

Final Closure and Data Report

Pakistan Technology Roadmap for NDC implementation

November 27, 2024



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1 Monitoring and Evaluation Plan

| Basic Information | |
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| Title of response plan | Pakistan Technology Roadmap for NDC Implementation |
| Technical assistance reference number | CTCN 23-004 |
| Country/ countries | Pakistan |
| NDE focal point and organisation | Ministry of Climate Change Dr Saima Shafique saimashafique76@hotmail.com |
| Sector(s) addressed | Waste and Water sectors |
| Technologies supported | Four concept notes were developed for scale up and adoption <ol style="list-style-type: none"> 1. AI-Integrated remote sensing for water resource management 2. Biochar production and utilization promoting agriculture and circular economy 3. Irrigation approaches 4. Strategy for mitigating methane emissions in organic waste |
| Implementation period and total duration | 01/06/2023 – 30/11/2024 |
| Total budget for implementation | US\$ 248,975 |
| Designer of the response plan | MoCCA |

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| Implementer of response plan | Global Green Growth Institute (GGGI) |
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| (A) Outputs and Activities as described in the Response Plan | (B) Indicator | (C) Expected results | (D) Method and frequency for data collection | (F) Comments |
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| <i>Output and activities as stated in Response Plan.</i> | <i>Select relevant indicators from the Closure Report (at least one core indicator, section B). You may also define additional relevant indicators to be added.</i> | <i>Add the expected quantitative or qualitative target/value of the indicator (e.g. number of studies, policy recommendations, etc.).</i> | <i>Describe the expected method and frequency for data collection (e.g. survey, head count at a training workshop, application of a standard methodology etc.)</i> | <i>Describe any assumptions made or anticipated challenges for collecting quantitative and qualitative data</i> |
| <i>Impact level: Pakistan achieves its NDC targets for water and waste sectors</i> | <p>a) CTCN core indicator: Anticipated metric tons of CO2 equivalent (CO2e) emissions reduced or avoided as a result of CTCN TA (disaggregated by annual and total)</p> <p>b) CTCN core indicator: Amount of funding/investment leveraged (USD) as a result of TA (disaggregated</p> | <p>a) Xxx metric tons of CO2 as per NDC for water and waste</p> <p>b) Estimated investment targets from one concept note for water and one concept note for waste (output 5)</p> | <i>CTCN definition of the two indicators will be applied</i> | <p>Assumptions:</p> <p>a) The Technology Roadmap resulting from the TA is adopted and implemented by the government.</p> <p>b) Two concept notes</p> |

| | by public, private, national, and international sources, as well as between anticipated/confirmed funding) | | | under output 5 are financed and implemented |
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| Output 1: Development of Response Plan and implementation planning and communication documents | a) Number of deliverables produced – (Number of tools and technical documents reinforced, revised or developed) | Total: 5 deliverables <ul style="list-style-type: none"> • Revised Response Plan approved • Implementation plan • M&E plan • Impact description (final version) • Closure and Data Collection Report at tend of TA | Methodology : Plans will be prepared at the start of the TA and completed at the end. | CTCN templates are used when available |
| 1.1. Response Plan | 1 Response Plan countersigned by CTCN and MoCCA | Total 1 deliverable: an updated Response plan is approved by MoCC and CTCN at start of project | Methodology : information and data prepared at the start of the TA | CTCN template used |
| 1.2 Implementation Plan | Number of deliverables produced | Total 1 deliverable | Methodology : information and data prepared at the start of the TA | GGGI template used |
| 1.3 Monitoring and Evaluation plan | Number of deliverables produced | Total 1 deliverable | Methodology : information and data prepared at the start of the TA | CTCN template used |
| 1.4 Impact description | Number of deliverables produced | Total 2 deliverables <ul style="list-style-type: none"> • Initial version • Final version | Methodology : information and data prepared at the start of the TA and | CTCN template used |

