Ministry of Tourism and Environment

MALDIVES

TECHNOLOGY ACTION PLAN REPORT

MITIGATION AND ADAPTATION
NOVEMBER 2024

TNA TECHNOLOGY NEEDS ASSESSMENT

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Foreword

The Government of Maldives is pleased to present the Maldives' Technology Action Plan (TAP), a strategic milestone in our collective pursuit for a low-carbon, climate-resilient future. Our vulnerability to the adverse effects of climate change compels us not to retreat, but to lead, by demonstrating what is possible through ambition, innovation, and collaboration.

The TAP is guided by our Third Nationally Determined Contribution and builds upon decades of national leadership in climate action. It embodies our commitment to both mitigation and adaptation, reflecting our lived experiences as a small island developing state, where the adverse impacts of climate change are not distant threats but everyday realities.

The TAP lays out a clear vision for safeguarding our islands, our people, and our economy while advancing sustainable development. On the mitigation front, the plan articulates our strategic priorities for accelerating the adoption of clean technologies across three essential sectors: electricity generation and consumption, waste management, and transport. On the adaptation side, this plan identifies targeted and practical actions for technology uptake across three priority sectors: coastal adaptation and disaster management, water resources, and agriculture and food security. These efforts demonstrate that solutions anchored in both science and traditional knowledge can deliver transformational change.

Despite high costs, technical constraints, and the geographic dispersion of our islands, we remain resolute in transforming ambition into action. This plan underscores the urgency of scaled-up international support in finance, capacity building, and technology transfer, while also showcasing the opportunities for innovation, locally led solutions, and partnerships that amplify climate action.

I extend my deepest appreciation to all stakeholders whose insights and contributions have shaped this plan, and I invite our national and international partners to join us in implementing it. Together, we can turn ambition into action and lead the way toward a more sustainable and equitable world.

H.E Thoriq Ibrahim

Minister of Tourism and Environment

TECHNOLOGY ACTION PLAN (TAP) REPORT - MITIGATION

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Executive Summary

This Technology Action Plan (TAP) report was developed based on the findings of Barrier Analysis and Enabling Framework (BAEF) report and extensive stakeholder consultations conducted between May to October 2024. The three sectors on which TAP was focused included (1) Electricity Generation and Consumption sector, (2) Waste Management Sector and (3) Transport Sector. TAP for 4 main technologies has been proposed in the report. They include (1) Rooftop Solar PV system with Batteries, (2) Floating Solar Platforms, (3) Waste to Energy (WTE) Facilities in Regional Waste Management Centres and (4) Electric Vehicles. The TAP provides action plans for the prioritized adaptation technologies in the three sectors after removal of financial and non-financial barriers, and the creation of appropriate enabling environment for technology uptake and diffusion. The Actions are derived from the measures that were identified in the Barriers Analysis and Enabling Framework (BAEF) Report.

TAP for Rooftop Solar PV system with batteries

The TAP actions for the Rooftop Solar PV system with batteries include understand the barriers in implementation of the Net-metering regulation, upgrading the existing electricity network grid in the islands and conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges. The anticipated budget for the implementation of these actions is 300,000 USD. The main stakeholders to be involved in the implementation of these actions include the Ministry of Climate Change, Environment and Energy (MCCEE). Utilities Regulatory Authority (URA), Utility companies (FENAKA and State Electric Company Limited), Ministry of Economic Development (MED), Maldives Customs Services (MCS), Ministry of Foreign Affairs (MFA), Maldives National Chamber of Commerce (MNCC), Island Councils and Private sector PV installation companies. The key barriers aimed to be overcome by these actions include instability of the existing electricity grid and unavailability of Material for PV Installation.

TAP for Floating Solar Platforms

The TAP actions for the floating solar platforms technology include Waiver of the import duty for the spare parts and different components of the Floating solar platform and collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works. The anticipated budget for the implementation of these actions is 150,000 USD. The main stakeholders to be involved in the implementation of these actions include the Ministry of Climate Change, Environment and Energy (MCCEE). Utilities Regulatory Authority (URA), Maldives National University (MNU), Maldives Polytechnics. Maldives Customs Services (MCS) and Attorney General's Office (AGO). The key barriers aimed to be overcome by these actions include high capital and maintenance costs and lack of skilled technicians.

TAP for Waste to Energy (WTE) Facilities at Regional Waste Management Facilities

The TAP actions for the Waste to Energy (WTE) Facilities at Regional Waste Management Facilities include Training for staff of WAMCO for operation of WTE facilities and Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022). The anticipated budget for

the implementation of these actions is 30,000 USD. The main stakeholders to be involved in the implementation of these actions include the Ministry of Climate Change, Environment and Energy Waste Management Cooperation (WAMCO), Design Build and Operate (DBO) Contractor for Waste to Energy Facilities, Attorney General's Office (AGO) and Utility Regulatory Authority (URA). The key barriers aimed to be overcome by these actions include lack of Regulatory Framework for WTE facilities, lack of trained human capital, limited experience in implementation of WTE facilities and address lack of means for management of by-products from WTE facilities such as bottom ash.

TAP for Electric Vehicles (EV)

The TAP actions for the Electric Vehicles (EV) include in collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs and Formulation of Regulation on importing, maintenance, and emission standards for EVs. The anticipated budget for the implementation of these actions is 145,000 USD. The main stakeholders to be involved in the implementation of these actions include the Ministry of Transport, Maldives National University (MNU) and Maldives Polytechnic Attorney General's Office (AGO). The key barriers aimed to be overcome by these actions include legal and administrative barriers and lack of trained mechanics for maintenance of the EVs.

Project Idea (PI) for Electricity Production and Consumption sector

The project idea (PI) prioritized for the Electricity Production and Consumption sector is Upgrading of existing electricity grid in selected islands of Maldives. The main objectives of the PI include

- To ensure electricity produced by Solar PV systems can be utilized via the electricity grid of the island.
- To ensure energy security of the island and reduce power outage events.
- To identify the islands which need to be given priority for upgrading the existing electricity.
- To estimate the resources required for the grid upgrading works.

The estimated budget for the project is 160,000 USD and the anticipated timeframe for implementation of the project is 1- 2 years. The project will be implemented by URA in collaboration with utility companies.

Project Idea (PI) for Waste Management sector

The PI for the Waste Management sector includes Formulation of WTE Regulation under Waste Management Act (24/2022). The main objectives of the PI include

- To develop regulations for WTE facilities.
- To develop emission standards for WTE facilities and means for management of bottom ash.

The estimated budget for the project is 25,000 USD and the anticipated timeframe for implementation of the project is 1 year. The project will be implemented by the Waste Management and Pollution Control Department of MCCEE. WAMCO and URA will be responsible for providing technical input and AGO will provide any legal assistance required.

Project Idea (PI) for Transport sector

The PI for the Capacity building of local mechanics on repair and maintenance of Electric Vehicles (EVs). The main objectives of the PI include

- To consult with different stakeholders on introduction of a vocational course on repair and maintenance of EVs
- To introduce a vocational course to Maldives National University (MNU) and Maldives Polytechnic on repair and maintenance of EVs.
- Build capacity of lecturers and tutors on management of EVs

The estimated budget for the project is 120,000 USD and the anticipated timeframe for implementation of the project is 1-2 years. The project will be implemented by the Ministry of Transport and MNU and Maldives Polytechnic will be responsible for conducting the vocational course on repair and maintenance of EVs using the curriculum and training material developed by the project.

Acronyms and Abbreviation

AGO	Attorney General's Office
ARISE	The Accelerating Renewable Energy Integration and Sustainable Energy Project
ASURE	Accelerating Sustainable System Development Using Renewable Energy
BAEF	Barrier Analysis and Enabling Framework
BUR1	Initial Biennial Update Report
EVs	Electric Vehicles
HDC	Housing Development Corporation
LNG	Liquified Natural Gas
MED	Ministry of Economic Development
MCS	Maldives Customs Services
MCCEE	Ministry of Climate Change, Environment and Energy
MFA	Ministry of Foreign Affairs
MSW	Municipal Solid Waste
NDC	Nationally Determined Contribution
PI	Project Ideas
POISED	Preparing Outer Islands for Sustainable Energy Development
RE	Renewable Energy
TNA	Technology Needs Assessment
UNFCCC	United Nations Framework Convention on Climate Change
URA	Utilities Regulatory Authority
WDC	Women Development Committee
WTE	Waste to Energy

CHAPTER 1: TECHNOLOGY ACTION PLAN FOR ELECTRICITY PRODUCTION AND CONSUMPTION SECTOR

1.1 TAP for Electricity Production and Consumption Sector

1.1.1 Sector Overview

Electricity production is one of the most significant sectors which contribute to Greenhouse gas (GHG) emissions in the Maldives. Maldives almost entirely relies on fossil fuel for electricity production. The GHG inventory reported on the Initial Biennial Update Report of Maldives (BUR1) indicates that 67% of the GHG emissions of the Maldives accounted for Energy Industries (Ministry of Environment 2019). Due to this high contribution of electricity production to GHG inventory of the country, electricity production and consumption sector was prioritized for Technology Needs Assessment (TNA) project.

The Maldives Energy Policy and Strategy (2016) included a policy to increase the share of renewable energy in the national energy mix. In addition, climate change mitigation interventions were included in the Maldives' Nationally Determined Contribution (NDC) that was submitted to UNFCCC in 2015 and updated on 2020. These interventions include;

- Increase of electricity production by renewable energy (RE) with storage and grid stabilization. Efforts would be made to increase installed RE share to 15%, which includes the public and private sector.
- Increase supply and demand side efficiency. Increase of efficiency of generators and upgrading the grids to minimize grid loss would be essential. Significant upgrading of the existing power production infrastructure needs to be done via routine scheduled maintenance, synchronization and optimization of power production and reducing grid loss to at least 5% is required. In addition, demand side management would include implementation of standard labelling program and improvement of building standards for energy efficiency.
- Use of Liquefied Natural Gas (LNG) for electricity generation within greater Malé region. The diesel used for power production could be replaced with LNG for the greater Malé region with the proposed LNG plant in Thilafushi and the interconnectivity bridge.

The emission scenarios described in the BUR1 indicates that Power generation sector is the dominant source of GHG emissions, and it grows by 192% by 2030 compared to the 2011 emission levels. The following Table 1 provides sectorial breakdown of the emissions projects in $GgCO_2e$.

Table 1: Sectorial Breakdown of the emission projections (Source: Maldives First Biennial Update Report (2019)

Source of Emission	2011 emission in GgCO2e	2030 projected emission in GgCO2e	Percentage Change
Commercial and Public Services	176.4	671.5	280.8%
Transport	263.9	740.4	180.5%

Industry	35.8	131.8	268.1%
Resorts	419.2	962.4	129.6%
Residential	226.2	707.3	212.7%
Fishing	58.0	71.4	23.1%
Waste	46.8	81.8	74.9%
Total Emission in GgCO2e	**1,226.30**	**3366.6**	**174.7%**

1.1.2 Action Plan for Technology for Roof Top Solar PV

1.1.2.1 Introduction

Solar PV energy is an indigenous resource with the most immediate exploitation possibilities in Maldives. Solar radiation is in the order of 1,200 kWh/m2/year, which is considered good for any solar PV project.

The solar PV project is being successfully implemented in hybrid systems in several inhabited islands through donor financed projects. PV panels are installed on the roofs of diesel power plants, schools, water desalination plants, sewage plants, and public buildings. PV panels are connected to diesel power plants through an energy management system (EMS) that enhances the regulation of power supply. This hybrid configuration can offer short pay back times when compared to current prices of electricity produced by diesel generation sets. Rooftop solar PV is also being installed in the country, under net metering.

There are 3 major donor financed projects which is currently implemented in Maldives which focuses on installation of Solar Photovoltaic. They include the following;

- The Accelerating Renewable Energy Integration and Sustainable Energy (ARISE) project;
- Preparing Outer Islands for Sustainable Energy Development (POISED) project.
- Accelerating Sustainable System Development Using Renewable Energy (ASURE) Project.

The ARISE project is funded by World Bank Group while POISED and ASURE projects are funded by Asian Development Bank (ADB). All these projects involve installation of Solar PV systems of different types and scale across the Maldives.

1.1.2.2 Ambition for TAP

Rooftop solar technology is a proven technology in the Maldives. The main ambition of the TAP is to enable the government to achieve the national RE targets. The main RE target which involves roof top solar technology will contribute to include;

1. To generate 33% of the country's electricity demand from renewable energy sources by the year 2028.

In addition, the ambition of the TAP is to improve access to renewable energy for women and other marginalized groups by ensuring a stable electricity grid which would flourish the economic activities conducted by women in atoll. Most of the residents of these islands and atolls are women who depend livelihood on economic activities within the island. Most of men engage in economic activities such as tuna fisheries and employment in tourist resorts.

1.1.2.3 Actions and Activities selected for inclusion in the TAP

This section of the report will describe the proposed actions and activities included for the Rooftop Solar technology. The Actions are linked to the measures that were identified following detailed analyses of barriers facing the technology (Ministry of Environment, Climate Change and Technology 2023), as well as the enabling environment required to promote the technology.

While the technology transfer will rest on the implementation of all Actions, Project Ideas have been proposed to start the technology transfer process by focusing on Actions and Activities of immediate urgency and those presenting low-hanging fruits. The Project Idea will focus on promoting an enabling environment that will be supportive of other mitigation technologies.

1.1.2.3.1 Summary of Barriers and measures to overcome barriers

The following Table 2 enlists the barriers and enabling measures identified for Roof Top Solar Technology. They are derived from Maldives Barrier Analysis and Enabling Framework Report – Mitigation (Ministry of Environment, Climate Change and Technology 2022).

Table 2: Identified barrier and measures to overcome barriers for roof top solar technology

Categories	Identified barrier	Measures to overcome barrier
Economic and Financial	• Lack of financial resources for large scale Rooftop Solar PV installation • Lack of US Dollars for importing • High Capital Investment	• Waiver of the import duty for the spare parts and different components of the Rooftop Solar PV system including batteries • Enhance implementation of Net-metering regulation and introduction of a national feed-in-tariff (FIT) mechanism. • De-risk the commercial banks by GoM to decrease the interest rates for Green Loan incentives by the commercial banks.
Technical	• Instability of the existing electricity grid • Physical conditions of the roofs	• Proper feasibility studies need to be conducted prior to any PV installation works and investing on Energy Storage Systems along with roof top Solar PV installation. • Upgrading the existing electricity network grid in the islands and utilization

		of a battery to stabilize the Roof Top Solar PV system. • Focus the installation on the new buildings, investing in upgrading the roofs as part of the PV installation works.
Market Condition	• Unavailability of Material for PV Installation	• Conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges.
Social, Cultural and Behavioral	• Impacts on Aesthetics in Tourism Sector	• Currently, the Ministry of Tourism (MoT) is working on a National Green Label Certification. Utilization of the RE for resort power generation can be included as a significant criterion for Green Label Certification which will incentivize tourist sector to utilize RE technologies such as rooftop solar PV.
Other	• Lack of availability of roof space	

1.1.2.3.2 Actions selected to be included in the TAP

The main actions to be included in the TAP for the Rooftop solar PV was determined through an assessment of the enabling measures identified for each of the barriers. In addition, stakeholder consultation workshops were held to brainstorm any potential action which can be included in the TAP. The following Table 3 is an assessment of the enabling measures and new enabling measures identified during the stakeholder consultation works.

Table 3: Assessment of enabling measures

Measures to overcome barriers	Assessment	Ranking
<u>Economic and Financial</u> Enhance implementation of Net-metering regulation and	Net-metering regulation was enacted in 2020, and it enables residential installations to offset electricity charges on their bills by feeding the	High

introduction of a national feed-in-tariff (FIT) mechanism.	surplus electricity produced via installed PV system. However, currently the implementation of the net-metering regulation requires significant improvements. In addition, introduction of a Feed-in-tariff (FIT) mechanism will encourage roof top solar installations.	
Technical Upgrading the existing electricity network grid in the islands.	The existing electricity grid in most of the islands are significantly old and outdated. There is a significant need to upgrade the existing electricity grids in order to utilize the electricity produced by Rooftop solar PV systems.	High
Market Conditions Conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges.	The private sector installation companies face significant challenges in obtaining adequate supplies of PV systems and material required for installation of Roof-top solar PV system. It is important to establish a network between regional suppliers and the private sector PV installation companies.	Medium

1.1.2.3.3 Activities identified for implementation of selected Actions

Three Actions (based on the measures identified in Table 2) have been retained for inclusion in the TAP for Rooftop Solar PV, and their accompanying activities are listed below.

Summary of Actions	
Action 1:	**Understand the barriers in implementation of the Net-metering regulation.**
Action 2:	**Upgrading the existing electricity network grid in the islands.**
Action 3:	**Conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges.**
Activities for Action Implementation	
Action 1: Understand the barriers in implementation of the Net-metering regulation.	
Activity 1.1:	**Conduct a gender-responsive stock-taking workshop for all the stakeholders involved in implementation of the Net-metering regulation.**
Activity 1.2:	**Develop a Terms of Reference for a consultant to conduct a barrier and needs assessment for implementation of Net-metering**

	regulation in the Maldives. Female consultants will be encouraged to apply.
Activity 1.3:	**Hire a consultant to conduct a barrier and needs assessment for implementation of Net-metering regulation in the Maldives.**
Activity 1.4:	**Conduct the barrier and need assessment**
Activity 1.5:	**Conduct gender-responsive stakeholder workshop to present the main findings of the barrier and needs assessment for implementation of Net-metering regulation in the Maldives.**
Activity 1.6:	**Prepare summary to policy makers regarding the main findings of barrier and needs assessment for implementation of Net-metering regulation in the Maldives.**
Action 2: Upgrading the existing electricity grid in the islands	
Activity 2.1:	**Consult with local utility companies regarding the islands which require immediate upgrading of the electricity grid.**
Activity 2.2:	**Identify the islands which require most urgent grid upgrading (Priority will be given to islands with active involvement of women in economic activities)**
Activity 2.3:	**Develop Terms of Reference for a consultant to conduct a condition assessment of the electricity grid in the selected islands.**
Activity 2.4:	**Hire a consultant to conduct a condition assessment of the electricity grid in the selected islands. Female consultants will be encouraged to apply.**
Activity 2.5:	**Conduct the Assessment and Estimate the funding required for the upgrading of the electricity grid in selected islands. Gender disaggregated data will be collected.**
Activity 2.6:	**Communicate the funding requirement for the upgrading of the electricity grid in selected islands with Utility Company.**
Activity 2.7:	**Include the funding requirement for upgrading of the electricity grids in selected grid in the project budgets of the utility companies.**
Action 3: Conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges.	
Activity 3.1:	**Map all the suppliers/importers of Rooftop Solar PV systems including batteries. Gender disaggregated data will be collected.**
Activity 3.2:	**Consult with all the national stakeholders involved in the supply chain of the Rooftop Solar PV systems such as Maldives Customs Service, Ministry of Economic Development and Maldives National Chamber of Commerce and Ministry of Foreign Affairs.**
Activity 3.3:	**Organize a gender responsive forum to facilitate connection between international manufacturers and local importers/retailers of Rooftop Solar PV System including batteries.**

1.1.2.3.4 Actions which are considered for the project ideas for electricity production and generation sector

Action 2: Upgrading the existing electricity grid in the islands is considered for the project idea for the electricity generation and consumption sector. This action was prioritized based on stakeholder

consultations conducted on June 2024. The main stakeholders present were MCCEE, URA and utility companies. The main rationale for selection of Action 2 is the potential of this action on enabling the update of Rooftop Solar PV with batteries technology in the Maldives. Currently, many islands of the Maldives have limited potential to incorporate electricity generated from Rooftop solar PV systems due to the instability of the electricity grids. This Action 2 is expected to identify the island which needs to be given priority for upgrading the existing electricity grid and estimate the resources required for the grid upgrading works. Thus, this information can be utilized for national planning and budgeting purposes for energy sector development or to approach donors for financial resources.

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1.1.2.4 Stakeholders and Timeline for Implementation of TAP

This section identifies the stakeholders who will be responsible to implement the Actions, as well as a clear definition of their roles in the process. It also gives the sequence and timing of each Activity.

The roles of the main stakeholders in the implementation of the TAP for Rooftop Solar PV technology are given in Table 4. The roles are attributed to specific Actions. The list also contains stakeholders whose identities are currently unknown – i.e. they will be recruited or appointed during TAP implementation, but whose roles are well defined. In these cases, and where possible and practicable, potential stakeholders are identified to guide further action.

Table 4: Roles of Stakeholders for Implementation of Rooftop Solar PV system TAP

Stakeholder	Role
Ministry of Climate Change, Environment and Energy (MCCEE) (Action 1 and 3)	The MCCEE is the main ministry responsible for formulating energy sector in the Maldives. MCCEE will be responsible for conducting the barriers and needs assessment for the implementation of Net-metering regulation in the Maldives. In addition, the MCCEE will be leading Action 3. MCCEE will be the beneficiary of the TAP Action 1 and 3 as the findings of the assessment will inform the future policy regarding Net-metering implementation and improved market condition for Rooftop Solar PV systems.
Utilities Regulatory Authority (URA) (Action 1 and 2)	URA will be a key stakeholder in the implementation of TAP Action 1 and 2. URA will work with MCCEE for the barriers and needs assessment for the implementation of Net-metering regulation in the Maldives and provide required permits for upgrading of the electricity grids in selected islands. URA will be a beneficiary of TAP action 1 and 2 as URA will be responsible for implementation of any regulatory or policy changes due to the findings of the barrier and

	needs assessment for implementation of Net-metering regulation in the Maldives and upgrading of the existing electricity grid in selected islands.
Utility companies (FENAKA and State Electric Company Limited) (Action 1 and 2)	Utility companies will be key stakeholders for Action 1 and 2 as they will contribute to the barrier and needs assessment for implementation of Net-metering regulation in the Maldives. In addition, utility companies will be key in determining the financial requirements for upgrading the electricity grid in the selected islands. Utility companies will be beneficiary of TAP Action 1 and 2 as the findings of the barrier and needs assessment for implementation of Net-metering regulation in the Maldives will enable the utilities companies to improve implementation of Net-metering regulations. The findings of the upgrading requirement of the existing electricity grids in selected islands will enable the utility companies to budget for the grid upgrading works.
Ministry of Economic Development (MED) (Action 3)	MED is the main ministry which is responsible for policy formulation for economic development. MED is also institution which provides permits for all the businesses in the Maldives including importers and retailers. MED will be a key stakeholder in Action 3 as they will be consulted to identify all the importers and retailers of spare parts for Rooftop Solar PV installations.
Maldives Customs Services (MCS) (Action 3)	MCS is the organization responsible for maintenance of import and export data of commodities in the Maldives. MCS will be a key stakeholder to identify main importers of spare parts for Rooftop Solar PV installations
Ministry of Foreign Affairs (MFA)	MFA is expected to coordinate with different embassies of Maldives in identifying the key suppliers of Rooftop Solar PV systems.
Maldives National Chamber of Commerce (MNCC)	MNCC is the main association of the business owners in the Maldives. MNCC is a key stakeholder which will be required to be consulted for Action 3.
Island Councils	Island councils will be a key stakeholder for Action 2 as they need to consult for the upgrading works of existing grids on the islands.
Women Development Committee (WDC)	WDCs will be a key stakeholder for Action 2 as they will be consulted to bring gender perspective to the study.
Private sector PV installation companies	Private sector PV installation companies will be consulted during the implementation of all 3 actions. Their expertise and data will be required for the assessments outlined in Actions 1 and 2.

	Private sector PV installation companies will be a beneficiary of Action 3 as they will be provided with an avenue to network with suppliers and manufacturers of spare parts for PV installation works.

1.1.2.5 Scheduling and sequencing of specific activities

A detailed timetable for the activities can be found in the planning table below (Table 8). The TAP for Rooftop Solar PV system is planned for implementation over the period 2025 – 2027. However, for the actions envisioned under this TAP the sequencing would be approximately as follows:

Action 1: Understand the barriers in implementation of the Net-metering regulation: Start in year 1 (2025) and complete by year 2 (2026). The following detailed schedule for Action 1.

Table 5: Detailed Schedule for Implementation of Action 1 – Rooftop Solar PV

#	Activity Detail	2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.1	**Conduct a gender-responsive stock-taking workshop for all the stakeholders involved in implementation of the Net-metering regulation.**								
Activity 1.2	**Develop a Terms of Reference for a consultant to conduct a barrier and needs assessment for implementation of Net-metering regulation in the Maldives.**								
Activity 1.3	**Hire a consultant to conduct a barrier and needs assessment for implementation of Net-metering regulation in the Maldives.**								
Activity 1.4	**Conduct the barrier and need assessment**								
Activity 1.5	**Conduct gender responsive stakeholder workshop to present the main findings of the barrier and needs assessment for implementation of Net-metering regulation in the Maldives.**								
Activity 1.5	**Prepare summary to policy makers regarding the main findings of barrier**								

	and needs assessment for implementation of Net-metering regulation in the Maldives.								

Action 2: Upgrading the existing electricity grid in the islands: Start in year 1 as depending on the number of islands selected for the study the action may be time consuming. The action is expected to be completed by year 3 (2027). The following detailed schedule for Action 2.

Table 6: Detailed Schedule for Implementation of Action 2 – Rooftop Solar PV

#	Activity Detail	2025				2026				2027			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 2.1:	**Consult with local utility companies regarding the islands which require immediate upgrading of the electricity grid.**												
Activity 2.2:	**Identify the islands which require most urgent grid upgrading**												
Activity 2.3:	**Develop Terms of Reference for a consultant to conduct a condition assessment of the electricity grid in the selected islands.**												
Activity 2.4:	**Hire a consultant to conduct a condition assessment of the electricity grid in the selected islands.**												
Activity 2.5:	**Conduct the Assessment and Estimate the funding required for the upgrading of the**												

	electricity grid in selected islands.												
Activity 2.6:	**Communicate the funding requirement for the upgrading of the electricity grid in selected islands with Utility Company.**												
Activity 2.7:	**Include the funding requirement for upgrading of the electricity grids in selected grid in the project budgets of the utility companies.**												

Action 3: Conduct forums for suppliers of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges: Start in year 2 (2026) and completed by year 3 (2027).

Table 7: Detailed Schedule for the Action 3 - Rooftop Solar PV

#	Activity Detail	2026				2027			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 3.1:	**Map all the suppliers/importers of Rooftop Solar PV systems including batteries**								
Activity 3.2:	**Consult with all the national stakeholders involved in the supply chain of the Rooftop Solar PV systems such as Maldives Customs Service, Ministry of Economic Development and Maldives National Chamber of Commerce and Ministry of Foreign Affairs.**								
Activity 3.3:	**Organize a forum to facilitate connection between international manufacturers and local importers/retailers of Rooftop Solar PV System including batteries.**								

1.1.2.6 Estimation of Resources Needed for Action and Activities

This section discusses the estimated implementation cost associated with selected actions for the TAP. The estimated cost for each of the actions is detailed in Table 8. The total cost estimated for the implementation of Rooftop Solar PV system TAP is 300,000 USD. These will be sourced through different proposals written to different donor funding avenues due to the financial constraints faced by Government of Maldives (GOM) at present. However, the GOM is expected to provide in-kind contributions to implementation of all 3 actions.

Table 8: Planning Table for Rooftop Solar PV systems TAP

Action 1: Understand the barriers in implementation of the Net-metering regulation										
Activities	**Planning**				**Implementation**				**Cost & Funding**	
	Start	Complete	Who	Capacity Needs	Start	Complete	Who	Capacity Needs	Cost (USD)	Potential Funding Source
Conduct Stock-taking workshop	Q3 - 2025	Q3 – 2025	MCCEE	None	Q4 - 2025	Q4 – 2025	MCCEE	None	5000	GOM
Develop TOR for consultant	Q4 - 2025	Q1 – 2026	MCCEE/ URA	Definition of Terms of Reference (ToR)	Q1 - 2026	Q1 - 2026	MCCEE/ URA	None	NIL	Donor/Development Partners
Hiring of consultant	Q1- 2026	Q1-2026	MCCEE	None	Q2- 2026	Q2 - 2026	MCCEE	None	50,000	Donor/Development Partners
Conduct the barrier and need assessment	Q2 - 2026	Q2 - 2026	MCCEE/ URA	Capacity development needs	Q2- 2026	Q4- 2026	MCCEE/ URA	None	50,000	Donor/Development Partners
Stakeholder Consultation workshop of validation of study findings	Q4 - 2026	Q4 - 2026	MCCEE	None	Q4 - 2026	Q4 - 2026	MCCEE	None	5,000	GOM
Prepare summary for policy makers regarding the findings of the study	Q4 – 2026	Q4 - 2024	MCCEE	None	Q4 - 2026	Q4 - 2026	MCCEE	None	5,000	Donor/Development Partners
Action 2: Upgrading the existing electricity grid in the islands										

Consult with local utility companies	Q3 - 2025	Q3 - 2025	MCCEE/ URA	None	Q3 - 2025	Q3 - 2025	MCCEE/ URA	None	NIL	N/A
Identification of the islands	Q3 - 2025	Q3 - 2025	URA/Utility companies	None	Q3 - 2025	Q3 - 2025	URA/Utility Companies	None	Nil	N/A
Develop TOR for consultant to conduct condition assessment for the existing electricity grid	Q4 - 2025	Q4 - 2025	URA/MCCEE	Definition of Terms of Reference (ToR)	Q4 - 2025	Q4 - 2025	URA/MCCEE	None	NIL	N/A
Hire a consultant for the condition assessment	Q4 - 2025	Q4 - 2025	URA/MCCEE	None	Q1 - 2026	Q1 - 2026	URA/MCCEE	None	80,000	Donor/Development Partners
Conduct the Assessment and Estimate the funding required for the upgrading of the electricity grid in selected islands.	Q1 - 2026	Q1 - 2027	URA/Utility companies and consultants	None	Q1 – 2026	Q1 - 2027	URA/Utility companies and consultants	None	80,000	Donor/Development Partners

Communicate the funding requirement for the upgrading of the electricity grid in selected islands with Utility Company.	Q1 – 2027	Q1 – 2027	URA/MCCEE	None	Q1 – 2027	Q1 – 2027	URA/MCCEE	None	Nil	N/A
Include the funding requirement for upgrading of the electricity grids in selected grid in the project budgets of the utility companies.	Q1 – 2027	Q2 – 2027	Utility companies	None	Q2 – 2027	Q2 – 2027	Utility Companies	None	Nil	N/A
Action 3: Conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges.										
Map all the suppliers/importers of Rooftop Solar PV systems including batteries	Q2 - 2026	Q2 – 2026	MCS, MED, MCCEE, URA, MFA, MNCC	None	Q2 - 2026	Q2 – 2026	MCS, MED, MCCEE, URA	None	Nil	N/A

Consultation with all the stakeholders	Q3 - 2026	Q3 – 2026	MCS, MED, MCCEE, URA, Private PV installation Companies, Importers and Supplier, retailers	None	Q3 - 2026	Q4 – 2026	MCS, MED, MCCEE, URA, Private PV installation Companies, Importers and Supplier, retailers	None	5000	GOM
Organize a forum to facilitate connection between international manufacturers and local importers/retailers of Rooftop Solar PV System including batteries.	Q1 – 2027	Q1 – 2027	MCS, MED, MCCEE, URA, Private PV installation Companies, Importers and Supplier, retailers	None	Q1 – 2027	Q1 – 2027	MCS, MED, MCCEE, URA, Private PV installation Companies, Importers and Supplier, retailers	None	20,000	Donor/Development Partners

1.1.2.7 Management Planning

This section identifies the risks to successful implementation of the TAP for Rooftop Solar PV system with batteries. Measures to mitigate the risks are also identified. It also identifies the immediate critical steps that would be required to initiate TAP implementation.

The following Table 9 provides an overview of the anticipated risk for TAP implementation and potential mitigation measures to mitigate the identified risks.

