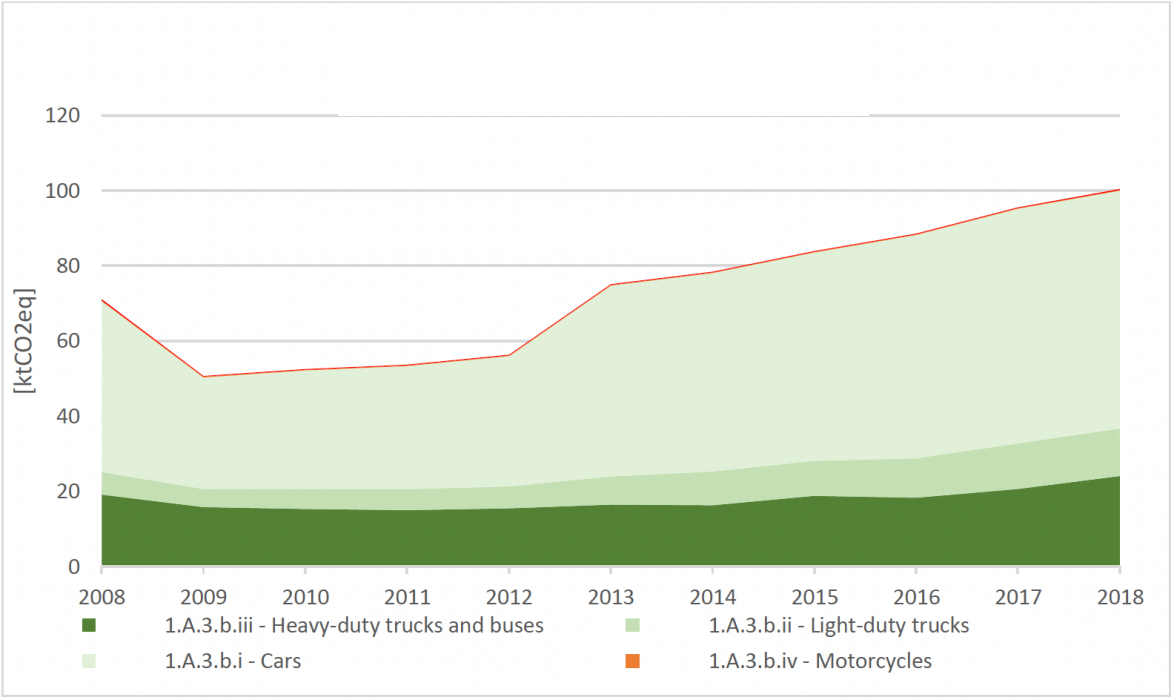

Figure 4.1: GHG Emissions from the Transport Sector St. Kitts and Nevis (2018)

4.1.2 Action plan for hybrids and battery electric vehicles

4.1.2.1 Introduction

Hybrids and electric vehicles were included in the TNA as a mitigation technology due to their potential to reduce GHG emissions from the transport sector, improve air quality and enhance energy independence for St. Kitts and Nevis. Recently, the GOSKN has taken steps to update its vision and action plan for the transition to electric vehicles by 2033 (GOSKN, 2024b). The targets to be achieved by 2033 set out in the draft policy are:

- **Increase EV Share**: Achieve a 2% share of electric vehicles in the national vehicle fleet.
- **Greenhouse Gas Emissions**: Reduce greenhouse gas emissions from the transportation sector by 5%.
- **Fossil Fuel Use**: Reduce the use of fossil fuels in transportation by 5%.
- **Charging Infrastructure**: Ensure that every single-family dwelling with an EV has a charging station and install at least five public fast chargers across the Federation.
- **Certified Workforce**: Train and certify 20 local technicians to maintain and repair electric vehicles.
- **Air Quality**: Improve the air quality by promoting cleaner transportation options.
- **Energy Security**: Enhance energy security by reducing reliance on imported fossil fuels. For the EV transition to be successful and sustainable, the country must transition to RE thus requiring grid upgrades and modernization to occur concurrently (TTPV, 2024a,b).

The market for hybrids and EVs in St. Kitts and Nevis is small, with approximately 3 EVs and 90 hybrids reported as part of the national vehicle fleet (over 24,000 ICE vehicles) as of 2024 (GOSKN, 2024b). There are no public charging stations.

4.1.2.2 Ambition for the TAP

In alignment with the mitigation chapters of the Third National Communication (TNC) (GOSKN, 2021a, 2022b) and the first Biennial Update Report (BUR1) (GOSKN, 2022a) and the Nationally Determined Contributions (NDCs), NDC Implementation Plan (GOSKN, 2021c, 2022d) and the draft EV policy (GOSKN, 2024b), the updated target for diffusion of EVs is 2% of the total number of vehicles by 2033. GHG emissions reduction would only be realized if there is a concurrent increase in renewables for power generation. As such, no estimate of GHG emissions for this target was made in the BUR1 (GOSKN, 2022a).

The SWG highlighted the need to focus the efforts of the TAP on setting the stage for the broader adoption of EVs by focussing on a pilot school bus project as outlined in a recent feasibility study conducted by the Greenhouse Gas Management Institute and the Caribbean Cooperative Measurement, Reporting and Verification Hub (GHGMI and CCMRVH, 2023). In addition, the TAP will highlight setting up conventional and solar charging stations at strategic locations, collecting and analyzing data on the performance and cost effectiveness of EVs, feasibility studies to further flesh out the ecosystem needed to fully transition to EVs and robust public awareness campaign to promote the transition to EVs. As such, the TAP target was set at deployment of 6 school buses and conventional charging stations (10) and solar chargers (5), training of a cadre of mechanics, bus drivers and first responders, demonstration of EV technology to the public, feasibility studies and rollout of incentive regime to promote the wider diffusion of hybrids and EVs and a wide-ranging public awareness campaign by 2030.

4.1.2.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, the SWG identified two (2) economic and financial (including market) and one (1) non-financial barrier (technical) as critical barriers for the diffusion of hybrids and EVs in St. Kitts and Nevis. These barriers included:

1. High capital costs
2. Lack of charging infrastructure
3. Small market size reducing the incentive for suppliers to offer competitive pricing

The root causes to barriers are inter-related and stem ultimately from the lack of government incentives and / or financing options which stem from lack of economies of scale, limited customer base and lower purchasing power of the average consumer. Currently, in St. Kitts and Nevis, there are no suppliers of hybrids and EVs. As with all conventional vehicles, these are not manufactured locally, and the costs are driven by market forces outside of the Caribbean. Currently, EVs are 30-40% higher in cost than ICE vehicles in St. Kitts and Nevis. Furthermore, even when EVs and hybrids reach price parity, the average consumer is not likely

to make a switch to EVs without a concerted effort by the government to promote such through major investments in charging infrastructure, duty free concessions and renewable energy for the generation of electricity. Table 4.1 summarizes the measures identified by the SWG to overcome these critical barriers for greater diffusion of hybrids and EVs.

Table 4.1: Key measures to overcome barriers for greater diffusion of hybrids and EVs

Barriers	Measures
High capital costs and small market size of hybrids and EVs	• Introduce tax rebates, subsidies, or reduced import duties for hybrids and EVs to lower the initial purchase cost. • Partner with financial institutions to create favourable loan conditions for the purchase of hybrids and EVs. • Government and large corporations in St. Kitts and Nevis could make bulk purchases of hybrids and EVs, which would help create economies of scale and reduce unit costs. • Establish leasing programs to lower the upfront cost and risk for consumers, thereby making hybrids and EVs more financially accessible. • Educate the public on the long-term cost benefits of owning a hybrid or EV, such as lower maintenance and operational costs compared to traditional vehicles.
Lack of charging infrastructure	• Invest in charging infrastructure to alleviate range anxiety and make the operation of hybrids and EVs more convenient. This includes public charging stations and incentives for private charging stations at homes or businesses. • Develop a regulatory framework that supports the adoption of hybrids and EVs, such as mandated charging points in new building plans or reserved parking spaces for EVs with charging points. • Promote the use of renewable energy sources for electricity generation to power the charging stations such as solar car ports. • Lead by example by electrifying public transportation fleets.

In determining the key actions and activities for the TAP, the SWG focused its consultations on a pilot project for electrifying the fleet of government school buses to demonstrate EV technology to the public. Table 4.2 summarizes the key actions and associated activities (Table 4.3) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 4.2: Key actions for greater diffusion of hybrids and EVs

Action	Description
Action 1	Develop and implement a pilot project to electrify the fleet of government school buses
Action 2	Conduct detailed electricity grid analysis to identify the most suitable locations for the installation of charging stations and install charging stations (both conventional and solar) at strategic locations to facilitate pilot school bus project
Action 3	Conduct comprehensive economic and financial feasibility study including design of incentive regime necessary for transition to EVs and policies for vehicle replacement and procurement of new vehicles for the government fleet.
Action 4	Conduct waste management study and policy for ICE vehicles and EV batteries disposal, recycling, reuse and repurpose.
Action 5	Develop and implement training programme for school bus drivers, mechanics and first responders
Action 6	Develop and implement public awareness campaign related to long-term benefits of hybrids and EVs