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| | | | updated at the end | |
| 1.5 Closure and data collection report | Number of deliverables produced | Total 1 deliverable | Methodology : information and data prepared at the start of the TA and updated at the end | CTCN template used |
| Output 2: Technology Roadmap Coordination Mechanisms | <p>a) Number of deliverables produced – (Number of tools and technical documents reinforced, revised or developed)</p> <p>b) Number of meetings held</p> | <p>Minimum of seven (7) and up to twelve (12) meetings held:</p> <ul style="list-style-type: none"> • Technology Roadmap committee (2) • Waste Technology Committee (Min. 2, up to 4) • Water Technology Committee (Min. 2, up to 4) • Kick off workshop (1) | Methodology : participants identified with MoCC. Committee TORs developed with stakeholders. Meeting TORs developed in consultation with MoCC and stakeholders. | Technical oversight and high-level coordination with Technical Roadmap Committee and sector level Technology Committees will be ensured by MoCC |
| 2.1 Establishing a coordination mechanism | <p>a) Number of events organized with stakeholders</p> <p>b) Percentage of men and women participants</p> | <p>a) 8 events (Committee meetings)</p> <p>b) 50% women participants</p> | Methodology : participants identified with MoCC. Committee TORs developed with stakeholders. Meeting TORs developed in consultation with MoCC and stakeholders. | MoCC will ensure coordination with government stakeholders |
| <i>Kick off workshop</i> | a) Number of events organized with stakeholders | a) 1 events | Methodology : participants identified | MoCC will ensure coordination |

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| | b) Percentage of men and women participants | b) 50% women participants | with MoCC. Meeting TORs developed in consultation with MoCC and stakeholders. | with government stakeholders |
| 2.2 Regular Technology Roadmap Committee meetings | a) Number of events organized with b) Number of meeting reports | Minimum of two, but up to four, meetings held Minimum of two, but up to four, meeting reports delivered | Methodology : participants identified with MoCC. Meeting TORs developed in consultation with MoCC and stakeholders. | MoCC will ensure coordination with government stakeholders |
| 2.3 Regular Waste Committee and Water Committee meetings | a) Number of events organized with b) Number of meeting reports | Minimum of two, but up to four, meetings held Minimum of two, but up to four, meeting reports delivered | Methodology : participants identified with MoCC. Meeting TORs developed in consultation with MoCC and stakeholders. | MoCC will ensure coordination with government stakeholders |
| Output 3: Identification of climate technologies for intervention in the high-impact sectors of waste management and water | Number of deliverables produced Number of tools and technical documents | Total 4 deliverables <ul style="list-style-type: none"> Waste sector analysis and technology identification report (with gender, youth issues integrated) Water sector analysis and technology identification report (with gender, youth issues integrated) | Methodology : prepare a research report and consult/verify the results with key stakeholders. Submit for review and comment by stakeholders. | Technical oversight and high-level coordination with Technical Roadmap Committee and sector level Technology Committees will be ensured by MoCC. |

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| | | <ul style="list-style-type: none"> Waste technology assessment (with gender, youth issues integrated) Water technology assessment (with gender, youth issues integrated) | | |
| 3.1a Analysis of waste sectors and identification of technologies | <p>Number of deliverables produced</p> <p>Number of tools and technical documents</p> | <p>Total 1 document</p> <ul style="list-style-type: none"> Waste sector analysis and technology identification report Gender and youth integration into analysis | <p>Methodology : Coordinate the analysis with the technical committee and ensure quality control, verification, inputs from key stakeholders.</p> | <p>Technical oversight and high-level coordination with Technical Roadmap Committee and sector level Technology Committees will be ensured by MoCC.</p> |
| 3.1b Analysis of water sectors and identification of technologies | <p>Number of deliverables produced</p> | <p>Total 1 document</p> <ul style="list-style-type: none"> Water sector and technology identification report Gender and youth integration into analysis | <p>Methodology : Coordinate the analysis with the technical committee and ensure quality control, verification, inputs from key stakeholders.</p> | <p>Technical oversight and high-level coordination with Technical Roadmap Committee and sector level Technology Committees will be ensured by MoCC.</p> |
| 3.2a Assessment of identified waste technologies | <p>Number of deliverables produced</p> | <p>Total 1 document</p> <ul style="list-style-type: none"> Waste technologies assessment Gender and youth integration into assessment | <p>Methodology : Coordinate the assessment with the technical committee and ensure quality control, verification, inputs from</p> | <p>Technical oversight and high-level coordination with Technical Roadmap Committee and sector level Technology Committees will be ensured by MoCC.</p> |

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| | | | key stakeholders. | |
| 3.2b Assessment of identified water technologies | Number of deliverables produced | <p>Total 1 document</p> <ul style="list-style-type: none"> • Water technologies assessment • Gender and youth integration into assessment | Methodology : Coordinate the assessment with the technical committee and ensure quality control, verification, inputs from key stakeholders. | Technical oversight and high-level coordination with Technical Roadmap Committee and sector level Technology Committees will be ensured by MoCC. |
| Output 4: Development of technology roadmap for NDC implementation | <p>Number of deliverables produced</p> <p>Number of deliverables verified by MoCC, key stakeholders</p> | Total 1 document: Technology Roadmap for NDC Implementation | Methodology : apply sector level analysis and assessments and develop a roadmap using CTCN template and in consultation with MoCC. | Technical oversight and high-level coordination with Technical Roadmap Committee and sector level Technology Committees will be ensured by MoCC. |
| 4.1 Development of an NDC technology roadmap for identified sectors | Number of deliverables produced | Total one document produced, revised and finalized | Methodology : data and information systematized , consulted and quality assured. Inputs and comments collected from MoCC and key stakeholders before finalized. | Templates by CTCN in consultation with MoCC applied. |
| Output 5: Preparation of | Number of deliverables produced | Total two documents produced | Based on technology | Involvement of GGGI Global |