Table 9: The risk and potential mitigation measures for the implementation of Rooftop Solar PV system TAP

Risk	Level	Mitigation
Low engagement of stakeholder and inputs	Medium	MCCEE will take the lead coordination and ensures regular communication with other key partners maintained and media campaign will be conducted to make sure they are well informed
Lack of political will to implement the findings of the studies outlined in the TAP	High	Develop summaries for policy makers which include policy implications to orientate the political staff.
No government funding for the identified activities designated for government funding	High	MCCEE together with URA should coordinate the with Ministry of Finance (MoF) and identify activities the government can contribute financially
Local council and City councils are reluctant to cooperate	Low	MCCEE needs to coordinate appropriately explaining the benefits of the project for the locals

Next Step

a) Immediate requirements to proceed

- Formulate a review committee consisting of the key ministries and review the project and make the necessary changes;
- Ensure TAP steps and priorities are in line with MCCEE including the Energy Department and Climate Change Department current plans and priorities;
- Secure partial Government funding for Activities designated government fundings

b) Critical steps to succeed

- Proper coordination with local island councils and utility companies for Action 2.
- Focus on building effective communication and coordination with key partners;
- Ensure that the technology is promoted and support by decision-makers

1.1.2.8 TAP overview table

The overview of the TAP for Rooftop Solar PV system is given in Table 10

Table 10: TAP overview table for Rooftop Solar System

Sector: Electricity Production and Consumption								
Technology: Rooftop Solar PV system with Batteries								
Ambitions	To contribute to the national renewable energy targets and emission reduction from electricity production and consumption. To overcome the existing barriers in update of the Rooftop Solar PV system with Batteries technology.							
Benefits	The main barriers and needs for implementation of Net-metering regulation will be determined. The islands which require immediate upgrading of the existing electricity grid will be determined and cost estimation for the upgrading of existing electricity grid will be determined. The local PV installation companies of Maldives will be given opportunity to network with manufacturers, suppliers and importers of spare-parts for Rooftop Solar PV installation.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible Agency**	**Time frame (Mo)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Understand the barriers in implementation of the Net-metering regulation	1.1 Conduct a gender responsive stock-taking workshop for all the stakeholders involved in implementation of the Net-metering regulation.	GOM	MCCEE	1	Lack of stakeholder engagement and lack of GOM funding Limited participation from women due	Determination of existing situation of Net-metering implementation in the Maldives.	Number of stakeholders participate in the workshop	5,000

					to nature of profession			
	1.2 Develop a Terms of Reference for a consultant to conduct a barrier and needs assessment for implementation of Net-metering regulation in the Maldives.	Donor	MCCEE/URA	1	No funding available for the activity	Comprehensive TOR for the study on barrier and needs assessment for implementation of net-metering regulation	Versions of TOR developed	Nil
	1.3 Hire a consultant to conduct a barrier and needs assessment for implementation of Net-metering regulation in the Maldives.	Donor	MCCEE	4	Limited number of qualified national consultant Limited no. of qualified female consultant	More consultants are aware of the opportunity	No. of applicants for the consultancy position	50,000
	1.4 Conduct the barrier and need assessment	Donor	MCCEE/URA	8	Lack of inputs from stakeholders	Identification of barriers and needs for implementation	No. of stakeholders consulted during the study	50,000

						of Net-metering Regulation		
	1.5 Conduct gender responsive stakeholder workshop to present the main findings of the barrier and needs assessment for implementation of Net-metering regulation in the Maldives.	GOM	MCCEE	1	Limited participation from stakeholders Limited participation from women	Substantial Inputs and discussion in the workshop	Increase the number of direct transections	5,000
	1.6 Prepare summary to policy makers regarding the main findings of barrier and needs assessment for implementation of Net-metering regulation in the Maldives.	GOM	MCCEE	1	Not a priority for policy makers	Relevant changes to net-metering regulation implementation	No. of amendment to the Net-metering regulation	Nil

Action 2: Upgrading the existing electricity grid in the islands	2.1 Consult with local utility companies regarding the islands which require immediate upgrading of the electricity grid.	GOM	MCCEE/URA	1	Lack of engagement and inputs from stakeholders	Involvement of the utility companies.	Inputs from utility companies.	Nil
	2.2 Identify the islands which require most urgent grid upgrading	GOM	URA/Utility companies	1	Not a priority for utility companies	Successful identification of islands which require grid upgrading	List of islands which require urgent upgrading of grid	Nil
	2.3 Develop Terms of Reference for a consultant to conduct a condition assessment of the electricity grid in the selected islands.	GOM	MCCEE/URA	4	Unavailability of funding for the action	A comprehensive TOR with scope for resource estimation for the grid upgrading works	No. of inputs from the stakeholders especially utility companies	Nil
	2.4 Hire a consultant to conduct a condition assessment of	GoM	MCCEE/URA	4	Lack of technically competent national consultants	Hire of a competent consultant	No. of application for the consultancy work	80,000

	the electricity grid in the selected islands.				Limited no. of female consultants			
	2.5 Conduct the Assessment and Estimate the funding required for the upgrading of the electricity grid in selected islands.	Donor	URA/Utility Companies/ Consultants	12	Low support for the study from utility companies and island councils Lack of gender segregated data	Estimation of cost required for grid upgrading works	No. of islands travelled for field data collection	80,000
	2.6 Communicate the funding requirement for the upgrading of the electricity grid in selected islands with Utility Company.	GOM	URA/Utility Companies	4	Low interest from utility companies	Budget allocation from either government budget or Donor funded project for grid upgrading works	No. of islands included in the project budget of utility companies	Nil
	2.7 Include the funding requirement for upgrading of the electricity	GOM	URA/Utility Companies	4	Low interest from utility companies	Budget allocation from either government budget or Donor funded project	No. of islands included in the project budget of utility companies	Nil

	grids in selected grid in the project budgets of the utility companies.					for grid upgrading works		
Action 3: Conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges.	3.1 Map all the suppliers/importers of Rooftop Solar PV systems including batteries	GOM	MCS, MED, MCCEE, URA, MFA, MNCC	1	Some suppliers may not be registered with relevant authorities	A comprehensive list of suppliers and importers	No. of suppliers and importers identified	Nil
	3.2 Consult with all the national stakeholders involved in the supply chain of the Rooftop Solar PV systems such as Maldives Customs Service, Ministry of Economic Development and Maldives National Chamber of Commerce	GoM	MCS, MED, MCCEE, URA, Private PV installation Companies, Importers and Supplier, retailers	4	Low interest from the stakeholders	Finalization of concept note for the forum	No. of stakeholder consultation meetings	5,000

	and Ministry of Foreign Affairs.							
	3.3 Organize a forum to facilitate connection between international manufacturers and local importers/retailers of Rooftop Solar PV System including batteries.	Donor	MCS, MED, MCCEE, URA, Private PV installation Companies, Importers and Supplier, retailers	4	Low interest from the suppliers and importers Limited participation from women	Networks established between local PV installation companies and manufacturers, suppliers and importers of PV spare parts	No. of supplier, importers participating in the forum	20,000

1.2 Action Plan for Floating Solar Platforms

1.2.1 Action Plan for Technology for Floating Solar Platforms

1.2.1.1 Introduction

Floating Solar Platforms have similar components as Roof Top Solar systems; however, they are deployed in a water body particularly in lakes and shallow lagoon areas. These are platforms moored in the sea with mounted PV arrays on top. These PV floating platforms are connected to the island's grid using a submarine cable. These platforms must be placed in areas close to the islands and with low wave activity to ensure their operations withstand. Effects of salinity over the solar panels must also be considered in the design.

In Maldives, currently there are international and local companies which provide installation services of floating solar platforms in tourist resorts. A significant number of tourist resorts has deployed floating solar platforms within their lagoon areas. In addition, 10MW solar PV platforms are planned to be installed in the Addu City under the World Bank financed ARISE project.

1.2.1.2 Ambition of TAP

The main ambition of the TAP in terms of the Floating solar platforms is to contribute to the renewable energy target as discussed in Section 1.1.2.2 of this report.

1.2.1.3 Summary of Barriers and measures to overcome barriers

The following Table 11 enlists the barriers and enabling measures identified for Floating Solar Platforms. They are derived from Maldives Barrier Analysis and Enabling Framework Report – Mitigation (Ministry of Environment, Climate Change and Technology 2022).

Table 11: Identified barrier and measures to overcome barriers for Floating Solar Platforms

Categories	Identified barrier	Measures to overcome barrier
Legal and Regulatory	• Boundary restriction to use lagoon space • Extra charges for sea space	• Revision of the boundary regulation to accommodate at least 500 m from the shoreline at Mean Sea Level (MSL) rather than the vegetation line. However, this can be a sensitive issue since there are large no. of tourist resorts in the Maldives and could impact livelihoods of residents living in nearby islands to these tourist resorts.

		• Collaboration with local island councils to share the electricity generated from Floating Solar Platforms so that the extra charges for space can be waivered.
Economical and Financial	• High Capital and Maintenance cost • Lack of US Dollars for importing • Lack of financial resources for large scale PV installation	• Waiver of the import duty for the spare parts and different components of the Floating solar platform
Human Skills	• Limited Skilled Technicians	• Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works.
Technical	• Lack of Technical Information regarding the environmental conditions of lagoon space	• Improve the EIA process to collect empirical data for wind, wave, and tidal information so that these reports can be utilized for feasibility studies for floating solar platforms.
Other	• Environmental Condition of the Lagoon	• Proper feasibility studies should be conducted which are informed from wave, wind, and tidal data for the project location so that environmental conditions of the proposed location can be determined prior to installation of floating solar platforms.

1.2.1.3.1 Actions and Activities selected for inclusion in the TAP

The main actions to be included in the TAP for the Floating Solar Platforms were determined through an assessment of the enabling measures identified for each of the barriers. In addition, stakeholder consultation workshops were held to brainstorm any potential action which can be included in the TAP. The following Table 12 is an assessment of the enabling measures and new enabling measures identified during the stakeholder consultation works.

Table 12: Assessment of enabling measures

Measures to overcome barriers	Assessment	Ranking
Economic and Financial Waiver of the import duty for the spare parts and different components of the Floating solar platform	The import duty for the Solar Panels has been waivered in accordance with the Regulation for Import, Export & Re-export (2012/R-34) which is implemented by Ministry of Economic Development. Guideline 2 of the regulation outlines the items from which import duty will be waivered in terms of renewable energy products. However, prior approval needs to be obtained from URA 14 days prior to the arrival of the shipment. However, there are no provisions for the rest of the material and equipment required for PV installation like cables, batteries or material required for construction of floating platforms.	High
Human Skills Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works.	There are limited skilled technicians working in installation of floating solar platforms. There is a need to develop human skills in the field by instruction of vocational programs in the Maldives National University (MNU) or Maldives Polytechnic.	High
Legal and Regulatory Revision of the boundary regulation to accommodate at least 500 m from the shoreline at Mean Sea Level (MSL) rather than the vegetation line.	According to the Boundary Regulation (2012/R-7) and Amendment (2016/R-94) under the Tourism Act of Maldives (Law No. 2/99) , the boundary of a tourist resort is as follows; • If a boundary has already been identified in the Lease Agreement, the boundary of the lagoon surrounding the island shall be as outlined in the Lease Agreement. • If a boundary has not been identified in the Lease Agreement, the lagoon of the island	Medium

	extends more than 500m from the vegetation line of the island, the boundary shall be 500m into the lagoon from the vegetation line of the island. • If the reef is less than 500m from the vegetation line of the island, then the boundary shall be up to the outer reef from the vegetation line of the island. • If another island is found greater than 500m within the same lagoon, the boundary of the resort island shall be 500m from vegetation line of the resort island. • If another island is found in less than 1000m within the same lagoon, the boundary shall be the middle point between the vegetation of the resort island and the other island Significant consultation will be required with different stakeholders to amend the regulation as nearby residential islands depend on the lagoon for their livelihood.	
<u>Other</u> Improve the EIA process to collect empirical data for wind, wave, and tidal information so that these reports can be utilized for feasibility studies for floating solar platforms.	There is limited information on the environmental conditions of the lagoon spaces. These environmental parameters include wind, waves and tidal information. This information is obtained mainly from Environmental Impact Assessment (EIA) reports conducted for the development of the tourist facilities particularly resort development. However, most of these EIA report has secondary data in terms of wind, wave and tidal information.	Medium

1.2.1.3.2 Activities identified for implementation of selected Actions

Two Actions (based on the measures identified in Table 11) have been retained for inclusion in the TAP for Floating Solar Platform Technology and their accompanying activities are listed below.

Summary of Actions	
Action 1:	**Waiver of the import duty for the spare parts and different components of the Floating solar platform**

Action 2:	**Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works.**
Activities for Action Implementation	
Action 1: Waiver of the import duty for the spare parts and different components of the Floating solar platform	
Activity 1.1:	**Conduct a Gender Responsive stakeholder consultation meeting with all the stakeholders.**
Activity 1.2:	**Develop TOR for a legal expert to amend the Regulation on Import Export, Re-export (2012/R-34)**
Activity 1.3:	**Hire a legal expert for the amendment of Regulation on Import Export, Re-export (2012/R-34). Female Applicants will be encouraged.**
Activity 1.4:	**Conduct a Gender Responsive stakeholder workshop to discuss the amendment**
Activity 1.5:	**Share the amendment with the Attorney General Office (AGO)**
Activity 1.6:	**Publish the amendment in the National Gazette**
Action 2: Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works.	
Activity 2.1:	**Consultation with MNU and Maldives Polytechnic regarding vocational trainings.**
Activity 2.2:	**Develop TOR for an international expert to develop curriculum for vocational training on PV installations.**
Activity 2.3:	**Hire an international expert to develop curriculum for vocational training on PV installations. Female applicants will be encouraged.**
Activity 2.4:	**Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic. Ensure that 50% of the lecturers and tutors trained are women.**
Activity 2.5:	**Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic. Female applicants will be encouraged to participate through incentives such as pocket money.**

1.2.1.3.3 Stakeholders and Timeline for Implementation of TAP

This section identifies the stakeholders who will be responsible to implement the Actions, as well as a clear definition of their roles in the process. It also gives the sequence and timing of each Activity.

The roles of the main stakeholders in the implementation of the TAP for Floating Solar Platforms are given in Table 13. The roles are attributed to specific Actions. The list also contains stakeholders whose identities are currently unknown – i.e. they will be recruited or appointed during TAP implementation, but whose roles are well defined. In these cases, and where possible and practicable, potential stakeholders are identified to guide further action.

Table 13: Roles of Stakeholders for Implementation of Floating Solar Platforms TAP

Stakeholder	Role
Ministry of Economic Development (MED) (Action 1)	The MED is the policy making institution for the economic develop and a key stakeholder in import and export of good in the Maldives. MED is a key stakeholder in amendment of the regulation to waver the spare parts required for installation of floating solar platforms.
Utilities Regulatory Authority (URA) (Action 1 and 2)	URA will be a key stakeholder in the implementation of TAP Action 1. Currently URA is responsible for coordination between Maldives Customs Service (MCS) and the importer of PV systems. URA will be the key implementation of the regulation (Guideline 2 under the regulation) once amended.
Maldives Customs Services (MCS) (Action 1)	MCS is the institution responsible for the enforcement of the Regulation for Import, Export & Re-export (2012/R-34) on behalf of MED. MCS will be responsible to wavier import duties for spare parts required for floating solar platforms once the regulation is amended.
Attorney General's Office (AGO) (Action 1)	AGO is the main government agency responsible for coordination of amendments and formulation of the regulations. AGO will be responsible formalization and publishing of the amended regulation.
Ministry of Climate Change, Environment and Energy (MCCEE) (Action 2)	MCCEE is the government institution responsible for promotion of renewable energy technologies in the Maldives. MCCEE will be responsible for coordination of curriculum development between MNU, Maldives Polytechnic and consultants hired.
Maldives National University (MNU)	MNU is the main public university in the Maldives which provide science and technical subjects. MNU is a beneficiary of Action 2 as they will be responsible to conduct the vocational courses developed by the consultant.
Maldives Polytechnic	Maldives Polytechnic is the main vocational education institution in the Maldives.

	Maldives Polytechnics is a beneficiary of Action 2 as they will be responsible to conduct the vocational courses developed by the consultant.

1.2.1.4 Scheduling and sequencing of specific activities

A detailed timetable for the activities can be found in the planning table below (Table 16). The TAP for Floating Solar platforms is planned for implementation over the period 2025 – 2026. However, for the actions envisioned under this TAP the sequencing would be approximately as follows:

Action 1: Waiver of the import duty for the spare parts and different components of the Floating solar platform: Start in year 1 (2025) and complete by year 2 (2026). The following detailed schedule for Action 1.

Table 14: Detailed Schedule for Implementation of Action 1 – Floating Solar Platforms

#	Activity Detail	2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.1:	**Conduct a gender responsive stakeholder consultation meeting with all the stakeholders.**								
Activity 1.2:	**Develop TOR for a legal expert to amend the Regulation on Import Export, Re-export (2012/R-34)**								
Activity 1.3:	**Hire a legal expert for the amendment of Regulation on Import Export, Re-export (2012/R-34)**								
Activity 1.4:	**Conduct a gender responsive stakeholder workshop to discuss the amendment**								
Activity 1.5:	**Share the amendment with the Attorney General Office (AGO)**								
Activity 1.6:	**Publish the amendment in the National Gazette**								

Action 2: Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works: Start in year 1 (2025) and complete by year 2 (2026). The following detailed schedule for Action 2.

Table 15: Detailed Schedule for Implementation of Action 2 – Floating Solar Platforms

#	Activity Detail	2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 2.1:	**Consultation with MNU and Maldives Polytechnic regarding vocational trainings.**								
Activity 2.2:	**Develop TOR for an international expert to develop curriculum for a vocational training on PV installations.**								
Activity 2.3:	**Hire an international expert to develop curriculum for a vocational training on PV installations**								
Activity 2.4:	**Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic**								
Activity 2.5:	**Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic**								

1.2.1.5 Estimation of Resources Needed for Actions and Activities

This section discusses the estimated implementation cost associated with selected actions for the TAP. The estimated cost for each of the actions is detailed in Table 13. The total cost estimated for the implementation of Floating Solar Platform TAP is 150,000 USD. These will be sourced through different proposals written to different donor funding avenues due to the financial constraints faced by Government of Maldives (GOM) at present. However, the GOM is expected to provide in-kind contributions to implementation of all 2 actions.

Table 16: Management Planning for Floating Solar Platform

Action 1: Waiver of the import duty for the spare parts and different components of the Floating solar platform										
Activities	**Planning**				**Implementation**				**Cost & Funding**	
	Start	Complete	Who	Capacity Needs	Start	Complete	Who	Capacity Needs	Cost (USD)	Potential Funding Source
Conduct a stakeholder consultation meeting with all the stakeholders.	Q3 - 2025	Q3 – 2025	MCCEE	None	Q4 - 2025	Q4 – 2025	URA	None	Nil	GOM
Develop TOR for Legal Expert	Q4 - 2025	Q1 – 2026	URA	Definition of Terms of Reference (ToR)	Q1 - 2026	Q1 - 2026	URA	None	Nil	N/A
Hiring of Legal Expert	Q1-2026	Q1-2026	URA	None	Q2-2026	Q2 - 2026	URA	None	20,000	Donor/Development Partners
Stakeholder Consultation on Amended Regulation	Q3 - 2026	Q3 - 2026	URA	None	Q3 - 2026	Q3 - 2026	URA	None	5,000	GOM
Share the amendment with the Attorney General Office (AGO)	Q4 – 2026	Q4 - 2026	URA	None	Q4 - 2026	Q4 - 2026	URA	None	Nil	N/A
Publish the amendment in the National Gazette	Q4-2026	Q4 - 2026	URA	None	Q4 - 2026	Q4 - 2026	URA	None	Nil	N/A

Action 2: Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works.										
Consult with MNU and Maldives Polytechnics	Q3 - 2025	Q3 - 2025	MCCEE	None	Q3 - 2025	Q3 - 2025	MCCEE	None	NIL	N/A
Develop TOR for an international expert to develop curriculum for a vocational training on PV installations.	Q4 - 2025	Q4 - 2025	MCCEE	Definition of Terms of Reference (ToR)	Q4 - 2025	Q4 - 2025	MCCEE	None	Nil	N/A
Hire an international expert to develop curriculum for a vocational training on PV installations	Q4 - 2025	Q4 - 2025	MCCEE	None	Q1 - 2026	Q1 - 2026	MCCEE	None	80,000	Donor/Development Partners
Provide capacity building training for the lecturers and tutors of MNU and	Q1 - 2026	Q1 - 2026	MCCEE, MNU and Maldives Polytechnics	Installation skills and maintenance of Floating Solar Platforms	Q1 - 2026	Q3 - 2026	MCCEE, MNU and Maldives Polytechnics	None	40,000	Donor/Development Partners

Maldives Polytechnic										
Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic	Q3 – 2026	Q3 – 2026	MNU and Maldives Polytechnics	None	Q3 – 2026	N/A	MNU and Maldives Polytechnics	None	Nil	N/A

1.2.1.6 Management Planning

This section identifies the risks to successful implementation of the Floating Solar Platforms. Measures to mitigate the risks are also identified. It also identifies the immediate critical steps that would be required to initiate TAP implementation.

The following Table 17 provides an overview of the anticipated risk for TAP implementation and potential mitigation measures to mitigate the identified risks.

Table 17: The risk and potential mitigation measures for the implementation of Rooftop Solar PV system TAP

Risk	Level	Mitigation
Low engagement of stakeholder and inputs	Medium	MCCEE will take the lead coordination and ensures regular communication with other key partners maintained and media campaign will be conducted to make sure they are well informed
Not a priority for MED and AGO	High	URA will coordinate with MED and AGO to ensure their support will be received during the amendment of the regulation.
No government funding for the identified activities designated for government funding	High	MCCEE together with URA should coordinate the with Ministry of Finance (MoF) and identify activities the government can contribute financially

Next Step

a) Immediate requirements to proceed

- Formulate a review committee consisting of the key ministries and review the project and make the necessary changes;
- Ensure TAP steps and priorities are in line with URA current plans and priorities;
- Secure partial Government funding for Activities designated government fundings

b) Critical steps to succeed

- Proper coordination between MNU/Maldives Polytechnic and consultants for development of the curriculum.
- Focus on building effective communication and coordination with key partners;
- Ensure that the technology is promoted and support by decision-makers

1.2.1.7 TAP overview table

The following is the TAP for floating solar platforms.

Sector: Electricity Production and Consumption								
Technology: Floating Solar Platforms								
Ambitions	To contribute to the national renewable energy targets and emission reduction from electricity production and consumption. To overcome the existing barriers in uptake of the Floating Solar Platform technology.							
Benefits	The importer of spare-parts of floating solar PV will be able to waiver the import duty for their shipments. In addition, the more skilled technicians in the field will be developed through the course to be offered by MNU and Maldives Polytechnics.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible Agency**	**Time frame (Mo)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Waiver of the import duty for the spare parts and different components of the Floating solar platform	1.1 Conduct a stakeholder consultation meeting with all the stakeholders.	GOM	URA	1	Lack of stakeholder engagement and lack of GOM funding Limited participation from women	Agreement with all stakeholders on amendment of the regulation 30% of participants are women	No. of participants of the stakeholder meeting No. of female participants in the meeting	5,000
	1.2 Develop TOR for a legal expert to amend the Regulation on	Donor	URA	4	Legal experts may have limited knowledge on RE	Comprehensive TOR to hire a legal expert	Versions of TOR developed	Nil

	Import Export, Re-export (2012/R-34).				technologies Limited no. of Female legal experts			
	1.3 Hire a legal expert for the amendment of Regulation on Import Export, Re-export (2012/R-34)	Donor	URA	4	Limited number of qualified national consultant Limited no. of female legal experts	More consultants are aware of the opportunity	No. of applicants for the consultancy position	20,000
	1.4 Conduct a gender responsive stakeholder workshop to discuss the amendment	GOM	URA	1	Limited participation from stakeholders Limited representation of women	Substantial Inputs and discussion in the workshop	No. of female participants in the workshop	5,000
	1.5 Share the amendment with the Attorney General Office (AGO)	GOM	URA	1	Not a priority for the AGO	Legal clearance from the AGO	No. of comments made by AGO	Nil

	1.6 Publish the amendment in the National Gazette	GOM	URA	1	Importers of RE may not be aware about the amendment	More uptake of RE technologies particularly floating solar	No. of shipment with custom duty waivered	Nil
Action 2: Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational trainings to produce skilled technicians required for PV installation works.	2.1 Consultation with MNU and Maldives Polytechnic regarding vocational trainings.	GOM	MCCEE	1	Lack of interest from MNU and Maldives Polytechnic	Identification of the existing related courses and challenges in conducting vocational courses	No. of challenges identified for conducting vocational courses	Nil
	2.2 Develop TOR for an international expert to develop curriculum for a vocational training on PV installations.	GOM	MCCEE	1	Lack of input from the stakeholder for the TOR	Successful identification of the scope of work for the international consultant	No. of comments on TOR by stakeholders	Nil
	2.3 Hire an international expert to develop curriculum for a vocational training on PV installations	Donor	MCCEE	4	Limited expertise national expertise	A competent international consultant hired	No. of applicants for the international consultant position	80,000

	2.4 Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic	Donor	MNU/ Maldives Polytechnic/ Consultant	9	Lecturers and tutors may be unwilling to learn Due to nature of the profession few female lecturers may be trained.	Hire of a competent consultant	No. of female lecturers trained. No. of lecturers and tutors trained.	20,000
	2.5 Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic	GOM	MNU/Maldives Polytechnic	1	Low interest from potential students in the field Limited students female students due to the nature of the trainings	No. of skilled technicians increased No. of female participants of the trainings	No. of students enrolled in the vocational programme No. of female participants of the trainings	Nil

1.2.1.8 Project Idea for Electricity Production and Consumption Sector

The project idea for the electricity production and consumption sector is included in Annex 1 of this report.

CHAPTER 2: WASTE MANAGEMENT SECTOR

2.1 TAP for Waste Management Sector

2.1.1 Sector Overview

Waste sector is key sectors with potential for implementation of climate change mitigation projects in Maldives. Waste sector is the second main contributor to the GHG emission in Maldives due to current practices of open burning of waste. The main strategies outlined in the Maldives' NDC for waste sector mitigation include the following;

- Waste to energy. The planned installation of 8 MW in Thilafushi and 1.5 MW in Addu City will be completed. These systems will be optimized for grid connection and electricity production.

At present there are 2 Waste to energy systems planned to be developed in Regional Waste Management Centres namely in Addu City at southern part of Maldives and K. Thilafushi at the Greater Male' Region. These two projects are donor funded projects. These projects are expected to be completed by 2028.

Organic waste constitutes the bulk of the waste generated. The total compostable waste accounts for 80% of the total waste generated in the Greater Male' Region (Moosa 2021). In the atolls, kitchen waste and green waste accounts for 88% of the total waste generated (Moosa 2021).

The emission from the waste sector accounts for 4% of the total GHG emission of the country in 2015 reported in First Biennial Update Report (2019). The following Figure 1 provides information on the sources of GHG emission from the waste sector.

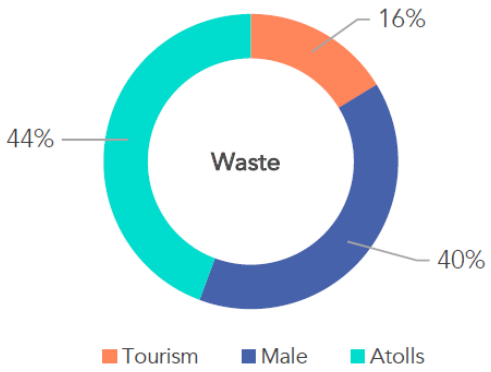

Figure 1: Emission contribution from the waste sector (adapted from First Biennial Update Report (2019))

According to the First Biennial Update Report (2019), emissions from the waste sector is expected to increase by 74.9% by 2030. The emission from waste sector was 46.8 $GgCO_2e$ in 2011 and expected to be approximately 81.8 $GgCO_2e$ in 2030.

2.1.2 Action Plan for Waste to Energy Facilities in Regional Waste Management Centres

2.1.2.1 Introduction

A waste to energy (WTE) facility that combusts waste to produce electricity. The traditional waste-to-energy process uses steam to turn a turbine to generate electricity. The steam is generated by burning the municipal solid waste (MSW). It is thus similar to conventional thermal power generation, but replaces traditional fuels (gas, coal) with waste. The Figure 2 shows a diagram showing different processes involved in Waste to Energy Facilities.

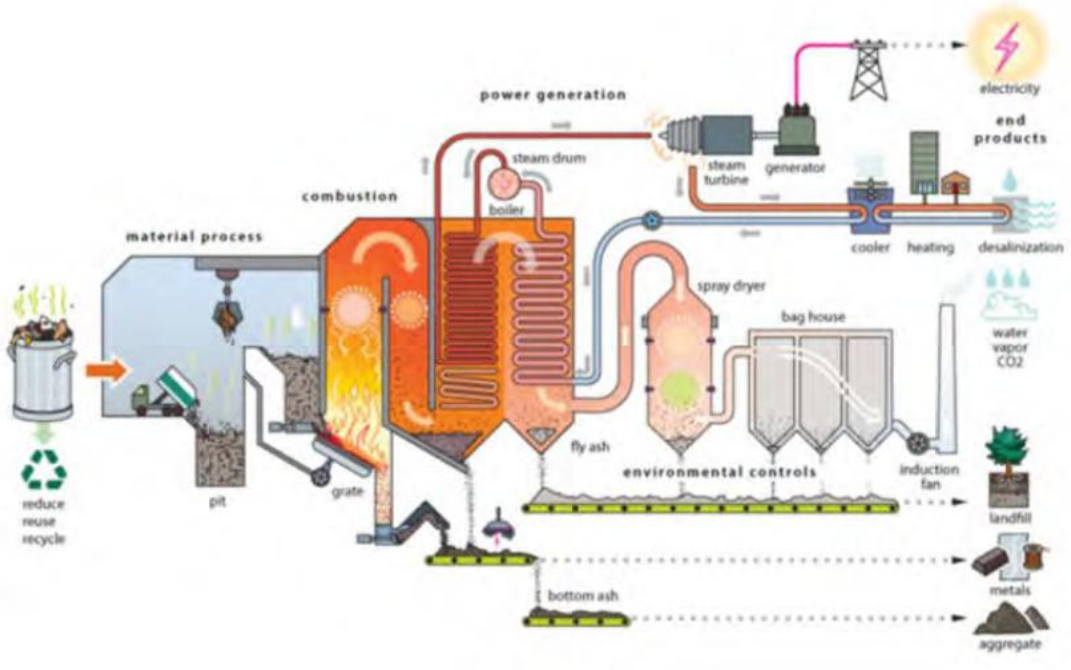

Figure 2: Schematic diagram of a Typical WTE plant (Source: Asian Development Bank (2019))

The WTE facilities are considered to be environmentally friendly, however, the facilities produce ash in the form of fly ash and bottom ash. Fly ash is considered as air pollutants and there are environmental control mechanisms such as scrubber utilized to minimize the impacts of the air pollutants. The bottom ash is used for different purposes such as preparation of aggregate for road construction projects.

2.1.2.2 Ambition for the TAP

WTE facilities are yet to be established and become operational in the Maldives. The main ambition of the TAP is to operationalize 2 WTE facilities which are currently in the planning stage.

2.1.2.3 Actions and Activities selected for inclusion in the TAP

This section of the report will describe the proposed actions and activities included for the WTE facilities in Regional Waste Management Centres. The Actions are linked to the measures that were identified following detailed analyses of barriers facing the technology (Ministry of Environment, Climate Change and Technology 2023), as well as the enabling environment required to promote the technology.

While the technology transfer will rest on the implementation of all Actions, Project Ideas have been proposed to start the technology transfer process by focusing on Actions and Activities of immediate urgency and those presenting low-hanging fruits. The Project Idea will focus on promoting an enabling environment that will be supportive of other mitigation technologies.

2.1.2.3.1 Summary of Barriers and measures to overcome barriers

The following Table 18 enlists the barriers and enabling measures identified for Floating Solar Platforms. They are derived from Maldives Barrier Analysis and Enabling Framework Report – Mitigation (Ministry of Environment, Climate Change and Technology 2022).

Table 18: Identified barrier and measures to overcome barriers for WTE facilities

Categories	Identified barrier	Measures to overcome barrier
Economic and Financial	• High Investment Cost • High Operational Cost • High Capital Required for Maintenance	• Mobilization of private sector finance for WTE facilities and other waste management projects is essential through successful demonstration of these donor funded projects.
Legal and Regulatory	• Lack of Regulatory Framework for WTE facilities	• A regulation on operation and regulatory standards such as emission and pollution control standards need to be developed under the umbrella of Waste Management Act (2022).
Human Skills	• Lack of trained human capital	• It is important to train the staff of WAMCO on

		operation of WTE facilities so that the WTE facilities can be operated successfully even after completion of contractor's operating period.
Technical	• Limited Experience in implementation of WTE facilities • Lack of means for management of By-products	• The findings of the studies for management of bottom ash of incinerators should be shared with various stakeholders and awareness amongst the stakeholders should be created regarding potential re-use of these bottom ash. Provide incentives for industries which utilize bottom ash.
Other	• Land Constraints for WTE facilities	

2.1.2.3.2 Actions selected to be included in the TAP

The main actions to be included in the TAP for the WTE facilities were determined through an assessment of the enabling measures identified for each of the barriers. In addition, stakeholder consultation workshops were held to brainstorm any potential action which can be included in the TAP. The following Table 19 is an assessment of the enabling measures and new enabling measures identified during the stakeholder consultation works.

Table 19: Assessment of enabling measures

Measures to overcome barriers	Assessment	Ranking
Economic and Financial Mobilization of private sector finance for WTE facilities and other waste management projects is essential through successful demonstration of these donor funded projects.	There are two WTE facilities currently under planning. They are planned to be constructed in Addu City and Greater Male' Region. Both are funded by donor funded projects. It is important for the planned projects to be successfully implemented and operations to be financially sustainable so that the private sector would be able update the technology.	Medium
Human Skills It is important to train the staff of WAMCO on operation of	The proposed WTE facilities are expected to be operated by the Design, Build and Operate (DBO) contractor for a certain period.	High

WTE facilities so that the WTE facilities can be operated successfully even after completion of contractor's operating period.	However, once this period is over Waste Management Corporation (WAMCO) staff will be responsible for operation of the WTE facilities. It is important to train the WAMCO staff on operation of WTE facilities as this is a new technology for the Maldives.	
Legal and Regulatory A regulation on operation and regulatory standards such as emission and pollution control standards need to be developed under the umbrella of Waste Management Act (2022).	Waste Management Act (24/2022) was ratified in 2022. There are no specific provisions for WTE facilities under the act. However, there are provision for the Pollution control under the act. A regulation which deals with WTE facilities need to be developed prior to the operation of the WTE facilities.	High
Other The findings of the studies for management of bottom ash of incinerators should be shared with various stakeholders and awareness amongst the stakeholders should be created regarding potential re-use of these bottom ash. Provide incentives for industries which utilize bottom ash.	Studies have been conducted on utilization of the bottom ash generated from WTE facilities. These studies need to be shared with stakeholders. In addition, the stakeholders need to be informed regarding the potential of these bottom-ash for various applications.	Low

2.1.2.3.3 Activities identified for implementation of selected Actions

Two Actions (based on the measures identified in (Table 18) have been retained for inclusion in the TAP for WTE Technology and their accompanying activities are listed below.

Summary of Actions	
Action 1:	**Training for staff of WAMCO for operation of WTE facilities**
Action 2:	**Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022)**
Activities for Action Implementation	
Action 1: Training for staff of WAMCO for operation of WTE facilities	
Activity 1.1:	**Include provision of training the WAMCO staff under the contract of DBO contractors for WTE facilities.**
Activity 1.2:	**Conduct Training of Trainers (TOT) for operation of WTE facilities. 50% of the TOTs will be female**
Activity 1.3:	**Institutionalize the training function with the organization structure of WAMCO**

Action 2: Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022).	
Activity 2.1:	**Conduct a stakeholder consultation meeting with all the stakeholders.**
Activity 2.2:	**Develop TOR for a legal expert to formulate regulation on WTE facilities. Female experts will be encouraged to apply.**
Activity 2.3:	**Hire a legal expert for the formulation of regulation on WTE facilities**
Activity 2.4:	**Conduct a gender responsive stakeholder workshop to discuss the Regulation**
Activity 2.5:	**Share the Regulation with the Attorney General Office (AGO)**
Activity 2.6:	**Publish the Regulation in the National Gazette**

2.1.2.3.4 Actions which are considered for the project ideas for waste management sector

Action 2: Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022). This Action 2 was selected based on stakeholder consultation sessions conducted on July 2024 which was represented by Waste Management and Pollution Prevention Department of MCCEE and WAMCO. The main rationale for selection of Action 2 is the potential to enhance implementation of WTE facilities in Maldives. The regulation developed under the PI is expected to regulate the WTE facilities once they become operational in 2028. Furthermore, it will contribute to potential co-benefits like environmental protection through clear emission standards for these WTE facilities and how the bottom ash generated in these facilities needs to be managed.