Table 4.3: Key activities for greater diffusion of hybrids and EVs

Action 1: Develop and implement a pilot project to electrify the fleet of government school buses
1.1 Conduct a feasibility study to assess the current fleet and identify the most suitable models of electric buses for the local environment and road conditions.
1.2 Procure electric school buses from suppliers, considering factors such as cost, range, durability, and ease of maintenance.
1.3 Develop and implement a deployment plan that outlines the specific routes, charging schedules, and maintenance protocols for the pilot buses.
1.4 Monitor and evaluate the performance of the electric buses during the pilot phase, collecting data on fuel savings, maintenance costs, and emissions reductions.
1.5 Engage with stakeholders including school administrators, parents, and students to ensure the smooth implementation of the pilot project.
Action 2: Conduct detailed electricity grid analysis to identify the most suitable locations for the installation of charging stations and install charging stations (both conventional and solar) at strategic locations to facilitate pilot school bus project
2.1 Collaborate with utility companies to conduct a detailed analysis of the electricity grid, to ensure the availability of grid connections and the integration of renewable energy sources for the charging stations.
2.2 Conduct a site assessment to determine the most strategic locations for charging stations, considering factors such as traffic density, proximity to schools, government offices, and residential areas.
2.3 Design the infrastructure for charging stations, including conventional electric charging points and solar-powered options.
2.4 Procure equipment for the installation of charging stations, ensuring compatibility with the types of electric vehicles being deployed.
2.5 Install and commission the charging stations.
2.6 Develop a maintenance plan for the charging infrastructure to ensure long-term reliability and functionality.
Action 3: Conduct comprehensive economic and financial feasibility study including design of incentive regime necessary for transition to EVs and policies for vehicle replacement and procurement of new vehicles for the government fleet.
3.1 Identify key economic factors that influence the cost and adoption of electric vehicles, including import duties, taxes, fuel prices, and maintenance costs.
3.2 Engage with financial institutions to explore options for providing low-interest loans or leasing programs for individuals and businesses.
3.3 Develop a detailed cost-benefit analysis comparing the long-term savings of electric vehicles against traditional ICE vehicles.
3.4 Propose tax incentives, subsidies, or rebates that could make electric vehicles more affordable and attractive to consumers.
3.5 Upgrade policy framework that includes regulations, incentives, and goals for the widespread adoption of electric vehicles in St. Kitts and Nevis including guidelines for vehicle replacement and procurement for the government fleet.
3.6 Consult with stakeholders including car dealerships, importers, and the public to ensure the proposed incentive regime is practical and well-received.
Action 4: Conduct waste management study and policy for ICE vehicles and EV batteries reuse, repurpose, recycling and disposal.
4.1 Research best practices for the repurposing, reuse, recycling and disposal of ICE vehicles and EV batteries and benchmark against similar small island developing states (SIDS) to identify relevant approaches.
4.2 Conduct an environmental impact assessment (EIA) to understand the potential risks and benefits of various waste management strategies and identify environmentally sustainable and economically viable options for St. Kitts and Nevis.
4.3 Develop a comprehensive waste management policy that includes guidelines for the reuse, recycling and disposal of ICE vehicles and EV batteries including incentives for compliance.

4.4 Establish partnerships with recycling companies and waste management facilities to handle the disposal of vehicles and batteries.
Action 5: Develop and implement training programme for school bus drivers, mechanics and first responders
5.1 Develop a curriculum focused on the technical skills required for servicing and maintaining electric vehicles, including battery management and safety protocols and for operating EVs.
5.2 Partner with vocational schools to deliver courses and certifications for mechanics specializing in electric vehicles.
5.3 Develop and deliver a training program for first responders that focuses on handling accidents involving electric vehicles, including battery fires and electrical hazards.
5.4 Evaluate the effectiveness of the training programs through assessments and feedback from participants, and update the curriculum as needed.
Action 6: Develop and implement public awareness campaign related to long-term benefits of hybrids and EVs
6.1 Design informational materials (brochures, flyers, videos) that explain the environmental, economic, and health benefits of hybrids and electric vehicles.
6.2 Launch a social media campaign to reach a wider audience, using platforms such as Facebook and Instagram to share success stories, tips, and benefits of EVs.
6.3 Organize community events such as EV fairs, test drive opportunities, and workshops where the public can learn about and experience electric vehicles firsthand.
6.4 Engage with local media to run stories, interviews, and features about the transition to electric vehicles.
6.5 Collaborate with schools to incorporate lessons about electric vehicles, renewable energy, and climate change into the curriculum.
6.6 Develop partnerships with local businesses to promote electric vehicles and the benefits of transitioning to greener transportation option.

4.1.2.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater diffusion of hybrids and EVs in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 4.4.

Table 4.4: Key stakeholders for greater diffusion of hybrids and EVs

Stakeholder	Role
Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport (MPI)	- Coordination and project management - Develop and enforce policies and regulations that support the adoption of hybrids and electric vehicles (EVs). - Establish guidelines for the installation of charging infrastructure and ensure compliance with safety standards. - Launch nationwide awareness campaigns to educate the public on the benefits of EVs and hybrids. - Engage with communities and stakeholders to promote the adoption of hybrids and EVs.
Ministry of Finance (MoF)	- Implement tax incentives, subsidies, and other financial mechanisms to lower the cost of EVs and hybrids. - Allocate budget for infrastructure development, such as charging stations.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Ministry of Justice and Legal Affairs	- Legal drafting of regulations
Ministry of Education (MoE)	- Develop and incorporate lessons about electric vehicles, renewable energy, and climate change into the curriculum
Private Sector (Auto Dealerships, Importers and Financial Institutions)	- Import and supply hybrids and electric vehicles to the local market. - Work with manufacturers to bring down the cost of vehicles by negotiating bulk purchases. - Partner with the government to offer favourable loan conditions or leasing options for EV buyers. - Provide financial products that make purchasing EVs and hybrids more accessible to consumers. - Invest in and install charging stations at private businesses, such as shopping malls and hotels. - Develop business models that incentivize private charging infrastructure, such as pay-per-use systems.
Utility companies (SKELEC and NEVLEC)	- Collaborate with the government and private sector to ensure the availability of grid connections for charging stations. - Promote the integration of renewable energy sources (such as solar power) into the grid to supply charging stations. - Provide technical expertise and support in the development and maintenance of charging infrastructure.

	- Monitor the energy demand from EVs and adjust grid operations accordingly.
Educational and Vocational Institutions (CFBC and AVEC)	- Develop and deliver training programs for mechanics on the maintenance and repair of hybrids and EVs. - Offer courses and certifications for first responders on handling EV-related emergencies. - Incorporate EV technology and renewable energy concepts into the school curriculum to educate future generations.
Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of hybrids and EVs through various media channels. - Highlight success stories, case studies, and interviews with early adopters of EV technology. - Provide accurate and timely information about government policies, incentives, and available financial options for EVs. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of EVs.
Local communities and consumers	- Participate in pilot projects, such as the electrification of school buses, and provide feedback on their effectiveness. - Consider the long-term benefits of EVs and hybrids when making vehicle purchasing decisions. - Advocate for better infrastructure and policies that support cleaner transportation. - Engage in community discussions and activities related to the transition to hybrids and EVs.

To ensure the successful implementation of the Technology Action Plan (TAP) for the transition to hybrids and EVs in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. Below is a summary of the sequence and timing for the specific activities.

Phase 1: Preparatory Phase (Year 1-2)

1. Stakeholder Engagement and Initial Planning (Months 1-3)
   - Activity: Conduct stakeholder meetings and workshops
   - Nature and Scale: Small-scale, involving government officials, private sector representatives, CSOs, NGOs, and international partners. This will ensure alignment of goals, clarify roles, and secure commitments.

2. Feasibility Studies, Economic Assessments and Policy Framework Development (Months 3-18)
   - Activities: Conduct feasibility study for pilot bus project, electricity grid analysis for location of charging stations, economic assessment and design of incentive regime, policy development for transition of the government vehicle fleet to EVs and waste management study.
   - Nature and Scale: Medium-scale, involving consultants, utility companies, and academic institutions. The studies will provide a basis for informed decision-making.

3. Public Awareness Campaign Design (Months 6-18)
   - Activity: Develop the strategy and materials for the public awareness campaign.
   - Nature and Scale: Small-scale, initially focusing on strategy development by communication experts, followed by broader public engagement.

Phase 2: Implementation Phase (Year 2-3)

1. Pilot Project Implementation – School Bus Electrification (Months 18-36)
   - Activity: Procure and deploy electric school buses.
   - Nature and Scale: Large-scale, involving government procurement processes, coordination with manufacturers, and training for drivers and maintenance staff.

2. Charging Infrastructure Development (Months 18-24)
   - Activity: Install conventional and solar-powered charging stations at strategic locations.
   - Nature and Scale: Large-scale, requiring significant investment, coordination with utility companies, and technical expertise for installation.

3. Training Programs for Mechanics, Drivers and First Responders (Months 18-24)
   - Activity: Develop and deliver training programs.
   - Nature and Scale: Medium-scale, involving educational institutions, international partners, and local vocational training centres.

4. Launch of Public Awareness Campaign (Month 18 onwards)
   - Activity: Implement the public awareness campaign through various media channels and community events.
   - Nature and Scale: Large-scale, targeting a broad audience through social media, radio, TV, and community outreach.

Phase 3: Monitoring, Evaluation, and Scale-Up Phase (Year 4-5)

1. Monitoring and Evaluation (Ongoing, starting Month 24)
   - Activity: Regularly monitor the performance of pilot projects and other initiatives, with data collection on costs, range and emissions reductions.
   - Nature and Scale: Medium-scale, with ongoing assessments conducted by government agencies and consultants.

2. Financial and Incentive Program Rollout (Months 36-48)
   - Activity: Launch financial support programs, including loans, subsidies, and tax incentives.
   - Nature and Scale: Medium-scale, involving partnerships with financial institutions and government agencies to implement and promote the programs.

3. Policy Adjustments and Program Expansion (Months 48-60)
   - Activity: Based on evaluation results, refine policies, adjust incentive programs, and plan for broader adoption of EVs and hybrids.
   - Nature and Scale: Medium-scale, requiring legislative adjustments, additional stakeholder consultations, and potentially new funding allocations.
4. Comprehensive Review and Reporting (Months 54-60)
   - Activity: Conduct a comprehensive review of the TAP implementation, assessing successes, challenges, and lessons learned.
   - Nature and Scale: Medium-scale, involving all stakeholders, with a focus on preparing a report and recommendations for future actions.

4.1.2.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the transition to hybrids and EVs.

The Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport requires human resources (at least 2-3 new officers) with key technical skills related to hybrids and EVs notably at least one mechanical / electrical engineer, one project manager, and one communications expert. In supporting roles, from the Ministry of Finance or Sustainable Development, at least one financial analyst or economist with expertise in financial modelling, cost-benefit analysis and design of incentive regimes. From the Ministry of Education, technical instructor to help validate training programmes and to integrate lessons plans on EVs and green transport into the curriculum at various levels. From the Ministry of Legal Affairs, a legal draftsperson with expertise in environmental law, regulatory frameworks and contract law.

Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 4.5 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the Nationally Determined Contributions (NDCs) (GOSKN, 2021c), NDC Implementation Plan (GOSKN, 2022d), the SKN Energy Policy and Action Plan (GOSKN, 2014), the Draft SKN EV Transition Policy and Action Plan (GOSKN, 2024b) and the Updated Report for the Transformation of the St. Kitts and Nevis Public Transport Sector to Electric Vehicles and a Pilot School Bus Project (GHGMI and CCMRVH, 2023). In addition, the senior staff the Energy Unit and both electrical utilities (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies.