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| Financing Support | | <ul style="list-style-type: none"> • Idea note for waste sector • Idea note for water sector | prioritization in the Roadmap (output 4) one idea note prepared per sector, identification of funding sources | Investment Services team in consultation with MoCC and sector technology committees |
| 5.1 Two funding concept ideas, including two GCF concept notes | Number of deliverables produced | Two project idea notes produced and verified by key stakeholders and MOCC | Structuring of ideas as preparation for submission to climate financiers | Targeting GCF or other climate financier |

3. Impact Description

Note: The Response Plan may contain information useful for the section below. The information in the table below will be used by the CTCN for public communication of the achieved and expected results of the Technical Assistance through the CTCN website www.ctc-n.org and other communication channels. See for example: https://www.ctc-n.org/sites/www.ctc-n.org/files/benin_a_ag_forestry.final_.pdf

| Impact Statement | |
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| Challenge | <p>The Technical Assistance is aimed at the development of Pakistan Technology Roadmap for NDC Implementation in Waste and Water sectors, ensuring the integration of sustainable technologies to achieve climate and development goals.</p> <p>Pakistan is a developing nation facing several development challenges. The waste and water sectors of Pakistan are plagued with inefficiencies that hinder effective and inclusive management and delivery within both sectors, with the issues being exacerbated due to the climate crisis. This has led to several impacts such as environmental degradation and resource exploitation. The CTCN TA aims to address this challenge by leveraging technology to improve operations within both sectors through a collaborative, informed and inclusive process.</p> |
| CTCN Assistance | <ul style="list-style-type: none"> ● Improved stakeholder communication and coordination through the formation of Technology Roadmap Coordination Mechanisms ● Water and Waste sector analyses, and sectoral technology identification and assessments ● Develop Technology Roadmap for NDC implementation ● Gender, youth integration ● Four concept notes (water and waste respectively) for financing support |
| Anticipated impact | <p>In achieving intended NDC mitigation and adaptation impacts in the waste and water sectors respectively, a sector analysis and technology identification will guide the strategic building of capacity and technology adoption along with priority steps within the Technology Roadmap. Gender and youth integration will ensure maximised socio economic co-benefits in terms of access to benefits such as emission mitigation , health improvement, jobs and environmental resilience.</p> <p><i>Summarize the problem statement and desired impact. Describe how the TA is expected to lead to the desired impact. Include description of stakeholders, deliverables and timelines. As a minimum, please include at least one of the core impact indicators from the closure report Annex.</i></p> |
| Co-benefits: Achieved or anticipated co-benefits from the TA | <p>Implementation of the Technology Roadmap is expected to generate green jobs and maintain or improve access to waste and water services.</p> |