2.1.2.4 Stakeholders and Timeline for Implementation of TAP

This section identifies the stakeholders who will be responsible to implement the Actions, as well as a clear definition of their roles in the process. It also gives the sequence and timing of each Activity.

The roles of the main stakeholders in the implementation of the TAP for WTE facilities are given in Table 20. The roles are attributed to specific Actions. The list also contains stakeholders whose identities are currently unknown – i.e. they will be recruited or appointed during TAP implementation, but whose roles are well defined. In these cases, and where possible and practicable, potential stakeholders are identified to guide further action.

Table 20: Roles of Stakeholders for Implementation of WTE Facilities TAP

Stakeholder	Role
Ministry of Climate Change, Environment and Energy (Action 1 and Action 2)	MCCEE is the main institution responsible for implementation of the donor funded project which funds the construction of WTE facilities both in Greater Male' Region and Addu City. MCCEE will be responsible for procurement of the DBO contractor who will be responsible for the capacity building of the WAMCO staff.

	In addition, MCCEE is the main institution responsible for policy making for the waste management and pollution prevention sector. MCCEE will responsible for formulating the regulation about WTE facilities.
Waste Management Cooperation (WAMCO) (Action 1)	WAMCO is a state-owned enterprise responsible waste management in major islands of the Maldives. WAMCO will be beneficiary of the Action 1 as their staff will be build capacity on operation of the WTE facilities.
Design Build and Operate (DBO) Contractor (Action 1)	DBO contractor will be responsible for training of WAMCO staff prior to completion of operating period for WTE facilities. MCS will be responsible to wavier import duties for spare parts required for floating solar platforms once the regulation is amended.
Attorney General's Office (AGO) (Action 2)	AGO is the main government agency responsible for coordination of amendments and formulation of the regulations. AGO will be responsible formalization and publishing of the regulation on WTE facilities.
Utility Regulatory Authority (URA) (Action 2)	URA is the main regulatory agency for waste management related laws and policies in the Maldives. URA will be consulted when the regulation on WTE facilities is formulated.

2.1.2.5 Scheduling and sequencing of specific activities

A detailed timetable for the activities can be found in the planning table below (Table 23). The TAP for WTE Facilities is planned for implementation over the period 2025 – 2028. However, for the actions envisioned under this TAP the sequencing would be approximately as follows:

Action 1: Training for staff of WAMCO for operation of WTE facilities: Start in year 1 (2025) and complete by year 4 (2028). A detailed schedule for Action 1 is given below.

Table 21: Detailed Schedule for Implementation of Action 1 - WTE facilities

#	Activity Detail	2025				2026				2027				2028			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.1:	**Include provision of training the WAMCO staff under the contract of DBO contractors**																

	for WTE facilities.																
Activity 1.2:	**Conduct Training of Trainers (TOT) for operation of WTE facilities**																
Activity 1.3:	**Institutionalize the training function with the organization structure of WAMCO**																

Action 2: Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022): Start in year 1 (2025) and complete by year 2. A detailed schedule for Action 2 is given below.

Table 22: Detail schedule for the Action 2 - WTE facilities

#	Activity Detail	2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 2.1:	**Conduct a stakeholder consultation meeting with all the stakeholders.**								
Activity 2.2:	**Develop TOR for a legal expert to formulate regulation on WTE facilities**								
Activity 2.3:	**Hire a legal expert for the formulation of regulation on WTE facilities**								
Activity 2.4:	**Conduct a stakeholder workshop to discuss the Regulation**								
Activity 2.5:	**Share the Regulation with the Attorney General Office (AGO)**								
Activity 2.6:	**Publish the Regulation in the National Gazette**								

2.1.2.6 Estimation of Resources Needed for Actions and Activities

This section discusses the estimated implementation cost associated with selected actions for the TAP. The estimated cost for each of the actions is detailed in Table 23. The total cost estimated for the implementation of WTE Facilities TAP is 30,000 USD. These will be sourced through different proposals written to different donor funding avenues due to the financial constraints faced by

Government of Maldives (GOM) at present. However, the GOM is expected to provide in-kind contributions to implementation of all 2 actions.

Table 23: Planning table for WTE Facilities TAP

Action 1: Training for staff of WAMCO for operation of WTE facilities										
Activities	**Planning**				**Implementation**				**Cost & Funding**	
	Start	Complete	Who	Capacity Needs	Start	Complete	Who	Capacity Needs	Cost (USD)	Potential Funding Source
Include provision of training the WAMCO staff under the contract of DBO contractors for WTE facilities.	Q3 - 2025	Q3 – 2025	MCCEE	Operation of WTE facilities	Q4 - 2025	Q1 – 2026	MCCEE	None	Included in DBO contractor' contract price	Donor/Development Partners
Conduct Training of Trainers (TOT) for operation of WTE facilities	Q1 - 2027	Q1 – 2027	DBO Contractor	Operation of WTE facilities	Q1 - 2028	Q1 - 2028	DBO contractor	None	Included in DBO contractor' contract price	N/A
Institutionalize the training function with the organization structure of WAMCO	Q1- 2028	Q1-2028	WAMCO	Operation of WTE facilities	Q1- 2028	Q1 - 2028	WAMCO	None	Nil	N/A
Action 2: Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022).										
Conduct a stakeholder	Q3 - 2025	Q3 - 2025	MCCEE	None	Q3 - 2025	Q3 - 2025	MCCEE	None	NIL	N/A

consultation meeting with all the stakeholders.										
Develop TOR for a legal expert to formulate regulation on WTE facilities	Q4 - 2025	Q4 - 2025	MCCEE	Definition of Terms of Reference (ToR)	Q4 - 2025	Q4 - 2025	MCCEE	None	Nil	N/A
Hire a legal expert for the formulation of regulation on WTE facilities	Q4 - 2025	Q4 - 2025	MCCEE	None	Q1 - 2026	Q1 - 2026	MCCEE	None	20,000	Donor/Development Partners
Conduct a stakeholder workshop to discuss the Regulation	Q4 - 2026	Q1 - 2026	MCCEE	None	Q1 - 2026	Q1 - 2026	MCCEE	None	5,000	GOM
Share the Regulation with the Attorney General Office (AGO)	Q1 - 2026	Q1– 2026	MCCEE	None	Q1 – 2026	Q1 – 2026	MCCEE	None	Nil	N/A
Publish the Regulation in the National Gazette	Q1 - 2026	Q1 – 2026	MCCEE/ AGO	None	Q2 - 2026	Q2 – 2026	MCCEE	None	Nil	N/A

2.1.2.7 Management Planning

This section identifies the risks to successful implementation of the WTE Facilities. Measures to mitigate the risks are also identified. It also identifies the immediate critical steps that would be required to initiate TAP implementation.

The following Table 24 provides an overview of the anticipated risk for TAP implementation and potential mitigation measures to mitigate the identified risks.

Table 24: The risk and potential mitigation measures for the implementation of Rooftop Solar PV system TAP

Risk	Level	Mitigation
Low engagement of stakeholder and inputs	Medium	MCCEE will take the lead coordination and ensures regular communication with other key partners maintained and media campaign will be conducted to make sure they are well informed
Not enough waste generated from the target area for operation of WTE facility	High	Proper feasibility studies will be conducted prior to construction phase of the project. In addition, the vessels and infrastructure required for transport of waste from outer islands will be made available.
No government funding for the identified activities designated for government funding	High	MCCEE together with URA should coordinate the with Ministry of Finance (MoF) and identify activities the government can contribute financially

Next Step

a) Immediate requirements to proceed

- Formulate a review committee consisting of the key ministries and review the project and make the necessary changes;
- Ensure TAP steps and priorities are in line with MCCEE current plans and priorities, particularly the plans and priorities of Waste Management and Pollution Control Department of MCCEE;
- Secure partial Government funding for Activities designated government fundings

b) Critical steps to succeed

- Proper capacity building of the WAMCO staff for operation of WTE facilities.
- Focus on building effective communication and coordination with key partners;
- Ensure that the technology is promoted and support by decision

2.1.2.8 TAP Overview Table

The following is the TAP for WTE Facilities.

Sector: Waste Management								
Technology: Waste to Energy (WTE) Facilities								
Ambitions	To contribute to successful operation of WTE facilities which are currently planned to be constructed.							
Benefits	Proper training of WAMCO staff for operation of WTE facilities is essential for successful implementation of WTE technology in the country. In addition, regulation on WTE facilities will be essential during operation of WTE facilities in the country. It will outline the emission standards and pollution control measures to be implemented in these WTE facilities.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible Agency**	**Time frame (Mo)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Training for staff of WAMCO for operation of WTE facilities	1.1 Include provision of training the WAMCO staff under the contract of DBO contractors for WTE facilities.	Donor	MCCEE	1	Limited no. of qualified DBO contractors	A contract signed with a competent DBO contractor	No. of participants of the stakeholder meeting	Nil
	1.2 Conduct Training of Trainers (TOT) for operation of WTE facilities	Donor	MCCEE	12	WAMCO staff may not be willing to get trained	Skilled operators of WTE facilities from WAMCO	No. of trained WAMCO staff No. of female staff trained	Already included in donor funded

					Limited no. of female trained			project budget
	1.3 Institutionalize the training function with the organization structure of WAMCO	GOM	WAMCO	4	Not a priority for the high level WAMCO staff	A team of technically competent WAMCO staff to operate WTE facilities	No. of female staff in WAMCO organization structure	Nil
Action 2: Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022	2.1 Conduct a stakeholder consultation meeting with all the stakeholders.	GOM	MCCEE	1	Lack of stakeholder engagement and lack of GOM funding	Agreement with all stakeholders on amendment of the regulation	No. of female participants of the stakeholder meeting	5,000
	2.2 Develop TOR for a legal expert to formulate regulation on WTE facilities	Donor	MCCEE	4	Legal experts may have limited knowledge on WTE technology Limited no. of female legal experts	Comprehensive TOR to hire a legal expert	Versions of TOR developed	Nil
	2.3 Hire a legal expert for the formulation of	Donor	MCCEE	4	Limited number of qualified	More consultants are aware of the opportunity	No. of applicants for the consultancy position	20,000

	regulation on WTE facilities				national consultant			
	2.4 Conduct a stakeholder workshop to discuss the Regulation	GOM	MCCEE	1	Limited participation from stakeholders Limited representation from women in the workshop	Substantial Inputs and discussion in the workshop	No. of female participants in the workshop	5,000
	2.5 Share the Regulation with the Attorney General Office (AGO)	GOM	MCCEE	1	Not a priority for the AGO	Legal clearance from the AGO	No. of comments made by AGO	Nil
	2.6 Publish the Regulation in the National Gazette	GOM	MCCEE	1	Extra burden for WAMCO and other stakeholders	Better governance of WTE facilities	No. of pollution prevention measures implemented in WTE facilities	Nil

2.1.2.9 Project Idea for Waste Management Sector

The project idea for the Waste Management sector is included in Annex 2 of this report.

CHAPTER 3: TRANSPORT SECTOR

3.1 TAP for Transport Sector

3.1.1 Sector Overview

The transport sector is a sector where climate change mitigation initiates were not implemented in the past. However, transport sector contributes to the national GHE emissions significantly. Most of the vehicles, vessels used in Maldives rely on fossil fuel such as petrol and diesel. Hence, there is immense potential for climate change mitigation activities in the Transport sector. The main strategies outline in the Maldives's NDC for transport sector mitigation include;

- Establishment of vehicle/vessels emissions standard and establishment of efficient transport management system and promotion of hybrid-vehicles.

The emission from the waste sector accounts for 25% of the total GHG emission of the country in 2015 reported in First Biennial Update Report (2019). The following Figure 3 provides information on the sources of GHG emission from the waste sector.

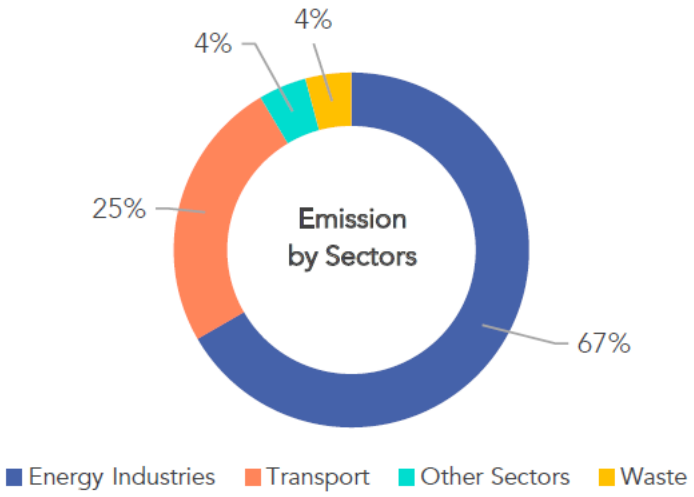

Figure 3: Emission by Sectors (adapted from First Biennial Update Report 2019)

According to the First Biennial Update Report (2019), emissions from the Transport sector is expected to increase by 180.5 % by 2030. The emission from waste sector was 263.9 GgCO2e in 2011 and expected to be approximately 740.4 GgCO2e in 2030.

3.1.2 Action Plan for Electric Vehicles

3.1.2.1 Introduction

Electric vehicle (EV) is a vehicle which uses one or more electric motors for propulsion. In many cases these electric motors are powered by rechargeable battery packs. EVs have several advantages compared to conventional vehicles which includes the following;

- EVs are more energy efficient: EVs convert over 77% of the electrical energy from the grid to power at the wheels. Conventional gasoline vehicles only convert about 12%–30% of the energy stored in gasoline to power at the wheels.
- EVs are considered to be more environmentally friendly since they do not emit air pollutants such as Sulphur dioxide, Nitrous oxide, Carbon monoxide and Particulate Matter. However, the power plant which is used for power the EVs may emit air pollutants. Nevertheless, electricity produced by solar power, wind power or nuclear power will not emit any air pollutants.
- Electric motors provide quiet, smooth operation and stronger acceleration and require less maintenance than internal combustion engines (ICEs).

There are some disadvantages of EVs in comparison with conventional vehicles. They include the following:

- EVs have a shorter driving range than most conventional vehicles—although EV driving ranges are improving. Most EVs can travel more than 100 miles on a charge, and some can travel in excess of 200 or 300 miles depending on the model.
- Fully recharging the battery pack can take 3 to 12 hours. Even a "fast charge" to 80% capacity can take 30 min.

There are 131,000 land use vehicles registered in the Maldives. Out of which only 4% of vehicles are EVs and most of these constitute of tricycles and e-bicycles. Despite having customs duty advantages up to 150% for imported electric motorcycles and cars over conventional fossil fuel-based vehicles, very limited EV penetration has been observed in islands like Male', Hulhumale and Addu city.

Despite having customs duties advantages of up to 150% for imported electric motorcycles and cars over their fossil fuel counterparts, islands like Male, Hulhumale, Addu etc. have witnessed limited EV penetration among their resident populations.

3.1.2.2 Ambition for the TAP

The preliminary target for transfer and diffusion of EVs in Maldives is to increase the share of EVs to 20% of all the land-based vehicles operational in the Maldives.

3.1.2.3 Actions and Activities selected for inclusion in the TAP

This section of the report will describe the proposed actions and activities included for the Electric Vehicles TAP. The Actions are linked to the measures that were identified following detailed analyses of barriers facing the technology (Ministry of Environment, Climate Change and Technology 2023), as well as the enabling environment required to promote the technology.

While the technology transfer will rest on the implementation of all Actions, Project Ideas have been proposed to start the technology transfer process by focusing on Actions and Activities of immediate urgency and those presenting low-hanging fruits. The Project Idea will focus on promoting an enabling environment that will be supportive of other mitigation technologies.

3.1.2.3.1 Summary of Barriers and measures to overcome barriers

The following Table 25 enlists the barriers and enabling measures identified for Electric Vehicles. They are derived from Maldives Barrier Analysis and Enabling Framework Report – Mitigation (Ministry of Environment, Climate Change and Technology 2022).

Table 25: Identified barrier and measures to overcome barriers for Electric Vehicles

Categories	Identified barrier	Measures to overcome barrier
Economic and Financial	• High Capital Cost	• Incentive the private sector vehicle suppliers and commercial banks to introduce installment schemes for EVs.
Legal and Regulatory	• Legal and Administrative Barriers	• Formulation of Regulation on importing, maintenance, and emission standards for EVs.
Human Skills	• Lack of trained mechanics	• In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs.
Institutional and organizational capacity	• Lack of EV infrastructure like charging stations • Communication gap between in-line ministries	• Establishment of Charging Stations in the Parking spaces especially in Hulhumale' Phase 1 and Phase 2. • Clear definition of mandates of local council and central government ministries
Information and Awareness	• Lack of Awareness and Advocacy efforts	• Conduct awareness campaigns regarding promotion of EVs for both vehicle owners, commercial banks, and vehicle suppliers.

Social, Cultural and Behavioral	• Highly Subsidized fossil fuels	
Other	• Legacy conventional waste and lack of means for battery disposal	• Improve the port infrastructure so that more companies will work on re-exporting the batteries and scrap metals

3.1.2.3.2 Actions selected to be included in the TAP

The main actions to be included in the TAP for the EV were determined through an assessment of the enabling measures identified for each of the barriers. In addition, stakeholder consultation workshops were held to brainstorm any potential action which can be included in the TAP. The following Table 26 is an assessment of the enabling measures and new enabling measures identified during the stakeholder consultation works.

Table 26: Assessment of enabling measures

Measures to overcome barriers	Assessment	Ranking
Economic and Financial Incentive the private sector vehicle suppliers and commercial banks to introduce installment schemes for EVs.	The private sector suppliers have installment schemes for conventional vehicles particularly motorbikes in the country. However, there are very few installment schemes for EVs in the country.	Medium
Human Skills In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs.	Most of the mechanics in the country are trained or experienced in maintenance of conventional vehicles. There is limited no. of mechanics which are trained to repair and maintain EVs.	High
Legal and Regulatory Formulation of Regulation on importing, maintenance, and emission standards for EVs.	There are many regulations which deals with import, registration and disposal of conventional vehicles. However, there are no regulations on importing, maintenance and emission standards for EVs.	High
Institutional and organizational capacity Establishment of Charging Stations in the Parking spaces especially in Hulhumale' Phase 1 and Phase 2.	There is limited no. of charging stations for EVs in the country. Most of the existing charging stations are limited to Greater Male' Region. However, Housing Development Corporation (HDC) and Male' City Council are currently working on a project to establish charging	Low

	stations for EVs across Male' and Hulhumale' Phase 1 and 2.	
Information and Awareness Conduct awareness campaigns regarding promotion of EVs for both vehicle owners, commercial banks, and vehicle suppliers.	There are limited resources for promoting update of EVs for retailers, vehicle suppliers and commercial banks.	Medium

3.1.2.3.3 Activities identified for implementation of selected Actions

Two Actions (based on the measures identified in (Table 26) have been retained for inclusion in the TAP for WTE Technology and their accompanying activities are listed below.

Summary of Actions	
Action 1:	**In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs.**
Action 2:	**Formulation of Regulation on importing, maintenance, and emission standards for EVs.**
Activities for Action Implementation	
Action 1: In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs.	
Activity 1.1:	**Consultation with MNU and Maldives Polytechnic regarding vocational trainings.**
Activity 1.2:	**Develop TOR for an international expert to develop curriculum for a vocational training on PV installations. Female applicants will be encouraged to apply.**
Activity 1.3:	**Hire an international expert to develop curriculum for a vocational training on repair and maintenance of EVs**
Activity 1.4:	**Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic. Ensure that 50% of the lecturers and tutors trained are women.**
Activity 1.5:	**Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic. Female students will be encouraged to join the course through incentive such as pocket money.**
Action 2: Formulation of Regulation on importing, maintenance, and emission standards for EVs.	
Activity 2.1:	**Conduct a gender responsive stakeholder consultation meeting with all the stakeholders.**
Activity 2.2:	**Develop TOR for a legal expert to formulate regulation on importing, maintenance, and emission standards for EVs. Female applicants will be encouraged.**
Activity 2.3:	**Hire a legal expert for the formulation of regulation on importing, maintenance, and emission standards for EVs.**

Activity 2.4:	**Conduct a gender responsive. stakeholder workshop to discuss the Regulation**
Activity 2.5:	**Share the Regulation with the Attorney General Office (AGO)**
Activity 2.6:	**Publish the Regulation in the National Gazette**

3.1.2.3.4 Actions which are considered for the project ideas for Transport sector

Action 1: In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs was selected for project idea for transport sector. This Action 1 was prioritized based on stakeholder consultation session conducted on July 2024 which was represented by Ministry of Transport and Housing Development Corporation (HDC). The main rationale for selection of Action 1 is the significance of the barriers of lacking skilled mechanics for EV maintenance. Currently, there are limited mechanics with technical skills and know-how for proper maintenance of EVs in the country. Most of these mechanics are expatriate workers. There is a need to train local mechanics for repair and maintenance of EVs.

3.1.2.4 Stakeholders and Timeline for Implementation of TAP

This section identifies the stakeholders who will be responsible to implement the Actions, as well as a clear definition of their roles in the process. It also gives the sequence and timing of each Activity.

The roles of the main stakeholders in the implementation of the TAP for EVs are given in Table 27. The roles are attributed to specific Actions. The list also contains stakeholders whose identities are currently unknown – i.e. they will be recruited or appointed during TAP implementation, but whose roles are well defined. In these cases, and where possible and practicable, potential stakeholders are identified to guide further action.

Table 27: Roles of Stakeholders for Implementation of EVs TAP

Stakeholder	Role
Ministry of Transport (Action 1 and Action 2)	The Ministry of Transport is the main institution responsible for policy making for the transport sector. Ministry of Transport will be responsible for regulation on importing, maintenance, and emission standards for EVs and coordinate with MNU and Maldives Polytechnic to establish vocational courses for repair and maintenance of EVs.
Maldives National University (MNU) (Action 1)	MNU is the main public university in the Maldives which provide science and technical subjects. MNU is a beneficiary of Action 2 as they will be responsible to conduct the vocational courses developed by the consultant.
Maldives Polytechnic (Action 1)	Maldives Polytechnic is the main vocational education institution in the Maldives.

	Maldives Polytechnics is a beneficiary of Action 2 as they will be responsible to conduct the vocational courses developed by the consultant.
Attorney General's Office (AGO) (Action 2)	AGO is the main government agency responsible for coordination of amendments and formulation of the regulations. AGO will be responsible for formalization and publishing of the regulation on WTE facilities.

3.1.2.5 Scheduling and sequencing of specific activities

A detailed timetable for the activities can be found in the planning table below (Table 29). The TAP for EVs is planned for implementation over the period 2025 – 2027. However, for the actions envisioned under this TAP the sequencing would be approximately as follows:

Action 1: In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs: Start in year 1 (2025) and complete by year 2 (2026). A detailed schedule for Action 1 is given below.

Table 28: Detailed Schedule for Action 1 - Electric Vehicles

#	Activity Detail	2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.1:	Consultation with MNU and Maldives Polytechnic regarding vocational trainings.								
Activity 1.2:	Develop TOR for an international expert to develop curriculum for vocational training on PV installations.								
Activity 1.3:	Hire an international expert to develop curriculum for a vocational training on repair and maintenance of EVs								
Activity 1.4:	Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic								
Activity 1.5:	Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic								

Action 2: Formulation of Regulation on importing, maintenance, and emission standards for EVs: Start in year 1 (2025) and complete by year 2 (2026). A detailed schedule for Action 2 is given below.

#	Activity Detail	2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 2.1:	Conduct a stakeholder consultation meeting with all the stakeholders.								
Activity 2.2:	Develop TOR for a legal expert to formulate regulation on importing, maintenance, and emission standards for EVs.								

Activity 2.3:	**Hire a legal expert for the formulation of regulation on importing, maintenance, and emission standards for EVs.**								
Activity 2.4:	**Conduct a stakeholder workshop to discuss the Regulation**								
Activity 2.5:	**Share the Regulation with the Attorney General Office (AGO)**								
Activity 2.6:	**Publish the Regulation in the National Gazette**								

3.1.2.6 Estimation of Resources Needed for Actions and Activities

This section discusses the estimated implementation cost associated with selected actions for the TAP. The estimated cost for each of the actions is detailed in Table 29. The total cost estimated for the implementation of EVs TAP is 145,000 USD. These will be sourced through different proposals written to different donor funding avenues due to the financial constraints faced by Government of Maldives (GOM) at present. However, the GOM is expected to provide in-kind contributions to implementation of all 2 actions.

Table 29: Planning table for Electric Vehicles

Action 1: In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs										
Activities	**Planning**				**Implementation**				**Cost & Funding**	
	Start	Complete	Who	Capacity Needs	Start	Complete	Who	Capacity Needs	Cost (USD)	Potential Funding Source
Consultation with MNU and Maldives Polytechnic regarding vocational trainings.	Q3 - 2025	Q3 - 2025	Ministry of Transport	None	Q3 - 2025	Q3 - 2025	Ministry of Transport	None	NIL	N/A
Develop TOR for an international expert to develop curriculum for a vocational training on PV installations.	Q4 - 2025	Q4 - 2025	Ministry of Transport	Definition of Terms of Reference (ToR)	Q4 - 2025	Q4 - 2025	Ministry of Transport	None	Nil	N/A
Hire an international expert to develop curriculum for a vocational training on repair and	Q4 - 2025	Q4 - 2025	Ministry of Transport	None	Q1 - 2026	Q1 - 2026	Ministry of Transport	None	80,000	Donor/Development Partners

maintenance of EVs										
Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic	Q1 - 2026	Q1 - 2026	Ministry of Transport, MNU and Maldives Polytechnics	Installation skills and maintenance of Floating Solar Platforms	Q1 - 2026	Q3 - 2026	Ministry of Transport, MNU and Maldives Polytechnics	None	40,000	Donor/Development Partners
Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic	Q3 – 2026	Q3 – 2026	MNU and Maldives Polytechnics	None	Q3 – 2026	N/A	MNU and Maldives Polytechnics	None	Nil	N/A
Action 2: Formulation of Regulation on importing, maintenance, and emission standards for EVs										
Conduct a stakeholder consultation meeting with all the stakeholders.	Q3 - 2025	Q3 - 2025	Ministry of Transport	None	Q3 - 2025	Q3 - 2025	Ministry of Transport	None	NIL	N/A
Develop TOR for a legal expert to formulate regulation on EVs	Q4 - 2025	Q4 - 2025	Ministry of Transport	Definition of Terms of Reference (ToR)	Q4 - 2025	Q4 - 2025	Ministry of Transport	None	Nil	N/A

Hire a legal expert for the formulation of regulation on EVs	Q4 - 2025	Q4 - 2025	Ministry of Transport	None	Q1 - 2026	Q1 - 2026	Ministry of Transport	None	20,000	Donor/Development Partners
Conduct a stakeholder workshop to discuss the Regulation	Q4 - 2026	Q1 - 2026	Ministry of Transport	None	Q2 - 2026	Q2 - 2026	Ministry of Transport	None	5,000	GOM
Share the Regulation with the Attorney General Office (AGO)	Q1 - 2026	Q1– 2026	Ministry of Transport	None	Q3 – 2026	Q3 – 2026	Ministry of Transport	None	Nil	N/A
Publish the Regulation in the National Gazette	Q1 - 2026	Q1 – 2026	Ministry of Transport /AGO	None	Q3 - 2026	Q3 – 2026	Ministry of Transport	None	Nil	N/A

3.1.2.7 Management Planning

This section identifies the risks to successful implementation of the WTE Facilities. Measures to mitigate the risks are also identified. It also identifies the immediate critical steps that would be required to initiate TAP implementation.

The following Table 30 provides an overview of the anticipated risk for TAP implementation and potential mitigation measures to mitigate the identified risks.

Table 30: The risk and potential mitigation measures for the implementation of Rooftop Solar PV system TAP

Risk	Level	Mitigation
Low engagement of stakeholder and inputs	Medium	Ministry of Transport will take the lead coordination and ensures regular communication with other key partners maintained and media campaign will be conducted to make sure they are well informed
Lack of commitment from Ministry of Transport to implement TAP EVs	High	MCCEE as the lead agency for implementation of climate change initiatives will work closely with Ministry of Transport to make sure that TAP activities are implemented.
No government funding for the identified activities designated for government funding	High	MCCEE together with URA should coordinate the with Ministry of Finance (MoF) and identify activities the government can contribute financially

Next Step

a) Immediate requirements to proceed

- Formulate a review committee consisting of the key ministries and review the project and make the necessary changes;
- Ensure TAP steps and priorities are in line with Ministry of Transport current plans and priorities.
- Secure partial Government funding for Activities designated government fundings

b) Critical steps to succeed

- Focus on building effective communication and coordination with key partners like MNU and Maldives Polytechnics.
- Ensure that the technology is promoted and support by decision.

3.1.2.8 TAP Overview Table

The following is the tap overview table for Electric Vehicles.

Sector: Transport Sector								
Technology: Electric Vehicles (EVs)								
Ambitions	The preliminary target for transfer and diffusion of EVs in Maldives is to increase the share of EVs to 20% of all the land-based vehicles operational in the Maldives.							
Benefits	Training of the mechanics for repair and maintenance of EVs is expected to provide better services for owners of EVs in Maldives thus incentivizing more import of EV and replacement of conventional vehicles. In addition, the regulation on EVs is expected to strengthen governance of transport sector in the Maldives.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible Agency**	**Time frame (Mo)**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs	1.1 Consultation with MNU and Maldives Polytechnic regarding vocational trainings.	GOM	Ministry of Transport	1	Lack of interest from MNU and Maldives Polytechnic	Identification of the existing related courses and challenges in conducting vocational courses	No. of challenges identified for conducting vocational courses	Nil
	1.2 Develop TOR for an international expert to develop curriculum for a vocational	GOM	Ministry of Transport	1	Lack of input from the stakeholder for the TOR Limited no. of female	Successful identification of the scope of work for the international consultant	No. of comments on TOR by stakeholders	Nil

	training on PV installations.				experts in the field			
	1.3 Hire an international expert to develop curriculum for a vocational training on repair and maintenance of EVs	Donor	Ministry of Transport	4	Limited expertise national expertise	A competent international consultant hired	No. of applicants for the international consultant position	80,000
	1.4 Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic	Donor	MNU/ Maldives Polytechnic/ Consultant	9	Lecturers and tutors may be unwilling to learn Participants of female lecturers and tutors due to nature of programme Limited no. of females joining the course	Hire of a competent consultant	No. of female lecturers and tutors trained No. of female joining the course.	20,000
Action 2: Formulation of	2.1 Conduct a stakeholder	GOM	Ministry of Transport	1	Lack of stakeholder	Agreement with all stakeholders	No. of female participants of	5,000

Regulation on importing, maintenance, and emission standards for EVs	consultation meeting with all the stakeholders.				engagement and lack of GOM funding	on amendment of the regulation	the stakeholder meeting	
	2.2 Develop TOR for a legal expert to formulate regulation on EVs	GOM	Ministry of Transport	4	Legal experts may have limited knowledge on EVs	Comprehensive TOR to hire a legal expert	Versions of TOR developed	Nil
	2.3 Hire a legal expert for the formulation of regulation on EVs	Donor	Ministry of Transport	4	Limited number of qualified national consultant Limited no. of female legal experts	More consultants are aware of the opportunity	No. of applicants for the consultancy position	20,000
	2.4 Conduct a stakeholder workshop to discuss the Regulation	GOM	Ministry of Transport	1	Limited participation from stakeholders Limited representation of women	Substantial Inputs and discussion in the workshop	No. of female participants in the workshop	5,000

	2.5 Share the Regulation with the Attorney General Office (AGO)	GOM	Ministry of Transport	1	Not a priority for the AGO	Legal clearance from the AGO	No. of comments made by AGO	Nil
	2.6 Publish the Regulation in the National Gazette	GOM	Ministry of Transport	1	Extra burden for Ministry of Transport and other stakeholders	Better governance of Transport Sector	No. of EVs imported	Nil

3.1.2.9 Project Idea for Transport Sector

The project idea for the Transport sector is included in Annex 3 of this report.

1. Conclusion

This Maldive TAP report for climate change mitigation is focused on 3 main sectors namely electricity production and consumption, waste management and transport sector. The main technologies prioritized for the electricity production and consumption sector include Rooftop Solar PV technology and Floating Solar Platforms. The technology prioritized for waste management sector is WTE facilities at Regional Waste Management Centres. The technology prioritized for the transport sector is Electric Vehicles.

This TAP report is based on the Technology Needs Assessment (TNA) report published in May 2022 and Barrier Analysis and Enabling Framework Report (BAEF) published in August 2023. This report identified actions to be implemented for each of the above-mentioned technologies and their timeline for implementation. In addition, this report identifies the risks, schedule and resources required for the implementation of the actions. The actions to be implemented for each technology was prioritized as project ideas were developed for each of the climate change mitigation sector.

This TAP can be used for policy formulation or planning purposes. In addition, the project ideas and actions identified can be used to develop proposals to approach donor assistance.

A snapshot summary of the TAP report is given below.