Table 4.5: Estimated costs per activity for greater diffusion of hybrids and EVs

Action 1: Develop and implement a pilot project to electrify the fleet of government school buses	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
1.1 Conduct a full feasibility study.	50,000	
1.2 Procure electric school buses (4 for St. Kitts and 2 for Nevis)		6 buses X 350,000= 2,100,000
1.3 Develop and implement a deployment plan that outlines the specific routes, charging schedules, and maintenance protocols for the pilot buses.	20,000	
1.4 Monitor and evaluate the performance of the electric buses during the pilot phase.	20,000	
1.5 Engage with stakeholders.	20,000	
Action 2: Conduct detailed electricity grid analysis and install charging stations (both conventional and solar) at strategic locations to facilitate pilot school bus project	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
2.1 Conduct a detailed analysis of the electricity grid.	200,000	
2.2 Conduct a site assessment to determine the most strategic locations for charging stations.	20,000	
2.3 Design the infrastructure for charging stations.	30,000	
2.4 Procure equipment for the installation of charging stations.		10 stations X 10,000= 100,000 5 solar stations X 30,000= 150,000
2.5 Install and commission the charging stations.	15 stations X 10,000 = 150,000	
2.6 Develop a maintenance plan for the charging infrastructure.	20,000	
Action 3: Conduct comprehensive economic and financial feasibility study including design of incentive regime necessary for transition to EVs and policies for vehicle replacement and procurement of new vehicles for the government fleet.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
3.1 Identify key economic factors that influence the cost and adoption of electric vehicles.	50,000	
3.2 Engage with financial institutions to explore options for providing low-interest loans or leasing programs.	50,000	
3.3 Develop a detailed cost-benefit analysis comparing the long-term savings of electric vehicles against traditional ICE vehicles.	50,000	

3.4 Propose tax incentives, subsidies, or rebates that could make electric vehicles more affordable and attractive to consumers.	50,000	
3.5 Upgrade policy framework that includes regulations, incentives, and goals for the widespread adoption of electric vehicles.	50,000	
3.6 Consult with stakeholders including car dealerships, importers, and the public.	20,000	
Action 4: Conduct waste management study and policy for ICE vehicles and EV batteries reuse, repurpose, recycling and disposal.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
4.1 Research and benchmark best practices for the repurposing, reuse, recycling and disposal of ICE vehicles and EV batteries.	50,000	
4.2 Conduct an environmental impact assessment (EIA) to understand the potential risks and benefits of various waste management strategies.	50,000	
4.3 Develop a comprehensive waste management policy.	50,000	
4.4 Establish partnerships with waste management facilities to handle the disposal of vehicles and batteries.	50,000	
Action 5: Develop and implement training programme for school bus drivers, mechanics and first responders	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
5.1 Develop a curriculum focused on the technical skills required for servicing and maintaining electric vehicles.	50,000	
5.2 Partner with vocational schools to deliver courses and certifications for mechanics.	100,000	100,000
5.3 Develop and deliver a training program for first responders.	100,000	100,000
5.4 Evaluate the effectiveness of the training programs.	20,000	
Action 6: Develop and implement public awareness campaign related to long-term benefits of hybrids and EVs	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Equipment costs (USD)**
6.1 Design informational materials (brochures, flyers, videos) that explain the environmental, economic, and health benefits of hybrids and electric vehicles.	50,000	
6.2 Launch a social media campaign to reach a wider audience.	50,000	
6.3 Organize community events such as EV fairs, test drive opportunities, and workshops.	100,000	
6.4 Engage with local media to run stories, interviews, and features about the transition to electric vehicles.	20,000	

6.5 Collaborate with schools to incorporate lessons about electric vehicles, renewable energy, and climate change into the curriculum.	20,000	
6.6 Develop partnerships with local businesses to promote electric vehicles.	20,000	
TOTAL	1,530,000	2,550,000

4.1.2.6 Management planning

Table 4.6 summarizes some of the key risks and their associated contingency actions.

Table 4.6: Key risks and contingency actions for greater diffusion of hybrids and EVs

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.
Delays in Charging Infrastructure Development	Delays in the installation of charging stations could lead to "range anxiety," where potential EV buyers are hesitant to purchase due to concerns about charging availability.	Temporary Solutions: Implement temporary charging solutions, such as mobile charging stations, to alleviate concerns until permanent infrastructure is in place. Collaboration with Private Sector: Encourage businesses and large institutions to install charging stations on their premises, increasing the number of available charging points. Prioritize High-Demand Areas: Focus initial infrastructure development in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement of EVs, charging stations, and other critical components.	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and Lack of Expertise	Technical issues related to the installation, maintenance, and operation of EVs and charging infrastructure could arise, especially given the limited local expertise.	Training and Capacity Building: Invest in comprehensive training programs for local technicians, mechanics, and first responders to build in-country expertise. Technical Partnerships: Partner with international experts or companies with experience in EV technology to provide technical support and knowledge transfer. Regular Maintenance and Monitoring: Implement a robust monitoring system to identify and address technical issues early, minimizing disruptions.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty for investors and stakeholders, hindering progress.	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives. Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.

Limited Public Acceptance and Adoption of EVs	Resistance from the public due to a lack of awareness or trust in new technology could slow down the adoption of hybrids and EVs.	Enhanced Public Education Campaign: Intensify efforts to educate the public on the long-term benefits, cost savings, and environmental impacts of EVs. Incentivize Early Adopters: Provide additional incentives, such as tax breaks or rebates, to early adopters of EVs to create a positive demonstration effect. Community Engagement: Engage community leaders and influencers to advocate for the adoption of EVs within their communities.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Domestic Transport and Energy Unit of the Ministry of Public Infrastructure, Energy, Utilities and Domestic Transport is critical to ensure the Unit can effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.
2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

4.1.2.7 TAP overview

Table 4.7: TAP overview table for greater diffusion of hybrids and EVs

Sector	Transport							
Technology	Hybrid and battery electric vehicles							
Ambition	Development and implementation of pilot electric school bus programme including setting up conventional and solar charging stations at strategic locations, collecting and analyzing data on the performance and cost effectiveness of EVs, feasibility studies to further flesh out the ecosystem needed to fully transition to EVs and robust public awareness campaign to promote the transition to EVs.							
Benefits	Deployment of 6 school buses and conventional charging stations (10) and solar chargers (5), training of a cadre of mechanics, bus drivers and first responders, demonstration of EV technology to the public, feasibility studies and rollout of incentive regime to promote the wider diffusion of hybrids and EVs and a wide-ranging public awareness campaign.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Develop and implement a pilot project to electrify the fleet of government school buses.	1.1 Conduct a feasibility study.	GCF	MPI	12	Technical Challenges and Lack of Expertise	Complete feasibility study by end of Year 1	Delivery of feasibility study for pilot project	50,000
	1.2 Procure electric school buses.	GCF	MPI	18	Insufficient Funding and Financial Support Supply Chain Disruptions	Complete procurement of 6 buses by middle of Year 2	Number of buses procured	2,100,000
	1.3 Develop and implement a deployment plan that outlines the specific routes, charging schedules, and maintenance protocols for the pilot buses	GCF	MPI	12	Technical Challenges and Lack of Expertise	Deploy 6 electric buses by end of Year 3	Percentage of the planned electric buses operational	20,000
	1.4 Monitor and evaluate the performance of the electric buses during the pilot phase.	GCF	MPI	24	Technical Challenges and Lack of Expertise	Maintain an uptime of 90% or higher for the electric bus fleet	Percentage of time buses are operational versus downtime	20,000

						Achieve a 50% reduction in fuel consumption for the fleet	Litres of fuel saved per bus compared to previous ICE fleet	
	1.5 Engage with stakeholders.	GCF GOSKN	MPI	6	Limited Public Acceptance	Achieve a stakeholder satisfaction rate of 75% or higher	Survey results from key stakeholders	20,000
Action 2: Conduct detailed electricity grid analysis and install charging stations (both conventional and solar) at strategic locations to facilitate pilot school bus project.	2.1 Conduct a detailed analysis of the electricity grid.	GCF	MPI SKELEC NEVLEC	12	Technical Challenges and Lack of Expertise	Complete grid analysis by end of Year 1	Delivery of grid analysis report	200,000
	2.2 Conduct a site assessment to determine the most strategic locations for charging stations.	GCF	MPI SKELEC NEVLEC	6	Technical Challenges and Lack of Expertise	Complete site assessment by middle of Year 2	Delivery of site assessment report	20,000
	2.3 Design the infrastructure for charging stations.	GCF	MPI SKELEC NEVLEC	6	Technical Challenges and Lack of Expertise	Complete design of charging stations by middle of Year 2	Delivery of design report	30,000
	2.4 Procure equipment for the installation of charging stations.	GCF	MPI SKELEC NEVLEC	12	Insufficient Funding and Financial Support Supply Chain Disruptions	Complete procurement of 15 charging stations by end of Year 2	Number of charging stations procured	250,000
	2.5 Install and commission the charging stations.	GCF	MPI SKELEC NEVLEC	6	Technical Challenges and Lack of Expertise	Complete installation of 15 charging stations by middle of Year 3	Number of charging stations installed and operational	150,000
	2.6 Develop a maintenance plan for the charging infrastructure.	GCF GOSKN	MPI SKELEC NEVLEC	3	Technical Challenges and Lack of Expertise	Complete maintenance plan by end of Year 2	Delivery of maintenance plan	20,000