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| | <p><i>Instruction: Please indicate expected co-benefits as described in the response plan and in the relevant deliverables</i></p> <p><i>The process of the development and implementation of the NDC Technology Roadmap has achieved co-benefits in the form of improved stakeholder engagement through the formation of technology roadmap, waste and water committees which have led to the formation of the NDC Technology Roadmap for the Water and Waste Sectors. Two funding notes have also been developed, and beyond the scope of work noted, two additional funding notes have been devised for the water and waste sectors. The project further aims to generate co-benefits through the implementation of the Roadmap and the formulated funding notes by contributing to emission mitigation, generation of green employment, finance mobilization, improved access and delivery in the waste and water sectors, improvement in cross-cutting sectors such as agriculture and disaster resilience.</i></p> |
| <p>Gender aspects of the TA</p> | <p>The Technology Roadmap for NDC implementation will integrate gender and youth, through technical assistance provided by national and international gender experts.</p> <p><i>Instruction: Please indicate if technical assistance was supported by a gender analysis. Describe gender aspects identified and additional considerations taken to mainstream gender (e.g. equal participation in trainings, gathering of gender-disaggregated data, etc.).</i></p> <p><i>The Technology Roadmap has ensured gender and youth inclusion integration across project activities and operations, including a gender assessment. Gender analyses have been conducted for Pakistan’s waste and water sectors and feasibility analyses for the assessed technologies. Gender and social inclusion have also been incorporated as a key scoring criteria for the identified technologies. Gender inclusion was further ensured through the Gender Specialist. Additional gender aspects considered included gender and social inclusion among stakeholders participating in project events and activities, gathering gender-disaggregated data, ensuring gender inclusion in the development of 4 project funding notes. Gender considerations have also been a part of project socialization as the gender assessment was discussed at the Pakistan Pavillion’s side event at COP29 on November 21 in collaboration with the MOCCA and UN Women. The 4 funding notes developed also include gender and social consideration.</i></p> |
| <p>Anticipated contribution to NDC</p> | <p>The sectors – waste and water – and the technical analysis will be aligned with the NDC.</p> <ul style="list-style-type: none"> • <i>Improve efficiency and management in the waste sector through promotion of reuse and reduction of waste</i> • <i>Improve efficiency and management in the water sector</i> • <i>Promote technology-based interventions and mobilize climate finance</i> • <i>Promote women awareness and inclusion in waste and water sectors</i> <p><i>2 to 4 bullet points. Approximately 350 characters with spaces</i></p> |
| <p>The narrative story</p> | <p>To be completed upon completion of the project.</p> <p><i>Approximately 1200 characters with spaces</i></p> |

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| | <p>Please provide a brief description of the background and context for the technical assistance. Describe the main problems and barriers for climate change mitigation and/or adaptation in terms of climate technologies that the CTCN technical assistance will address</p> <p>Pakistan ranks as one of the most vulnerable nations to climate change. As a developing nation struggling with development challenges such as poverty, resource degradation and economic fragility, the climate crisis has further exacerbated its dire situation. The water and waste sectors in Pakistan are also vulnerable to the climate crisis and face significant hurdles which have led to inefficient management and inadequate delivery. To initiate action the country has prioritized the adoption of sustainable technologies to enable climate adaptation and improved resource management. The main challenges the country faces are inadequate capacity, lack of awareness and conclusion, and a lack of finance. The CTCN technical assistance addresses the noted barriers by ensuring stakeholder engagement and improved capacity, gender and social inclusion, comprehensive feasibility analyses for identified water and waste technologies and the development of 04 funding notes to mobilize climate finance for both sectors. The development of the NDC Technology Roadmap for the water and waste sectors through this process ensures progress towards improvement and climate adaptation through sustainable and suitable technologies in Pakistan.</p> |
| <p>Contribution to SDGs</p> <p>A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/</p> | <p>Reduction in GHG emissions in the waste sector through use of low carbon technology and integration of climate change measures in national strategies and planning</p> <p>(Contribution to 13: Climate Action 13.2 - Integrate climate change measures into national policies, strategies and planning)</p> <p>Strengthening adaptive capacity through climate smart technology in the water sectors</p> <p>(Contribution to 13: 13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries)</p> <p><i>To the extent possible, please describe contribution to approximately 3 SDGs, including SDG13, with a few sentences for each SDG concerned.</i></p> <p>SDG 6-Clean Water and Sanitation</p> <p>Contribution to 6: 6.1- Safe and affordable drinking water</p> <p><i>The NDC Technology Roadmap provides a comprehensive strategy for Pakistan’s water sector to leverage technology and ensure safe and affordable drinking water for its citizens. The Roadmap proposes three sustainable and low-carbon technologies for the country to prioritize.</i></p> <p>Contribution to 6: 6.4- Increase water use efficiency and ensure freshwater supplies</p> |

The NDC Technology Roadmap identifies sustainable and low-carbon technologies for Pakistan’s water sector, aiming to improve the efficiency of the management and delivery of water resources, specifically in agriculture, domestic and hydropower. Additionally, the project has led to the development of 04 funding concept notes for Pakistan’s water sector, specifically to integrate AI into the flood telemetry network across Pakistan and to improve irrigation practices to minimize water loss.

SDG 12- Responsible Consumption and Production

Contribution to 12: 12.4 – Responsible management of chemicals and waste

The NDC Technology Roadmap identifies sustainable and low-carbon technologies for Pakistan’s waste sector, aiming to improve its efficiency and management. The identified technologies, once implemented, will aim to reduce harmful gases and waste components into the air, water, and soil. Additionally, the project has devised two funding concept notes to address agricultural waste by converting crop residues into biochar and developing a comprehensive strategy to mitigate methane emissions in the organic waste sector.