Table 31: Summary Snapshot of TAP report

Sector	Technology	Actions	Project Ideas
Electricity Production and Consumption	Rooftop Solar PV with Batteries	1. Understand the barriers in implementation of the Net-metering regulation. 2. Upgrading the existing electricity network grid in the islands. 3. Conduct forums for supplier of Rooftop solar PV systems and material required for PV installation so that required network is established to overcome any logistical challenges.	Upgrading of existing electricity grid in selected islands of Maldives
	Floating Solar Platform	1. Waiver of the import duty for the spare parts and different components of the Floating solar platform 2. Collaboration with Maldives National University (MNU) and Maldives Polytechnic to conduct vocational	Formulation of WTE Regulation under Waste Management Act (24/2022)

		trainings to produce skilled technicians required for PV installation works.	
Waste Management	Waste To Energy Facilities at Regional Waste Management Centers	1. Training for staff of WAMCO for operation of WTE facilities 2. Formulation of the regulation which deals with WTE facilities under Waste Management Act (24/2022)	
Transport	Electric Vehicles	1. In collaboration with MNU and Maldives Polytechnics vocational education courses can be conducted for repair and maintenance of EVs. 2. Formulation of Regulation on importing, maintenance, and emission standards for EVs.	Capacity building of local mechanics on repair and maintenance of Electric Vehicles (EVs)

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Annex 1 – Project Idea for Electricity Generation & Consumption

Project Idea (PI): Upgrading of existing electricity grid in selected islands of Maldives

Introduction/Background (Briefly describe the project and how it was developed)	Many donors funded RE projects are being implemented in the Maldives. However, a key barrier for successful implementation of RE projects particularly Solar PV installation projects especially in the islands away from Greater Male' Area is the instability of the existing electricity grids in the islands. Some of the donor funded projects have components which deals with upgrading of existing electricity networks of the island. Thus, there is a significant need to identify the islands which need to be given priority for the upgrading works and estimate the resources required for the upgrading works. This PI was developed through stakeholder consultations and brainstorming sessions conducted during June 2024. The main stakeholders present at the sessions include MCCEE, URA and utility companies. The stakeholders were further consulted to obtain specific information required to elaborate the PI.
Objectives	1- To ensure electricity produced by Solar PV systems can be utilized via the electricity grid of the island. 2- To ensure energy security of the island and reduce power outage events. 3- To identify the islands which need to be given priority for upgrading the existing electricity. 4- To estimate the resources required for the grid upgrading works.
What are the outputs and are they measurable?	1- A study on the existing condition of the electricity grids of the selected islands. 2- Resources (cost, equipment and manpower) required for the upgrading works of existing electricity grids in the island.
Relationship to the country's sustainable development priorities	1- The project will contribute to the renewable energy target in the electricity generation sector of the Maldives. 2- The project will contribute to achievement of the NDC target of Maldives. 3- The project is expected to contribute to Development Goal (SDG) 7 which is focused on ensuring that everyone has access to affordable, reliable, and sustainable energy.

Project Deliverables e.g. Value/Benefits/Messages	1- A detailed report on existing condition of the electricity grids in selected islands of the Maldives. 2- A detailed cost estimate including the resources required for grid upgrading works at selected islands.
Project Scope and Possible Implementation	1- The project will be focused on 3 atolls of the Maldives where donor funded RE projects are planned to be implemented.
Project activities	1- Consult with local utility companies regarding the islands which require immediate upgrading of the electricity grid. 2- Identify the islands which require most urgent grid upgrading 3- Develop Terms of Reference for a consultant to conduct a condition assessment of the electricity grid in the selected islands. 4- Hire a consultant to conduct a condition assessment of the electricity grid in the selected islands. 5- Conduct the Assessment and Estimate the funding required for the upgrading of the electricity grid in selected islands. 6- Communicate the funding requirement for the upgrading of the electricity grid in selected islands with Utility Company. 7- Include the funding requirement for upgrading of the electricity grids in selected grid in the project budgets of the utility companies.
Timelines	This project is envisioned for implementation within a 1-2 year timeframe.
Budget/Resource requirements	The estimated budget would be about 160,000 USD.
Measurement/Evaluation	1- Total number of islands visited during the study 2- Number of islands identified which require immediate upgrading works of electricity grid
Possible Complications/Challenges	1- Logistics and travel cost for the study will be very high due to geographical isolation. 2- Delays in coordination with stakeholders 3- Lack of collaboration from utility companies and island councils.
Responsibilities and Coordination	1- The overall coordination of the project will be carried out by URA 2- Utility companies like FENAKA and STELCO will work with consultants for data collection.

Annex 2 – Project Idea for Waste Management Sector

Project Idea (PI): Formulation of WTE Regulation under Waste Management Act (24/2022)

Introduction/Background (Briefly describe the project and how it was developed)	There are two WTE facilities planned for construction namely in Greater Male' Region (K. Thilafushi) and Addu City. These facilities are constructed by donor funding by Asian Development Bank (ADB) and Abu Dhabi Fund for International Development. Waste Management Act (24/2022) was ratified 2022. There are many provisions for formulation of many regulations under the Waste Management Act (24/2022). A regulation which deals with different aspects of the WTE facilities is essential for the operational phase of the WTE facilities in Greater Male' Region and Addu City. This PI was developed through stakeholder consultations and brainstorming sessions conducted during July 2024. The main stakeholders present at the sessions include Waste Management and Pollution Prevention Department of MCCEE and WAMCO. The stakeholders were further consulted to obtain specific information required to elaborate the PI.
Objectives	1- To develop regulations for WTE facilities. 2- To develop emission standards for WTE facilities and means for management of bottom ash.
What are the outputs and are they measurable?	1- A regulation on WTE facility 2- Emission standard and guidelines for management of bottom ash.
Relationship to the country's sustainable development priorities	1- The project will contribute to National Waste Management Policy of Maldives. 2- The project will contribute to achievement of the NDC target of Maldives.
Project Deliverables e.g. Value/Benefits/Messages	1- A detailed regulation on WTE facilities. 2- Emission standards for WTE facilities and guidelines for management of bottom ash.
Project Scope and Possible Implementation	The project is focused on national level and the deliverables of the project is expected to be beneficial for the entire population of Maldives.
Project activities	1- Conduct a stakeholder consultation meeting with all the stakeholders.

	2- Develop TOR for a legal expert to formulate regulation on WTE facilities 3- Hire a legal expert for the formulation of regulation on WTE facilities 4- Conduct a stakeholder workshop to discuss the Regulation 5- Share the Regulation with the Attorney General Office (AGO) 6- Publish the Regulation in the National Gazette
Timelines	This project is envisioned for implementation within a 1 year timeframe.
Budget/Resource requirements	The estimated budget would be about 25,000 USD.
Measurement/Evaluation	1- No. of comments from the stakeholders on the draft regulation 2- No. of comments from Attorney General's Office (AGO)
Possible Complications/Challenges	1- Lack of coordination with different stakeholders involved in the operation of WTE facilities. 2- Lack of experience in operation of WTE facilities. 3- Lack of legal experts familiar with RE technologies.
Responsibilities and Coordination	1- The overall coordination of the project will be carried out by Waste Management and Pollution Control Department of MCCEE. 2- WAMCO and URA will be responsible to provide technical inputs. 3- Attorney General Office will provide any legal assistance required.

Annex 3 – Project Idea for Transport Sector

Project Idea (PI): Capacity building of local mechanics on repair and maintenance of Electric Vehicles (EVs)

Introduction/Background (Briefly describe the project and how it was developed)	There are 131,000 land use vehicles registered in the Maldives. Out of which only 4% of vehicles are EVs and most of these constitute of tricycles and e-bicycles. Despite having customs duty advantages up to 150% for imported electric motorcycles and cars over conventional fossil fuel-based vehicles, very limited EV penetration has been observed in islands like Male', Hulhumale and Addu city. Despite having customs duties advantages of up to 150% for imported electric motorcycles and cars over their fossil fuel counterparts, islands like Male, Hulhumale, Addu etc. have witnessed limited EV penetration among their resident populations. There is limited no. of trained mechanics who have experience in repair and maintenance of EVs in the country. This PI was developed through stakeholder consultations and brainstorming sessions conducted during July 2024. The main stakeholders present at the sessions include Ministry of Transport and HDC. The stakeholders were further consulted to obtain specific information required to elaborate the PI.
Objectives	1- To consult with different stakeholders on introduction of a vocational course on repair and maintenance of EVs 2- To introduce a vocational course to Maldives National University (MNU) and Maldives Polytechnic on repair and maintenance of EVs. 3- Build capacity of lecturers and tutors on management of EVs
What are the outputs and are they measurable?	1- Curriculum and training material for vocational course on repair and maintenance of EVs. 2- Estimate the resource required for implementation of a vocational course on repair and maintenance of EVs. 3- Capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic.
Relationship to the country's sustainable development priorities	1- The project will contribute to transport sector policies of the country. 2- The project will contribute to achievement of the NDC target of Maldives.

	3- The project will contribute SDG goal 13 on climate action
Project Deliverables e.g. Value/Benefits/Messages	1- Curriculum and training materials for vocational course on repair and maintenance of EVs. 2- A detailed cost estimate of the resource required for implementation of vocational course on repair and maintenance of EVs.
Project Scope and Possible Implementation	1- The project will be targeted to greater Male' Region where most number of EVs are concentrated.
Project activities	1- Consultation with MNU and Maldives Polytechnic regarding vocational trainings. 2- Develop TOR for an international expert to develop curriculum for a vocational training on PV installations. 3- Hire an international expert to develop curriculum for a vocational training on repair and maintenance of EVs 4- Provide capacity building training for the lecturers and tutors of MNU and Maldives Polytechnic 5- Initiate the vocational trainings on PV installation in MNU and Maldives Polytechnic.
Timelines	This project is envisioned for implementation within a 1-2 year timeframe.
Budget/Resource requirements	The estimated budget would be about 120,000 USD.
Measurement/Evaluation	1- No. of lecturers and tutors trained from MNU and Maldives Polytechnics. 2- No. of mechanics trained in repair and maintenance of EVs
Possible Complications/Challenges	1- Lack of support from MNU and Maldives Polytechnic. 2- Sustainability of the introduced vocational course on repair and maintenance of EVs. 3- Coordination between Ministry of Transport, MNU and Maldives Polytechnics.
Responsibilities and Coordination	1- The overall coordination of the project will be carried out by Ministry of Transport. 2- MNU and Maldives Polytechnic will be responsible for conducting the vocational course on repair and maintenance of EVs using the curriculum and training material developed by the project.

TECHNOLOGY ACTION PLAN REPORT -ADAPTATION

Authors: Ministry of Climate Change Energy and Environment, Republic of Maldives

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Abbreviations

ADB	Asian Development Bank
AGO	Attorney General's Office
AR	Assessment Report
ARISE	Accelerating Renewable Energy Integration and Sustainable Energy
BAEF	Barrier Analysis and Enabling Framework
BUR	Biennial Update Report
CC	Climate Change
CCD	Climate Change Department
CCDRM	Climate Change Disaster Risk Management
CCKP	Climate Change Knowledge Portal
CIA	Central Intelligence Agency
DGPS	Differential Global Positioning System
DTU	Danish Technical University
EbA	Ecosystem-based Adaptation
EST	Environmentally Sound Technologies
EPA	Environmental Protection Agency
ENSO	El Niño–Southern Oscillation
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GIS	Geographic Information System
GHG	Green House Gas
GoM	Government of Maldives
GNI	Gross national income
HPA	Health Protection Agency
ICZM	Integrated Coastal Zone Management
IKLK	Indigenous Knowledge and Local Knowledge
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resource Management
LUP	Land Use Plan
ILUP	Integrated Land Use Plan
MASPLAN	Master Plan for Sustainable Fisheries
MCA	Multi-Criteria Analysis
MCCPF	Maldives Climate Change Policy Framework
MoTE	Ministry of Climate Change Environment and Energy
MoCI	Ministry of Construction and Infrastructure
MECCT	Ministry of Environment Climate Change and Technology
MEE	Ministry of Environment and Energy
MEEW	Ministry of Environment Energy and Water
MHLUD	Ministry of Housing Land and Urban Development
MMRI	Maldives Marine Research Institute
MNU	Maldives National University
MNSDA	Maldives National Skills Development Authority
MoAAW	Ministry of Agriculture and Animal Welfare
MoH	Ministry of Health
MTDF	Mariculture Training and Demonstration Facility
NAMA	Nationally Appropriate Mitigation Action
NAPA	National Adaptation Programme of Action

NBS	Nature Based Solutions
NC	National Communications
NCIT	National Center for Information Technology
NDMA	National Disaster Management Authority
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organization
NSC	National Steering committee
ODA	Official Development Assistance
PI	Project Idea
RCP	Representative Concentration Pathways
SAP	Strategic Action Plan
SC	Steering Committee
SDG	Sustainable Development Goals
SLR	Sea Level Riyaz
SNC	Second National Communication
TAC	Total Allowable Catch
TAP	Technology Action Plans
TFS	Technology Fact Sheets
TNA	Technology Needs Assessment
TWG	Technical Working Group
UDP	UNEP DTU Partnership
UNDESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
URI	Utility Regulatory Authoriy
USD	United States Dollar
WDC	Women's Development Committees

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Executive summary

The Technology Action Plan (TAP) Report is the third and final report under the Maldives Technology Needs Assessment (TNA) project. The TAP Report is based on extensive consultations with the stakeholders, TNA steering committee and through MCA using an inclusive, multi-stakeholder process for promoting climate change adaptation technologies in the three sectors qualified for the BAEF report. This includes; (1) Coastal adaptation & Disaster management; (2) Water resources; (3) Agriculture and Food security sectors. The TAP provides action plans for the prioritised adaptation technologies in the three sectors after removal of financial and non-financial barriers, and the creation of appropriate enabling environment for technology uptake and diffusion. The Actions are derived from the measures that were identified in the Barriers Analysis and Enabling Framework (BAEF) Report. Each TAP provides an action plan with budgeted activities, and accompanied by a logical framework with objectively verifiable indicators, and a risk and contingency matrix in order to achieve long-term technology penetration targets. Further, each TAP lists the national stakeholders that will be responsible for the planning and implementation of the Activities that are proposed.

The TAPs will be useful to a broad audience, including policy makers, technology analysts, suppliers and end users of the proposed mitigation technologies, researchers, the private sector, and local, regional and international financial institutions. A selected set of Activities presented in the TAPs have been retained in the form of Project Ideas (PIs) to achieve the proposed technology targets. The PIs is based on immediate urgency of action; the capacity to create an enabling environment that is supportive of the implementation of the other Actions/Activities; and ability to support the uptake of several adaptation technologies simultaneously.

A brief summary of the main contents of the TAPs and PIs for the sectors are given here. The summary states the adaptation technology, its ambitions and sustainable development benefits; provides an estimate of expected costs and their proposed sources of funding; and describes the contents of the Project Ideas.

Technology Action Plan (TAP) and Project Ideas (PIs) for agriculture and food security sector

A TAP and two PIs have been developed for the agriculture and food security sector. While the TNA project prioritised two technologies in the sector, and due to similarities between the Community farming & community gardens and household therapeutic farming and the Agritourism developments have been combined into a single TAP.

Action Plan for Technology community-based urban farming and agritourism technologies

Ambitions and benefits

The overall ambition is to achieve self-sufficiency and minimize dependency on imported fruits and vegetables that can grow locally and to work with local farmers to develop agriculture related infrastructure and food storage facilities to pursue food security and self-sufficiency that will boosts local production, facilitate value-addition in the agriculture sector and increase overall resiliency of the country.

Proposed actions and timeline for implementation

Action 1: *Increase investment opportunities and enhance financial accessibility and diversify market availabilities* – Must start in year 1 and continue throughout the project until 2035 to ensure that system is established

Action 2: *Strengthening the institutional, policy and legal framework for agriculture development* –focus on this heavily for years 1-3 then maintain until 2035

Action 3: *Regulate and manage local and expatriate labour engagement in agriculture* -Focus on the first 2 years heavily and then keep monitoring throughout the project until 2035.

Action 4: *Improve awareness and knowledge: develop tertiary and higher diploma level training in Agronomy, Horticulture and Agribusiness technicians*- Start in years 1 and continue steadily until 2035.

Action 5: *Improving the availability/ accessibility of cost-effective good quality fertilizers plant material, plant nutrition irrigation systems, and hydroponic systems etc* - start in year 1 then normalize in 3 years and then keep monitoring until 2035.

Estimated cost for TAP implementation

The TAP is estimated at ~USD 2,356,000, 69% funded through donor, 26% donor and GOM combined and 5 % from the Government budget. In some cases, recurrent budget of the MoTE could be supported and Maldives' Green climate fund given their relevance to climate change and environmental management.

Project Ideas for community-based urban farming and agritourism technologies

1- Project Idea I: Roof tops, Terraces and Balcony Farming at Vinares and Hiya Towers Phase II Hulhumale. The idea is to promote community urban farming of easily grown salad vegetables and fruits in the roof tops, traces and balconies in these buildings to achieve self sufficiency and reduce the demand for imported certain selected types of crops. It will increase urban community involvement farming and maximize the space utilization in an urban environment by creating productive green spaces. Estimated cost of the PI is 520,000.00USD over 3 years.

2- Project Idea II: Agritourism. The overall idea of the concept is to integrate agritourism components into the islands designated for agricultural purpose to link agricultural production and/or processing with tourism to attract visitors. This is generate additional economic benefits through introducing additional services. Estimated costs for the PI implementation is 5, 200,000. 00 USD over 5 years.

Technology Action Plan and Project Ideas for Water Resource Sector

One TAP and a PI have been developed for the Water Resource Sector. While the TNA project prioritised two technologies in the sector, and due to similarities between the Rain Water Integration and Flood water recovery developments have been combined into Rainwater integration into, irrigation, industrial purposes, building code technologies in a single TAP.

Ambition for the TAP

The overall ambition is to establish rainwater integrated water network to improve the livelihood of the community and contribute health and wellbeing of the people and increase of economic activities specifically for the water resource management where the groundwater resources are scarce and rain water storge capacity is limited.

Proposed actions and timeline for implementation

Action 1: *Provide incentives to encourage investment in rainwater harvesting systems at household level to promote rainwater harvesting at household level– Must start in year 1 and continue throughout the project until 2030 to ensure that system is established.*

Action 2: *Revise the national building code to include ground water rain water harvesting in real state buildings/households and ground water infiltration* –Necessary regulatory revision must be completed within 1-3 then implemented until 2035.

Action 3: *Establish a government institution for IWRM compliance monitoring, water related research, establishing and implementing water related standards, and guidelines*.- The proposed institution must be in place by 2027 monitoring throughout the project until 2035.

Action 4: *Increase awareness on Climate Change impacts water saving and purification technologies and maintenance of rainwater harvesting systems and good practices , social and cultural behavior change* - Start in years 1 and continue steadily until 2035.

Action 5: *Facilitate private sector involvement in water resource management collection maintance health and hygiene of rainwater harvesting systems* – the process of facilitating private sector involvement should start in year 1 then normalize in 3 years and continue until 2035.

Estimated cost for TAP implementation

The TAP is estimated at ~USD 3,525,000, 72% funded through donor, 66% combined donor and GOM funds and 12 % from the Government budget. In some cases, recurrent budget of the MoTE could be supported and Maldives' Green climate fund given their relevance to climate change and environmental management.

<u>Project Ideas for Promotion of rainwater integration into, irrigation, industrial purposes, building code technology</u>

1- Project Idea I: Establishing water quality testing laborites in Atolls and Cities.

Piped water in the Maldives is produced from the two independent sources (rainwater and seawater) directly connected to the household to realize the ultimate goal of safe and sustained piped water supply system. The output of the system is combination harvested rainwater and desalinated water. Most of the islands neither have capacity ensure health and hygiene of the collection system nor facilities to ensure the required minimum water qualities standards. Therefore, this PI is about establishing water quality testing laborites in 19 Atolls and 5 Cities. Estimated budget for the PI is USD 5,700,000.00 over 10 years timeframe.

Technology Action Plan and Project Ideas for Coastal Adaptation and Disaster Management Sector

A TAP and two PIs have been developed for the Coastal Adaptation and Disaster Management Sector. While the TNA project prioritised two technologies in the sector, and due to similarities

between the Sustainable infiltration and drainage management and Integrated Land Use Planning (ILUP) Drone mapping, satellite imagery and GIS have been combined into Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes in a single TAP.

Ambition for the TAP

The overall ambition of Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes will be used for flood mapping, coastal ecosystems mapping, bathymetry and current mapping to better understand island dynamics in order to allow for better planning of coastal restoration and protection measures and to make evidence based informed decision by optimizing land use with carrying capacity of small islands and adaptation to CCDRM to ensure that climate change is integrated into development planning and decision-making process.

Proposed actions and timeline for implementation

Action 1: *Establish a financial scheme to reduce the high capital cost of survey equipment – Must start in year 1 and continue throughout the project until 2035 to ensure that system is established and functioning*.

Action 2: *Establish data sharing protocols within the country* –Necessary regulatory revision guidelines protocols and SOPS must be completed within 1-3 then implemented until 2035

Action 3: *Establish and implement rules engagement of locals and expatriates in mapping monitoring and surveying projects*.-these rules and regulations must be in place by 2026 monitoring throughout the project until 2035.

Action 4: *Staff training budget and include Environmental and IT curriculum to include GIS. mapping and data management* – Curriculum development in 2025 and 2026 and start courses by 2027 and continue steadily until 2035.

Action 5: *Awareness raising on climate change integration of surveying, mapping, monitoring and modeling technologies into LUP.*– The existing processes will be improved and awareness campaigns should start in year 1 then normalize by 2027 and continue until 2035

Action 6: *Develop short term training courses and field work (Tertiary and higher diploma level) in mapping GIS and surveying data science related disciplines*. development of short term trainings courses should start by 2026 and start implementation by 2028 and continue until 2035

Action 7: *Include IKLK in LUP development*. –incorporation of IKLK in islands LUPs should start immediately and continue until 2035

Estimated cost for TAP implementation

The TAP is estimated at ~USD 8,835,000.00, 88% funded through donor, 8% combined donor and GOM funds and 3 % from the Government budget. In some cases, recurrent budget of

the MoTE could be supported and Maldives' Green climate fund given their relevance to climate change and environmental management.

Project Ideas for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes

1- Project Idea I: Obtaining multiple satellite images set and drones to assess island dynamics, LULC change and erosion monitoring

The islands of Maldives are extremely dynamic and seasonally adjusting to the its beach morphology shape, size and other parameters with the change in monsoon. Monitoring and mapping both short-term (seasonal changes) and long term (years to decades) will help to understand the holistic approach for island development that needs to in cooperated in the long term developmental plans and local level island specific LUPs. Estimated budget for the PI is USD 10,700,000.00 over 10 years timeframe

2- Project Idea II: Habitable multi-purpose shore protection structures for Climate proofing through Ecosystem-based Adaptation (EbA)

These are deployment of shoreline protection hard structures such as breakwaters, groyne revetments that are inspired and supported by nature. These structures will contribute to the climate proofing through EbA in inhabited islands as well as in resort islands. The structures also can be used to rehabilitate coral reefs conservation through EbA. Estimated budget for the PI is 1,200,000.00 USD over 5 years timeframe.

Chapter 1: Technology Action Plan and Project Ideas for agriculture and food security sector

1.1 TAP Agriculture and food security sector

1.1.1 Overview of Agriculture and Food Security sector in Maldives

The agriculture and food security sectors are essential for the livelihoods of the rural population of Maldives, playing a critical role in food and nutrition security, especially for communities in the outer islands. Growth in the agriculture sector is vital for the country's economy in the face of global climate change and its impacts. However, due to the small island size, limited arable land, poor soil conditions, and restricted freshwater resources, agricultural development has been challenging. The Maldives remains heavily dependent on food imports, with logistical complexities arising from the need to supply geographically dispersed islands, particularly during extreme weather events and market disruptions. The total cultivable land area is estimated to be around 4,000 hectares, and the sector is one of the most vulnerable to climate change impacts, facing frequent threats from torrential rains, flooding, strong winds, saltwater intrusion, extended droughts, and rising temperatures (Agriculture Master Plan, 2013-2017). Extreme weather events further disrupt food supply chains and transportation systems, affecting both food and agricultural input distribution across the country.

Agriculture is crucial for food security in two ways: it provides direct food supply and serves as a primary livelihood source for local farmers and their families. The Maldives' key priorities for agriculture and food security are detailed in its Nationally Determined Contributions (NDC, 2020) and the Second National Communication (SNC, 2016) submitted to the UNFCCC. The government has adopted broad policies to diversify the agriculture sector and improve the livelihoods of island communities, opening avenues for interventions in agrotourism, community-supported urban farming, and climate-smart agriculture. Given that a significant portion of the population resides in the Greater Malé Region, promoting urban farming with innovative technologies has become a key policy focus. Urban farming could mitigate supply chain challenges, enhance nutritional security, and encourage the consumption of fresh produce. Additionally, it offers a sustainable model to engage communities in food production, strengthen food resilience, and promote social cohesion and well-being.

1.1.2 Action Plan for Technology community-based urban farming and agritourism technologies.

1.1.2.1 Description of the technology

Urban farming in densely populated areas, including roof gardens, balcony farming, and vertical agriculture, has gained attraction. Community-supported urban farming has emerged as a practical solution to enhance food security and resilience in the Maldives, particularly following the COVID-19 pandemic, which highlighted the vulnerabilities of relying on imported food. The country's' demographical patterns indicate mass movement of populace to urban areas and with governments' plan to develop urban centers, the need integrates and adjust farming systems and food production practices to the rapidly changing setting have become crucial. The emerging cityscapes of north and south Maldives have the potential to demonstrate modern farming methods requiring a coordinated effort from the city residents. It enables communities to grow fresh produce, reduce dependency on imports, and generate income. Community-supported urban farming integrates small-scale, diverse crop production systems within urban settings, offering a sustainable food supply while promoting ecological benefits like waste recycling, microclimate regulation, and water conservation.

In addition, agrotourism is gaining attention as a complementary strategy to strengthen the agriculture sector. Agrotourism involves transforming farms and agricultural sites into experiential destinations, attracting both local and international visitors to learn about sustainable farming practices and local food production. This approach supports local farmers by creating an alternative revenue stream and helps preserve cultural heritage by promoting traditional agricultural practices. This in turn opens up new marketing avenues for farmers. Agrotourism aligns with the Maldives' Strategic Action Plan (SAP) under the Blue Economy for SMEs and Agriculture sectors, with strategies focusing on developing Agri-centers, promoting standardized food production, establishing urban gardening models, enhancing agricultural data collection, and building capacity within the sector. By offering authentic experiences, agrotourism can increase community involvement, raise awareness of sustainable agriculture, and provide educational value to visitors. It also presents an opportunity to boost rural employment, reduce urban-rural income disparities, and encourage youth engagement in agriculture.

1.1.2.2 Ambition for the TAP

The overall ambition is to achieve long-term self-sufficiency and minimize dependency on imported fruits and vegetables that can grow locally. The ambition also involve increasing the production quality and nutritional value of locally produced food. The aim of the TAP is to work with local producers to develop agriculture related infrastructure and food storage facilities to pursue food security and self-sufficiency that will boost local production, facilitate value-addition in the agriculture sector and increase overall resiliency of the country.

1.1.2.3 Actions and Activities selected for inclusion in the TAP

This section provides a discussion of the Actions and Activities that have been selected to include in the agriculture and food safety sector in the TAP. The Actions are linked to the measures that were

identified following detailed analyses of barriers facing the technology (Maldives BAEF report , 2023), as well as the enabling environment required to promote the technology. A programmatic approach is used to justify the formulation of TAP. While the technology transfer will rest on the implementation of all Actions, Project Ideas have been proposed to start the technology transfer process by focusing on Actions and Activities of immediate urgency and those that can be implemented in the long term. The Project Idea will focus on promoting an enabling environment that will be supportive of other adaptation technologies selected for the sector.

Summary of barriers and measures to overcome barriers

Table 32 provides a summary of the barriers and measures for community-based urban farming and agritourism technologies identified in the BAEF report

Table 32: Summary of identified barriers and measures to overcome barriers

Category	Barrier	Measure
Economic and financial	• Land scarcity • High land fees and unavailability of micro financing options • High cost of agriculture inputs • High competition from foreign markets and lack of economic incentives • Unregulated expatriate labor involvement in market chain • lack of produce and product diversification • Value chain restrictions and challenges in small-holder to access tourism markets and involvement of middle man	• Create awareness on financial market opportunities and available products to support • Opportunity to access tourism industry • Provide need based financial options • Donor finance options
Institutional and organizational l	• Lack of supporting policy and regulatory instruments • There are no national standards and regulations; • Overlapping mandates of various institution ; and • Inefficient institutional arrangement	• Create adequate policy and regulatory framework • Reduce institutional overlapping mandates • Overarching mechanism
Human skill	• Lack of skilled agriculture technical personnel • Labor market issues • Domination of unregulated and illegal expatriate cheap labor involvement in agricultural farms	• Develop locally skilled labour • Regulate expatriate labour
Information, awareness and capacity	• Limited access to relevant information on technologies • lack of information dissemination and training, • limited coordination among key actors in the market chain	• Awareness campaigns • Atoll and island level exhibitions and training activities
Technical Barriers	• Lack of skilled persons to properly install and maintain complex systems • Few qualified, trained and knowledgeable Agronomists and Horticulture technicians • Lacking R&D	• Short term training courses • Development of Agronomists horticulture and agribusiness' technicians •

Category	Barrier	Measure
Social, cultural, and behavioral barriers	• lack of youth and women involvement in farming • Foreign unskilled labor involvement in farming and farmland management distribution chain of agricultural produces in the country • Lack of fresh-food in local diets	• Youth & woman encouragement • Expatriate labour regulate • Promote local diets

Source: Maldives BAEF report 2023

Actions selected for inclusion in the TAP

Table 33 provides an assessment of the measures considered for inclusion in the TAP. These measures are based on the problem/objective trees from the BAEF Adaptation Report (BAEF Maldives , 2023) and have already been identified as critical for inclusion in the TAP. The factors used to assess each measure are cost effectiveness, efficiency, interactions with other measures, suitability, and benefits/costs as per the TAP Guidelines (UNFCCC and UDP, 2017).

Table 33: Ranking of measures for inclusion in the for community-based urban farming and agritourism technologies TAP

Measures to overcome the barriers	Assessment	Ranking
1- Economic and financial Reducing investment costs and increase accessibility to micro finance, produce and market diversification	Scarcity of land for commercial scale agriculture contributes to high initial investment cost. Additionally, most of projects are leveraging direct donor financing options thereby reducing accessibility for funds and financing option for local farmers. Channeling financial opportunities direct to the farming communities is vital. Awareness of the farming communities on the opportunities to support diffusion of sector technologies are important. Also, existing issue with the illegal unregulated expatriate community domination in agriculture sector has to be regulated. Opportunity to direct access for farmer to diverse market such as tourism industry has to be provided to incentivize local producers.	high
2- Legal Institutional and organizational measures. policy & regulatory framework development, reduce institutional over-lapping of mandates, and establish over-arching mechanism	Lack of institutional, policy and regulatory framework to promote efficient, equitable and sustainable methods of urban farming and agritourism. Agriculture and food security sector specific objectives of the Government must be aligned with the private sector and overlapping of mandates of various institutions such as SOEs, MoFA AgroNet etc should reduce. An overreaching strategy should be established to promote and monitor and regulate the activities of urban farming. National policy support in terms of regulatory framework such as production quality standards, promoting efficient irrigation systems and, climate specific, high yielding crop varieties, monitoring of pesticide residue on agricultural products.	High
3- Human skill Regulate expatriate labor, Develop locally skilled labor	Maldives has a very limited number of skilled and trained knowledgeable people in the agriculture and food security. Agronomists and horticulture technicians are numbered. Research and development services both in private and public sector are lacking. Agrobusiness technicians, and other professional who can provide technical service for installation and maintenance of	Medium

	complex small-scale agricultural technologies and renewable energy systems are few. Technical capacity building at vocational level is required. For this, climate adaptation technologies could be included in the curriculum of MNU and specialized training and educational institutes. Enforcement of laws and regulation on expatriate labor will regulate foreign labor involvement in the agriculture sector.	
4- <u>Information, awareness and capacity</u> Conduct awareness Campaigns, Atoll & island level exhibitions	A nationwide knowledge, information and awareness campaign is needed to increase the awareness on climate change issues in general and food security, agriculture related adaptation in particular. The objectives of such a campaign would be to promote community farming in limited spaces and urban environment, introduce existing technologies and benefit of community farming, promote measures in place to support the adoption community farming at household level.	Medium
5- <u>Technical Barriers</u> Short-term training courses. Agronomists horticulture and agribusiness technicians	Lack of land and availability of very limited space, Agriculture technology that can be adapted to small scale community and urban farming needs special skills such as skilled people on installation and maintenance of small scale irrigation systems, "rain seed production and storage, plant micro-propagation technology, soil fertility and integrated pest management technologies, improved, climate specific, high yielding crop varieties, hydroponic systems, and marketing knowledgeable agronomists and Horticulture technicians etc., These are very specific skills that needs to be developed to train locals at household levels to implement small scale farming at local levels.	High
6- <u>Social, cultural, and behavioral barriers</u> Youth & woman encouragement Regulate expatriate labour	Youth and woman must be encouraging to undertake community farming, community gardening and agritourism though various types of economic and social incentive and other supportive measures. Existing unskilled expatriate labor issues has to be properly regulated with strict implementation existing laws and regulations. Consumption and deitary habits of young generation has vastly reduced the use of locally grown fresh produce there by impacting the national security and wellbeing of younger generation.	High

Based on the above assessment in Table 33 , Actions to be included in the TAP for community-based urban farming and agritourism technologies have been slightly reorganized as shown in Table 34. xxxIn the previous step of TNA process Barriers Analysis and Enabling Framework (BAEF) and various measures for overcoming barriers were identified for the technologies. The identified relevant measures to a overcome the barriers for a specific technology are converted into 'Actions', prioritized, costed and then the most important, appropriate and implementable actions are selected for TAP.

Table 34: Final selection of measures to be included as Actions in TAP for Agriculture and food security.

Category	Identified measures to overcome barriers	Measures selected as Actions for inclusion in TAP
Economic and financial	• Create awareness on financial market opportunities and available products to support • Opportunity to access tourism industry • Provide need based financial options • Donor finance options	1- Increase investment opportunities and enhance financial accessibility and diversify market availabilities.
Institutional and organizational	• Adequate policy and regulatory framework • Reduce institutional overlapping mandates • Overarching mechanism	2- Strengthening the institutional, policy and legal framework for agriculture development
Social, cultural, and behavioral barriers	• Youth & woman encouragement • Regulate expatriate labour involvement in farming and agriculture supply chain	3- Regulate and manage local and expatriate labour engagement in agriculture
Human skill	• Develop local skilled labour • Regulate expatriate labour involvement in farming and agriculture supply chain.	4- Improve awareness and knowledge: develop tertiary and higher diploma level training in Agronomy, Horticulture and Agribusiness technicians
Information, awareness and capacity	• Awareness campaigns • Atoll and island level exhibitions and training activities.	
Technical Barriers	• Short-term training courses • Development of Agronomists horticulture and agribusiness' technicians.	5- Improving the availability/ accessibility of cost-effective good quality fertilizers plant material, plant nutrition irrigation systems, and hydroponic systems etc

Activities identified for implementation of selected actions

Table 35 details the Activities for each Action (previously referred to as measure) that will be included in the TAP for community-based urban farming and agritourism technologies.