Action 3: Conduct comprehensive economic and financial feasibility study including design of incentive regime necessary for transition to EVs and policies for vehicle replacement and procurement of new vehicles for the government fleet.	3.1 Identify key economic factors that influence the cost and adoption of electric vehicles.	GCF	MoF MoSD	6	Technical Challenges and Lack of Expertise	Complete economic impact study by end of Year 1	Delivery of economic impact study	50,000
	3.2 Engage with financial institutions to explore options for providing low-interest loans or leasing programs.	GCF GOSKN	MoF MoSD	12	Policy and Regulatory Uncertainty	Complete consultative process with 80% of financial institutions by end of Year 1	Delivery of consultation report	50,000
	3.3 Develop a detailed cost-benefit analysis comparing the long-term savings of electric vehicles against traditional ICE vehicles.	GCF	MoF MoSD	6	Technical Challenges and Lack of Expertise	Complete cost benefit study by end of Year 1	Delivery of cost benefit study	50,000
	3.4 Propose tax incentives, subsidies, or rebates that could make electric vehicles more affordable and attractive to consumers.	GCF	MoF MoSD	6	Technical Challenges and Lack of Expertise	Complete design of incentive regime by middle of Year 2	Delivery of incentive regime report	50,000
	3.5 Upgrade policy framework that includes regulations, incentives, and goals for the widespread adoption of electric vehicles.	GCF	MoF MoSD	6	Policy and Regulatory Uncertainty	Complete policy framework by middle of Year 2	Delivery of policy framework Number of policies officially approved and implemented	50,000
	3.6 Consult with stakeholders including car dealerships, importers, and the public.	GCF GOSKN	MoF MoSD	6	Policy and Regulatory Uncertainty	Achieve a stakeholder satisfaction rate of 75% or higher	Survey results from key stakeholders	20,000
Action 4: Conduct waste management study and policy for ICE vehicles and EV batteries	4.1 Research and benchmark best practices for the repurposing, reuse, recycling and disposal of ICE vehicles and EV batteries.	GCF	MoECA	3	Technical Challenges and Lack of Expertise	Complete benchmarking study by end of Year 2	Delivery of benchmarking study	50,000
	4.2 Conduct an environmental impact assessment (EIA) to understand the potential risks and benefits of various waste management strategies.	GCF	MoECA	6	Technical Challenges and Lack of Expertise	Complete EIA by end of Year 2	Delivery of EIA study	50,000

reuse, repurpose, recycling and disposal.	4.3 Develop a comprehensive waste management policy.	GCF	MoECA	6	Technical Challenges and Lack of Expertise	Complete policy by end of Year 2	Delivery of policy	50,000
	4.4 Establish partnerships with waste management facilities to handle the disposal of vehicles and batteries.	GCF GOSKN	MoECA	12	Policy and Regulatory Uncertainty	Complete consultative process with 80% of waste management facilities by end of Year 2	Delivery of consultation report and MOU with key stakeholders	50,000
Action 5: Develop and implement training programme for school bus drivers, mechanics and first responders.	5.1 Develop a curriculum focused on the technical skills required for servicing and maintaining electric vehicles.	GCF	MoE CFBC AVEC	12	Technical Challenges and Lack of Expertise	Complete technical skills program by middle of Year 1	Delivery of training programs	50,000
	5.2 Partner with vocational schools to deliver courses and certifications for mechanics.	GCF	MoE CFBC AVEC	12	Supply Chain Disruptions	Complete consultative process with CFBC / AVEC by end of Year 2	Delivery of consultation report	200,000
	5.3 Develop and deliver a training program for first responders.	GCF	MoE CFBC AVEC	12	Technical Challenges and Lack of Expertise	Train at least 20 each bus drivers, mechanics and first responders by end of Year 3	Number of individuals trained Percentage of trainees who pass certification assessments	200,000
	5.4 Evaluate the effectiveness of the training programs.	GCF GOSKN	MoE CFBC AVEC	6	Low number of trainees	Achieve a satisfaction rate of 80% or higher among trainees	Survey results from trainees	20,000
Action 6: Develop and implement public awareness	6.1 Design informational materials (brochures, flyers, videos) that explain the environmental, economic, and health benefits of hybrids and electric vehicles.	GCF	MPI MoECA	6	Limited Public Acceptance	Complete design of public awareness campaign by middle of Year 1	Delivery of design report	50,000

campaign related to long-term benefits of hybrids and EVs.	6.2 Launch a social media campaign to reach a wider audience.	GCF	MPI MoECA	12	Limited Public Acceptance	Achieve an engagement rate of 75% on social media platforms	Number of likes, shares, comments and other interactions on campaign-related content	50,000
	6.3 Organize community events such as EV fairs, test drive opportunities, and workshops.	GCF	MPI MoECA	12	Limited Public Acceptance	Increase public awareness of the benefits of hybrids / EVs by 50% by end of Year 3	Survey results	100,000
	6.4 Engage with local media to run stories, interviews, and features about the transition to electric vehicles.	GCF	MPI MoECA	12	Limited Public Acceptance	Achieve an engagement rate of 75% on traditional media platforms	Number of interactions on campaign-related content	20,000
	6.5 Collaborate with schools to incorporate lessons about electric vehicles, renewable energy, and climate change into the curriculum.	GCF GOSKN	MPI MoECA	12		Increase awareness of school children by 50% by end of Year 3	Survey results	20,000
	6.6 Develop partnerships with local businesses to promote electric vehicles.	GCF GOSKN	MPI MoECA	12	Policy and Regulatory Uncertainty	Increase public awareness of the benefits of hybrids / EVs by 50% by end of Year 3	Survey results	20,000

4.1.3 Action plan for promotion of non-motorised transport

4.1.3.1 Introduction

An important part of the equation in trying to reform the transportation sector is a revival of non-motorized transport (NMT), more specifically promotion of walking and cycling to move around for short distances. The key to reversing the trend towards more private vehicle use is making walking and cycling attractive, together with improving public transport. This can be done by a range of activities including construction of sidewalks and bike lanes, bike sharing programmes, urban planning, and pedestrian-oriented development. NMT is a highly cost-effective transportation strategy and brings about large health, economic and social co-benefits, particularly for the urban poor (CTCN 2016).

NMT is adequate for local conditions and endorsed by local experts. There are major advantages related to costs as it is generally more cost effective to develop sidewalks and cycling routes relative to the cost of other transport infrastructure. It is well suited to short to medium travel distances which are common in SIDS. The main benefits related to NMT are:

Economic benefits:

- NMT, particularly cycling, is easy, flexible, cheap, and fast
- More attractive cities for tourists and residents, particularly if car-free zones are included
- Reduced travel times due to improved traffic flow
- Energy security due to lower vehicle energy use
- Greater economic inclusion

Social and environmental benefits:

- Congestion reduction
- Health benefits due to exercise.
- Diverts income from car and gas expenditure to other priorities
- Improved safety
- Air quality improvement
- Noise reduction
- GHG emissions reduction

NMT features in the Urban Resilience Plan for Basseterre (GOSKN, 2023b) which identified as one of its objectives to develop a pedestrian priority avenue in historic Basseterre to be actualized with various projects including an integrated mobility study focused on multi-modal transportation.

4.1.3.2 Ambition for the TAP

As it relates to promotion of NMT, this technology was not included as part of the mitigation actions in the NDCs. However, a preliminary target was set for improvement in public transport to install a shift of 20% away from personal cars. As such, the SWG proposed a similar target where promotion of NMT through the development of sidewalks, cycle lanes and safe cycle parking allows for a modal shift of 5% from personal vehicles by 2030. Table 4.8 presents targets for the scale of diffusion for NMT.

Table 4.8: Key targets for promotion of NMT

Action	Target
Construction and rehabilitation of sidewalks in Basseterre, Sandy Point and Cayon in St. Kitts and Charlestown and Market Shop, Gingerland in Nevis	2 km of sidewalk built 5 km of sidewalk rehabilitated
Safe cycle parking near to bus depots	200 slots
Allocation of cycle lanes along main sections of the island main road (along the shoulder where feasible)	5 km of cycle lanes delineated
Development of a strategy to promote NMT, survey to understand current use of NMT, development of an incentive regime to promote walking and cycling	One comprehensive strategy
Public education and outreach campaign to promote NMT	One comprehensive campaign for both islands

4.1.3.3 Actions and activities selected for the TAP

During the BAEF phase of the TNA, one (1) economic and financial barrier and two (2) non-financial barriers (technical and socio-cultural) were the top ranked critical barriers for the SWG including:

1. Space constraints / limited land area / narrow streets
2. High capital costs of NMT infrastructure (sidewalks, cycle lanes etc.)
3. Cultural preference and status associated with motorized transport over NMT

The root causes to the main economic barrier are overall high construction costs related mostly to the high cost of construction materials and to a lesser degree the cost of labour. Inadequate public funding and poor urban planning limit options for development of NMT infrastructure. Closely related, the absence of a government policy or regulations promoting NMT, has led to a development pathway that is focused on motorized transport. As such, the increase in motorized transport is widely regarded as positive in terms of development progress. Furthermore, such long-term emphasis on motorized transportation has dominated urban planning and infrastructure development leading to less space for NMT. Concurrently, cultural preference has shifted to motorized transport and owning a vehicle has become a symbol of personal success and status further reinforcing the focus on motorized transport. Table 4.9 summarizes the key measures to overcome these barriers to NMT.

Table 4.9: Key measures to overcome barriers to NMT

Barriers	Measures
High capital infrastructure costs associated with NMT	• Allocate specific funds or subsidies for the development of NMT infrastructure, such as sidewalks and cycle lanes. This could be a part of the national budget or through international grants aimed at sustainable transport projects. • Provide secure and convenient parking for bicycles to encourage cycling. This could be at transport hubs, workplaces, and commercial centres.
Space constraints / limited land area / narrow streets	• Integrate NMT into urban planning and development regulations (such as building codes) to ensure that future developments are built with sidewalks and bike lanes. • Start with small-scale, low-cost interventions that can be gradually expanded, such as painting bike lanes on existing roads or creating shared spaces.
Cultural preference and status associated with motorized transport over NMT	• Launch campaigns to shift cultural perceptions of NMT, emphasizing the health, environmental, and economic benefits of walking and cycling. • Include education on the benefits of NMT in schools and through community outreach programs, such as the importance of physical activity for health. Encourage public figures and leaders to use NMT to help shift the status symbol from motorized to non-motorized transport. • Introduce traffic calming measures in urban areas to make walking and cycling safer and more appealing, such as speed bumps and pedestrian zones. • Develop and implement policies that specifically promote NMT, including regulations that require new developments to include NMT infrastructure. • Involve the community in the planning and development process to ensure that the NMT infrastructure meets the needs of residents and is maintained. • Organize regular car-free days to encourage walking and cycling, and to help residents experience the benefits of NMT.

In determining the key actions and activities for the TAP, the SWG focused its consultations on infrastructure development especially sidewalks, cycle lanes and cycle parking. Table 4.10 summarizes the key actions and associated activities (Table 4.11) to be included in the TAP further elaborating on the measures identified in the BAEF.