SDG 13-Climate Action

Contribution to 13: 13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

The project contributes to strengthening resilience and adaptive capacity through climate smart technologies in the water sector. Additionally, the development of 04 funding notes for the water and waste sectors aim to inculcate improvement in both the management and delivery of the sectors, ensuring climate resilience.

Contribution to SDG 13 Climate Action, 13.2 - Integrate climate change measures into national policies, strategies and planning

The project has contributed to the attainment of 13.2 as the NDC Technology Roadmap has been provided official ownership by the Government of Pakistan (GoP) at the COP29 side event held to socialize the project and foster awareness. The gender assessment conducted as part of the TA was also presented at the UN Women pavilion at COP29.

2 Technical Assistance Closure Report Template

Technical Assistance Closure Report Template

Objective of the technical assistance (TA) Closure Report:

- To communicate publicly in one document a summary of progress made and lessons learned during the TA towards the anticipated impact (sections 1-4).
- To document qualitative and quantitative data collected during TA, for use in donor and UN reporting (Annex 1).
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Steps for completing the TA closure report:

1. The lead TA implementer submits the closure report at the end of the technical assistance as a final deliverable. The TA closure report will capture outputs, outcomes and impacts of all activities conducted under the TA. Please copy and summarise relevant material from previous TA outputs/deliverables and the Response Plan, as relevant.
2. A CTCN Manager will review and revise the closure report before final approval by the CTCN Deputy Director.

Important note on public and internal use of the closure report:

Once approved by the CTCN Deputy Director, the TA closure report will be a public document available on the CTCN website www.ctc-n.org. Selected content will be used for targeted communication activities. Annex 2 is for internal use only and will not be publicly available.

Closure Report for CTCN Technical Assistance

1. Basic information

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| Title of response plan | Pakistan Technology Roadmap for NDC Implementation |
| Technical assistance reference number | CTCN 23-004 |
| Country / countries | Pakistan |
| NDE organisation | Ministry of Climate Change |
| NDE focal point | Dr Saima Shafique |
| NDE contact information | saimashafique76@hotmail.com |
| Proponent focal point and organisation | <i>Ingvild Solvang, GGGI, ingvild.solvang@gggi.org</i> |
| Designer of the response plan | <i>Ingvild Solvang, GGGI, ingvild.solvang@gggi.org</i> |
| Implementer(s) of technical assistance | <p>Global Green Growth Institute (GGGI)</p> <p>Green Growth Consultants (GGC): This company was subcontracted by GGGI. The project manager is Ms Leena Aktab.</p> <p><i><u>Instruction: Implementers and other partner organisations are defined as the people and institutions engaged in the implementation of the TA</u></i></p> |

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| Beneficiaries | <p>Ministry of Climate Change (MoCC)</p> <p><i>Instruction: Beneficiaries are defined as people and institutions benefitting from the TA</i></p> |
| Sector(s) addressed | <p>Waste and Water – subsectors subject to assessment</p> <p><i>Instruction: Select relevant sector(s) from the CTCN taxonomy https://www.ctc-n.org/resources/ctcn-taxonomy</i></p> |
| Technologies supported | <p>Subsectors and technologies are subject to identification.</p> <p><i>Instruction: Please indicate the type of technologies supported by this assistance. Technologies may be identified from the CTCN taxonomy of climate sectors and technologies (download in pdf format and choose from column C): https://www.ctc-n.org/resources/ctcn-taxonomy</i></p> <p><u>Following extensive stakeholder consultations, and detailed desk review; the following technologies emerged for both the water and waste sectors:</u></p> <p><u>Within the water sector the sub-arching sectors were identified as: Agriculture, Domestic, and Hydropower. From here four existing technologies were selected: Drip Irrigation; Run of the River Plant; Micro and Small Hydropower, and rainwater Harvesting. Two emerging technologies were selected: IoT Solar Based Pumps and Storage, and AI Integrated GIS and Remote Sensing for Water Management.</u></p> <p><u>Within the waste sector, the primary sectors to be selected were: Municipal Solid Waste, Plastic Waste, and Agriculture Waste. Four existing technologies were short-listed: Aerobic Windrow Composting, Waste Segregation Facility, Refuse-Derived Fuel, and Engineered Landfill Technology. Furthermore, one existing technology was identified: Integrated Biomass Gasification for Synqas and Biochar.</u></p> <p><i>If technologies supported are not found in the taxonomy, please suggest.</i></p> |
| Implementation start date | 01/05/2023 |
| Implementation end date | 30/11/2024 |
| Total budget for implementation | USD 248,974 |