Table 35. Summary of Actions for Agriculture and food security sector TAP and their corresponding Activities.

Activities for Action implementation
Action 1: Increase investment opportunities and enhance financial accessibility and diversify market availabilities

Activity 1.1	Establish a mechanism to channel donor financing opportunities to the small-scale farming communities and interested groups
Activity 1.2	Develop an appropriate scheme for need-based financing options for agriculture related tools and systems. eg irrigation, hydroponics, vertical farming etc,
Activity 1.3	Create awareness on financial market opportunities available to support small scale urban farming technologies
Activity 1.4	Facilitate direct market access opportunities in tourism industry (resorts and hotels) for local farmers
Activity 1.5	Scale-up investments in building public food reserves and stocks and expanding regional distribution
Action 2: Strengthening the institutional, policy and legal framework for agriculture development	
Activity 2.1	Develop a regulatory framework for promotion of efficient, equitable and sustainable methods of urban farming and agritourism is practices
Activity 2.2	Implement GAP certification and standards
Activity 2.3	Integrate pest management and nutrient management regulations into small scale farming
Activity 2.4	Establish institutional inter agency arrangements to reduce the overlapping of mandates of various institutions such as SOEs, MoFA AgroNATt etc
Action 3: Regulate and manage local and expatriate labour engagement in agriculture	
Activity 3.1	Strictly enforce immigration laws and regulations particularly in rural and remote islands.
Activity 3.2	Identify areas and disciplines where expatriates can engage in agriculture sector
Activity 3.3	Establish regulatory limitations (maximum number) for the engagement of expatriate labour in agriculture field.
Action 4: Improve awareness and knowledge: develop tertiary and higher diploma level training in Agronomy, Horticulture and Agribusiness technicians	
Activity 4.1	Conduct short term training courses for local farmers on onsite compost and fertilizer production, technologies to increase soil fertility, improved, climate specific, high yielding crop varieties, identification of crops that has the potential to attain self-sufficiency, post-harvest loss reduction technologies and storage facilities, and value-addition and food processing technologies
Activity 4.2	Develop short-term training courses and TVET education on installation and maintenance of small-scale irrigation systems, “rain seed production and storage, plant micro-propagation technology, hydroponic systems, and marketing
Activity 4.3	Develop and implement tertiary and higher diploma level training in Agronomy, Horticulture and Agrobusiness technicians
Activity 4.4	Establish a national agriculture research education, and technology institute and laboratory
Activity 4.5	Establishment of national standards for agricultural produce and a mobile and web applications for producers.
Activity 4.6	Establish Agri boats ferry system for marketing and distribution of agriculture produce between island
Activity 4.7	Develop an adaptation plans to constrain mass infections and outbreaks
Action 5: Improving the availability/ accessibility of cost-effective good quality fertilizers plant material, irrigation systems, and hydroponic systems etc	
Activity 5.1	Make compost and fertilizer and fertile soil easily available for farmers
Activity 5.2	Make tools and equipment needed for farmers easily available: such as crop protection and pest control nets, irrigation and watering equipment, tools for soil preparation and maintenance, vertical planters, storage, plant micro-propagation technology, hydroponic systems, energy and power tools etc
Activity 5.3	Make relevant educational resources and books available and accessible

Actions to be implemented as Project Ideas

All of the above Actions (measures) are integrated and should be included in the TAP simultaneously. Nevertheless, project Ideas have been developed using actions that cut across multiple adaptation technologies, and which will provide the enabling conditions for scaling up interventions. Activities designed to create a more enabling framework and having a high urgency for the implementation of technologies measures will constitute Project ideas - Community-based urban farming and agritourism for the TAP in this sector.

1.1.2.4. Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

The roles of the main stakeholders for the implementation of the TAP for community-based urban farming and agritourism technologies are given in Table 36.

Table 36. Roles of main stakeholders involved in the implementation of TAP in Agriculture and food security sector .

Key Stakeholders	Role
Ministry of Climate Change Environment and Energy (MoTE)	Overall responsibility of climate Change coordination and implementation climate adaption measures and coordination with stakeholders
Ministry of Agriculture and Animal Welfare	Overall responsibility related to agriculture, animal welfare, and rural development. Supporting farmers ,promoting rural development promoting sustainable agriculture, enhancing access to markets, and developing rural communities and accrediting agricultural trainings.
Local councils, Atoll, island and City councils)	Land management local coordination and implementation of Agriculture and food security and farming, liase with all government office to facilitate the activities
Maldives National Skills Development Authority (MNSDA)	Provide TVET trainings in agriculture sector other relevant training providers are Maldives Institute of Technology and Villa Collage
Attorney Generals Office	Legal and regulatory revision to the existing laws and formulation of new regulations relevant to agriculture and food security
Labour Relations Authority	Overall responsibility for compliance of Employment Act (2/2008), and its regulations enacted, and to implement the administrative steps required for adherence to the Employment Act.
Maldives Immigration	Responsible for implementation of regulation on expatriate labour engagement locally
Maldives National University (MNU	Coordinate Agriculture and food security related research and internships, develop partnerships with other research institutions, conduct training and higher education in agriculture field.
Civil society	develop and implement training and education programs in agriculture and food security related adaptation, guidance for farmers and overall monitoring of implementation and evaluation of the programs
Media Houses	disseminate information about agriculture and food security related adaptation
Housing Development Corporation	Provide support for implementation of proposed projects that relate to community-supported urban farming in Hulhumale, Phase 2.

Scheduling and sequencing of specific activities

A detailed plan with the timelines for the activities and actions can be found in the TAP overview table (Table 39). This TAP is planned for implementation over the period 2025-2035. However, for the five actions envisioned under this TAP for agriculture and food security sector the sequencing would be as follows:

Table 37. Timeline for implementation of actions

xxx

		Planning		*Implementation*		*Responsibility*	*Funding*
#	**Actions**	*Start*	*Complete*	*start*	*complete*		
1	**Increase investment opportunities and enhance financial accessibility and diversify market availabilities** – Must start in year 1 and continue throughout the project until 2035 to ensure that system is established	*Q1-2025*	*Q4-2030*	*Q3-2025*	*Q4-2035*	*MoTE & MoAAW*	*GOM and external*
2	**Strengthening the institutional, policy and legal framework for agriculture development –**focus on this heavily for years 1-3 then maintain until 2035	*Q1-2025*	*Q4-2028*	*Q2-2026*	*Q4-2035*	*AG, MoAAW, MoTE*	*GOM*
3	**Regulate and manage local and expatriate labour engagement in agriculture -**Focus on the first 2 years heavily and then keep monitoring throughout the project until 2035**.**	*Q1-2025*	*Q4-2027*	*Q1-2025*	*Q4-2035*	*LRA, AG, CS*	*GOM*
4	**Improve awareness and knowledge: develop tertiary and higher diploma level training in Agronomy, Horticulture and Agribusiness technicians-** Start in years 1 and continue steadily until 2035.	*Q1-2026*	*Q1-2027*	*Q1-2026*	*Q4-2035*	*MNU, MH, CS*	*GOM external*
5	**Improving the availability/ accessibility of cost-effective good quality fertilizers plant material, plant nutrition irrigation systems, and hydroponic systems etc -**start in year 1 then normalize in 3 years and then keep monitoring until 2035**.**	*Q3-2025*	*Q4-2028*	*Q1-2026*	*Q4-2035*	*MoAEE*	*GOM External*

1.1.2.5. Estimation of Resources Needed for Action and Activities

Estimation of capacity building needs

The capacity building aspects are envisioned in two levels. Firstly, with references to Action 4 (under 4.1, 4.2), skill-based short duration training and knowledge sharing programs are planned for existing farmers and new entrants to the field. The idea is to develop field technicians, field officers, and potential future trainers that will be actively involved in the field level activities. As indicated in this action, the interventions are aimed for specific areas including onsite composting, fertilizer

production, local crop development, post-harvest handling, managing agri-storage facilities, food processing and value addition. These field level practical-oriented programs will be carried out in conjunction with the Action 5, Action 5, that involve building the capacity of farmers through provision of farm tools, cost-effective good quality fertilizers, planting material, irrigation systems, and hydroponic systems.

These programs can be carried out through collaboration with existing training institutes that cater for short-duration agriculture, landscaping and gardening certificate level programs that are developed under Maldives National Skills Development Authority (MNSDA). Some of these institutes include, Maldives Polytechnic, Maldives Institute of Technology, Mi College etc. Additionally, some resources may also be required to develop new and targeted short-term training packages and program materials that can be adopted by the training and extension officers of the national agriculture training and extension system mostly based out of the MoAAW.

Secondly, Action 4 (under 4.3) for also involve activities that aim at implement tertiary and higher diploma level educational programs in agronomy, horticulture and agribusiness. Significant resources may be required for developing the curriculum and other aspects of these programs. The programs can be implemented in collaboration with existing tertiary eduction providers in the Maldives. The capacity building program will need to continue throughout the timeframe envisioned for the TAP from now until 2030.

Estimations of initial material costs of actions and activities

The deployment of both of the project ideas in year 1 and 2 would require the projects to invest in materials in order to involve the targeted communities and islands. Especially, with regard to Action 5, where activities involve introduction and demonstration of various agricultural technologies that target climate-smart, resource conservation and space saving aspects of farming. For the case of community-supported urban farming project, a demonstration area might be required to showcase the technologies envisioned for mainstreaming.

For agritourism project, initial activities may require resources for redesigning farms/tourist establishment to integrate agritourism elements. This part would also entail installation of required infrastructure, land modification, installation of plants and support structures so that a context specific agritourism establishment is properly demonstrated. The amount of resources would depend on the number of islands and scale selected for the initial phase.

Estimations of costs of actions and activities

The estimated budget of around ~USD 2.3 million for its implementation. Funding for Action 1, 4, and 5 training equipment and tools can be sought from international agencies but some costs from Actions 2 and 3, would need to be borne by the Government budget. These recurrent costs will in some cases be covered under project grants but could be supported by local funding mechanisms such as the Maldives Green Climate Fund (GCF) or other ongoing projects such as the ADB food security project, given their relevance to climate change and environmental management.

1.1.2.6. Management Planning

Risks and Contingency Planning

Table 38 provides an overview of the main risks to the successful implementation of the TAP for community-based urban farming and agritourism technologies

Table 38. Risks associated with the for-community-based urban farming and agritourism technologies TAP and their mitigation measures.

Risk	Level	Mitigation
Stakeholder engagement and input low	Medium	MoTE will take the lead coordination and ensures regular communication with other key partners maintained and media campaign will be conducted to make sure they are well informed
Proposed legislative and regulatory changes may delay in the parliamentary process	High	MoTE together with Attorney Generals Office should coordinate with line ministries and other relevant government Ministries
GCF might not be able allocate funding as this might be new to their programme budget	Medium	MoTE to coordinate with GCF and discuss with them potential availability of funds prior to finalizing the proposal
No government funding available to start new activities in Agriculture and food security sector	High	MoTE together with MoAAW should coordinate the with MoF and identify activities the government can contribute financially
Opportunity to contribute from ongoing relevant projects (eg ADB) is low because the existing funds are barely enough for the project	Medium	MoTE should look into common components/ activities that can share costs with the ongoing project
Local council and City councils are reluctant to cooperate	Low	MoTE needs to coordinate appropriately explaining the benefits of the project for the locals
Private sector may be reluctant to participate	High	Project team shall demonstrate the economic incentives of the engagement and reduce barriers to entry

Next Step

a) Immediate requirements to proceed

- Formulate a review committee consisting of the key ministries and review the project and make the necessary changes;
- After the review send the project for cabinet approval for submission– focal point MoTE ;
- Ensure TAP steps and priorities are in line with MoTE /CCD current plans and priorities;
- Establish a steering committee representing key stakeholder to oversee the project implementation- MoCCE to lead
- Secure partial Government funding and in-kind for the Action 2 and 3
- Secure funding sources to build human capacity and training for farmers; and
- Secure funding to invest in equipment and tools.

b) Critical steps to succeed

- Ensure that budget support for Actions 2 and 3 will encourage securing donor funding for other activities;
- Focus on building effective communication and coordination with key partners;
- Promotion of the technology is essential for agriculture and food security in confined spaces and planning and integrate it into existing policies, plans, and procedures is an important adaptation measure in urban settings; and

- Ensure that the technology is promoted and support by decision-maker
- Ensure private sector is sufficiently engaged and incetivised to uptake and participate in the project activities.

1.1.2.7. Gender issues

The Constitution of the Maldives recognizes equal freedom and rights to all citizens without any discrimination. Article 17 of the Constitution prohibits any form of discrimination between men and women in access to any social service, employment or rights and freedoms specified within the Constitution. It further legitimizes affirmative action to redress inequalities faced by vulnerable groups, such as introducing quotas or special temporary measures that targets only a certain group of people. This has been recognized on a national level with the establishment and maintenance of a governmental Ministry of Family Gender and Social Services over the past two decades.

To ensure equal protection and benefits of the law for both men and women the Maldivian Parliament passed the Gender Equality Act in 2016. The Act seeks to facilitate measures taken towards prevention of gender discrimination and address all ideas and practices that promote gender discrimination while ensuring that women are guaranteed equal rights and opportunities in economic, social, cultural, civil and political life.

The Decentralization Act has provisions to increase female participation in local governance and decentralized decision making and 33% of all council seats are reserved exclusively for women. Also Women's Development Committees (WDC) elected through an electoral process, is established within the formal structure of the local government and, 5% of the grant money that council attains needs to be given to WDC under the provision of the act.

Maldives has developed its National Gender Equality action plan for 2022-20261 to promote gender equality and ensure protection for all individuals from discrimination, equitable participation and representation of men and women in decision-making and governance, economic development, and addressing gender-based violence. Also Maldives has developed gender actions plans for POPs2 and Accelerating Renewable Energy Integration and Sustainable Energy (ARISE)3 project funded by World bank. Gender Action plan for POPs identifies challenges in gender dynamics in the chemicals management sector in the Maldives. Aims to improve participation and representation of women in POPs related activities and focuses on redressing gender inequalities and updating gender mainstreaming strategies. Gender Action plan on ARISE focuses on addressing gender gaps and implementing a Gender Action Plan in energy sector. It highlights challenges faced by women in the energy sector, particularly in technical roles. The report emphasizes increasing women's participation in decision-making, employment, and promoting STEM education and career opportunities for females. Maldives has developed gender action plans for various sectors such as education heath etc.

Gender related key figures and statistics are listed below:

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[1] http://gender.gov.mv/wp-content/uploads/sites/2/2022/02/Gender-Equality-Action-Plan-2022-2026.pdf (accessed June 2024)

[2] https://www.environment.gov.mv/v2/wp-content/files/publications/20220530-pub-gender-action-plan-pops.pdf Accessed June 2024)

[3] https://www.environment.gov.mv/v2/wp-content/files/publications/20210110-pub-arise-gender-action-plan.pdf (accessed June 2024)

- In 2021, Maldives was 0.348 in Gender Inequality Index.
- In 2021 Global Gender Gap Index score was 0.642
- Out of the 568,362 total population, 36% are women and 64% are men
- Graduate output in higher education: 37% are women and 63% are men
- Labour force participation rate (2019): 45.6% women and 77.1% men
- Proportion of seats held by women in the parliaments 3.2%
- Women are more likely to spend more hours on informal employment- 44% of women and 36% of men work in informal employment
- Proportion of seats held by women in local governments 39.5%
- Proportion of women in managerial positions 22.3 %
- Percentage of female judges and magistrates 11%

Gender mainstreaming for TNA, BAEF and TAP process

During the TNA preparation process women representation on both the National Steering Committee (NSC) and the sector technical working groups (TWG) are actively encouraged to provide feedback and comments. Further, members of the sector working groups were required to consider and discuss specific gender related impacts of all selected technologies. The established protocol within the TNA process makes provision for inclusion of gender sensitivity analysis during the technology selection and analysis process. The same approach was adopted with representatives of people with disabilities and youth at risk.

Through this process inclusiveness of women and other vulnerable community group's active participation and their significant contribution to the TNA development process was ensured by implementing the following measure.

- Ensure balanced participation of men and women in the decision-making, brainstorming and advisory, monitoring and evaluation process relevant to implementation of activities under TNA gender mainstreaming item to understand perspective of women toward different actions in TAP.
- Encourage women to come forward in if necessary provide incentives to take part in technical fields and increase the number od women participation in administrative positions and other activities such as meetings, training workshops, outreach activities etc.
- Collect sex-disaggregated data, where possible, for the reporting for monitoring and evaluation and collect data on gender issues to allow monitoring and regular reporting on gender impacts on TAP activities.
- Ensure balanced representation in training workshops, awareness and out reach activities and include special sessions to discuss gender issues during the workshops to share experiences and lessons learned on gender mainstreaming when appropriate.

1.1.2.8. TAP overview table – Community-based Urban Farming and Agritourism Technologies

The overview of the TAP for community-based urban farming and agritourism technologies is given in Table 39.

Table 39. TAP overview table for Community-based urban farming and agritourism

Sector: Agriculture and food Security								
Technology: Community-based urban farming and agritourism								
Ambitions	To achieve self-sufficiency and minimize dependency on imported fruits and vegetables that can grow locally. Through community farming including agritourism, community gardens and household farming locally grown crops that are somehow climate resilient adaptable to local conditions with less fertilizer and pesticides will be promoted							
Benefits	to develop agriculture related infrastructure and food storage facilities , to pursue food security and self-sufficiency , boost economy local production, facilitate value-addition , increase overall resiliency of the country, increase employment opportunities,							
Action	Activities to be implemented	Sources of funding	Responsible Agency	Time frame (yr)	Risks	Success criteria	Indicators for Monitoring of implementation	Budget per activity (USD)
Action 1: Increase investment opportunities and enhance financial accessibility and diversify market availabilities	1.1 Establish a mechanism to channel donor financing opportunities to the small-scale farming communities and interested groups.	GoM/Donor	MoTE	1-5	Willingness to participate	Channeling funds approval	Number of applications	10,000
	1.2 Developing need-based financing options for agriculture related tools and systems. eg irrigation,	Donor	MoTE	1-2	No funding available	Availability of tools and small systems in the market	Number of farmers procured tools and systems for installation	150,000

	hydroponics. Vertical farming etc,							
	1.3 Creating awareness on financial market opportunities available to support small scale urban farming technologies	GoM/Donor	MoTE/ MoAAW	1-2	Low representation of farmers in sessions	More people are aware of the opportunities	Increased the number of people engaging in the farming technology	25,000
	1.4 Direct market access opportunities for local farmers	GoM/	MoTE	1-5	Industry's resistance to allow direct access	Increase the number of producers having access to markets	Increase the number of direct transections	10,000
	1.5 Scaling-up investments in building public food reserves and stocks and expanding regional distribution	Donor/GoM	MoTE/ Local councils	1-5	Not a donor priority	Increase the number food storages in the island	Number of local islands food storage facilities are installed	300,000
Action 2: Strengthening the institutional, policy and legal framework for agriculture development	2.1 Develop a regulatory framework for promotion of efficient, equitable and sustainable methods of urban farming and	GoM donor	MoAAW/ AGO	1-3	Bill gets delayed in the parliament	Draft submission to Parliament	Parliament approval of the regulation	20,000

	agritourism is practices							
	2.2 Implement GAP certification and standards	GoM/ donor	MoAAW	1-5	Resistance to accept GAP standards	Increased awareness of farmers on GAP	Increase the number of produce meeting GAP standards	50,000
	2.3 Integrate pest management and nutrient management regulations into small scale farming	GoM /donor	MoAAW/ AGO	1-3	Unavailability of alternatives to pesticides and nutrients	Increase the number of farmers using organic and natural methods	Amount of pesticide import into the country	75,000
	2.4 Establish institutional inter agency arrangements to reduce the overlapping of mandates of various institutions such as SOEs, MoAAW AgroNet etc	GoM	MoTE MoAAW SOEs and other stakeholders	1-2	Inter-agency coordination and communication is poor	Mandate over lapping are identified	Mandate overlapping cleared	5,000
Action 3: Regulate and manage local and expatriate labour engagement in agriculture	3.1 Enforce immigration laws and regulations	GoM	MoHST/ MoAAW	1	Remoteness of the areas/ islands	Decreasing number illegal labours	Increase number of local engaging in agriculture	50,000
	3.2 Identify areas and disciplines where expatriates	GoM	MoAAW / Cabinet	1	Low priority economic impact	Identification of restricted disciplines	Issue government approved list of disciplines	8,000

	can engage in agriculture sector						designated for Maldivians only	
	3.3 Establish regulatory limit (maximum number) for the engagement of expatriate labour in agriculture field	GoM	MoAAW	1-2	Establishing criteria to determine the limit of expatriate labour in agriculture field	Issue official rules of engagement of expatriates in Agriculture sector	Decreasing the number of expatriate labours in agriculture sector	8,000
Action 4: Improve awareness and knowledge: develop tertiary and higher diploma level training in Agronomy, Horticulture and Agribusiness technicians	4.1 Short term training courses for local farmers	Donor	MoTE/ MoAAW	1-3	Securing donor funding, local capacity to conduct trainings	Trained farmers are engaged in farming	Number of persons trained and practicing	175,000
	4.2 Develop short-term training courses and TVET education on installation and maintenance of small scale irrigation systems, “rain seed production and storage, plant micro-propagation technology, hydroponic systems, and marketing	Donor funding and inking GoM contribution	MoTE/ MoAAW MNSDA	1-5	Lack of technical capacity Lack of resources	Types and numbers of training conducted nationwide	Number of trained people involved in farming diversification of farming methods in small spaces	250,000

	4.3 Develop and implement tertiary and higher diploma level training in Agronomy, Horticulture and Agrobusiness technicians	Donor funding	MoTE/ MNU MoAAW	1-5	Lack of human resources to implement the activity	Increase the number of technically knowledgeable people engaged in the farming	Number of degree and diploma holders engaged in farming management and development	200,000
	4.4 Establish a nation agriculture Research Education, and Technology institute and a laboratory	Donor funding and in-kind GoM funding for building and land	MoAAW/ MoTE MNU	1-5	Low priority for donors Increase in GoM Contributions	Ability to conduct laboratory analysis and R&D locally	Establishment of R&D in the agriculture field	450,000
	4.5 Establishment of national standards for Agricultural produce and a Mobile and web applications for producers	Donar	MoAAW/ MoTE	1-3	Local capacity to undertake the work -low	Presence/increase of local capacity to implement the standards	Improvement in the quality of agriculture produce	75,000
	4.6 Establish Agri boats ferry system for marketing and distribution of agriculture produce between island	Donar GoM to provide the existing boats for the purpose	MoAAW/ SOEs Local councils	1-5	Availability of required resources	Farmers can send their produce directly to the intended markets	Number of island agri-ferry is travelled and quantity of produce transported to the markets	250,000

	4.7 Develop an adaptation plans to constrain mass infections and outbreaks	Donor	MoTE/ MoAAW	1-3	Low priority lack of human capacity	Resources available for development of the plan	Status of the plan and implementation modalities	70,000
Action 5: Improving the availability/ accessibility of cost-effective good quality fertilizers plant material, plant nutrition irrigation systems, and hydroponic systems etc	5.1 Make compost and fertilizer and fertile soil easily available for farmers	Donor/GoM	MoTE/ MoAAW	1	Cost might be too high	Increase in the homemade Compost and fertilizers	Increased use of homemade compost and fertilizers	40,000
	5.2 Make tools and equipment needed for farmers easily available: such as Crop Protection and Pest Control nets, Irrigation and Watering Equipment, Tools for Soil Preparation and Maintenance, Vertical Planters, storage, plant micro-propagation technology, hydroponic systems, Energy and Power Tools etc	Donor/ GoM	MoAAW/ MoTE	1-3	Tools might not be suitable for very small scale farming such Balcony or terrace farming	Automated systems are used for home gardening	Increase the number of farmers using modern tools and systems for their farming needs	100,000

	5.3 Make relevant Educational Resources and Books available and accessible	GoM	MoAAW/ MoTE	1-3	Number of books available in Dhivehi language is low	Accessibility to relevant books and information at rural level increased	Overall increase in the level of knowledge and information among the farmers	35,000

1.2 Project Ideas for community-based urban farming and agritourism technologies

1.2.1 Brief summary of the Project Ideas for community-based urban farming and agritourism technologies

The TAP described in this document is designed with specific Actions and Activities in mind that are interrelated and will together contribute to the successful application of the proposed technologies. Some components included in the TAP are already taking place or at the pipeline, however, activities and action included in the TAP will contribute to complement/scale up or to improve the ongoing activities and developed as PIs which can be implemented quickly, while waiting for the larger funds needed to implement the more substantial parts of Action Plan. Importantly, the PIs contain activities that provide an enabling framework that is supportive of multiple adaptation technologies in the agriculture and food security sector. These project ideas are:

1- **Project Idea I: Community-based Urban Farming in Phase II Hulhumale**. Hulhumale' houses are significant portion of country's population. Vinares and Hiya Towers are Residential social housing buildings located in the urbanizing phase II of Hulhumale in the Greater Male region. These residential units along resides around 21000 residents. The idea is to promote community urban farming of easily grown salad vegetables and fruits in the roof tops, traces and balconies in these buildings to support self-sufficiency and reduce the demand for certain selected types of imported crops. This will contribute to climate change adaptation in the urban environment and empower women and vulnerable groups of the community of Hulhumalé and to provide opportunities for income generation. It will also promote community togetherness and maximize the space utilization in an urban environment by creating productive green spaces. The project is expected to provide the community with equitable and fair access to space for community gardening and urban farming, access to organic fresh produce and contribute to diversification of the agricultural sector through enhancing urban farming practices. Through collaboration with the Housing Development Corporation, and various community groups of the target area the project envisions to extend community participation and through working in a shared farming environment.

2- **Project Idea II: Agritourism**. The overall idea of the concept is to integrate the agritourism components into the farming operations of islands designated for agricultural purposes. However, the intervention can be extended to inhabited island that has successful agribusinesses and tourism establishments. This is to increase community participation and increase across t community. Agritourism is a form of commercial enterprise that links agricultural production and/or processing with tourism. The idea is to combine agriculture and tourism, and offers new sources of revenue and includes the following factors:

   - Combine essential elements of the tourism and agriculture industries.
   - Attract members of the public to visit agricultural operations;
   - Enables increase business revenue through additional income streams

- Provides additional services including on-farm sales, recreation, entertainment, and/or educational experiences to visitors

1.2.2 Specific Project Ideas

The PIs for community-based urban farming and agritourism technologies sector are summarized in Table 40 and Table 41.

Table 40. Project Idea 1: Roof tops, Terraces and Balcony Farming at Vinares and Hiya Towers Phase II Hulhumalé.

Introduction/Background (Briefly describe the project and how it was developed)	Hulhumalé was created by reclaiming the shallow reef and lagoon to address the existing congestion in Malé and future housing, commercial and industrial needs in the greater Malé region. Hulhumalé was planned with a number of green and open spaces included in its development to provide a better quality of environment to its residents. The first phase of Hulhumalé is almost completely occupied with residential, commercial and industrial areas and the second phase has already reclaimed and urbanization has started and a large number of residential high-rise buildings are constructed in the island. Hiya and Vinares consists of 26 high-rise residential buildings. In order to promote community health and well-being, address the issues of higher fresh food prices, unavailibility of local food in Hulhumalé phase II, this project plans to involve the community in Vinares and Hiya flats renovation of their neighbourhoods, women youth and community empowerment through a roof-top terrace and balcony gardening programme.
Objectives	5- to minimize dependency on imported fruits and vegetables that can grown locally 6- to work towards self-sufficiency and food security, 7- to empower youth women and local community 8- to promote locally grown crops that are climate resilient adaptable to local conditions with less fertilizer and pesticides 9- To strengthen local productivity of agricultural produce in the Maldives 10- To create productive green spaces in roof tops terraces and balconies in Hiya and Vinares residential buildings
What are the outputs and are they measurable?	3- Pilot and mainstream the urban agricultural in confined spaces programme for community farmers in Hulhumale Phase II 4- Development of small-scale community level Agri-centres, 5- Standardizing food production and quality of produce, 6- Establishing urban gardening models, 7- Increasing the efficiency of resource allocation/use through capacity building

	8- Assist community farmers to adopt innovative and 'greener' farming practices in limited spaces to generate income
Relationship to the country's sustainable development priorities	4- Inclusive, sustainable growth, increase resilience to climate change through agriculture and food sector adaptation, 5- Contribute to enhanced food, energy and water security and natural resource management 6- This project will build on enduring partnerships, strengthen institutional capacity with strong business model to leverage on community commitment and engagement
Project Deliverables e.g. Value/Benefits/Messages	3- increase the involvement of youth women and local community to achieve self sufficient, self dependent economic targets relating to food security, import substitution, creation of jobs 4- improved agricultural capacities and opportunities to ensure food security 5- Demonstrate that climate resilient crops that are adaptable to local conditions with less fertilizer and pesticides can be grown and marketed 6- The project will contribute to reduce the vulnerability 7- Economic diversification and reduction of dependency to imports particularly for fruits and vegetables that can be grown in local conditions
Project Scope and Possible Implementation	2- The project can build on the ongoing urban farming initiatives, however the scope of the project should focus to roof-tops, terraces and balcony gardens in a community. In this context (Vinares and Hiya residential would be an ideal location) 3- Although the project is suggested to be in Hulhumale phase II it can be expanded to a national project and broaden in scope reach a large segment of the population particularly in over populated and urbanized local islands and cities.
Project activities	8- Identification of space available for urban farming in Vinares and Hiya buildings 9- Identification of interested communities to undertake farming in roof-tops terraces and balconies 10- Stakeholder consultations with farmers to identify needs, issues and challenges, required financial and material assistance. Marketing mechanism and strategy and opportunities and possible way forward with the idea 11- Selection of interested farmers and space allotment, 12- Identify type of crops and methods of growth etc 13- Training and capacity building of farmers and providing necessary tools, equipment growth medium etc 14- Preparation of space allocated for farming and installation of equipment and necessary protection etc

	15- Developing an incubation plan for the agricultural produce marketing and distribution. 16- Creating additional support structures to enhance urban farming sectors. 17- Establishing a sustainable, effective, reliable marketing and distribution mechanism for agricultural produce from roof-tops terraces and balconies to markets, clients and customers.
Timelines	This project is envisioned for implementation within a 2-3 year timeframe.
Budget/Resource requirements	The estimated budget would be about USD520,000 (at a rate of 20,000 USD per building) and this would need to be funded through a project grant, although in-kind co-funding and involvement of government institutions would be included. 2. The project would be coordinated by the MoTE together with MoAAW but some activities could be subcontracted to local NGOs or consultants (e.g. training programs, procurement of equipment and tools)
Measurement/Evaluation	3- Number of farmers enrolled in the project 4- Types of crops used and the yield 5- Status of cost recovery and improved income of farmers 6- Number of farmers trained in the trainings conducted 7- Number of agro-entrepreneurs enabled to sell produce within the market
Possible Complications/Challenges	4- Limited human resources available in government institutions for management coordination, implementation and monitoring 5- Delays in coordination with stakeholders 6- Establishing just, fair and transparent criteria for the selection of farmers for the project 7- Safety and security concerns of the roof-tops and other arrangements such as utilities protection from extreme weather events 8- Capacity of and maturity of set-up of responsible partners in operational management.
Responsibilities and Coordination	3- The overall coordination of the project will be carried out by MoTE 4- A steering committee will be established to coordinate and make policy decisions (The Steering Committee will be held at least once every 6 months) 5- MoAAW will be responsible for technical issues such as trainings, capacity building and technical advisory 6- Housing Development Cooperation (HDC) will be responsible for the overall Administrative logistical as well as security and safety related regulatory authority and management of the buildings used for the project. 7- Community associations from Hiya and Vinares together with AgroNet, relevant NGOs MNSDA, MNU, Male City council and the grantees will be stakeholders of the project