Table 4.10: Key actions for promotion of NMT

Action	Description
Action 1	Develop a comprehensive policy, strategy and action plan to promote NMT including a survey to understand current use, upgrades to the national physical development plans and regulations and development of an incentive regime.
Action 2	Develop an infrastructure rehabilitation and development plan including site assessments and design of sidewalks, cycle lanes and cycle parking.
Action 3	Rehabilitate existing and construct new sidewalks, cycle lanes and cycle parking including associated traffic calming measures.
Action 4	Develop and implement public awareness campaign to promote NMT
Action 5	Monitor and evaluate current and emerging use of NMT

Table 4.11: Key activities for promotion of NMT

Action 1: Develop a comprehensive policy, strategy and action plan to promote NMT including a survey to understand current use, upgrades to the national physical development plans and regulations and development of an incentive regime.
1.1 Conduct surveys to gather data on current NMT usage, barriers, and opportunities.
1.2 Organize workshops and meetings with key stakeholders, including urban planners, transportation experts, community leaders, and NMT users, to gather input and consensus on the NMT policy.
1.3 Develop a comprehensive NMT policy that integrates findings from the surveys and stakeholder consultations, focusing on long-term strategies and short-term actions.
1.4 Design an incentive program that includes subsidies for bicycles, tax rebates for businesses promoting NMT, and rewards for regular NMT users.
1.5 Revise national physical development plans and regulations to incorporate NMT infrastructure requirements, such as mandatory sidewalks and cycle lanes in new developments.
Action 2: Develop an infrastructure rehabilitation and development plan including site assessments and design of sidewalks, cycle lanes and cycle parking.
2.1 Conduct thorough assessments of potential sites for NMT infrastructure, focusing on high-traffic areas, schools, business districts, and residential neighborhoods.
2.2 Organize design workshops with urban planners, architects, and civil engineers to create plans for sidewalks, cycle lanes, and cycle parking that are context-specific and culturally sensitive.
2.3 Perform EIA to ensure that NMT infrastructure development aligns with environmental sustainability goals.
2.4 Engage the public in the planning process through town hall meetings, online platforms, and public exhibitions of proposed NMT infrastructure designs.
Action 3: Rehabilitate existing and construct new sidewalks, cycle lanes and cycle parking including associated traffic calming measures.
3.1 Develop detailed project plans with timelines and milestones for the construction and rehabilitation of NMT infrastructure.
3.2 Begin construction and rehabilitation of sidewalks and cycle lanes in prioritized areas, ensuring the use of high-quality materials and adherence to safety standards.
3.3 Install secure and well-placed cycle parking facilities near transport hubs, workplaces, and commercial areas.
3.4 Introduce traffic calming measures, such as speed bumps, pedestrian crossings, and dedicated NMT zones, in areas with new and rehabilitated NMT infrastructure.
Action 4: Develop and implement public awareness campaign to promote NMT
4.1 Design a campaign strategy that includes key messages, target audiences, and a mix of communication channels (social media, radio, TV, billboards).
4.2 Collaborate with local media outlets to broadcast NMT promotion messages, success stories, and interviews with NMT users and advocates.
4.3 Develop and implement educational programs in schools and community centers that highlight the benefits of NMT for health, the environment, and the economy.
4.4 Organize community events, such as car-free days, walking and cycling festivals, and NMT demonstration projects, to engage the public and encourage participation.
4.5 Create channels for public feedback on the campaign, such as surveys and suggestion boxes, to continuously improve and adapt the messaging.
Action 5: Monitor and evaluate current and emerging use of NMT
5.1 Set up a system for regular data collection on NMT usage, including automated counters on cycle lanes and sidewalks, and periodic surveys of users.

5.2 Develop key performance indicators (KPIs) to track the progress of NMT adoption, such as the percentage of trips made by walking or cycling, and reductions in traffic congestion and air pollution.
5.3 Produce regular reports that summarize the findings of monitoring and evaluation activities and share them with stakeholders and the public.
5.4 Use the data and findings to adjust policies and strategies, ensuring continuous improvement in the promotion and adoption of NMT.

4.1.3.4 Stakeholders and timeline for implementation of TAP

To accomplish the goals of the Technology Action Plan (TAP) for greater promotion of NMT in St. Kitts and Nevis, various stakeholders will need to be involved. Each stakeholder will have specific roles and functions that contribute to the successful implementation of the TAP as outlined in Table 4.12.

Table 4.12: Key stakeholders for promotion of NMT

Stakeholder	Role
Department of Physical Planning (DPP)	- Lead the development of policies, strategies, and regulations related to NMT. - Coordinate the implementation of NMT projects and infrastructure development. - Integrate NMT into urban planning processes, ensuring that new developments include adequate NMT infrastructure. - Enforce building codes and regulations that support the inclusion of NMT infrastructure in new and existing developments.
Public Works Department (PWD)	- Responsible for the planning, design, construction and maintenance of NMT infrastructure.
Traffic Department	- Assist in the implementation of NMT projects and infrastructure development. - Enforce traffic laws that protect cyclists and pedestrians. - Implement traffic calming measures and ensure compliance with NMT-related regulations.
Ministry of Finance (MoF)	- Implement tax incentives, subsidies, and other financial mechanisms to lower the cost of EVs and hybrids. - Allocate budget for infrastructure development.
Ministry of Sustainable Development (MoSD) and Ministry of Environment and Climate Action (MoECA)	- Secure international climate finance or grants to support the TAP initiatives. - Coordination between financiers and implementing agencies.
Ministry of Health (MoH)	- Promote the health benefits of NMT through public health campaigns and initiatives. Collaborate with other ministries to integrate NMT into health promotion activities.
Private Sector	- Support NMT by providing facilities such as secure cycle parking, showers, and changing rooms for employees. Participate in incentive programs to encourage the use of NMT by staff and customers.
Media Outlets (ZIZ, NTV, VON Radio, Freedom FM, Winn FM and others)	- Broadcast information about the benefits of NMT through various media channels. - Highlight success stories, case studies, and interviews with early adopters of NMT. - Provide accurate and timely information about government policies, incentives, and available financial options for NMT. - Engage with the public through talk shows, articles, and social media to increase understanding and acceptance of NMT.
Local communities, pedestrians and cyclists	- Act as primary users of NMT infrastructure. Provide feedback on the usability and safety of NMT facilities and participate in public consultations. - Participate in the planning and decision-making processes related to NMT.

	- Provide feedback and suggestions on proposed projects to ensure they meet the needs of the community. - Engage in community discussions and activities related to the transition to NMT.

To ensure the successful implementation of the Technology Action Plan (TAP) for the promotion of NMT in St. Kitts and Nevis, it is essential to plan a sequence of activities with clear timelines, as well as define the nature and scale of each activity. Below is a summary of the sequence and timing for the specific activities.

Phase 1: Policy and Planning (Year 1-2)

1. Survey and Data Collection (Month 0-6)
- Nature: Conduct comprehensive surveys to understand the current usage patterns of NMT, barriers to adoption, and public perception. Surveys will include online questionnaires, in-person interviews, and traffic observation studies.
- Scale: Nationwide, focusing on both urban and rural areas.

2. Stakeholder Consultations (Month 0-6)
- Nature: Organize workshops and meetings with government agencies, NGOs, community leaders, and transport experts to gather inputs for the NMT strategy.
- Scale: Series of workshops, townhall meetings on both islands.

3. Policy Drafting and Approval (Month 6-12)
- Nature: Develop a draft policy document outlining the NMT strategy, including infrastructure, incentives, regulations, and public awareness campaigns.
- Scale: National policy, with specific chapters dedicated to urban and rural considerations.

4. Development of Infrastructure Plans (Month 6-18)
- Nature: Based on the policy, design detailed plans for the development and rehabilitation of NMT infrastructure, including sidewalks, cycle lanes, and parking. This will include site assessments and environmental impact assessments.
- Scale: Plans for key towns and major roads.

Phase 2: Infrastructure Development (Year 2-4)

1. Pilot Project Implementation (Month 18-24)
- Nature: Begin with interventions in selected pilot areas to test the feasibility of the proposed infrastructure.
- Scale: Pilot in 2-3 high-traffic areas in both urban and rural settings.

2. Comprehensive Infrastructure Rollout (Month 24-48)

- Nature: Based on the pilot projects, scale up the construction of NMT infrastructure across the country. This phase will involve more extensive construction efforts and include traffic calming measures.
- Scale: Nationwide, targeting all major towns and connecting routes.

Phase 3: Public Awareness (Year 3-5)

1. Launch Public Awareness Campaign (Month 36 onwards)
- Nature: Roll out a comprehensive campaign using media, educational programs, and community events to promote the benefits of NMT.
- Scale: National campaign, with particular focus on urban areas. Multiple channels including social media, TV, radio, and billboards.

2. Educational Programs in Schools and Communities (Month 36 onwards)
- Nature: Develop and integrate NMT education into schools and community workshops to instil the importance of NMT.
- Scale: Targeting all primary and secondary schools, with additional community outreach programs in high NMT potential areas.

3. Car-Free Days and Public Events (Month 36-onwards)
- Nature: Organize car-free days to allow the public to experience the benefits of NMT. Include activities like cycling tours, walking marathons, and health checks.
- Scale: Major urban towns.

Phase 4: Monitoring, Evaluation, and Adjustments (Year 3-5)

1. Set Up Monitoring Systems (Month 18-60)
- Nature: Install systems to monitor the use of NMT infrastructure, collect data on traffic patterns, and evaluate public satisfaction.
- Scale: Key NMT zones, including pilot areas and high-traffic routes.

2. Regular Evaluation and Reporting (Month 24 and ongoing)
- Nature: Conduct bi-annual evaluations of NMT usage, infrastructure quality, and campaign effectiveness. Produce reports with recommendations for policy adjustments.
- Scale: Nationwide, with reports tailored for different areas.

3. Policy and Infrastructure Adjustments (Month 48-60)
- Nature: Based on the monitoring and evaluation results, make necessary adjustments to policies, infrastructure, and campaigns to ensure continuous improvement and increased adoption of NMT.
- Scale: Targeted adjustments based on specific needs and feedback.

This phased approach, with specific activities and timelines, will ensure a systematic promotion and integration of NMT across the Federation, leading to long-term success.