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| | <p>Instruction: In addition to financial value of the technical assistance, please also include if any pro bono or in-kind support has been provided by either the implementer and/or the national counterparts.</p> |
| <p>Description of delivered outputs and products as well as the activities undertaken to achieve them. In doing so, review the log frame of the original response plan and refer to it as appropriate</p> | <p>The response plan includes 5 outputs with corresponding activities</p> <p>Output 1: Development of Response Plan and implementation planning and communication documents</p> <p>1.1. Response Plan</p> <p>1.2 Implementation Plan</p> <p>1.3 Monitoring and Evaluation plan</p> <p>1.4 Impact description</p> <p>1.5 Closure and data collection report</p> <p>Output 2: Technology Roadmap Coordination Mechanisms</p> <p>2.1 Establishing a coordination mechanism</p> <p>Kick off Meeting with report</p> <p>2.2 Regular Technology Roadmap Committee meetings with corresponding meeting reports</p> <p>2.3 Regular Waste Committee and Water Committee meetings with corresponding meeting reports</p> <p>Output 3: Identification of climate technologies for intervention in the high-impact sectors of waste management and water</p> <p>3.1a Analysis of waste sectors and identification of technologies</p> <p>3.1b Analysis of water sectors and identification of technologies</p> <p>3.2a Assessment of identified waste technologies</p> <p>3.2b Assessment of identified water technologies</p> <p>A Gender Assessment Report</p> |

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| | <p>Output 4: Development of technology roadmap for NDC implementation</p> <p>4.1 Development of an NDC technology roadmap for identified sectors</p> <p>Output 5: Preparation of Financing Support</p> <p>5.1 Four funding concept ideas developed</p> |
| <p>Methodologies applied to produce outputs and products</p> | <p>Methodology subject to further elaboration.</p> <p><i>Instruction: Examples of methodologies: E.g. cost-benefit analysis; surveys and structured interviews with key stakeholders etc.</i></p> <p><i>The NDC Technology Roadmap for the water and waste sectors of Pakistan, was based on a data-driven approach, governed by a thorough analysis of the selected sectors, subsectors, and the applicability of their respective technologies. The formulation of this roadmap is based on extensive desk reviews, baselines assessments of both water and waste sectors, a kick-off workshop, followed by sensitization of the selected stakeholders, and the formulation of the Technology Roadmap Committee and the Technical Committees for water and waste sectors. Detailed sub-sector assessments, and technology prioritization was done followed by a gender and social assessment along with committee meetings to gather feedback and validation. To develop a well-informed Technology Roadmap, the positioning of the selected technologies was defined via existing legal and financial frameworks, economic and technical feasibility of the technology and the capacity to incorporate social considerations and reduce environmental impacts. Against this the Technology Readiness was presented that indicated the standing of each technology in the different progress phases of readiness. The roadmap development process then proceeded to committee verification of sector level technologies and final validation, followed by the development of 04 funding notes. The validation was fundamental in obtaining feedback, and further refining the Roadmap to best suit the needs of the target sectors.</i></p> <p><i>Over the course of the project, the technology roadmap committee gathered two times, while the water and waste committees met a total of 4 times.</i></p> |
| <p>Reference to knowledge resources</p> | <p><i>Instruction: Please indicate if any UNFCCC Technology Executive Committee (TEC) knowledge products (publications, briefs, tools etc.) were used in the implementation of the TA request, and which.</i></p> <p><i>The products used include:</i></p> <ul style="list-style-type: none"> <i>Implementation of Technology needs Assessments - Linkages Between the technology Needs Assessment Process and the Nationally Determined Contribution Process (2022)</i> <i>Technology and NDCs: Stimulating the Uptake of Technologies in Support of NDC Implementation (2021)</i> |