Table 41. Project Idea 2: Agritourism

Introduction/Background (Briefly describe the project and how it was developed)	Agritourism is a field that is growing in popularity as a diversification of tourism sector in the Maldives. The overall idea of the concept is to add the agritourism components into the islands designated for industrial scale agricultural developments. Agritourism is a form of commercial enterprise that links agricultural production and/or processing with tourism to attract visitors onto the designated islands for agricultural business for the purposes of entertaining or educating the visitors while generating income for the farm, or business owner. Agritourism presents a unique opportunity to combine aspects of the tourism and agriculture industries to provide a number of financial, educational, and social benefits to tourists, producers, and communities. It can also provide communities with the potential to increase their local tax bases and new employment opportunities. Additionally, agritourism provides educational opportunities to the public, helps to preserve agricultural lands, and allows island and communities to develop business enterprises. Inhabited islands/communities with extensive farming, as well as designated island for commercial scale agricultural development can be used for the promotion of Agritourism with proper established standards and guidelines for the operation of both agriculture and tourism. Land scarcity and limited availability of arable agritourism can leverage existing land for both agricultural production and tourism, creating a win-win situation. Developing agritourism diversifies the economy, reduces dependence on a single sector, and enhances resilience. Agritourism can promote sustainable agricultural practices, such as organic farming, agroforestry, and water-efficient techniques. It can showcase climate-smart approaches to visitors and local communities. Agritourism can be developed in three main settings below: • Local agricultural lands or local tourism in inhabited islands • Commercial agricultural islands • Resort islands
Objectives	**Enhance Food Security**: Strengthen local food production to reduce reliance on imports. Promote climate-resilient varieties. Improve access to nutritious food for both residents and tourists. **Capacity building and creating entrepreneurship**: Empower community farmers and local entrepreneurs to engage in agribusiness by provide training on sustainable farming, value addition, and marketing. **Create climate-resilient Agri-Businesses**: Establish innovative, climate-conscious agricultural practices, climate-smart value chains (e.g., farm-to-table experiences).Demonstrate aquaponics, vertical farming, and

	other resource-efficient methods for farming in confined spaces . **Unique tourist experience and visitor education**: Design engaging agritourism experiences (farm tours, cooking classes, etc.). Educate tourists about the importance of sustainable food systems, climate adaptation agriculture and food security. Strengthen Institutional Coordination: Collaborate with government agencies, Island and Atoll councils, industrial agricultural islands, NGOs, and local communities.
What are the outputs and are they measurable?	Outputs of the project are: 1. Increased climate resilient varieties of agricultural produce and locally grown food availability 2. Boost local economy and household Livelihoods from agritourism (from agriculture and farm visitors). 3. Improve food security dietary diversity, and nutrient consumption. 4. Strengthen community engagement in planning, decision-making, and project implementation. Measurable Outputs of the project are: 1. Number of Agritourism Enterprises Established (e.g., farms with visitor facilities, cooking classes, or guided tours). 2. Increase number of tourist visiting the agritourism sites. 3. Increase farm revenue generated from Agritourism activities (e.g., farm tours, workshops, or product sales). 4. Number of farmers and local community members trained in agritourism practices, knowledge and skills development.
Relationship to the country's sustainable development priorities	1- Inclusive, sustainable growth, increase resilience to climate change through agritourism business, 2- Contribute to enhanced food, energy and water security and natural resource management 3- This project will build on enduring partnerships between local farmers/agriculture industry and tourism industry, creating a win-win situation.
Project Deliverables e.g. Value/Benefits/Messages	1- Empowering local community and entrepreneurs to be innovative, self-dependent to achieve economic targets by combining agriculture and tourism 2- Enhance agricultural capacities and opportunities to ensure food security 3- Demonstrate that climate resilient crops that are adaptable to local conditions can be organic 4- Agritourism will be unique blend of cultural, environmental, and economic benefit 5- 4-The project will contribute to reduce the vulnerability 6- Economic diversification and reduction of dependency to imports particularly for fruits and vegetables that can be grown in local conditions 7- Authentic Maldivian lifestyle can be demonstrated through immersive sustainable agritourism experiences

Project Scope and Possible Implementation	1- The project can build on the ongoing industrial or community level agricultural plot or farm, however the scope of the project should focus on establishing facilities for tourist experience, such as cooking classes, trainings, education, touring through the farm, feeding poultry to making your own dish at the farm and other unique activities to explore.
Project activities	1- Assess market demand, potential sites, and financial viability. 2- Outline the strategic, operational, and financial aspects of the project. 3- Evaluate potential environmental impacts and propose mitigation measures. 4- Consult with local communities, government agencies, NGOs island and Atoll councils and other stakeholders. 5- Secure funding obtain necessary finance for the investment. 6- Select a suitable location and prepare the land for agritourism activities. 7- Develop necessary infrastructure and facilities such as accommodation, farm structures, and visitor amenities. 8- Plan and implement agritourism activities like farm tours, workshops, and local cuisine experiences. 9- Develop a marketing strategy and discuss with the nearby resorts to attract tourists and promote the agritourism. 10- Provide training for local farmers and staff to ensure high-quality experiences. 11- Pilot Testing 12- Launch a pilot phase to test and refine the agritourism offerings. 13- Continuously monitor progress and evaluate the impact of the project.
Timelines	This project is envisioned for implementation within a 3-5 year timeframe.
Budget/Resource requirements	The estimated budget would be about USD 5, 200,000. 00 and this would need to be funded through a project grant or an interested investor who is ready to invest mainly in Agriculture. 2. The project would be coordinated by the MoTE together with MoAAW and MoT.
Measurement/Evaluation	1- Number of agritourism enterprises established (e.g., farms with visitor facilities, cooking classes, or guided tours). 2- Number of tourist visiting the agritourism sites. 3- 3farm revenue generated from Agritourism activities (e.g., farm tours, workshops, or product sales). 4- Number of farmers and local community members trained in agritourism practices, knowledge and skills development 5- Number of agri-entrepreneurs enabled to sell produce within the market

Possible Complications/Challenges	1- Existing farmers agricultural industrial islands may lack the willingness to share resources, the ingenuity and appetite required for engaging tourists and visitors. 2- Policy and legal setting for Agritourism must be developed 3- Limited human resources available in government institutions for management coordination, implementation and monitoring 4- Delays in coordination with stakeholders 5- Capacity of and maturity of set-up of responsible partners in operational management.
Responsibilities and Coordination	The overall coordination of the project will be carried out by MoTE A steering committee will be established to coordinate and make policy decisions (The Steering Committee will be held at least once every 6 months) MoAAW will be responsible for technical issues such as trainings, capacity building and technical advisory Ministry of Tourism (MOT) will be responsible for the overall Administrative logistical as well as security and safety related regulatory authority and management of the agri-tourism activities. Community associations AgroNet, relevant NGOs MNSDA, MNU, Male City council and the grantees will be stakeholders of the project

Chapter 2 Technology Action Plan and Project Ideas for Water Resource Sector

2.1. TAP for water resource sector

2.1.1. Short description of Maldives Water Resource Sector

Groundwater and rainwater are the main sources of fresh water in Maldives. In most of the islands, groundwater is not suitable for potable use due to saltwater intrusion and poor water quality. Future climate projections show that Maldives will experience issues with adequate availability of rain water which increases risk to accessibility and quality of water sources. Groundwater aquifers on islands lie at an average depth of 1-1.5m below the ground surface. Average, thickness of the freshwater lens is 3-5 m. The porous sandy soil in the islands make the thin freshwater lens highly vulnerable to SLR subsequent increase in salinity level due to saltwater intrusion

Integrated water resource management is the policy adopted by the country to provide portable water for the islands and local community. IWRM involves combination of protection and conservation of fresh ground water lens, integration of rainwater for domestic consumption and aquifer recharge, inclusion of rainwater in public supply, demand management through use of efficient water fixtures and consumer practices, leakage control in the system at consumer level.

Ministry of Environment (MoE, 2021) has recommended to adopt and promote sustainable infiltration drainage techniques in road drainage schemes in islands to maximise groundwater recharge. The most important benefit of sustainable drainage methods is its potential for groundwater recharge when applied to urban road drainage schemes.

Promotion of rainwater integration into, irrigation, industrial purposes, building code technologies in the climate adaptation in water sector is based on the actions identified in the, National water and Sewerage policy, National water and sewerage act (2020) and Water and Sewerage master plan (2021-2035).

2.1.2. Action Plan for promotion of rainwater integration into, irrigation, industrial purposes, building code technologies

2.1.2.1 Description of the technology

Groundwater and rainwater are the main sources of fresh water in Maldives. In most of the islands, groundwater is not suitable for potable use due to saltwater intrusion and poor water quality. Future climate projections show that Maldives will experience issues with adequate availability of rain water which increases risk to accessibility and quality of water sources.

The primary target for the diffusion of rainwater integration into, irrigation, industrial purposes, building code technologies is to facilitate community and household-based rainwater harvesting system integration into irrigation and industrial purposes to secure minimum water requirement in all situations. This will be in combination with sustainable drainage aimed to intercept the hydrologic cycle, catch most of the rain water instead of removing excess water from road surfaces and discharging to sea, use drainage infiltration techniques supports the replenishment of groundwater resources in urban road drainage schemes.

Promotion of rainwater integration into, irrigation, industrial purposes, building code technologies includes many different methods for harvesting, storage and management of water resources in the Maldives. Rainwater and groundwater are the source of portable water to cater for water demand in the country. On average, the southern atolls receive about 2,218 mm of rainfall per year, while the annual rainfalls over central and northern atolls are 1,966 and 1,779 mm respectively. Flat topography and the porous sandy soil in the islands make the thin freshwater lens highly vulnerable to SLR subsequent increase in salinity level due to saltwater intrusion. Contamination from inappropriate waste disposal and sub-standard sanitation practices makes the groundwater unsuitable for human consumption in many of the islands.

The proposed technology includes combination a broad range of technologies for rainwater integration into various types of, irrigation, industrial purposes with sustainable drainage systems to use drainage infiltration techniques that supports the replenishment of groundwater resources in urban road drainage schemes. The technology also includes harvesting and storage of rainwater to use in different types of micro-irrigation technologies such as the low-head, low-cost gravity-fed drip (GFD) irrigation kits, micro sprinklers, micro tube drip system suited for smallholder farmers to highly sophisticated, capital intensive pressurized commercial micro-irrigation systems .

Technologies addressed under industrial use includes waste water recovery and reuse which is widely practiced in some resorts and possibly some industrial island but not common in habited islands. Storm water recovery and reuse after filtration and treatment is also included in this category.

Technologies that will allow rainwater infiltrate into the subsoil layer during the road and drainage design is widely practices in the existing road networks. Infiltration drainage systems (natural or artificial) are used in combination with underground piped system and conventional stormwater drainage system to prevent flooding and inundation. The system is designed to replenish and recharge the island freshwater aquifer through design enhanced infiltration techniques.

2.1.2.2. Ambition for the TAP

The overall ambition is to establish rainwater integrated water network to improve the livelihood of the community and contribute health and wellbeing of the people and increase of economic activities specifically for the water resource management where the groundwater resources are scarce and rain water storge capacity is limited. The aim of TAP is to promote a technology that is cost-effective, economically viable and environmentally friendly, low capital investment with minimum affordable production, operation and maintenance cost to the end users.

2.1.2.3. Actions and Activities selected for inclusion in the TAP

This section provides a discussion of the Actions and Activities that have been selected to include in the Rainwater integration into, irrigation, industrial purposes, building code technologies in the TAP. The Actions are linked to the measures that were identified following detailed analyses of barriers facing the technology (Maldives BAEF report, 2023), as well as the enabling environment required to promote the technology. A programmatic approach is used to justify the formulation of TAP. While the technology transfer will rest on the implementation of all Actions, Project Ideas have been proposed to start the technology transfer process by focusing on Actions and Activities of immediate urgency and those that can be implemented in the long term. The Project Idea will focus on promoting an enabling environment that will be supportive of other adaptation technologies selected for the sector.

Summary of barriers and measures to overcome barriers

Table 42 provides a summary of the barriers and measures for Rainwater integration into, irrigation, industrial purposes, building code technologies identified BAEF report.

Table 42. Summary of identified barriers and measures to overcome barriers

Category	Barrier	Measure
Economic and financial	Lack of government funding for establishment of rainwater harvesting systems at household level. Lacks government budget allocation for system repair and maintenance. Lack of skilled staffs to undertake regular cleaning, repair and maintenance of the already existing rainwater harvesting systems. No financial resources for portable water quality control and testing in islands. No access to financial resources for Small and medium-sized farmers to purchase hardware required for establishment of appropriate irrigations systems	incentives for local households to invest in rainwater harvesting Agriculture sector to encourage small-scale farmers invest in rainwater harvesting Bank loans to promote rainwater-based irrigation systems • Financial disincentives to optimal use of harvested rainwater in micro irrigation systems water price revision for water use in agricultural fields • Duty exception renewable energy & energy efficient rainwater harvesting systems
Market barriers	Lack of demand for/ tools and fittings; High costs for purchasing, and low funding to achieve	Promotion of water saving fittings and tools to create a market demand • Duty exception renewable energy & energy efficient rainwater harvesting systmes
Legal regulatory and Institutional	Lacking mandatory Monitoring of rooftop rainwater harvesting system at household/ community levels lack of legal regulatory and institutional arrangements to foster private sector investment in this sector. no overreaching national water institution with water committees at the local island level for promoting IWRM No building code regulations on regulations/ guidelines related to water efficiency for real estate development /household levels in local communities	IWRM systems compliance monitoring Building code regulations review Overarching national water institution for promoting IWRM & Rainwater harvesting Develop national standards and guideline for water harvesting • include Building code regulations related to rainwater harvesting and ground water infiltration • Establish institution to conduct research in

Category	Barrier	Measure
		water sector technologies relevant to small islands
Information, awareness and capacity	● lack of information and awareness in the general public of the adverse impact of climate change on water resources ● lack knowledge on the long-term water savings at household level ● awareness on how to maintain the cleanliness and hygiene of the water harvesting system ● Limited knowledge on water efficiency technologies; ● inadequate information on properly cleaning and maintaining; and ● Lack of awareness about issues related to water - climate change and water efficiency ● Regular testing of harvested rainwater to ensure the quality and maintain the standards ●	awarenes on impct of CC on water resources household level water saving devices filteration and purification technology awareness • Awareness on maintiaing cleanliness, helath and hygiene for rainwater harvesting systems
Technical Barriers	Lacking technical details and knowhow on the safety, hygiene proper storage and maintenance Small and medium- sized farmers who lacks proper technical skills to setup and operate rainwater harvesting, sprinkler, and drip irrigation systems Technical capacity development treatment technologies, install and maintance of systems for the efficient collection and use of water; optimizing production or implementing ground infiltration techniques.	Gov collaboration with Private sector research institutions etc on viability of rainwater harvesting technologies Technical knowhow on collection maintance health and hygiene of rainwater harvesting systems • chemical treatment of harvested rainwater for portable, industrial and agricultural use

Category	Barrier	Measure
Social, cultural, and behavioral barriers	Change in habit of general tendency to purchase bottled drinking water rather than harvested rainwater water resources are always envisaged as infinite consequently bad consumer habits are developed • Consumer preferences and social bases • Traditions, habits perceptions	Conduct large scale awareness campaigns Regular laboratory testing of harvested rainwater • Filtration and treatment of Harvested rainwater to guaranty safety

Source: Maldives BAEF report 2023

Actions selected for inclusion in the TAP

Table 43 provides an assessment of the measures considered for inclusion in the TAP. These measures are based on the problem/objective trees from the BAEF Adaptation Report (BAEF Maldives, 2023) and have already been identified as critical for inclusion in the TAP. The factors used to assess each measure are cost effectiveness, efficiency, interactions with other measures, suitability, and benefits/costs as per the TAP Guidelines (UNFCCC and UDP, 2017)

Table 43. Ranking of measures for inclusion in the rainwater integration into, irrigation, industrial purposes, building code technologies TAP

Measures to overcome the barriers	Assessment	Ranking
1- Economic financial and market barrier Incentives for rainwater harvesting at household level, water price revision for agricultures use, Duty exception for renewable energy and energy efficien rain water harvesting tools and euipment	There is no government funding scheme for establishment of rainwater harvesting systems hardware required for the systems for farmers, promotion of water saving fittings and tools, at household levels particularly in rural island level. The existing public water collection systems installed in islands are not regularly monitored and repaired. Also there is no trained staff to conduct monitoring and repair of systems and to undertake water quality control and testing in islands	High
2- Legal regulator and Institutional measures. Establish regulatory measures for IWRM compliance monitoring and institutional arrangements to foster private sector investment in water resources sector	There is no proper monitoring arrangements for the existing rainwater harvesting systems installed in the islands, as there is no regulatory requirement for period monitoring of roof-top rain water harvesting in local islands. An institution with a mandate to implement an over arching strategy for promotion of IWRM will help to establish necessary standards and guidelines for rainwater harvesting monitoring and quality control and research in water sector technologies relevant to small islands. Rain water harvesting guidelines particularly in house hold and real state buildings needs to be included in the Maldives building code. Private sector involvement in IWRM will reduce the burden of management monitoring and development of the sector to the Government.	High

	The government has to facilitate private sector involvement through appropriate regulation and necessary assistance	
3- Information, awareness and capacity Awareness on impacts CC on water resource management particularly at household levels maintenance cleaning health and hygiene of rainwater harvesting systems	Maldives has a very limited number of skilled and trained knowledgeable people in the water resource management sector. The general public needs to be more aware of the adverse impact of climate change on water resources, maintain the cleanliness and hygiene of the water harvesting system, water efficiency technologies, long-term water savings at household level and regular testing of harvested rainwater to ensure the quality and maintain the standards.	High
4- Technical Barriers Conduct R&D in rainwater harvesting technologies, maintenance health and hygiene of harvesting systems and chemical treatment harvested rainwater for portable, industrial and agricultural use	Major issue in the Maldives is that technical capacity and know how on the safety, hygiene proper cost effective storage and maintenance of the installed rainwater harvesting systems is lacking. There is a need to increase the technical skills to setup and operate rainwater harvesting, sprinkler, and drip irrigation systems in farm lands and treatment technologies, install and maintance of systems for the efficient collection and use of water; optimizing production or implementing ground infiltration techniques.	Medium
5- Social, cultural, and behavioral barriers Awareness campaigns on safety on regular laboratory testing, filtration and treatment of harvested water	Changing traditional habit and perceptions on harvested rainwater through awareness is necessary to minimize spending on bottled water for drinking by promoting harvested	Low

Based on the above assessment in Table 43 , Actions to be included in the TAP for Rainwater integration into, irrigation, industrial purposes, have been slightly reorganized as shown in Table 44.

Table 44. Final selection of measures to be included as Actions in TAP for rainwater integration into, irrigation, industrial purposes, building code technologies

Category	Identified measures to overcome barriers	Measures selected as Actions for inclusion in TAP
Economic and financial	incentives for local households to invest in rainwater harvesting Agriculture sector to encourage small-scale farmers invest in rainwater harvesting Bank loans to promote rainwater based irrigation systems • Financial disincentives to optimal use of harvested rainwater in micro irrigation systems water price revision for water use in agricultural fields	1- Provide incentives to encourage investment in rainwater harvesting systems at household level

	• Duty exception renewable energy & energy efficient rainwater harvesting systems	
Market barriers	Promotion of water saving fittings and tools to create a market demand • Duty exception renewable energy & energy efficient rainwater harvesting systmes	This is included in Action 1. As incentives
Legal regulatory and Institutional	IWRM systems compliance monitoring Building code regulations review Overarching national water institution for promoting IWRM & Rainwater harvesting Develop national standards and guideline for water harvesting • include in the national building code regulations related to rainwater harvesting and ground water infiltration • Establish institution to conduct research in water sector technologies relevant to small islands	2- Revise the national building code to include ground water rain water harvesting in real state buildings/households and ground water infiltration. 3- Establish a government institution for IWRM compliance monitoring, water related research, establishing and implementing water related standards, and guidelines.
Information, awareness and capacity	awareness on impact of CC on water resources household level water saving devices filtration and purification technology awareness • Awareness on maintaining cleanliness, health and hygiene for rainwater harvesting systems	4- Increase awareness on CC impacts water saving and purification technologies and maintenance of rainwater harvesting systems and good practices, social and cultural behavior change.
Social, cultural, and behavioral barriers	Conduct large scale awareness campaigns Regular laboratory testing of harvested rainwater • Filtration and treatment of Harvested rainwater to guaranty safety	Included in Action 5
Technical Barriers	Gov collaboration with Private sector research institutions etc on viability of rainwater harvesting technologies Technical know-how on collection maintance health and hygiene of rainwater harvesting systems	5- Facilitate private sector involvement in water resource management collection maintance health and hygiene of rainwater harvesting systems.

	• chemical treatment of harvested rainwater for portable, industrial and agricultural use	

Activities identified for implementation of selected actions

Table 45. Details the Activities for each Action (previously referred to as measure) that will be included in the TAP for rainwater integration into, irrigation, industrial purposes, building code technologies

Activities for Action implementation	
Action 1: Provide incentives to encourage investment in rainwater harvesting systems at household level	
Activity 1.1	Establish a loan scheme to provide soft loans for establishment rainwater harvesting systems at household level and for Small and medium-sized farmers to purchase hardware required for establishment of appropriate irrigations systems
Activity 1.2	Allocate Government budget for rainwater harvesting system system repair and maintenance
Activity 1.3	Provide financial resources for portable water quality control and testing in islands
Activity 1.4	Promotion of water saving fittings and tools to create a market demand Customs duty waiver on renewable energy & energy efficient rainwater harvesting systems and water saving fittings and tools
Activity 1.5	Revision of water tariffs used for agricultural purposes
Action 2: Revise the national building code to include ground water rain water harvesting in real state buildings/households and ground water infiltration	
Activity 2.1	Develop and implement mandatory compliance monitoring of rooftop rainwater harvesting system at household/ community levels
Activity 2.2	Revise the national building code to include rainwater harvesting buildings and ground water infiltration
Activity 2.3	Amend the building code to include guidelines related to water efficiency for real estate development /household levels in local communities
Action 3: Establish a government institution for IWRM compliance monitoring, water related research, establishing and implementing water related standards, and guidelines.	
Activity 3.1	undertake a feasibility study and identify mandates and activities of the institute and financial plan
Activity 3.2	Develop and oversee the implementation of national standards on repair and maintenance, cleaning , health and hygiene for rainwater harvesting systems
Activity 3.3	Develop and implement testing of harvested rainwater storage to ensure the quality and maintain the standards
Activity 3.4	Colloborate with research institutes universities and academia, home and abroad, on water related research
Activity 3.5	Establish water testing laboratories in major cities and Atoll capitals
Action 4: Increase awareness on Climate Change impacts water saving and purification technologies and maintenance of rainwater harvesting systems and good practices , social and cultural behavior change	
Activity 4.1	Conduct information and awareness campaigns for the general public on the adverse impact of climate change on water resources
Activity 4.2	Conduct community level information campaigns on the long-term water savings, water efficiency technologies; repair and maintenance, cleanliness and hygiene of the water harvesting system
Activity 4.3	Train local communities on regular water testing and monitoring of harvested rainwater to ensure the quality and maintain the standards
Activity 4.4	Capacity building workshops on technical details and knowhow on the safety, hygiene proper storage and maintenance of harvested water systems

Activity 4.5	Community level training courses on technical capacity development for treatment technologies, install and maintance of systems for the efficient collection and use of water; optimizing production or implementing ground infiltration techniques.
Activity 4.6	Capacity building on chemical treatment of harvested rainwater for portable, industrial and agricultural use
Action 5. Facilitate private sector involvement in water resource management collection maintance health and hygiene of rainwater harvesting systems	
Activity 5.1	Encourage private sector to get involved with the IWRM
Activity 5.2	Outsource water quality monitoring and quality control verifications to third party private sector companies
Activity 5.3	Amend existing laws and regulation to facilitate private sector involvement in IWRM
Activity 5.4	Outsource related education training courses and awareness campaigns to private sector

Actions to be implemented as Project Ideas

All of the above Actions (measures) are integrated and should be included in the TAP together. The approach for selecting Actions or Activities for inclusion in PIs is the same as that used for other sector TAP. Project Ideas have been developed using Actions that cut across multiple adaptation technologies, and which will provide the enabling conditions for scaling up interventions. The PIs will include:

Repair maintenance, standards and guidance development regular testing and chemical treatment for rainwater harvesting systems

2.1.2.4. Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

The roles of the main stakeholders for the implementation of the TAP for rainwater integration into, irrigation, industrial purposes, building code technologies are given in Table 46.

Table 46. Roles of main stakeholders involved in the implementation of TAP in rainwater integration into, irrigation, industrial purposes, building code technologies

Key Stakeholders	Role
Ministry of Climate Change Environment and Energy (MoTE)	Overall responsibility of climate Change coordination and implementation climate adaption measures and coordination with stakeholders
Utility Regulatory Authoriy	Overall responsibility related to rainwater integration into, irrigation, industrial purposes, building code technologies . Supporting local communities and households ,promoting rural development promoting sustainable rain water harvesting, , and developing rural communities and implementing standards and guidelines.
Ministry of Health (Department of Public Health and HPA))	Health hygiene of the rainwater collection system, water quality, standard and guidelines of output water
Local councils, Atoll, island and City councils)	Overall responsibility and care taker of public rainwater collection systems , liaise with all government office to facilitate the activities
Maldives National Skills Development Authority (MNSDA)	Provide TVET trainings in water resource management other relevant training providers are Maldives Institute of Technology and Villa Collage
Ministry of Finance	Responsible government budget and financial schemes

Attorney Generals Office	Legal and regulatory revision to the existing laws and formulation of new regulations relevant to to rainwater integration into, irrigation, industrial purposes, building code technologies
NCIT	The government agency for the development, promotion and dissemination of Information Technology in the Maldives It also promotes e-government, digital transformation, and cyber security
Maldives National University (MNU)	Coordinate to rainwater integration into, irrigation, industrial purposes, building code technologies related research and internships, develop partnerships with other research institutions, conduct training and higher education in water resource management sector
Civil society	develop and implement training and education programs in a to rainwater integration into, irrigation, industrial purposes, building code technologies related adaptation, guidance for local community and overall monitoring of implementation and evaluation of the programs
Media Houses	disseminate information about to rainwater integration into, irrigation, industrial purposes, building code technologies related adaptation

Scheduling and sequencing of specific activities

A detailed plan with the timelines for the activities and actions can be found in the TAP planning table (Table 49). This TAP is planned for implementation over the period 2025-2035. However, for the five actions envisioned under this TAP for rainwater integration into, irrigation, industrial purposes, building code technologies the sequencing would be as follows:

Action 1: Provide incentives to encourage investment in rainwater harvesting systems at household level to promote rainwater harvesting at household level– Must start in year 1 and continue throughout the project until 2030 to ensure that system is established

Action 2: Revise the national building code to include ground water rain water harvesting in real state buildings/households and ground water infiltration –Necessary regulatory revision must be completed within 1-3 then implemented until 2035

Action 3: **Establish a government institution for IWRM compliance monitoring, water related research, establishing and implementing water related standards, and guidelines**.- The proposed institution must be in place by 2027 monitoring throughout the project until 2035.

Action 4: **Increase awareness on Climate Change impacts water saving and purification technologies and maintenance of rainwater harvesting systems and good practices , social and cultural behavior change** - Start in years 1 and continue steadily until 2035.

Action 5: **Facilitate private sector involvement in water resource management collection maintance health and hygiene of rainwater harvesting systems** – the process of facilitating private sector involvement should start in year 1 then normalize in and continue until 2035

Table 47. Characterisation of activities for implementation of actions

Action	Activities	Planning		Implementation		Responsibility	Funding
		Start	Complete	Start	Complete		
Action 1: Provide incentives to encourage investment in rainwater harvesting systems at household level	1.1 Establish a loan scheme to provide soft loans for establishment rainwater harvesting systems	Q2-2025	Q4-2025	Q1-2026	Q4-2030	MoTE	GOM
	1,2 Allocate Government budget for rainwater harvesting system repair and maintenance	Q2-2025	Q4-2025	Q1-2026	Q4-2035	MoEECC/ MOF	GOM
	1.3 Provide financial resources for portable water quality control and testing in islands	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE	Dornor
	1.4 Promotion of water saving fittings and tools to create a market demand Customs duty waiver	Q2-2025	Q4-2026	Q12027	Q4-2035	MoTE	GOM
	1.5 Revision of water tariffs used for agricultural purposes	Q3-2025	Q3-2026	Q4-2026	Q4-2035	MoCCE/URA	GOM
Action 2 Revise the national building	2.1 Develop and implement	Q2-2025	Q2-2026	Q3-2026	Q4-2035	MoCCE AGO	GOM

code to include ground water rain water harvesting in real state buildings/households and ground water infiltration	mandatory compliance monitoring of rooftop rainwater harvesting system						
	2.2 Revise the national building code to include rainwater harvesting buildings and ground water infiltration	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/ AGO/ MHLUD	GOM
	2.3 Amend the building code to include guidelines related to water efficiency for real estate development /household levels in local communities	Q2-2025	Q4-2026	Q1-2027	Q42035	MoTE/ AGO/ MHLUD	GOM
Action 3: Establish a government institution for IWRM compliance monitoring, water related research, establishing and implementing water related standards, and guidelines.	3.1 undertake a feasibility study and identify mandates and activities of the institute and financial plan	Q2-2025	Q4-2025	Q1-2026	Q3-2028	MoTE	Donor
	3.2 Develop and oversee the implementation of national standards on repair and maintenance, cleaning , health	Q1-2026	Q4-2035	Q1-2026	Q4-2035	MoTE/ MOH	Donor

	and hygiene for rainwater harvesting systems						
	3.3 Develop and implement testing of harvested rainwater storage to ensure the quality and maintain the standards	Q2-2025	Q3-2027	Q3-2027	Q4-2035	MoTE/ MOH	Donor
	3.4 Colloborate with research institutes universities and academia, home and abroad, on water related research	Q2-2026	Q4-2035	Q2-2026	Q4-2035	MoTE/	Donor
	3.5 Establish water testing laboratories in major cities and Atoll capitals	Q2-2026	Q4-2035	Q2-2026	Q4-2035	MoTE/URA /MoH	Donor
Action 4: Increase awareness on Climate Change impacts water saving and purification technologies and maintenance of rainwater harvesting systems and good practices , social and cultural behavior change	4.1 Conduct information and awareness campaigns for the general public on the adverse impact of climate change on water resources	Q1-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/MoH /URA	GOM/ Doror
	4.2 Conduct community level information campaigns on the	Q1-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/MoH /URA	GOM/ Donor

	long-term water savings, water efficiency technologies; repair and maintenance, cleanliness and hygiene of the water harvesting system						
	4.3 Train local communities on regular water testing and monitoring of harvested rainwater to ensure the quality and maintain the standards	Q2-2025	Q3-2026	Q4-2026	Q4-2035	MNSDA/ MNU	Donor /GOM
	4.4 Capacity building workshops on technical details and knowhow on the safety, hygiene proper storage and maintenance of harvested water systems	Q2-2025	Q3-2026	Q4-2026	Q4-2035	MNSDA/ MNU	Donor /GOM
	4.5 Community level training courses on technical capacity development for	Q2-2025	Q3-2026	Q4-2026	Q4-2035	MNSDA/ MNU	Donor /GOM

	treatment technologies, install and maintance of systems for the efficient collection and use of water; optimizing production or implementing ground infiltration techniques						
	4.6Capacity building on chemical treatment of harvested rainwater for portable, industrial and agricultural use	Q2-2025	Q3-2026	Q4-2026	Q4-2035	MNSDA/ MNU	Donor /GOM
Action 5: Facilitate private sector involvement in water resource management collection maintance health and hygiene of rainwater harvesting systems	5.1 Encourage private sector to get involved with the IWRM	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE	GOM
	5.2 Outsource water quality monitoring and quality control verifications to third party private sector companies	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/ MOH /URA	GOM
	5.3 Amend existing laws and regulation to facilitate private	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE /AGO	GOM

	sector involvement in IWRM						
	5.4 Outsource related education training courses and awareness campaigns to private sector	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MNSDA/ MNU	Dornor

2.1.2.5 Estimation of Resources Needed for Action and Activities

Estimation of capacity building needs

Action 4 from Table 45 above highlights the need to build the capacity of local communities to undertake regular water testing and monitoring of harvested rainwater to ensure the quality and maintain the standards . Also capacity is building is needed on the safety, hygiene proper storage and maintenance of harvested water systems. Apart from this establishment of water testing facilities equipment and trainings are needed. This can be done through long and short training opportunities, via TVET education. Action 5 involves encouragement of private sector to take part in IWRM which will also require training water quality monitoring and quality control verifications to third party process as well as IWRM related education training courses and awareness campaigns to build he capacity of private sector in this fields. The capacity building program will need to continue throughout the timeframe envisioned for the TAP from now until 2035.

Estimations of costs of actions and activities

The estimated budget of around ~USD 3.5 million for its implementation. Funding for most of the activities in Actions 1, 2 can be covered from the Government , and most of the funding for Actions 3,4 and 5 has to be sought from international donor agencies but costs of few would need to be borne by the Government budget. These recurrent costs will in some cases be covered under project grants but could be supported by local funding mechanisms such as the Maldives Green Climate Fund (GCF) or other ongoing projects such depending their relevance to climate change and environmental management.

2.1.2.6 Management Planning

Risks and Contingency Planning

Table 48 provides an overview of the main risks to the successful implementation of the TAP for rainwater integration into, irrigation, industrial purposes, building code technologies.

Table 48. Risks associated with the rainwater integration into, irrigation, industrial purposes, building code technologies TAP and their mitigation measures.