4.1.3.5 Estimation of resources needed for action and activities

To ensure proper implementation of the TAP, it is important to build up the capacity of the key government agencies charged with coordination, project management, financial resources planning and allocation, and implementation of the projects stemming from the TAP as it related to the promotion of NMT.

The Department of Physical Planning requires human resources (at least 2 new officers) with key technical skills related to NMT and transportation planning and one 1project manager. In supporting roles, from the Ministry of Finance or Sustainable Development, at least one financial analyst or economist with expertise in financial modelling, cost-benefit analysis and design of incentive regimes. From the Ministry of Legal Affairs, a legal draftsperson with expertise in environmental law and regulatory frameworks.

Once these capacities are built up and human and financial resources allocated to the key government stakeholders, grant funding will need to be secured. Table 4.13 summarizes the approximate costs per activity. These estimates (adjusted for inflation) were retrieved from historical reports namely the Nationally Determined Contributions (NDCs) (GOSKN, 2021c), NDC Implementation Plan (GOSKN, 2022d) and Urban Resilience Plan for Basseterre (GOSKN, 2023b). In addition, the senior staff the Energy Unit and Public Works Department (and members of the SWG) provided estimates based on their expert opinion and recent procurement exercises in their respective agencies. These estimates are robust and indicative in the absence of full feasibility studies, which would generally be required once concept notes are approved, and full detailed project designs are being finalized.

Table 4.13: Estimated costs per activity for promotion of NMT

Action 1: Develop a comprehensive policy, strategy and action plan to promote NMT	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Infrastructure costs (USD)**
1.1 Conduct surveys to gather data on current NMT usage, barriers, and opportunities.	50,000	
1.2 Organize workshops and meetings with key stakeholders.	20,000	
1.3 Develop a comprehensive NMT policy.	50,000	
1.4 Design an incentive program.	50,000	
1.5 Revise national physical development plans and regulations to incorporate NMT.	50,000	
Action 2: Develop an infrastructure rehabilitation and development plan including site assessments and design of sidewalks, cycle lanes and cycle parking.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Infrastructure costs (USD)**
2.1 Conduct thorough assessments of potential sites for NMT infrastructure.	100,000	
2.2 Organize design workshops with key stakeholders.	20,000	
2.3 Perform EIA.	50,000	
2.4 Engage in public consultations.	20,000	
Action 3: Rehabilitate existing and construct new sidewalks, cycle lanes and cycle parking including associated traffic calming measures.	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Infrastructure costs (USD)[1]**
3.1 Develop detailed project plans for the construction and rehabilitation of NMT infrastructure.	50,000	
3.2 Begin construction and rehabilitation of sidewalks and cycle lanes in prioritized areas.		2 km new sidewalks = 230,000 5 km of sidewalk rehabilitated = 287,500 5 km of cycle lanes delineated = 25,000
3.3 Install cycle parking facilities near transport hubs, workplaces, and commercial areas.		200 cycle parking slots = 200,000
3.4 Introduce traffic calming measures.		200,000

Action 4: Develop and implement public awareness campaign to promote NMT	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Infrastructure costs (USD)**
4.1 Design a campaign strategy.	100,000	
4.2 Collaborate with local media outlets to broadcast NMT promotion messages.	50,000	
4.3 Develop and implement educational programs in schools and community centers.	50,000	
4.4 Organize community events.	100,000	
Action 5: Monitor and evaluate current and emerging use of NMT	**Consultancies (including expertise, logistics, materials etc) (USD)**	**Infrastructure costs (USD)**
5.1 Set up a system for regular data collection on NMT usage.	50,000	
5.2 Develop key performance indicators (KPIs) to track the progress of NMT adoption.	20,000	
5.3 Produce regular reports that summarize the findings of monitoring and evaluation activities.	20,000	
5.4 Use the data and findings to adjust policies and strategies.	20,000	
TOTAL	870,000	942,500

[1]**Assumptions:**
Sidewalk is 1.5 m width and the cost is approximately 115 USD per linear m or 115,000 USD per linear km (Personal communication, PWD, 2024).
Rehabilitation of sidewalk is assumed to cost half this amount – 57,500 per linear km
Painting of cycle lanes estimated at 5,000 per linear km

4.1.3.6 Management planning

Table 4.14 summarizes some of the key risks and their associated contingency actions.

Table 4.14: Key risks and contingency actions for promotion of NMT

Risk	Description	Contingency actions
Insufficient Funding and Financial Support	Lack of sufficient funds could delay or derail key activities.	Diversify Funding Sources: Explore additional funding opportunities, including international climate funds, grants, and public-private partnerships. Phased Implementation: Prioritize critical actions and implement them in phases, allowing time to secure additional funding for subsequent phases. Cost Reduction Strategies: Reevaluate project budgets to identify potential cost-saving measures without compromising project goals.
Delays in NMT Infrastructure Development	Delays in the construction of sidewalks and bike lanes	Prioritize High-Demand Areas: Focus initial infrastructure development in high-demand areas to maximize utilization and visibility.
Supply Chain Disruptions	Disruptions in the global supply chain could delay the procurement construction materials and other traffic related items	Advance Procurement Planning: Place orders well in advance and maintain strong relationships with suppliers to mitigate potential delays. Identify Alternative Suppliers: Develop a list of alternative suppliers to avoid reliance on a single source, reducing the impact of any supply chain disruptions. Stockpiling Critical Components: Where possible, stockpile key components or equipment to avoid delays caused by supply chain interruptions.
Technical Challenges and Lack of Expertise	Technical issues related to the building of NMT infrastructure	Training and Capacity Building: Invest in comprehensive training programs Technical Partnerships: Partner with international experts or companies with experience in NMT.
Policy and Regulatory Uncertainty	Delays or changes in government policies and regulations could create uncertainty thus hindering progress.	Stakeholder Engagement: Ensure continuous dialogue with policymakers to keep them informed of the TAP's progress and the importance of regulatory support. Flexible Policy Framework: Design policies with built-in flexibility to adapt to changing circumstances without compromising the overall objectives. Public-Private Partnerships: Strengthen partnerships between the government and private sector to ensure alignment of interests and reduce the impact of policy changes.
Limited Public Acceptance	Resistance from the public due to a lack of awareness or trust in NMT	Enhanced Public Education Campaign: Intensify efforts to educate the public on the long-term benefits, cost savings, and environmental impacts of NMT. Incentivize Early Adopters: Provide additional incentives, such as tax breaks or rebates, to early adopters of NMT to create a positive demonstration effect. Community Engagement: Engage community leaders and influencers to advocate for the adoption of NMT within their communities.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

By proactively identifying these risks and implementing the associated contingency actions, the likelihood of achieving the goals of the TAP can be significantly increased. Next, it is important to identify the immediate requirements to proceed and the critical steps to succeed.

Immediate requirements to proceed:

1. Kick-start capacity building and robust staffing within the Department of Physical Planning to ensure the Unit can effectively implement the project and coordinate with sister government agencies to attract the climate finance required to advance the work.
2. Secure funding (from international grants and / or public-private partnerships) and financial resources (from government budgets) to ensure smooth implementation of project activities.

Critical steps to ensure success:

1. Establish a robust project management framework with clear governance structures, timelines and accountability measures.
2. Foster participatory, early and active stakeholder engagement and coordination to ensure a shared understanding and commitment to the TAP objectives and workplan and clear lines of communication established.
3. Develop detailed workplan focused on phased implementation and flexibility allowing for adjustments based on initial outcomes, stakeholder feedback and changing circumstances.

4.1.3.7 TAP overview

Table 4.15: TAP overview table for promotion of NMT

Sector	Transport							
Technology	Promotion of non-motorized transport							
Ambition	Promotion of NMT through the development of sidewalks, cycle lanes and safe cycle parking allows for a modal shift of 5% from personal vehicles by 2030.							
Benefits	Comprehensive policy, strategy and action plan for NMT including infrastructure development planning and construction of 2 km of new sidewalks, 5 km of rehabilitated sidewalks, 5 km of cycle lanes and 200 safe cycle parking spots and a wide-ranging public awareness campaign.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame (months)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Develop a comprehensive policy, strategy and action plan to promote NMT	1.1 Conduct surveys to gather data on current NMT usage, barriers, and opportunities.	GCF	MPI	6	Technical Challenges and Lack of Expertise	Complete survey by middle of Year 1	Delivery of survey report	50,000
	1.2 Organize workshops and meetings with key stakeholders.	GCF	MPI	6	Limited Stakeholder Engagement	Complete workshops by middle of Year 1	Number of buses procured	20,000
	1.3 Develop a comprehensive NMT policy.	GCF	MPI	6	Policy and Regulatory Uncertainty	Complete policy and action plan by end of Year 1	Delivery of policy and action plan report	50,000
	1.4 Design an incentive program.	GCF	MPI	6	Policy and Regulatory Uncertainty	Complete incentive program design by end of Year 1	Delivery of incentive program design report	50,000
	1.5 Revise national physical development plans and regulations to incorporate NMT.	GCF GOSKN	MPI	6	Policy and Regulatory Uncertainty	Complete upgrades to development plans and regulations by end of Year 1	Delivery of upgraded plans and regulations report	50,000

Action 2: Develop an infrastructure rehabilitation and development plan including site assessments and design of sidewalks, cycle lanes and cycle parking.	2.1 Conduct thorough assessments of potential sites for NMT infrastructure.	GCF	MPI SKELEC NEVLEC	12	Technical Challenges and Lack of Expertise	Complete site assessments by middle of Year 2	Delivery of site assessment report	100,000
	2.2 Organize design workshops with key stakeholders.	GCF	MPI SKELEC NEVLEC	3	Limited Stakeholder Engagement	Complete workshops by middle of Year 2	Delivery of workshop report	20,000
	2.3 Perform EIA.	GCF	MPI SKELEC NEVLEC	6	Technical Challenges and Lack of Expertise	Complete EIA by middle of Year 2	Delivery of EIA report	50,000
	2.4 Engage in public consultations.	GCF GOSKN	MPI SKELEC NEVLEC	3	Limited Public Acceptance	Complete public consultation by end of Year 2	Delivery of consultation report	20,000
Action 3: Rehabilitate existing and construct new sidewalks, cycle lanes and cycle parking including associated traffic calming measures.	3.1 Develop detailed project plans for the construction and rehabilitation of NMT infrastructure.	GCF	MoF MoSD	6	Technical Challenges and Lack of Expertise	Complete infrastructure plan by end of Year 2	Delivery of infrastructure plan	50,000
	3.2 Begin construction and rehabilitation of sidewalks and cycle lanes in prioritized areas.	GCF	MoF MoSD	24	Insufficient Funding and Financial Support Supply Chain Disruptions	Complete construction of 2 km of sidewalk, rehabilitation of 5 km of sidewalk and delineation of 5 km of bike lanes by end of Year 4	Number of km of sidewalks newly constructed or rehabilitated and km of bike lanes delineated	542,500
	3.3 Install cycle parking facilities near transport hubs, workplaces, and commercial areas.	GCF	MoF MoSD	12	Insufficient Funding and Financial Support	Complete installation of 200 safe cycle parking spots by end of Year 4	Number of cycle parking spots	200,000
	3.4 Introduce traffic calming measures.	GCF	MoF MoSD	12	Insufficient Funding and Financial Support	Complete installation of traffic calming measures at each key site by Year 4	Number of measures installed	200,000