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| | <p>Link to TEC knowledge database: https://unfccc.int/ttclear/tec/documents.html</p> |
| <p>Deviations</p> | <p><i>Instruction: Please describe any deviations from the response plan against the actual implemented activities, outputs and products</i></p> <p><i>There have been no deviations from the response plan against the actual implemented activities, outputs and products. However, additional activities have been conducted in the form of 02 side events at COP29 for the NDC Technology Roadmap aiming to disseminate awareness and foster socialization. One of the side events was organized for socialization, and to spread awareness regarding the NDC Technology Roadmap, in presence of representatives from the Government of Pakistan (GoP). Furthermore, a side event was held at the UN Women Pavilion that was conducted to foster awareness of the gender assessment undertaken during this project. This is a pivotal achievement as it fostered awareness amongst the international community, presenting the efforts of CTCN, GGGI and Pakistan.</i></p> |
| <p>Anticipated follow-up activities and next steps</p> | <p><i>Instruction: Please describe planned follow-up activities after completion of technical assistance, including information on involved stakeholders and anticipated timelines.</i></p> <p><i>The following are some examples of next steps:</i></p> <ul style="list-style-type: none"> ● <i>Submission of a draft law/policy developed by the CTCN to cabinet/parliament.</i> ● <i>Follow-up and formal submission of funding proposal drafted with support from the CTCN.</i> ● <i>Implementation of activities designed by the CTCN.</i> ● <i>Dissemination of report drafted by the CTCN.</i> <p><i>Use of new expertise acquired during training led by CTCN.</i></p> <p><i>Through the Technical Assistance the NDC Technology Roadmap for the water and waste sectors in Pakistan was developed along with the finalization of 04 funding concept notes to improve not only the management and delivery of both, but to further mobilize climate finance in order to work towards adaptation. Apart from the expected achievement attained through the TA, additional steps included side events held at COP29. One of the side events was organized for socialization purposes and to spread awareness of the NDC Technology Roadmap along with representatives from GoP, and a side event at the UN Women Pavilion was conducted to foster awareness of the gender assessment conducted during this project. Additional steps include:</i></p> <ul style="list-style-type: none"> ● <i>Developing of funding notes into bankable project documents</i> ● <i>Mobilize further funding for the 04 project ideas</i> ● <i>Implementation of the technology roadmap</i> |