Risk	Level	Mitigation
GOM contribution risk, funding included to seek from the Government for some activities might not be available as the priority of the government may shift to different activities	High	MoTE will work with line ministries to ensure realization of government contribution
Human resource no enough technical resources to conduct basic training in islands	High	MoTE together with URA and MOH and other agencies will pool the human resources to start the trainings
Donor funding may not be possible within the timeframe allocated in the TAP projects might not be implimented	High	TAP might have to be re scheduled to push back until the funding is sorted out
Opportunity to contribute from ongoing relevant project is low because the existing funds are barely enough for the project	High	MoTE should look into common components/ activities that can share costs with the ongoing project

Local council and City councils are reluctant to cooperate	Low	MoTE needs to coordinate appropriately explaining the benefits of the project for the locals

Next Step

a) Immediate requirements to proceed

- Formulate a review committee consisting of the key ministries and review the project;
- After the review send the project for cabinet approval for submission– focal point MoTE ;
- Ensure TAP steps and priorities are in line with MoTE /WATSAN section current plans and priorities;
- Establish a steering committee representing key stakeholder to oversee the project implementation- MoCCE to lead
- Secure partial Government funding and in-kind for the activities in Table 47 (activities number 1.1, 1.2, 1.4, 1.5, Action 2, 4.1, 4.2, 4.3, 4.4, 4.5 4.6, 5.1,5.2, 5.3.

b) Critical steps to succeed

- Ensure that budget support for Table 47 (activities 1.1, 1.2, 1.4, 1.5, Action 2, 4.1, 4.2, 4.3, 4.4, 4.5 4.6, 5.1,5.2, 5.3) will encourage securing donor funding for other activities;
- Appointment of local consultant (Finance and Legal Expert) to develop Activities in Action 1;
- Conducive regulatory framework: The technology is expected to be implemented using private sector involvement. For this to happen, market visibility supported by an appropriate national policy and supporting instruments such as legislation, regulations and standards are necessary; and
- Ensure that the technology is promoted and support by decision-maker and enough awareness is created at community level

2.1.2.7 TAP overview table for Promotion of rainwater integration into, irrigation, industrial purposes, building code technology

Table 49. TAP overview table for Promotion of rainwater integration into, irrigation, industrial purposes, building code technology

Sector	Water Resource Sector							
Technology	Promotion of rainwater integration into, irrigation, industrial purposes, building code technology							
Ambitions	To improve the livelihood of the community and contribute health and wellbeing of the people and increase of economic activities specifically for the water resource management where the groundwater resources are scarce and rain water storge capacity is limited							
Benefits	promote a technology that is cost-effective, economically viable and environmentally friendly, low capital investment with minimum affordable production, operation and maintenance cost to the end users							
Action	Activities	Source of Funding	Responsible Agency	Time frame (yr)	Risks	Success criteria	Indicator for monitoring	Budget per Activity (USD)
Action 1: Provide incentives to encourage investment in rainwater harvesting systems at household level	1.1 Establish a loan scheme to provide soft loans for establishment rainwater harvesting systems	GOM	MoTE	1	Willingness to establish loan scheme	Loan scheme established with and eligible criteria defined	Number of request to participate in the loan scheme	200,000
	1,2 Allocate Government budget for rainwater harvesting system repair and maintenance	GOM	MoTE/ MOF	1	Partial budget provided	Allocated budget given to the sector	Amount of money spent on the activities from the budget	40,000

	1.3 Provide financial resources for portable water quality control and testing in islands	Donor	MoTE	1-2	Donor financing not available, no interest from donors	Donor financing received /agreed	Number testing facilities established in islands	950,000
	1.4 Promotion of water saving fittings and tools to create a market demand Customs duty waiver	GOM	MoTE	1	Identifying the criteria for best water saving fittings and tools	Identified fittings and tools are available in the market	Price difference and number of people selecting the water saving fittings and tools	20,000
	1.5 Revision of water tariffs used for agricultural purposes	GOM	MoTE/URA	1	Utility provider is reluctant to revise the tariffs	Regulator accepting the need to revise the tariffs	Tariff reduction and number people using the water from the network for agricultural proposes	15,000
Action 2 Revise the national building code to include ground water rain water harvesting in real state buildings/households and ground water infiltration	2.1 Develop and implement mandatory compliance monitoring of rooftop rainwater harvesting system	GOM	MoCCE AGO	1-2	Don't have capacity in the regulatory authority to implement monitoring of rooftop rainwater harvesting system	Existing capacity is used and more people are trained to undertake the monitoring	Number of rainwater harvesting systems regularly monitored	20,000

	2.2 Revise the national building code to include rainwater harvesting buildings and ground water infiltration	GOM	MoTE/ AGO/ MHLUD	1-2	MHLUD is not convinced that a revision for building code is needed in this sector	Building code revision team formulated the meetings are conducted	Number of changes brought to the building code and implemented to address the issue	25,000
	2.3 Amend the building code to include guidelines related to water efficiency for real estate development /household levels in local communities	GOM	MoTE/ AGO/ MHLUD	1-2	MHLUD is not convinced that a revision for building code is needed in this sector	Criteria and guidelines developed to include real state buildings in rainwater harvesting	Number of real state building implementing rainwater harvesting	15,000
Action 3: Establish a government institution for IWRM compliance monitoring, water related research, establishing and implementing water related standards, and guidelines.	3.1 undertake a feasibility study and identify mandates and activities of the institute and financial plan	GOM	MoTE	1	Finding a suitable local consultant to undertake the study	Major requirements, mandates and financial plan is developed	The institutes is established and starts functioning	20,000
	3.2 Develop and oversee the implementation of national standards on repair and maintenance,	Donor	MoTE/ MOH	10	Establishing national standards	Stakeholders identifying requirements of the standards and implementation modalities	Number of systems that has been maintained using the established standards	350,000

	cleaning, health and hygiene for rainwater harvesting systems							
	3.3 Develop and implement testing of harvested rainwater storage to ensure the quality and maintain the standards	Donor	MoTE/ MOH	2	Exiting laboratories have limited capacity to undertake nationwide testing	Develop the capacity of existing laboratories and provide necessary equipment	Number of rainwater harvesting systems tested for the water quality	450,000
	3.4 Colloborate with research institutes universities and academia, home and abroad, on water related research	Donor	MoTE/	10	Limited number of institutions are interested to collaborate	Establish promotional material and approach at various levels	Number of institution collaborating together	25,000
	3.5 Establish water testing laboratories in major cities and Atoll capitals	Donor	MoTE/URA /MoH	10	Securing donor funding for activity	Amending the proposal to address donor conditions	Number of laboratories established	670,000
Action 4: Increase awareness on Climate Change impacts water saving and purification	4.1 Conduct information and awareness campaigns for the general public on the adverse	GOM/Donor	MoTE/MoH /URA	1-2	Number of interested people in the public are less	Develop promotion activities for the information session	Number of people participated in the awareness sessions	20,000

technologies and maintenance of rainwater harvesting systems and good practices , social and cultural behavior change	impact of climate change on water resources							
	4.2 Conduct community level information campaigns on the long-term water savings, water efficiency technologies; repair and maintenance, cleanliness and hygiene of the water harvesting system	GOM/Donor	MoTE/MoH /URA	1-2	Reaching out communities in the rural areas and far away islands	Alternative methods established to reach out rural areas	Number of people participated in the information and awareness campaign	45,000
	4.3 Train local communities on regular water testing and monitoring of harvested rainwater to ensure the quality and maintain the standards	GOM/Donor	MNSDA/ MNU	1-2	Local capacity is limited and could not cover the whole country	Develop train-the-trainers approach to train local communities	Number of participant trained in each island	75,000
	4.4 Capacity building workshops on technical details and knowhow on the safety, hygiene proper	GOM/Donor	MNSDA/ MNU	1-2	Local capacity is limited and could not cover the whole country	Develop train-the-trainers approach to train local communities	Number of workshops conducted in each island	35,000

	storage and maintenance of harvested water systems							
	4.5 Community level training courses on technical capacity development for treatment technologies, install and maintance of systems for the efficient collection and use of water; optimizing production or implementing ground infiltration techniques	GOM/Donor	MNSDA/ MNU	1-2	Limited capacity to develop necessary curriculum for the course in each local institutes	Recruit a consultant for curriculum development	Number of courses conducted and number of graduates working in the field	150,000
	4.6 Capacity building on chemical treatment of harvested rainwater for portable, industrial and agricultural use	GOM/Donor	MNSDA/ MNU	1-2	Limited capacity to develop conduct trainings and Required chemicals are difficult to find locally	Pool the local capacities to train more in each island	Number of trained people who can conduct chemical treatment of harvested rain water	250,000
Action 5: Facilitate private sector	5.1 Encourage private sector to	GOM	MoTE	1-2	Not many in the private	Conduct promotional	Number of private	20,000

involvement in water resource management collection maintance health and hygiene of rainwater harvesting systems	get involved with the IWRM				sector are interested to get involved	activities to attract the Private sector	companies engaged in IWRM	
	5.2 Outsource water quality monitoring and quality control verifications to third party private sector companies	GOM	MoTE/ MOH /URA	1-2	Length bidding process and potential for corruption	Make the process transparent the assessment criteria accessible to participants	Number of contracts awarded to private parties	20,000
	5.3 Amend existing laws and regulation to facilitate private sector involvement in IWRM	GOM	MoTE /AGO	1-2	Appropriate laws and regulations does not exist	Recruit a local consultant to study the necessary amendments needed	Number of amendments made to the regulation to facilitate private sector involvement in IWRM	25,000
	5.4 Outsource related education training courses and awareness campaigns to private sector	Donor	MNSDA/ MNU	1-2	Limited number of companies are interested in conducting education training courses and awareness campaigns	Develop and implement promotion activities targeted to the private sector involvement	Number of private companies expressed interest to conduct the activities	85,000

2.2 Project Ideas for Promotion of rainwater integration into, irrigation, industrial purposes, building code technology

2.2.1 Brief summary of the Project Ideas for Promotion of rainwater integration into, irrigation, industrial purposes, building code technology

The TAP described in this document is designed with specific Actions and Activities in mind that are interrelated and will together contribute to the successful application of the proposed technologies. Some components included in the TAP are already taking place or at the pipeline, however, activities and action included in the TAP will contribute to complement/scale up or to improve the ongoing activities and developed as PIs which can be implemented quickly, while waiting for the larger funds needed to implement the more substantial parts of Action Plan. Importantly, the PIs contain activities that provide an enabling framework that is supportive of multiple adaptation technologies in the water resource sector. These project ideas are:

1- **Project Idea I: Establishing water quality testing laborites in Atolls and Cities** .
Piped water network is installed in almost 40% of the inhabited islands in the Maldives. Potable water produced from the two independent sources (rainwater and seawater) would be directly connected to the household to realize the ultimate goal of safe and sustained piped water supply system. The output of the system is combination harvested rainwater and desalinated water. Most of the islands neither have capacity ensure health and hygiene of the collection system nor facilities to ensure the required minimum water qualities standards. Therefore, this PI is about establishing water quality testing laborites in Atolls and Cities

2.2.2 Specific Project Ideas

The PIs for the Promotion of rainwater integration into, irrigation, industrial purposes, building code technology is summarised in Table 50**.**

Table 50. Project Idea 1: Establishing water quality testing laborites in Atolls and Cities.

Introduction/Background (Briefly describe the project and how it was developed)	project Ideas have been developed using actions that cut across multiple adaptation technologies, and which will provide the enabling conditions for scaling up interventions. Activities designed to create a more enabling framework and having a high urgency for the implementation of technologies measures will constitute Project ideas - Promotion of rainwater integration into, irrigation, industrial purposes, building code technology The project focuses on important need in the water resource sector in small island. In Maldives where IWRM systems use combined source of harvested rainwater from roof tops and desalinated water sourced from the sea. In islands and Cities there is no facility to ensure the quality and standards of portable water

	delivered to the public through the water network. However, the process and standard procedures and activities of rainwater harvesting is currently not integrated into the national building code. The idea of this project is to establish water testing facilities in the 19 administrative atolls and 5 Cities in the Maldives.
Objectives	Objectives of Water Quality Testing Laboratories: 1- Quality Assurance and Control: implementing robust quality assurance and control measures in the laboratory. 2- Compliance Monitoring: Regularly assess water quality against established standards to ensure water safety 3- Early Detection of Contaminants: Detect pollutants, pathogens, and chemical substances early to prevent health risks. 4- Environmental Protection by regularly monitoring water quality parameters. 5- Generate awareness among the public about the water quality and its health impacts
What are the outputs and are they measurable?	1- Water Quality Data on parameters (e.g., pH, conductivity, TDS, TSS, turbidity, dissolved oxygen, nutrients, metals, etc.). 2- Laboratory assurance to ensures that water out-put from the systems adherence to quality standards. 3- Regular monitoring and submission of water quality reports to relevant authorities. 4- Awareness Campaigns to educate the public about water quality. 5- Avoid use of Contaminated water 6- Monitor health indicators related to waterborne diseases and ensure health and hygiene of the water 7- Regular monitoring reports showing the water Quality parameters like temperature, conductivity, TDS, TSS dissolved oxygen, pH, turbidity, and nutrient levels. 8- SMART Criteria with time-bound indicators to track progress will be developed.
Relationship to the country's sustainable development priorities	Establishment of testing facilities will ensure clean water SDG goal 6 that will improve the livelihood of the community and contribute health and wellbeing of the people and increase of economic activities
Project Deliverables e.g. Value/Benefits/Messages	1- Water quality assurance Plan to outline the procedures, protocols, and quality control measures for water quality testing project. The plan will include details on sampling, frequency, laboratory analysis quality control measures and methods data management and interpretation and reporting etc., 2- Laboratory setup and equipment 3- Compliance with regulations and standards to ensure testing procedures adhere national and international eg WHO regulations or guidelines.

	4- Capacity building: training local staff (lab technicians, field workers). 5- Building local expertise to sustain the project beyond its initial phase. 6- Public awareness campaigns about water quality, potential risks, and safe practices. 7- Continuous monitoring and improvement to track changes over time. 8- Implementing corrective actions if issues arise (e.g., addressing contamination sources).
Project Scope and Possible Implementation	1- The scope of the project is to assurance of the quality of portable water from the exiting water networks in the islands to safeguard the health and well-being of Maldivians. 2- To establish the necessary infrastructure and facilities for water quality testing which may include the following 3- Laboratory design and establishment • Establish standard rigorous testing methods • Procuring necessary equipment's • Training staffs and laboratory technicians • Awareness and education of the public and local communities • Conduct regular sampling and monitoring • Submitting regular monitoring reports to the relevant authorities • Establish emergency response mechanism
Project activities	1- Identify islands and cities to establish the laboratories 2- Identify the amount of land required and allocate for establishment of the laboratory 3- Develop the building infrastructure needed for the laboratory 4- Train laboratory staff and technicians 5- Procure and import laboratory equipment reagents and other chemicals needed for the laboratory 6- Establish methods and protocol for sample collection and reservation 7- Quality Control (QC) Procedures 8- Laboratory analysis procedures 9- Data management and reporting protocols and procedures 10- Local capacity building to ensure the sustainability 11- Community engagement awareness and education procedure 12- Continuous monitoring and improvement procedures and protocols
Timelines	This project is envisioned to be planned within 2-3 year and the implementation will be within 10-year timeframe.
Budget/Resource requirements	The estimated budget would be about USD 5,700.000(at a rate of 300,000 USD per laboratory) assuming land and costs of some infrastructure will be borne from the Government budget.

	Grant funding would be needed for laboratory equipment procurement and capacity building. 2. The project would be coordinated by the MoTE together with MoH and URA but some activities could be subcontracted to local NGOs or consultants (e.g. training programs, procurement of equipment and tools)
Measurement/Evaluation	1- Number of laboratories established 2- Number of tests conducted 3- Number of monitoring reports submitted 4- Number of technicians and staffs trained 5- Number of awareness and education sessions conducted
Possible Complications/Challenges	1- Planning and development phase Infrastructure challenges: land allocation, setting up and maintaining laboratories require proper infrastructure, including specialized equipment, trained personnel, and suitable facilities. 2- During the operation phase(laboratory hazards • Risk: exposure chemical hazards, biological hazards, physical hazards. • Implementing safety measures and staff training to handle risks • Quality assurance and Calibration of equipment and validation of testing methods • Ensuring consistent access to resources and skilled staff can be challenging, especially in remote atolls. • Public perception and trust of water quality is critical
Responsibilities and Coordination	8- The overall coordination of the project will be carried out by MoTE 9- A steering committee will be established to coordinate and make policy decisions (The Steering Committee will be held at least once every 6 months) 10- MoH and URA will be responsible for technical issues such as trainings, capacity building and technical advisory 11- Atoll councils City councils and relevant NGOs MNSDA, MNU, and the grantees will be stakeholders of the project

Chapter 3 Technology Action Plan and Project Ideas for Coastal Adaptation and Disaster Management Sector

3.1 TAP for Coastal Adaptation and Disaster Management

3.1.1. Short sector description of Coastal Adaptation and Disaster Management

Maldives being formed of Small low-lying geographically diapered islands, the communities are living in very close proximity to the shoreline and highly exposed to risks associated with coastal hazards such as sea swells, sea level rise. Climate change impacts have increased many folds over the past few decades. Over 80% of the total land area of the Maldives is less than 1 m above mean sea level (MSL). Approximately 44% of the settlement footprints of all islands are within 100 m of the coastline and more than 50% of the housing structures in islands are within 100 m of the coastline. More than 67% of inhabited islands reported beach erosion in 2013 at different scales and of different severity. Given the climate change vulnerability context, the adaptation technologies in coastal adaptation and disaster management sector must enhance maintain and where necessary restore the integrity of natural processes that are reducing hazards and vulnerability of both natural and physical systems. According to the second national Communication and the updated NDC, coastal adaptation in the Maldives should include the following areas.

1. Promote use of evidence-based decision making on coastal adaptation planning and management of coastal zones.
2. Reduce exposure of communities to coastal hazards.
3. Mainstream climate change risks into coastal development policies.
4. Continue to facilitate investments in coastal protection of inhabited islands, industrial islands and resorts
5. Strengthen the early warning systems and disaster risk management

Broadly the vulnerabilities and adaptation need in the coastal areas are selected based on the following policy, regulatory documents:

- Climate Emergency Act (9/2021)
- Guidance Manual for Climate Risk Resilient Coastal Protection in the Maldives
- Regulation for Protection and Preservation of Island Vegetation and Flora in the Maldives
- Ground Water Conservation Regulation (2021/R-22)
- Guidelines for building climate resilient safer islands in the Maldives

Given the above narrative Maldives prioritised Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes in the Technology Needs Assessment (TNA) as the resilience of natural environment is the key to coping with climate change impacts. Therefore, the technology was selected for BAEF and further analysis though the TAP process.

Mapping is generally considered to be a basic necessity for the successful implementation of all other technologies for island dynamics and historical changes of shoreline extreme hydro meteorological events is a vital component for appropriate land use planning and to address climate change related vulnerabilities of islands. It creates easily-read, rapidly-accessible visual maps which facilitate the identification of areas at risk of erosion flooding etc., and also helps prioritise mitigation and response efforts. Such maps contribute to increase awareness of the likelihood of climate risks among the public, local authorities and other organizations and serve as an indispensable resource for integrated planning. Hence the Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes is important for climate change disaster risk reduction and coastal adaptation.

3.1.2 Action Plan for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes

3.1.2.1 Description of the technology

One of the main challenges to implement impactful adaptation in Maldives is lack of contextualized and quantifiable historical and monitoring data and information on island to atoll level disaster risks, coastal erosion, flood prone areas, land uses biodiversity etc, as data acquisition is challenging for various parameters such as coastal, terrain, infrastructure, geology, weather history and hydro meteorological events etc to use for the decision-making purpose. Maldives prioritised Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes in the Technology Needs Assessment (TNA) as the resilience of natural environment is the key to coping with climate adaptation. The technology is important to . facilitate identification of areas at risk of land loss, flooding etc., and to prioritise mitigation and response efforts to coastal risks and strengthens other adaptation options, such as coastal erosion, island dynamics flood mitigation measures, emergency planning, provision and evacuation planning. Integrated Land Use Planning (ILUP) Drone mapping, satellite imagery and GIS will employ combination of existing latest technologies such as Drones, DGPS high resolution satellite imageries as well as conventional methods for data collection surveying and mapping which is necessary for island development, environmental protection and CCDRM.

3.1.2.2. Ambition for the TAP

The overall ambition of Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes will be used for flood mapping, coastal ecosystems mapping, bathymetry and current mapping to better understand waves dynamics in order to allow for better planning of coastal restoration and protection measures. This is important to make evidence based informed decision by optimizing land use with carrying capacity of small islands and adaptation to CCDRM. Establish, database, modeling and GIS platform for data analysis and integrated land use planning for decision support system and decision making to ensure that climate change is integrated into development planning and decision-making process.

3.1.2.3. Actions and Activities selected for inclusion in the TAP

This section provides a discussion of the Actions and Activities that have been selected to include in the Coastal Adaptation and Disaster Management sector in the TAP. The Actions are linked to the measures that were identified following detailed analyses of barriers facing the technology (Maldives BAEF report, 2023), as well as the enabling environment required to promote the technology. A programmatic approach is used to justify the formulation of TAP. While the technology transfer will rest on the implementation of all Actions, Project Ideas have been proposed to start the technology transfer process by focusing on Actions and Activities of immediate urgency and those that can be implemented in the long term. The Project Idea will focus on promoting an enabling environment that will be supportive of other adaptation technologies selected for the sector.

Summary of barriers and measures to overcome barriers

Table 51 provides a summary of the barriers and measures for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes identified BAEF report

Table 51. Summary of identified barriers and measures to overcome barriers

Category	Barrier	Measure
Economic and financial	High capital cost Lack of state funds in the annual national budget financial resources needed to train skilled staffs for maintenance of LIS Freelancers/private sector need financing Micro financing options for procurement of survey equipment.	invest in surveying, mapping and monitoring equipment, as well as computer hardware and software for storing and processing data Seek external grant funding from any of the climate adaptation funds Allocate Government budget capacity building and equipment maintenance Channel donor financial opportunities to the private sector and freelancers/SMEs Procure yearly country data sets of two monsoons
Market barriers	Unregulated expatriate involvement results in substandard maps and survey products; lack of technology means and tools available to aid LUP; High costs for purchasing, and low funding to achieve. Mapping projects are sporadically financed through project grants, private developments or in-kind support	Regulate foreign farms involvement in professional and technical fields
Legal Institutional and organizational	Centralized GIS platform integrating MLSA) EPA, MNPHI, MECCT and several NGOs to a database is important for integrated LUP	centralized system to integrate existing databases Establish data sharing mechanisms between institutions

Category	Barrier	Measure
	No data sharing mechanisms between institutions and organizations. Policy level mindsets on planning needs to improved and tailored on case by case as two islands/locations will not be the same. Data used in policy level. Limited understanding of science-based decision-making Bottom-up approach and importance of local level consultation to make use of available data. Weak capacity; Lack of integration between institutions on common interests	Bottom-up approach in local level consultation
Human skill	lack of properly trained people with technical expertise in mapping, survey monitoring and modeling Lack of skilled surveyors and GIS technical personnel Lack of centralized institution, to compile and collate information about mapping and surveying	Allocate Government funding for staff development and training Enhance MNU Environmental and IT curriculum to include GIS. mapping and data management Providing opportunities for Maldivian experts to work alongside international consultants Develop partnership with overseas universities and research institutions
Information, awareness and capacity measures	Lacking awareness on impacts of climate change on islands and reefs Lack of information dissemination and training, and limited coordination among key actors and institutions	awareness on climate change issues integration of surveying, mapping, monitoring and modeling technologies into LUP Awareness on CC linkages on Flooding, coastal erosion sensitive ecosystems and adaptation conduct CC education programmes for decision makers media and developers contractors etc.
Technical Barriers	Political bias towards fulfillment of presidential campaign promises with quick solutions to life and infrastructure threatening problems eg: flooding or erosion	Short-term training courses and TVET education programs for skill development in hydrography surveying Drone mapping image analysis LIDA Data Tertiary and higher diploma level Mapping and GIS professional and surveyors

Category	Barrier	Measure
	need an in-depth climate change education programs for decision-makers Research and Development services both in private and public sector are la	
Social, cultural, and behavioral barriers	lack incorporation or use of indigenous knowledge on island dynamics Engagement of foreign farms in island surveying and mapping project has reduced the availability of local professionals for competitive prices	IKLK use in island dynamics terrestrial and marine environment assessment and LUP development Expatriate labour regulate encourage and create opportunity for local professionals

Source: Maldives BAEF report 2023

Actions selected for inclusion in the TAP

Table 52 provides an assessment of the measures considered for inclusion in the TAP. These measures are based on the problem/objective trees from the BAEF Adaptation Report (BAEF Maldives, 2023) and have already been identified as critical for inclusion in the TAP. The factors used to assess each measure are cost effectiveness, efficiency, interactions with other measures, suitability, and benefits/costs as per the TAP Guidelines (UNFCCC and UDP, 2017).

Table 52. Ranking of measures for inclusion in the Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes TAP

Measure to overcome barrier	Assessment	Ranking
1- Economic and financial Seek donor funding to invest in equipment for mapping and monitoring, Allocate Government budget for capacity building and equipment maintenance. Obtain yearly country data sets for two monsoons.	Major issue in diffusion of the technology is the high capital cost of the necessary equipment for mapping and monitoring. Also rarely the government allocates budget for maintenance of existing equipment as well as the human capacity building in the field. Private companies as well as freelancer surveyors don't have necessary equipment due to high capital costs therefore establishing a micro financing/ loan scheme to will help them to procure the equipment and repay the loan in the long term	Medium
Market barriers	Meged with legal and institutional and organization	
2- Legal Institutional and organizational	Currently mapping and survey data exists in different government agencies such as	High

Develop necessary policy and regulatory measures to establish a centralized databased platform sharing data from MLSA) EPA, MNPHI, MECCT and several NGOs for integrated LUP process. Regulate expatriate involvement in mapping and surveying Develop necessary MOUS with different Agencies on sharing and integrating data	MLSA, EPA, MNPHI, MECCT, private sector and several NGOs. At present mapping projects are sporadically financed through project grants, private developments or in-kind support There is a need to establish centralized GIS platform to share the data, to make integrate into the LUP process and other developmental project planning and implementation through integration between institutions on common interests	
3- <u>Human skill</u> Allocate Government budget for staff development and training Include on the MNU Environmental and IT curriculum GIS. mapping and data management. Develop partnership with overseas universities and research institutions to facilitate opportunities to work alongside international consultants	Trained technical people working in the government is very limited often there is no government budget for staff training and human skill development which makes the difficult to keep-up with the technical advancement in the field. Mapping and surveying courses are not available in the MNU and other institutions therefore human skill development in this field is extremely expensive. This will encourage to create opportunities for local professionals	Medium
4- Information, awareness and capacity measures Integration of surveying, mapping, monitoring and modeling technologies into LUP Information and awareness on CCDR linkages with flooding, coastal erosion sensitive ecosystems and adaptation incorporation in LUP process Education and awareness for contractor and decision makes	Technical staff engaged in survey and mapping DRR must be aware of the impacts of climate change on islands and reefs and it should be included in the LUP and survey process for various planning and development project. Proper understanding of CCDR linkages with flooding, coastal erosion sensitive ecosystems and adaptation will help to address them during the mapping process to reflect them in LUP, planning and development related maps	High
5- <u>Technical Barriers</u> Technical capacity and skill development though TVET education programs eg: hydrography surveying Drone mapping, image analysis LIDA and satellite Data. Tertiary and higher diploma level for Mapping, GIS professional and surveyors.	Technically qualified people to conduct monitoring survey and GIS related fileds are very limited in the Maldives. Also training and tertiary level curses in these disciplines are not available locally. Therefore TVET courses on surveying and monitoring related fields needs to developed and training opportunities	Medium

	must be facilitated for the technical people interested in engaging these field. Also, the capacity to R&D in these field must be established in the universities and higher education institutes.	
6- Social, cultural, and behavioral barriers Indigenous knowledge and local knowledge (IKLK) needs to be in cooperated into island dynamics terrestrial and marine environment assessment and LUP development.	lack incorporation or use of indigenous knowledge on island dynamics Engagement of foreign farms in island surveying and mapping project has reduced the availability of local professionals for competitive prices	Low

Based on the above assessment in Table 52 , Actions to be included in the TAP for Agriculture and food security have been slightly reorganized as shown in Table 53.

Table 53. Final selection of measures to be included as Actions in TAP for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes.

Category	Identified measure to overcome barrier	Measures selected as Actions for inclusion in TAP
Economic and financial	Invest in surveying, mapping and monitoring equipment, as well as computer hardware and software for storing and processing data Seek external grant funding from any of the climate adaptation funds Allocate Government budget capacity building and equipment maintenance Channel donor financial opportunities to the private sector and freelancers/SMEs Procure yearly country data sets of two monsoons	1- Establish a financial scheme to reduce the high capital cost of survey equipment
Market barriers	Regulate foreign farms involvement in professional and technical fields	2- Establish data sharing MOUs with various agencies 3- Regulate local engagement of expatriate in monitoring and surveying projects
Legal Institutional and organizational	centralized system to integrate existing databases Establish data sharing mechanisms between institutions Bottom-up approach in local level consultation	
Human skill	Allocate Government funding for staff development and training	4- Staff training budget and include Environmental and IT curriculum to include GIS.

	Enhance MNU Environmental and IT curriculum to include GIS. mapping and data management Providing opportunities for Maldivian experts to work alongside international consultants Develop partnership with overseas universities and research institutions	mapping and data management
Information, awareness and capacity measures	awareness on climate change issues integration of surveying, mapping, monitoring and modeling technologies into LUP Awareness on CC linkages on Flooding, coastal erosion sensitive ecosystems and adaptation conduct CC education programmes for decision makers media and developers contractors etc.	5- Awareness raising on climate change integration of surveying, mapping, monitoring and modeling technologies into LUP.
Technical Barriers	Short-term training courses and TVET education programs for skill development in hydrography surveying Drone mapping image analysis LIDA Data Tertiary and higher diploma level Mapping and GIS professional and surveyors	6- Develop short term training courses and field work (Tertiary and higher diploma level) in mapping GIS and surveying data science related disciplines
Social, cultural, and behavioral barriers	IKLK use in island dynamics terrestrial and marine environment assessment and LUP development Expatriate labour regulate encourage and create opportunity for local professionals	7- Include IKLK in LUP development

Activities identified for implementation of selected actions

Table 54. Details the Activities for each Action (previously referred to as measure) that will be included in the TAP Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes

Summery Actions	
Action 1:	Establish a financial scheme to reduce the high capital cost of survey equipment
Action 2:	Establish data sharing protocols within the country
Action 3:	Establish and implement rules engagement of locals and expatriates in mapping monitoring and surveying projects
Action 4:	Staff training budget and include Environmental and IT curriculum to include GIS. mapping and data management
Action 5:	Awareness raising on climate change integration of surveying, mapping, monitoring and modeling technologies into LUP.
Action 6:	Develop short term training courses and field work (Tertiary and higher diploma level) in mapping GIS and surveying data science related disciplines

Action 7:	Include IKLK in LUP development

Activities for Action implementation	
Action 1: Reducing the high capital cost of survey equipment	
Activity 1.1	Establish a financial scheme with long-term repayment to help in procuring mapping and surveying hardware and software, tools and equipment for freelancers and small and medium enterprises
Activity 1.2	Allocate government budget for training technical staff for maintenance of LIS (land information system) capacity building and equipment maintenance
Activity 1.3	Procure high resolution satellite data for yearly country data sets of two monsoon
Activity 1.4	Invest in surveying, mapping and monitoring equipment, as well as computer hardware and software for storing and processing data
Activity 1.5	
Action 2: Establishing data sharing protocols and procedures within the country	
Activity 2.1	Develop necessary regulatory protocols guidelines MOUs etc for establishing centralized GIS platform and sharing data among the Government agencies, private sector and NGOs.
Activity 2.2	Establish a mechanism to use the centralized GIS platform for science-based decision-making within the government
Activity 2.3	Conduct local level stakeholder consultation to make use of available data.
Activity 2.4	Make institutional arrangements, sign MOUs /protocols/SOP for integration/data sharing between institutions on common interests
Action 3: Establish and implement rules engagement of locals and expatriates in monitoring and surveying projects	
Activity 3.1	Identify areas where only locals can be engaged in monitoring and surveying projects
Activity 3.2	Introduce national certification /qualification, standards, levels and minimum requirements that is needed from surveyors
Activity 3.3	
Activity 3.4	
Activity 3.5	
Action 4: Staff training budget and include Environmental and IT curriculum to include GIS. mapping and data management	
Activity 4.1	Provide staff training opportunities in specialized areas eg. Hydrography, Oceanography, land survey, tree survey, cadastral survey topography survey , etc
Activity 4.2	Provide training opportunities for Maldivian surveyor to gain working experience by working together with international survey expert both in Maldives and abroad.
Activity 4.3	Revise the MNU Environmental and IT curriculum to include GIS. mapping and data science and management
Activity 4.4	Establish a centralized institution, to compile and collate information about mapping and surveying
Activity 4.5	Provide scholarships for post-graduate studies in monitoring mapping and surveying
Activity 4.6	Engage local expertise in development and implementation of LUPs
Action 5. Awareness raising on climate change integration of surveying, mapping, monitoring and modeling technologies into LUP	
Activity 5.1	Training sessions for policy makers, politicians, senior engineers and planners on use of evidence-based decision making and climate change for LUP development
Activity 5.2	Regularly conduct training sessions on mapping monitoring, surveying and LUP for local stakeholders
Activity 5.3	Conduct media campaigns on CC and importance of mapping surveying and monitoring for developmental planning, targeting general public
Activity 5.4	Organise and arrange site visits and open days for secondary schools at survey sites to encourage them to engage in this field
Action 6. Develop short term training courses and field work (Tertiary and higher diploma level) in mapping GIS and surveying data science related disciplines	

Activity 6.1	Develop and implement tertiary and higher diploma level short term training courses in mapping GIS, surveying and data science for professional engaged in the field
Activity 6.2	Short-term training courses and TVET education programs for skill development in hydrography surveying Drone mapping image analysis LIDA Data
Activity 6.2	Develop mapping capacity of flood impacts and erosion
Action 7. Include IKLK in LUP development	
Activity 7.1	Engage local expertise in development and implementation of LUPs
Activity 7.2	Use IKLK for developmental planning, of harbours, entrance channels, shore protection environmentally sensitive areas eg Kulhi and wetlands etc

Actions to be implemented as Project Ideas

All of the above Actions (measures) are integrated and should be included in the TAP together. The approach for selecting Actions or Activities for inclusion in PIs is the same as that used for other sector TAP. Project Ideas have been developed using Actions that cut across multiple adaptation technologies, and which will provide the enabling conditions for scaling up interventions. The PIs will include:

- Integrated Land Use Planning (ILUP) Drone mapping, satellite imagery and GIS
- Habitable multi-purpose living coastal structures for shore protection ecosystem-based adaptation (EbA)

3.1.2.4. Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

The roles of the main stakeholders for the implementation of the TAP for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes are given in Table 55.

Table 55. Roles of main stakeholders involved in the implementation of TAP in Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes.