					Supply Chain Disruptions			
Action 4: Develop and implement public awareness campaign to promote NMT	4.1 Design a campaign strategy.	GCF	MoECA	6	Limited Public Acceptance	Complete design of public awareness campaign by end of Year 2	Delivery of design report	100,000
	4.2 Collaborate with local media outlets to broadcast NMT promotion messages.	GCF	MoECA	6	Limited Public Acceptance	Achieve an engagement rate of 75% on social media platforms	Number of likes, shares, comments and other interactions on campaign-related content	50,000
	4.3 Develop and implement educational programs in schools and community centers.	GCF GOSKN	MoECA	6	Limited Public Acceptance	Increase awareness of school children by 50% by end of Year 3	Survey results	50,000
	4.4 Organize community events.	GCF GOSKN	MoECA	6	Limited Public Acceptance	Increase public awareness of the benefits of hybrids / EVs by 50% by end of Year 3	Survey results	100,000
Action 5: Monitor and evaluate current and emerging use of NMT	5.1 Set up a system for regular data collection on NMT usage.	GCF	MoE CFBC AVEC	12	Technical Challenges and Lack of Expertise	Complete design of monitoring system by end of Year 4	Delivery of monitoring system report	50,000
	5.2 Develop key performance indicators (KPIs) to track the progress of NMT adoption.	GCF	MoE CFBC AVEC	12	Technical Challenges and Lack of Expertise	Complete design of KPI by end of Year 4	Delivery of KPI report	20,000
	5.3 Produce regular reports that summarize the findings of monitoring and evaluation activities.	GCF GOSKN	MoE CFBC AVEC	12	Technical Challenges and Lack of Expertise	Complete monitoring reports by end of Year 5	Delivery of monitoring reports	20,000

	5.4 Use the data and findings to adjust policies and strategies.	GCF GOSKN	MoE CFBC AVEC	6	Technical Challenges and Lack of Expertise	Complete policy adjustments / recommendations by end of Year 5	Number of policies completed, upgraded and adopted	20,000

4.2 Project Ideas for the Transport Sector

4.2.1 Summary of project ideas for the transport sector

There are several concrete project ideas which can be extracted from the TAP to support phased actions towards the fulfilment of the overall goals for diffusion of EVs and NMT outlined in sections 4.1.2.2 and 4.1.3.2. Several project ideas are outlined in Table 4.17.

Table 4.17: Project ideas for the transport sector

Project Ideas	Overall TAP Target
Project Idea #1: Develop and implement a pilot project to electrify the fleet of government school buses including feasibility studies related to charging stations and policies for vehicle replacement and procurement of new vehicles for the government fleet and training for school bus drivers, mechanics and first responders. **Project Idea #2:** Develop incentive regime for the widespread diffusion of EVs for the public sector including public awareness campaign related to long-term benefits of hybrids and EVs. **Project Idea #3:** Develop a comprehensive policy, strategy, action plan and public awareness campaign to promote NMT and design and implement infrastructure rehabilitation and development including site sidewalks, cycle lanes and cycle parking.	Deployment of 6 school buses and conventional charging stations (10) and solar chargers (5), training of a cadre of mechanics, bus drivers and first responders, demonstration of EV technology to the public, feasibility studies and rollout of incentive regime to promote the wider diffusion of hybrids and EVs and a wide-ranging public awareness campaign by 2030. Promotion of NMT through the development of sidewalks, cycle lanes and safe cycle parking allows for a modal shift of 5% from personal vehicles by 2030.

4.2.2 Specific project idea

Project idea #1 related to a pilot school bus project is a priority and should be one of the first actions of the TAP for the transport sector. Table 4.18 summarizes the key elements of a future project proposal for this project.

Table 4.18: Key project proposal elements for selected project idea

Section	Narrative
Introduction/ Background	This project aims to implement a pilot program to electrify the government's school bus fleet in St. Kitts and Nevis. The electrification project has been developed in response to the government's commitment to reduce greenhouse gas (GHG) emissions from the transport sector as outlined in the national Technology Action Plan (TAP) and mitigation strategies. The project will also conduct feasibility studies on charging stations, and develop policies related to vehicle replacement, procurement of electric vehicles, and training for bus drivers, mechanics, and first responders.
Objectives	The primary objectives of the project are: • Reduce GHG emissions by replacing conventional internal combustion engine (ICE) school buses with electric vehicles (EVs). • Develop EV policies for government vehicle procurement and replacement. • Train school bus drivers, mechanics, and first responders to operate, maintain, and handle electric school buses.
Outputs	• Electrification of a portion of the school bus fleet. • Installation of electric vehicle (EV) charging stations in strategic locations. • Creation of a training program for drivers, mechanics, and first responders.

	• Policy recommendations for the long-term procurement and replacement of government vehicles. • Feasibility study report on grid capacity and charging infrastructure. • Reduction in annual GHG emissions by 5% from the transport sector within the first five years of implementation.
Relationship to national priorities	This project directly aligns with the government's sustainable development priorities to transition to low-carbon technologies in line with national commitments under the Paris Agreement and the National Climate Change Strategy. It is also in accordance with the Government of St. Kitts and Nevis' ambition to increase the use of renewable energy and promote energy efficiency, especially in the transport sector.
Project deliverables	• The key benefit is the reduction of GHG emissions and improved air quality. • Long-term savings on fuel and maintenance costs for government school buses. • Creation of a framework for a nationwide transition to electric vehicles • Development of skilled labor for EV maintenance and emergency response.
Project scope	The project will initially focus on a pilot program that will electrify a specific portion of the school bus fleet. It will also include feasibility studies for charging stations at key locations (schools, government buildings, etc.) and policy recommendations. The pilot will test operational, financial, and environmental impacts before scaling up to a full fleet electrification. The project is linked to the broader national agenda of transitioning to hybrid and electric vehicles as highlighted in the national TAP for transport.
Project activities	- Conduct a detailed grid capacity analysis and determine charging station requirements. - Procure electric school buses and charging stations. - Develop and implement a training program for school bus drivers and first responders. - Develop policy recommendations for the long-term transition to EVs (procurement and replacement) of government vehicles.
Timelines	The project will be implemented over a **5-year** period: **Year 1:** Feasibility studies, procurement of buses and charging stations, start of training programs. **Year 2:** Full implementation of the pilot with an initial portion of buses electrified. **Year 3-5:** Monitoring, evaluation, and adjustments based on the pilot results, followed by scaling up the project.
Budget	The total budget for the project is estimated at **USD 3 million**, broken down as follows: **Feasibility Studies and Policy Document**: USD 450,000 **Pilot School Buses and Charging stations**: USD 2,500,000 **Monitoring and Evaluation**: USD 50,000
Measurement and evaluation	• Success will be measured through reductions in fuel consumption, GHG emissions, and operational costs. • Evaluation will involve performance reviews of the pilot fleet, feedback from drivers, and operational data on charging stations. • Long-term success metrics will include the scalability of the pilot and adoption of EV buses across the entire school bus fleet.
Possible challenges	• High upfront costs for buses and charging stations. • Potential grid capacity issues that could delay installation of charging stations. • Limited availability of local expertise for maintaining electric buses. • Resistance to change from traditional fuel-based operations to electric technology.
Responsibilities / coordination	**Ministry of Public Infrastructure:** Overall project coordination and policy development. **Ministry of Education:** Coordination of school bus services and training. **Energy utilities:** Ensuring grid readiness for charging stations. **Private sector:** Suppliers for buses and charging infrastructure. **International partners:** Possible technical and financial assistance.

Chapter 5 Cross-cutting issues

Technological advancements across sectors such as water, agriculture, energy, and transport are crucial for addressing climate change and sustainable development challenges. However, the successful diffusion and implementation of these technologies are hindered by several barriers, including technical, financial, institutional, and social challenges. Cross-cutting policies and enabling actions can help overcome these barriers, providing a shared framework for the various sectors to thrive. In this section, we explore the common enabling policies and actions that can be adopted across sectors to ensure successful implementation of the TAPs.

5.1 Policy Integration and Coherence

One of the critical barriers identified is the lack of policy coherence and integration across sectors. For example, in the water sector, the absence of an integrated water resource management framework is a key barrier, and in the energy sector, outdated regulatory frameworks limit the diffusion of renewable technologies. To address these issues, there is a need to focus on creating integrated climate policies that align national development strategies with climate adaptation and mitigation goals. Integration would involve harmonizing sectoral policies to promote synergies and overcome inefficiencies in resource allocation between water and agriculture on the adaptation side and energy and transport on the mitigation side. Next, the establishment of cross-sectoral collaboration mechanisms, such as inter-ministerial task forces, would ensure consistent implementation of policies across different areas. This process is presently in motion in St. Kitts and Nevis. Finally, incorporation of climate resilience and sustainability criteria in all infrastructure projects and development plans would ensure that future investments contribute to national climate goals. This is also in progress and spearheaded by the Ministry of Sustainable Development.

5.2 Strengthening Institutional Capacities

Throughout the TNA process in St. Kitts and Nevis, the SWG consistently highlighted that capacity-building is essential for the successful implementation of climate technologies. Across all sectors—water, agriculture, energy, and transport—there is a need for strengthening the technical and management capacities of key institutions. Enabling actions include investment in capacity-building programs to train technicians, engineers, and policymakers on the latest climate technologies and management strategies. This can be done through partnerships with universities and international organizations. Furthermore, establishment of robust data collection, monitoring, and evaluation systems (GIS, SCADA etc.) across sectors will improve decision-making and policy implementation. Finally, development of dedicated units within relevant ministries or agencies tasked with monitoring and promoting technology diffusion in their respective sectors and providing support to local stakeholders could ensure progress in technological advancement across multiple sectors.