Key Stakeholders	Role
Ministry of Climate Change Environment and Energy (MoTE)	Overall responsibility of climate Change coordination and implementation climate adaption measures and coordination with stakeholders
Ministry of Housing Land and Urban Development (MHLUD)	Overall responsibility for creating updating and maintaining the basemap of the Maldives and registry of islands and reefs in the Maldives produce authoritative boundary maps establish the national GIS as well as portal for dissemination of spatial information as maps
Environmental Protection Agency (EPA)	EPA is responsible for regulatory activities for protection, conservation and management of environment and biodiversity, as well as waste management and pollution prevention under the Environment Protection and Preservation Act (4/93).
Ministry of construction and infra structure (MoCI)	The ministry of responsible for the development of new urban areas. Development of mainstreaming guidelines as well as standards for resilient infrastructure. Building resilient infrastructure including retrofitting existing ones to make these resilient. Priority infrastructure: flood mitigation in urban areas, island protection, interlinkages, population consolidation

National Disaster Management Authority (NDMA)	Focused on response and relief and recovery. DRR related policy making and planning. Maintains a disaster database only covers urban areas. Undertakes risk assessment to inform development planning and investment programming. Develop policy, standards and guidelines on mainstreaming resilience in infrastructure. Creating awareness to increae risk understanding of communities.
Local councils, Atoll, island and City councils)	Overall responsibility and care taker of public rainwater collection systems , liaise with all government office to facilitate the activities
Maldives National Skills Development Authority (MNSDA)	Provide TVET trainings in water resource management other relevant training providers are Maldives Institute of Technology and Villa Collage
Ministry of Finance	Responsible government budget and financial schemes
Attorney Generals Office	Legal and regulatory revision to the existing laws and formulation of new regulations relevant to to rainwater integration into, irrigation, industrial purposes, building code technologies
Maldives National University (MNU)	Coordinate to rainwater integration into, irrigation, industrial purposes, building code technologies related research and internships, develop partnerships with other research institutions, conduct training and higher education in water resource management sector
Civil society	develop and implement training and education programs in a to rainwater integration into, irrigation, industrial purposes, building code technologies related adaptation, guidance for local community and overall monitoring of implementation and evaluation of the programs
Media Houses	disseminate information about to rainwater integration into, irrigation, industrial purposes, building code technologies related adaptation

Scheduling and sequencing of specific activities

A detailed plan with the timelines for the activities and actions can be found in the TAP planning table (Table 58). This TAP is planned for implementation over the period 2025-2035. However, for the five actions envisioned under this TAP for agriculture and food security sector the sequencing would be as follows:

Action 1: Establish a financial scheme to reduce the high capital cost of survey equipment – Must start in year 1 and continue throughout the project until 2035 to ensure that system is established and functioning

Action 2: Establish data sharing protocols within the country –Necessary regulatory revision guidelines protocols and SOPS must be completed within 1-3 then implemented until 2035

Action 3: **Establish and implement rules engagement of locals and expatriates in mapping monitoring and surveying projects** .-these rules and regulations must be in place by 2026 monitoring throughout the project until 2035.

Action 4: **Staff training budget and include Environmental and IT curriculum to include GIS. mapping and data management** – Curriculum development in 2025 and 2026 and start courses by 2027 and continue steadily until 2035.

Action 5: **Awareness raising on climate change integration of surveying, mapping, monitoring and modeling technologies into LUP.**– The existing processes will be improved and awareness campaigns should start in year 1 then normalize by 2027 and continue until 2035

Action 6: **Develop short term training courses and field work (Tertiary and higher diploma level) in mapping GIS and surveying data science related disciplines .** development of short term trainings courses should start by 2026 and start implementation by 2028 and continue until 2035

Action 7: **Include IKLK in LUP development.** –incorporation of IKLK in islands LUPs should start immediately and continue until 2035

Table 56. Characterisation of activities for implementation of actions

Action	Activities	Planning		Implementation		Responsibility	Funding
		Start	Complete	Start	Complete		
Action 1: Reducing the high capital cost of survey equipment	1.1 Establish a financial scheme with long-term repayment to help in procuring mapping and surveying hardware and software, tools and equipment for freelancers and small and medium enterprises	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE	GOM
	1,2 Allocate government budget for training technical staff for maintenance of LIS (land information system) capacity building and equipment maintenance	Q2-2025	Q1-2026	Q2-2026	Q4-2035	MoEECC/ MOF	GOM
	1.3 Procure high resolution satellite data for yearly country data sets of two monsoon	Q2-2025	Q4-2027	Q1-2028	Q4-2035	MoTE	Dornor
	1.4 Invest in surveying, mapping	Q2-2025	Q4-2027	Q1-2028	Q4-2035	MoTEMoTE	Donor

	and monitoring equipment, as well as computer hardware and software for storing and processing data						
Action2: Establishing data sharing protocols and procedures within the country	2.1 Develop necessary regulatory protocols guidelines MOUs etc for establishing centralized GIS platform and sharing data among the Government agencies, private sector and NGOs.	Q2-2025	Q2-2026	Q3-2026	Q4-2035	MoTE other line ministries	GOM
	2.2 Establish a mechanism to use the centralized GIS platform for science-based decision-making within the government	Q2-2025	Q4-2027	Q1-2028	Q4-2035	MoTE/ MHLUD and stakeholder	Dornor
	2.3 Conduct local level stakeholder consultation to make use of available data.	Q2-2025	Q4-2027	Q1-2028	Q4-2035	MoTE/ Other stakeholder	GOM
	2.4 Make institutional	Q2- 2025	Q2-2028	Q3-2028	Q4-2035	MoTE with MLSA, EPA,	GOM

	arrangements, sign MOUs /protocols/SOP for integration/data sharing between institutions on common interests					MHLUD, MoCI, NDMA	
Action 3: Establish and implement rules engagement of locals and expatriates in monitoring and surveying projects	3.1 Identify areas where only locals can be engaged in monitoring and surveying projects	Q2-2025	Q4-2025	Q1-2026	Q3-2028	MoTE /LRA	GOM
	3.2 Introduce national certification /qualification, standards, levels and minimum requirements that is needed from surveyors	Q1-2026	Q4-2035	Q1-2026	Q4-2035	MoTE/ MOH	Donor
Action 4: Staff training budget and include Environmental and IT curriculum to include GIS. mapping and data management	4.1 Provide staff training opportunities in specialized areas eg. Hydrography, Oceanography, land survey, tree survey, cadastral survey topography survey , etc	Q1-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/MoH /URA	GOM/ Doror
	4.2 Provide training opportunities for Maldivian surveyor	Q1-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/MoH /URA	GOM/ Donor

	to gain working experience by working together with international survey expert both in Maldives and abroad						
	4.3 Revise the MNU Environmental and IT curriculum to include GIS. mapping and data science and management	Q2-2025	Q3-2026	Q4-2026	Q4-2035	MNSDA/ MNU	Donor /GOM
	4.4 Establish a centralized institution, to compile and collate information about mapping and surveying	Q2-2025	Q3-2027	Q4-2028	Q4-2035	MoTE/ MLSA EPA other stakeholders	Donor
	4.5 Provide scholarships for post-graduate studies in monitoring mapping and surveying	Q2-2025	Q3-2026	Q4-2026	Q4-2035	MoTE/ MNU	Donor /GOM
	4.6 Engage local expertise in development and implementation of LUPs	Q2-2025	Q3-2026	Q4-2026	Q4-2035	MoTE/ MLSA	GOM
Action 5: Awareness raising on climate change	5.1 Training sessions for policy makers, politicians,	Q2-2025	Q4-2027	Q1-2028	Q4-2035	MoTE/MLSA	GOM

integration of surveying, mapping, monitoring and modeling technologies into LUP	senior engineers and planners on use of evidence-based decision making and climate change for LUP development						
	5.2 Regularly conduct training sessions on mapping monitoring, surveying and LUP for local stakeholders	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/ MLSA/EPA	Dornor/GOM
	5.3 Conduct media campaigns on CC and importance of mapping surveying and monitoring for developmental planning, targeting general public	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE MLSA /Media and civil society	GOM
	5.4 Organise and arrange site visits and open days for secondary schools at survey sites to encourage them to engage in this field	Q2-2025	Q4-2026	Q1-2027	Q4-2035	MoTE/ MLSA /MoE	GOM
Action 6. Develop short term training courses and field	6.1 Develop and implement tertiary and higher diploma	Q4-2026	Q4-2028	Q1-2029	Q4 2035	MoTE/ MNU/MLSA	Dornor

work (Tertiary and higher diploma level) in mapping GIS and surveying data science related disciplines	level short term training courses in mapping GIS, surveying and data science for professional engaged in the field						
	6.2 Short-term training courses and TVET education programs for skill development in hydrography surveying Drone mapping image analysis LIDA Data	Q4-2026	Q4-2028	Q1-2029	Q4 2035	MoTE/ MSDA/MLSA	Dornor
	6.3Develop mapping capacity of flood impacts and erosion	Q4-2025	Q4-2028	Q1-2029	Q4 2035	MoTE/ /MLSA EPA	Dornor
Action 7. Include IKLK in LUP development	7.1 Engage local expertise in development and implementation of LUPs	Q2-2025	Q4-2026	Q1-2027	Q4 2035	MoTE/ /MLSA	GOM
	7.2 Use IKLK for developmental planning, of harbours, entrance channels, shore protection environmentally sensitive areas eg	Q2-2025	Q4-2027	Q1-2028	Q4 2035	MoTE/ /MLSA	Dornor

	Kulhi and wetlands etc						

3.1.2.5 Estimation of Resources Needed for Action and Activities

Estimation of capacity building needs

Actions 4 5 and 6 from Table 54 above highlights the need to build the capacity of staff and professionals engaged in mapping, monitoring surveying and GIS for LUP planning and development . Also, capacity building is needed to provide training opportunities in specialized areas eg. Hydrography, Oceanography, land survey, tree survey, cadastral survey topography survey , etc. This can be done through long and short training opportunities, via TVET education. Apart from this establishment of a centralized institution, to compile and collate information about mapping and surveying. Action 7 involves encouragement of use of IKLK in LUP development The capacity building program will need to continue throughout the timeframe envisioned for the TAP from now until 2035.

Estimations of costs of actions and activities

The estimated budget of around ~USD 8.8 million for its implementation. Funding for most of the activities in Actions 1, 2 can be covered from the Government , and most of the funding for Actions 3,4, 5 and6 has to be sought mostly from international donor agencies but costs of few would need to be borne by the Government budget with in-kind support from the Government. These recurrent costs will in some cases be covered under project grants but could be supported by local funding mechanisms such as the Maldives Green Climate Fund (GCF) or other ongoing projects depending their relevance to climate change and environmental management.

3.1.2.6 Management Planning

Risks and Contingency Planning

Table 57provides an overview of the main risks to the successful implementation of the TAP for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes.

Table 57. Risks associated with the Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes TAP and their mitigation measures.

Risk	Level	Mitigation
Funding from the proposed sources might not be realized	High	MoTE will work with doners and the government to ensure necessary finanacial resources for the TAP
Technology advancements and associated price increase	Medium	Price difference has to be accommodated during the procuring process
Donor funding may not be possible within the timeframe allocated in the TAP	High	TAP might have to be re scheduled to push back until the funding is sorted out
Staff and profession trainings courses could not be conducted because the equipment needed is not available in the institutions	High	Provision of the equipment to use in practical session must be included in the design stage
Local council and City councils and other stakeholders are reluctant to cooperate	Low	MoTE needs to coordinate appropriately explaining the benefits of the project for the locals

Next Step

a) Immediate requirements to proceed

- Formulate a review committee consisting of the key ministries and review the project;
- After the review send the project for cabinet approval for submission– focal point MoTE ;
- Ensure TAP steps and priorities are in line with MoTE /CCD section current plans and priorities;
- Establish a steering committee representing key stakeholder to oversee the project implementation- MoCCE to lead
- Secure partial Government funding and in-kind for the activities 1.1, 1.2, 2.1, 2.3, 2.4, 3.1, 4.6, 5.1, 5.3, 5.4 and 7.1.

b) Critical steps to succeed

- Ensure that budget support for 1.1, 1.2, 2.1, 2.3, 2.4, 3.1, 4.6, 5.1, 5.3, 5.4 and 7.1.will encourage securing donor funding for other activities;
- Appointment of local consultant (Finance and Legal Expert) to develop Activities in Actions 1and 2 and 3;
- Recruit a suitable consultant to advise the existing Environmental and IT curriculum in MNU to include GIS mapping monitoring and data management
- Ensure that the technology is promoted and support by decision-maker and enough awareness is created at community level.

3.1.2.7 TAP overview table for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes

Table 58. TAP overview table for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes

Sector: **Coastal adaptation and disaster Management**								
Technology	Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes							
Ambitions	The overall ambition of Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes to make evidence based informed decision by optimizing land use with carrying capacity of small islands and adaptation to CCDRM							
Benefits	Using integrated land use planning for decision support system and decision making to ensure that climate change is integrated into development planning and decision-making process.							
Action	Activities	Source of Funding	Responsible Agency	Time frame (yr)	Risks	Success criteria	Indicator for monitoring	Budget per Activity (USD)
Action 1: Reducing the high capital cost of survey equipment	1.1 Establish a financial scheme with long-term repayment to help in procuring mapping and surveying hardware and software, tools and equipment for freelancers and small and medium enterprises	GOM/Donor	MoTE	1	Willingness to establish loan scheme	Loan scheme established and professionals are prticipaing	Number of equipment/ hardware software procured using the scheme	450,000.00
	1.2 Allocate government budget for training technical staff for maintenance of LIS (land	GOM	MoEECC/ MOF	1	Partial budget provided	Criteria to use the allocated budget established	Amount of money used for staff and professionals training from GOM Budget	50,000.00

	information system) capacity building and equipment maintenance							
	1.3 Procure high resolution satellite data for yearly country data sets of two monsoon	Donor	MoTE	1-2	Donor financing not available, no interest from donors	Source for providing satellite image identified and agreement signed	Number of image sets received and used for mapping and monitoring	2, 950,000.00
	1.4 Invest in surveying, mapping and monitoring equipment, as well as computer hardware and software for storing and processing data	Donor	MoTE	1	Donor not interested in financing equipment only	Equipment hardware and software needed has been identified and agreed	Number of equipment received and used acquiring, storage and processing data	2,345,00.00
Action 2 Establishing data sharing protocols and procedures within the country	21. Develop necessary regulatory protocols guidelines MOUs etc for establishing centralized GIS platform and sharing data among the Government	GOM	MoCCE other line ministries	1-2	Willingness to integrate, share and participate in the protocols and MOUs	Areas for data sharing and agencies responsible and willing to participate are identified	Number of protocols and MOUS signed and number of agencies participated	50,000.00

	agencies, private sector and NGOs.							
	2.2 Establish a mechanism to use the centralized GIS platform for science-based decision-making within the government	Donor	MoTE/ MHLUD and stakeholder	1-2	Identifying mechanism to share and standardize the data that will be shared	Quality control measures for data is established and implemented	Number of agencies cooperating and providing the data for decision making process	300,000.00
	2.3 Conduct local level stakeholder consultation to make use of available data.	GOM	MoTE/ Other stakeholder	1-2	Low participation in the consultation and reluctant to contribute	Information and awareness of Stakeholders prior to commencement of the consultations	Number of stakeholders participated and contributed to the consultation	15,000.00
	2.4 Make institutional arrangements, sign MOUs /protocols/SOP for integration/data sharing between institutions on common interests	GOM/donor	MoTE with MLSA, EPA, MHLUD, MoCI, NDMA	1-3	Willingness to participate and provide data	Standards and data quality agreed and necessary protocols SOPs MOUS signed	Number of institutions participating the protocols SOPs and MOUS	60,000.00
Action 3: Establish and implement rules	3.1 Identify areas where only locals can be engaged	GOM	MoTE /LRA	1	Identification of areas may take long time	A list of areas designated for only local	Number of local and expatriates	30,000.00

engagement of locals and expatriates in monitoring and surveying projects .	in monitoring and surveying projects					engagement is established	involved project	
	3.2 Introduce national certification /qualification, standards, levels and minimum requirements that is needed from surveyors	Donor	MoTE/ MOH	10	Inclusion of minimum requirements in the registration process	Minimum requirements and standards are established and implemented	Number of registered surveyors meet the criteria established	150,000.00
Action 4 Staff training budget and include Environmental and IT curriculum to include GIS. mapping and data management	4.1 Provide staff training opportunities in specialized areas eg. Hydrography, Oceanography, land survey, tree survey, cadastral survey topography survey , etc	GOM/donor	MoTE/MoH /URA	1-2	GoM budget not available for trainings	Training opportunities created for professional from the GoM budget	Number of professionals trained and the amount of money spent on trainings	60,000.00
	4.2 Provide training opportunities for Maldivian surveyor to gain working experience by working together with international	Doror	MoTE/MoH /URA	1-2	Willingness to share the experience and to provide opportunity to work with international experts	Type of surveys and methods and equipment used by the international experts	Number of projects providing opportunities to engage locals with international experts	100,000.00

	survey expert both in Maldives and abroad.							
	4.3 Revise the MNU Environmental and IT curriculum to include GIS. mapping and data science and management	GOM/donor	MNSDA/ MNU	1-2	Need for curriculum revision is not seen as a necessity	Modules of the revised curriculum is taught in the university	Number of students taking the new modules	85,000.00
	4.4Establish a centralized institution, to compile and collate information about mapping and surveying	Donor	MoTE/ MLSA EPA other stakeholders	1-2	Centralized institution not agreed by the existing policies of Government	Policy support for the establishment of a centralized institution	Amount of information processed through the centralized institution	560,000.00
	4.5 Provide scholarships for post-graduate studies in monitoring mapping and surveying	Donor /GOM	MoTE/ MNU	1-2	Donor may not be interested in providing scholarships	Special scheme for post-graduate studies in monitoring mapping and surveying is established	Number of courses conducted and number of graduates working in the field	150,000.00
	4.6 Engage local expertise in development and	Donor	MoTE/ MLSA	1-2	Difficult to get local experts, not may qualified professionals	Number of local experts engaged in LUP development	Number of LUPS developed by local experts	450,000.00

	implementation of LUPs					and implementation		
Action 5: Awareness raising on climate change integration of surveying, mapping, monitoring and modeling technologies into LUP	5.1Training sessions for policy makers, politicians, senior engineers and planners on use of evidence-based decision making and climate change for LUP development	Donor /GOM	MoTE/MLSA	1-2	Low participation from decision making level	Number of trainings conducted	Number of participants in the training and level of participation	250,000.00
	5.2 Regularly conduct training sessions on mapping monitoring, surveying and LUP for local stakeholders	GOM	MoTE/ MLSA/EPA	1-2	Level of technical information is not understandable for locals laymen	Level of simplification of technical information provided in the sessions	Number of participants in each session and general trends over time	50,000.00
	5.3 Conduct media campaigns on CC and importance of mapping surveying and monitoring for developmental planning,	GOM	MoTE MLSA /Media and civil society	1-2	Lack of media interest in the technicality of the information in the campaign	Simplifying the information and material provided in the sessions	Participation and the number of media engagement and articles published	75,000.00

	targeting general public							
	5.4 Organise and arrange site visits and open days for secondary schools at survey sites to encourage them to engage in this field	Donor/GOM	MoTE/ MLSA /MoE	1-2	Remoteness of surveying location makes it difficult to access for students	Surveys conducted in urbanized areas and parks could be access for schools	Number of school showing interest in bringing students to the filed	60,000.00
Action 6. Develop short term training courses and field work (Tertiary and higher diploma level) in mapping GIS and surveying data science related disciplines	6.1 Develop and implement tertiary and higher diploma level short term training courses in mapping GIS, surveying and data science for professional engaged in the field	Donor	MoTE/ MNU/MLSA	1-3	Lack of capacity to conduct locally	Short term training opportunities available for semi professional working in the field	Number of professional completed short term courses and practicing mapping monitoring and surveying	70,000.00
	6.2 Short-term training courses and TVET education programs for skill development in hydrography surveying Drone mapping image	Donor	MoTE/ MSDA/MLSA	1-2	Capacity to conduct TVET level training in hydrography surveying Drone mapping image analysis LIDA Data not available in TVET institutes	Number courses available to prepare new surveyors for the field work	Number of skilled trainings conducted and practically engaged in in the field	270, 000.00

	analysis LIDA Data							
	6.3 Develop mapping capacity of flood impacts and erosion	Donor	MoTE/ /MLSA EPA	2-3	Technical capacity and software not available	Number flood impact and erosion surveys conducted	Number of island where flood mitigation plan is developed and erosion is assessed	150,000.00
Action 7. Include IKLK in LUP development	7.1 Engage local expertise in development and implementation of LUPs	GOM	MoTE/ /MLSA	2-3	Local capacity to develop LUPs is limited	Number of LUPS developed by local expersts	Increase the number of LUPs developed by local experts	35,000.00
	7.2 Use IKLK for developmental planning, of harbours, entrance channels, shore protection environmentally sensitive areas eg Kulhi and wetlands etc	Donor	MoTE/ /MLSA	1-2	Identifying areas where IKLK can be used in LUP development	Level of understanding of specific local condition of islands	Number of LUP components included based on IKLK	70,000.00

3.2Project Ideas for Adaptation and Disaster Management sector

3.2.1 Brief summary of the Project Ideas for Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes

The TAP described in this document is designed with specific Actions and Activities in mind that are interrelated and will together contribute to the successful application of the proposed technologies. Some components included in the TAP are already taking place at different implementation level or in other forms, however, activities and action included in the TAP will contribute to complement/scale up or to improve the ongoing activities and developed as PIs which can be implemented quickly, while waiting for the larger funds needed to implement the more substantial parts of Action Plan. Importantly, the PIs contain activities that provide an enabling framework that is supportive of multiple adaptation technologies in the Integration of technologies (drone, satellite imagery and GIS) into existing land use planning processes. These project ideas are:

1- **Project Idea I: Obtaining multiple satellite images set and drones to assess island dynamics, LULC change and erosion monitoring**

The islands of Maldives are extremely dynamic and seasonally adjusting to the its beach morphology shape, size and other parameters with the change in monsoon. Population expansion and change in land use and cover is also changing rapidly. Monitoring and mapping both short-term (seasonal changes) and long term (years to decades) will help to understand the holistic approach for island development that needs to in cooperated in the long term developmental plans and local level island specific LUPs

2- **Project Idea II: Habitable multi-purpose shore protection structures for Climate proofing through Ecosystem Based Adaptation (EbA)**

These are deployment of shoreline protection hard structures such as breakwaters, groyne revetments that are inspired and supported by nature. These structures will contribute to the climate proofing through EBA in inhabited islands as well as in resort islands. The structures also can be used to rehabilitate coral reefs conservation through EbA.

3.2.2 Specific Project Ideas

The PIs for the Water resources sector are summarised in Table 59 and Table 60

Table 59. Project Idea 1: Obtaining multiple satellite images set and drones to assess island dynamics, LULC change and erosion monitoring.

Introduction/Background (Briefly describe the project and how it was developed)	The project focuses on assessing island dynamics, land use and land cover (LULC) changes, and erosion monitoring in coral reef islands which is imperative in the context of climate adaptation in the Maldives.
Objectives	1- Vulnerability assessment to identify areas most at risk due to climate change impacts which can guide targeted interventions and adaptive strategies. 2- Change detection using satellite imagery and drones to create detailed LULC maps. To understand how human interventions, climate change, and natural processes the

	island dynamics which can be used for management decision making. 3- Identification of chronic severe erosion and to understand erosion patterns which can be used for coastal protection measures and habitat restoration efforts. 4- Assess coral reefs heath using high-resolution imagery. Monitor coral bleaching, sedimentation, and other stressors which is useful for climate resilience and biodiversity conservation. 5- Engage stakeholders in sustainable land use practices. 6- Integration with existing national or regional climate adaptation plans and to contribute to adaptive strategies and policies.
What are the outputs and are they measurable?	1- Develop detailed LULC change maps showing island transformation urbanization, agricultural expansion, human interventions and natural processes 2- Erosion Patterns, erosion risk maps, Island dynamics and potential inundation areas due to SLR Impact 3- Maps showing biodiversity and coral reef hot spots health indices, which can be used foridentifying areas that need conservation efforts. 4- Identify and assess actionable adaptation options for policymakers, communities, and relevant stakeholders. 5- Community Engagement and Awareness: 6- Engage with local communities to produce educational materials or workshops to raise awareness about climate change impacts. The outputs are measurable 1- Baseline assessment and comparison with historical satellite data to compare changes over time 2- Calculate percentages of different land cover types (e.g., built-up areas, vegetation). 3- Measure shoreline retreat rates using satellite imagery. Compare beach change over time to identify erosion-prone areas. 4- Drones equipped with multispectral or hyperspectral sensors can be used to assess water quality parameters (e.g., turbidity, chlorophyll-a concentration, sediment load 5- Effectiveness of adaptation Measures using indicator like indicators like shoreline stability, sediment deposition, and habitat health
Relationship to the country's sustainable development priorities	Assessing island dynamics, land use and land cover (LULC) changes, and erosion monitoring in coral reef islands will help to understand the dynamic nature of the islands and the climate impacts which can be used for better planning and improve land use. This will improve the livelihood of the community and contribute to create a more resilient islands.

Project Deliverables e.g. Value/Benefits/Messages	1- The project can contribute to the NAP that is already at the preparation stage. The NAP process aims to can strengthen the country's resilience to climate change in the medium- and long-term adaptation needs in alignment with the country's climate policy framework and SDG goals. sustainable development by addressing adaptation needs. 2- Production of maps using high-resolution satellite images and drone data allows for accurate assessment of island dynamics, LULC changes, and erosion. Useful for evidence-based decision-making, policy formulation, and targeted interventions. This shows the importance of reliable data for informed climate adaptation strategies. 3- Analyzing shoreline changes using drone and sattelite can provide insights into coastal erosion patterns. This is important to safeguarding vulnerable coastlines and communities. 4- Building technical capacity within local institutions (government, NGOs, etc.) ensures sustained monitoring and can effectively implement climate resilience measures.
Project Scope and Possible Implementation	1- Obtain high-resolution satellite images to assess island dynamics, LULC changes, shoreline shifts, vegetation cover, and urban development 2- Drones data, including topography, and erosion patterns. Use photogrammetry techniques to create 3D models and orthomosaics from drone imagery. 3- Monitor island dynamics changes in island size, shape, and elevation over time ,beach erosion rates and sediment transport. 4- Integration of satellite and drone date with GIS to create spatial databases to store and manage data. 5- Collaboration capacity building, policy and decision support
Project activities	1- Secure financial resources and partnerships (e.g., Green Climate Fund) or bilateral cooperation collaborate with research institutions, universities, and other organizations to leverage expertise and resources) 2- Baseline assessment and data collection: 3- Gather and evaluate existing data on LULC, topography, and bathymetry hydrography etc for the target islands. 4- Satellite image acquisition and processing 5- Drone deployment and aerial mapping with multispectral or hyperspectral sensors to capture detailed imagery at a finer spatial resolution. 6- Repeat aerial surveys to monitor changes over time. 7- LULC change detection compare LULC maps from different time periods to identify changes.

	8- Erosion monitoring and vulnerability assessment. Use both satellite and drone data to assess erosion rates, sediment transport, and shoreline retreat. 9- Integration with climate models and projections (e.g., sea-level rise, storm frequency) interact with land dynamics. 10- Stakeholder engagement and capacity building: 11- Involve local communities, government agencies, and NGOs. Build capacity among local researchers and technicians to continue monitoring and analyzing LULC changes. 12- Policy recommendations and adaptation strategies for sustainable land use and coastal management. 13- Long-term monitoring and reporting . Regularly update shoreline change and erosion assessments.
Timelines	This project is envisioned to be planned within 1-2 year and the implementation will be within 10-year timeframe.
Budget/Resource requirements	1- The estimated budget would be about USD 10,700,000.00 for obtaining 2 sets satellite images for two monsoon yearly and procuring the Survey quality 5 drones software for processing images and data. Grant funding would be necessary to procure hardware and software as well as capacity building and training. 2. The project would be coordinated by the MoTE together with MHLUD and MLSA but some activities could be subcontracted to local NGOs or consultants (e.g. training programs, procurement of equipment and tools)
Measurement/Evaluation	• Number of equipment procured • Number of satellite image set obtained • Level of data processing enhancement hard and software obtained • Human capacity development • Project influence on policy development or decision making process • Long term sustainability plans for maintenance, replication, or upscaling of activities/outcomes of the project
Possible Complications/Challenges	1- Planning and development phase • Securing funding for the project, • Obtaining satellite images sets and drones hardware and software 2- During the operation phase • Human resource, capacity trained people to operate drones, satellite data processing GIS experts etc . • Regulatory Frameworks and Permissions • Coordinating with relevant authorities and agencies to access satellite data • Data Quality and Availability can be challenging, especially in remote atolls.

	• Technical Expertise and Infrastructure
Responsibilities and Coordination	1- The overall coordination of the project will be carried out by MoTE 2- A steering committee will be established to coordinate and make policy decisions (The Steering Committee will be held at least once every 6 months) 3- NCIT and MLSA will be responsible for technical issues such as trainings, capacity building and technical advisory 4- Atoll councils City councils and relevant NGOs MNSDA, MNU, and the grantees will be stakeholders of the project

Table 60. Project Idea 2: Habitable multi-purpose shore protection structures for Climate proofing through Ecosystem Based Adaptation (EbA)

Introduction/Background (Briefly describe the project and how it was developed)	These types of interventions – also referred to as green infrastructure, natural infrastructure, living shorelines or hybrid soft and hard engineering – include coastal habitat restoration, vegetation replanting and beach nourishment schemes. The basic idea is to make greener sea defense through providing habitable areas within the structure. Under mutual benefit/value theme, these structures create symbiosis between artificial sea defense and natural sea defense through habitation of trees or corals within the structure
Objectives	1- Enhancing coastal resilience against climate change impacts. These living shorelines can stabilize the coastline and reduce damage during extreme weather events. 2- Biodiversity conservation by providing habitat for various species. Trees, corals, and other vegetation within the structures can attract birds, fish, and other wildlife. 3- Ecosystem services provision: habitats within the structures can offer valuable ecosystem services eg; Carbon Sequestration, Water Filtration, Coral reefs and support fish populations, recreation and tourism. 4- Climate adaptation and mitigation by Protecting communities from climate impacts (e.g., sea-level rise, storms) and reducing greenhouse gas emissions (e.g., through carbon sequestration by trees and corals)
What are the outputs and are they measurable?	Major outputs of the project are: 1- Reducing coastal erosion and stablising the island by incorporating trees, corals, or other natural elements into the structures can mitigate the impact of extreme events (like storms or flooding) on islands. 2- Enhancing biodiversity: promoting healthier ecosystems and more resilient coastal areas. 3- Carbon Sequestration: Incorporating corals and trees into the structures contributes to climate change mitigation. The measurable indicators of the outputs are: • Survival rates of planted trees, mangroves, or corals within the structure. • Assessing species richness, abundance, and diversity within the structure over time • Evaluating how well the structure protects the island/beach during extreme events. • Islanders' perception of the structure's benefits and their engagement in its maintenance.
Relationship to the country's sustainable development priorities	• provides a high degree of protection against coastal flooding, storm surges and erosion reduce island vulnerability

	• Provide protection to the critical infra structure in inhabited islands and resorts. • Reduces repair/maintenance costs after storms as natural systems have the capacity to self-repair • Supports eco-tourism through fishing, hunting and wildlife viewing activities • Enhances recreational opportunities • Protects and/or creates habitat for near-shore organism, invertebrates, and other sessile and benthic species such as coral reefs
Project Deliverables e.g. Value/Benefits/Messages	1- The proposed Multi-purpose shore protection structures will be climate resilient by providing protection against erosion, storm surges, and rising sea levels. 2- Enhancing ecosystems, supports biodiversity, and contributes to overall ecological health. 3- Mitigate climate change by incorporating trees corals etc into the design will contribute carbon sequestration and helps combat global warming. 4- Multi-purpose structures can serve as recreational areas and provide spaces for people to enjoy the coastline while also serving as protective shoreline. 5- Aesthetic enhancement by integrating greenery into sea defenses improves the visual appeal of coastal areas Key Values/benefits/ messages: 1- Symbiotic relationship between artificial and natural elements benefit both humans and the environment. 2- Innovation by combining engineering with ecology 3- Habitable structures are investments in a sustainable, resilient future for islands.
Project Scope and Possible Implementation	1- The overall scope of the project is to reduce beach erosion, enhance biodiversity, provide recreational spaces by installing Habitable multi-purpose shore protection structures in areas exposed for severe erosion. 2- The structure can be designed by using materials that are durable, eco-friendly, and suitable for the marine environment. 3- The structures can be integrated with the existing Infrastructure (e.g., breakwater, groynes revetments, Quay walls) Possible implementations as 1- Hybrid solutions by combining natural features (e.g., coral reefs, mangroves,) with engineered elements (e.g., groynes and breakwaters). 2- Living shorelines to stabilize shorelines to reduce erosion, the habitat will be with the environment.

	3- Green revetments/ breakwater/ groynes etc using coastal vegetation (e.g., magoo, kuredhi boashi) absorb wave energy, prevent erosion, and support biodiversity. 4- Floating shore protection structures that can host vegetation, corals. They dissipate wave energy while supporting marine life.
Project activities	**1-** Secure financial resources and partnerships (e.g., Green Climate Fund) or bilateral cooperation collaborate with research institutions, universities, and other organizations to leverage expertise and resources) **2-** Identify islands and location to construct habitable multi-purpose shore protection structures **3-** Collect baseline information about the location, climate conditions, wave, current, sediment, morphology, dynamics etc. **4-** Undertake preliminary feasibility study on location, type of structure based on the predefines objectives **5-** Design size length, width type of structure, distance from shore, orientation and other dimensions based on prevailing hydro dynamic conditions **6-** Selected construction material of the structure **7-** Determine the type of habitat that will be targeted to include in the structure (eg coral, plant species etc) **8-** Determine the standards and design controls of the structure **9-** Call for bid proposals from potential contractors and select the contractor **10-** Project implementation and monitoring
Timelines	This project is envisioned to be planned within 1 year and the implementation will be within 1-2 -year timeframe monitoring should continue for minimum 5 years and it should be replicable in other areas
Budget/Resource requirements	1- The project is designed to install 500m offshore habitable multi purpose breakwater to protect the eroding shoreline. 2- One linier meter of breakwater is estimated to be 2400USD/m therefore based on this the estimated budget for a 500m long breakwater is estimated to be 1,200,000.00 USD. Grant funding would be necessary to pilot this project. 3- The project would be coordinated by the MoTE together with EPA.
Measurement/Evaluation	• Survival rates of planted trees, mangroves, or corals within the structure. • Assessing species richness, abundance, and diversity within the structure over time

	• Evaluating how well the structure protects the island/beach during extreme events. • Islanders' perception of the structure's benefits and their engagement in its maintenance. • Long term sustainability plans for maintenance, replication, or upscaling of the structure
Possible Complications/Challenges	1- Planning and development phase • Securing funding for the project, • Design finalization and selection of type of habitat that will be in cooperated in the structure • Local community acceptance and agreement on the design 2- During the operation phase • Coordinating with relevant authorities and agencies • Data Quality and Availability can be challenging, especially in remote atolls. • Technical Expertise and Infrastructure
Responsibilities and Coordination	**1.** The overall coordination of the project will be carried out by MoTE **2.** A steering committee will be established to coordinate and make policy decisions (The Steering Committee will be held at least once every 6 months) **3.** EPA and MHLUD will be responsible for technical issues such as design finalization and implementation modalities **4.** Atoll councils City councils and relevant NGOs MNSDA, MNU, and the grantees will be stakeholders of the project

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