5.3 Financing and Investment Mechanisms

High capital costs for new technologies are a common barrier in all sectors. Whether it is smart metering systems for water conservation or solar photovoltaic (PV) systems in the energy

sector, the financial burden often inhibits their uptake. Therefore, the establishment of innovative financing mechanisms and investment partnerships is crucial. It will be important to explore enabling actions such as blended finance models that combine public and private investments to reduce financial risks for investors in climate technologies. Also, increased access to international climate funds will be important to fund large-scale technology projects across multiple sectors. Finally, financial incentives to make climate-friendly technologies more affordable for households and businesses, particularly in sectors like transport (for EVs) and agriculture (for pest management systems and soil monitoring technologies) will be critical.

5.4 Public Awareness and Stakeholder Engagement

As highlighted throughout this report, public acceptance and engagement are essential for the widespread adoption of climate technologies. In many cases, resistance to new technologies arises due to a lack of understanding of their benefits or concerns over costs. Therefore, public awareness campaigns and stakeholder engagement strategies are necessary to create an enabling environment for technology diffusion. Key actions include:

- National public awareness campaigns to educate citizens about the environmental, economic, and social benefits of adopting sustainable technologies.
- Stakeholder consultation processes in the development of sectoral technology plans. Involving local communities, industry stakeholders, and civil society organizations in decision-making processes ensures that the solutions proposed are culturally acceptable and economically viable.
- Establishment of small-scale pilot projects showcasing the benefits of climate technologies, as highlighted in the TAPs, can build public trust and encourage wider adoption.

5.5 Addressing Social and Gender Equity Issues

The adoption of climate technologies can have unequal impacts on different segments of society, particularly vulnerable groups such as women, youth, and low-income households. Policies should ensure that the benefits of climate technology diffusion are equitably distributed. Actions include:

- Integrating gender considerations into technology planning and policymaking to ensure that technologies are designed and implemented in ways that benefit all members of society. For example, in agriculture, technologies such as pest management systems should be accessible and affordable to smallholder women farmers.
- Social protection measures for those negatively impacted by technology transitions, such as workers in industries that may face job losses due to technological advancements (e.g., ICE mechanics in EVs transition). Training programs to reskill workers in emerging green technologies can provide alternative employment opportunities.
- Ensuring access to affordable technologies for low-income households through targeted subsidies or social financing schemes.

Chapter 6 Summary and Conclusions

This Technology Action Plan (TAP) for St. Kitts and Nevis presents a comprehensive approach to addressing the barriers to climate adaptation and mitigation by prioritizing key technologies across four major sectors: water, agriculture, energy, and transport. Each sector has been thoroughly analyzed, with tailored action plans developed to facilitate the diffusion of technologies that contribute to the country's climate resilience and low-carbon transition. In this chapter, we summarize the key findings from the previous sections and draw conclusions about the critical actions necessary to achieve these goals.

Water Sector: The water sector in St. Kitts and Nevis faces growing challenges related to resource scarcity and inefficiencies, compounded by climate change. Two key technologies were prioritized for this sector—apparent water loss management and real water loss management. Addressing non-revenue water (NRW) is critical to improving overall water management in both islands. Specific actions in this sector focus on detailed water audits, enhanced universal metering, leakage detection, and pressure management through advanced technologies like Supervisory Control and Data Acquisition (SCADA) systems.
The key TAP targets for the water sector are:

- Reduce apparent water losses by 25% over five years.
- Reduce real water losses by 25% over five years.

The overview of the TAPs for the water sector can be found in Tables 1.8 and 1.16.

Agriculture Sector: The agricultural sector is vital to national food security and rural livelihoods, but it is highly vulnerable to climate change impacts such as drought, pests, and declining soil moisture. The TAP focuses on two key technologies: integrated pest management (IPM) and soil moisture conservation monitoring techniques. These technologies aim to improve resilience in the agricultural sector by reducing the use of harmful pesticides, conserving water, and promoting sustainable farming practices.
The key TAP targets for the agriculture sector are:

- Ensure the diffusion of IPM practices across half of the active farms by 2030.
- Promote soil moisture conservation and monitoring on half of active farms by 2030.

The overview of the TAPs for the agriculture sector can be found in Tables 2.8 and 2.16.

Energy Sector: The energy sector in St. Kitts and Nevis is heavily dependent on fossil fuels, making it crucial for the country's climate mitigation efforts to focus on renewable energy and energy efficiency. The prioritized technologies include solar water heating and residential grid-tied solar photovoltaic (PV) systems. The TAP outlines actions aimed at increasing the penetration of these renewable technologies through feasibility studies, training, incentive schemes, and pilot projects.
The key TAP targets for the energy sector are:

- Installation of at least 30 solar water heating systems at critical government buildings by 2030.

- Installation of 500 kW of grid-tied solar PV capacity at critical government buildings by 2028.

The overview of the TAPs for the energy sector can be found in Tables 3.8 and 3.16.

Transport Sector: Transport is one of the major contributors to greenhouse gas (GHG) emissions in St. Kitts and Nevis. The TAP prioritizes the adoption of hybrid and battery electric vehicles (EVs), along with the promotion of non-motorized transport (NMT) options such as cycling and walking. The action plan emphasizes creating the necessary infrastructure for electric vehicles, including charging stations, and promoting active modes of transportation through the development of sidewalks and cycle lanes.

The key TAP targets for the transport sector are:

- Deploy 5 electric school buses and 15 charging stations (both conventional and solar) by 2030.
- Facilitate a modal shift of 5% from personal vehicles to non-motorized transport by 2030.

The overview of the TAPs for the transport sector can be found in Tables 4.8 and 4.16.

The successful implementation of the TAP will require:

- Strong political commitment and leadership to drive the adoption of climate technologies.
- Collaboration across government, private sector, and civil society to align efforts and ensure efficient resource allocation.
- Sustained financial investment and capacity-building to overcome the high capital costs and technical challenges associated with climate technology diffusion.
- Continuous stakeholder engagement to build public awareness and support for climate-friendly solutions.
- Effective monitoring and evaluation mechanisms to track progress and adapt to evolving challenges.

Overall, the TAP report for St. Kitts and Nevis serves as a valuable resource for policymakers, stakeholders, and development partners in their efforts to facilitate technology transfer and diffusion in the context of climate change adaptation and mitigation. It provides a solid foundation for the implementation of effective strategies that will contribute to the sustainable and resilient development of St. Kitts and Nevis.

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Annex I: List of Stakeholders

Stakeholder	Primary function	Agency Representative on the SWG Name and Email Address
Climate Action Unit Ministry of Environment, Climate Action and Constituency Empowerment	Primary focal agency for climate change action in St. Kitts and Nevis, with responsibility for compliance with the reporting requirements under the UNFCCC.	Cheryl Jeffers, Chief Technical Officer National TNA Coordinator
Water Working Group		
Integrated Water Resources Management Unit Ministry of Communications Nevis Island Administration	Responsible for the identification, upkeep, and protection of water supply sources on Nevis.	Floyd Robinson, Engineer floyd.robinson@niagovkn.com
Water Services Department Ministry of Public Infrastructure, Utilities, Posts and Urban Development	Maintains control over water production and distribution.	Cromwell Williams, Manager / Water Engineer cromwell.williams@gov.kn
Private Sector – Waterworks Solutions Inc.	Provision of services to the water sector including installation of water distribution and storage systems.	Denison Paul, Engineer wwsolutions.paul@gmail.com
Agriculture Working Group		
Nevis Department of Agriculture Ministry of Agriculture	Provides technical support that is needed to ensure that the citizens and residents of the Federation are food and nutritionally secured through various initiatives and programmes.	Quincy Bart, Quarantine Officer agriculture.dept@niagovkn.com bartquincy@gmail.com Hydeia Tyson, Extension Officer hydeiatyson18@gmail.com
Department of Agriculture Ministry of Agriculture, Fisheries and Marine Resources	Provides technical support that is needed to ensure that the citizens and residents of the Federation are food and nutritionally secured through various initiatives and programmes.	Brontie Tucker, Agronomist brontie.tucker@gov.kn

Stakeholder	Primary function	Agency Representative on the SWG Name and Email Address
Private sector – agriculture consultant	Provision of services to the agricultural sector through consultancy services.	Stephen Duggins, Consultant / Agriculture expert dugskn@gmail.com
GEF – Small Grants Programme / UNDP	GEF-SGP provides financial and technical support to community-based projects that conserve and restore the environment while enhancing well-being and livelihoods.	Ilis Watts, National Project Coordinator and Agronomist Iliswatts@unops.org
Energy and Transport Working Group		
Energy Unit Ministry of Public Infrastructure, Utilities, Posts and Urban Development	Strategic and planning unit for the energy and transport sector	Bertill Browne, Engineer bertillb@skelec.kn Denasio Frank, Engineer Denasio.frank@gov.kn
Ministry of Sustainable Development Urban Development Unit Department of Physical Planning	Strategic and planning unit for urban planning and revitalization Focal department for development control and forward planning	Rhon Boddie, Unit Head rhon.boddie@gov.kn Austin-Jay Farier, Director austin-jay.farier@gov.kn Jarid Sutton, Development Control Officer jarid.sutton@gov.kn
SKELEC	St. Kitts Electricity Company, sole electricity provider in St. Kitts	Jonathan Kelley, Engineer jkelly@skelec.kn Rhondel Phillip, Engineer rphillip@skelec.kn

Stakeholder	Primary function	Agency Representative on the SWG Name and Email Address
NEVLEC	Nevis Electricity Company, sole electricity provider in Nevis	Ian Ward, Engineer ian.ward@nevlec.com Jervan Swanston jervan.swanston@nevlec.com Naftalie Errar, Project Manager naftalie.errar@nevlec.com
Department of Maritime Affairs	Strategic and planning unit for the maritime transport sector	Wayne Edmeade waynejrsm@gmail.com
Private Sector – New Era	Provider of RE products	Davian Trotman, Owner neweraskn@gmail.com