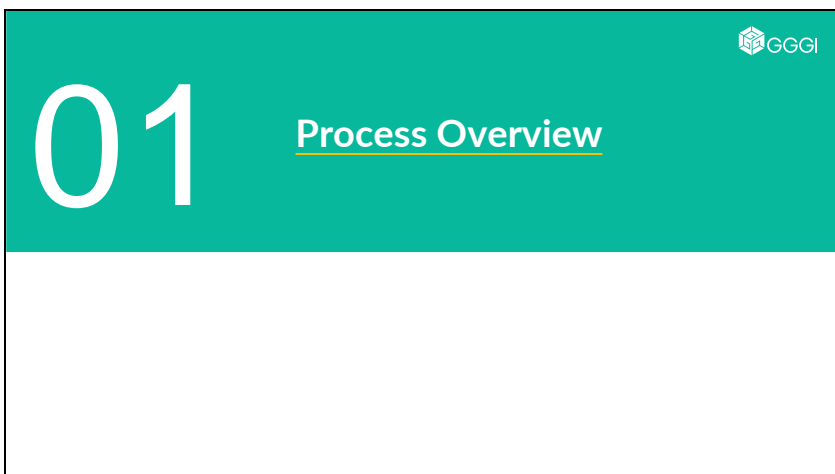
2. Lessons learned

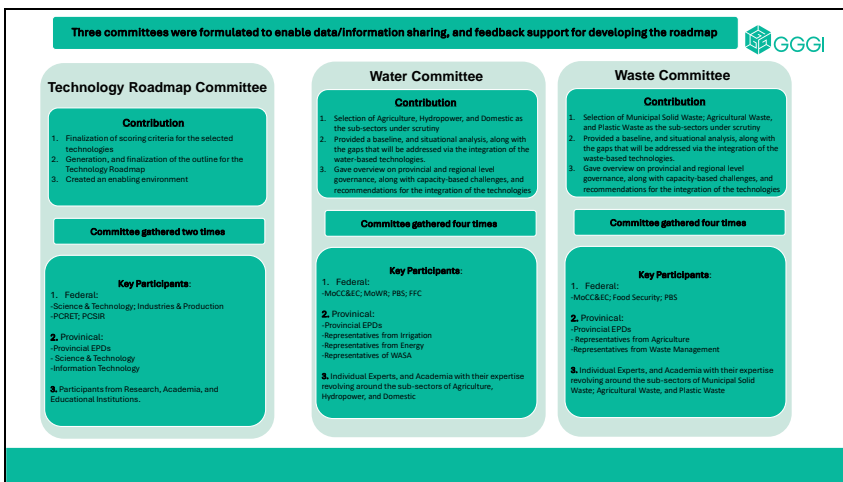
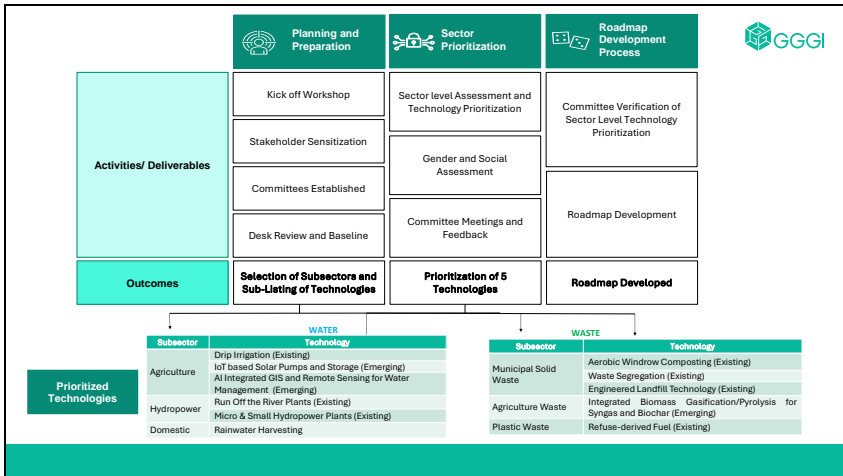
| | Lessons learned | Recommendations |
|---|---|--|
| <p>Lessons learned from the CTCN TA process</p> | <p><i>Describe lessons learned from following the steps of the TA process and interacting with the CTCN Secretariat. What were the challenges and essential factors contributing to successful implementation</i></p> <p><i>The CTCN TA process has provided invaluable lessons for action towards sustainable development and climate resilience in Pakistan. There were no significant challenges, however, notably the attainment of gender indicators and gender specific data demonstrated the need for improved activities and interventions to target gender inclusion. Other hindrances are noted below:</i></p> <ul style="list-style-type: none"> ● <i>Political unrest led to a delayed start of the project, due to which the project team had to complete the project in 06 months instead of the original timeline of 01 year</i> ● <i>A number of engagements were held virtually, hindering effective interaction and engagement. However, in order to mitigate this the team utilized the interactive presentation tool called Mentimeter to ensure maximum participation in an immersive and innovative manner</i> ● <i>As a developing country with restricted capacities, stakeholder awareness and capacities cause a</i> | <p><i>Recommendations include</i></p> <ul style="list-style-type: none"> ● <i>Steps which could be taken to improve the CTCN TA process</i> ● <i>Considerations for increased success of similar efforts (i.e. regulatory, legal, stakeholders, communication, etc.)</i> ● <i>Training and inputs on primary data collection to address specific gaps such as gender informed data</i> ● <i>Capacity building and sensitization to prepare stakeholders for projects.</i> ● <i>To ensure maximum engagement and interaction during virtual meetings and sessions, there should be a budget for interactive engagement tools that can be utilized by stakeholders</i> ● <i>Stakeholder sensitization and awareness sessions prior to project initiation may prove fruitful to maximize engagement and guide the project to successful and inclusive completion as it provides efficient feedback and addresses information gaps that may exist.</i> |

| | | |
|---|---|--|
| | <p><i>key concern, due to which stakeholder sensitizations were proposed to ensure effective participation throughout the project</i></p> | |
| <p>Lessons learned related to climate technology transfer</p> | <p><i>Describe lessons learned, opportunities, and barriers for the use and deployment of the technology or technologies supported by the TA. The objective is to identify specific success factors for technology transfer</i></p> <p><i>The TA process demonstrated that potential barriers to use and deployment of technologies may include:</i></p> <ul style="list-style-type: none"> ● <i>A lack of hesitation or reluctance to promote the technology, that may have arisen due to a lack of awareness or inadequate capacities</i> ● <i>Fiscal restrictions will also impact technology uptake as financing measures are required to not only adopt but also sustain the technologies which is difficult to manage</i> ● <i>Absence of a strong market presence of the technology, and the value chain for its by-products such as in the case of waste technologies, may also impact adoption</i> <p><i>Specific success factors included technical, social, economic and environmental feasibility along with awareness and skills to inculcate the technology.</i></p> | <p><i>Recommendations include</i></p> <ul style="list-style-type: none"> ● <i>Risk mitigation measures</i> ● <i>Identified opportunities for over-coming barriers</i> ● <i>Long-term sustainability (e.g. building endogenous capacities, funding opportunities, etc.)</i> <ul style="list-style-type: none"> ● <i>Capacity-building to promote adoption in key areas where the technology is feasible</i> ● <i>Devise risk mitigation plan and measures</i> ● <i>Identify market opportunities and avenues for the technology</i> ● <i>Identify and mobilize green financing solutions and work towards development of public private partnerships in the country to promote technologies</i> ● <i>Promote research and development pertaining to technology and adoption</i> |

3. Illustration of the TA and photos

For communication purposes, please provide 2-4 Power Point slides, including illustrations or charts, describing barriers, opportunities, methodology, activities, outputs and achieved results. The illustrations must be copied into the TA Closure report but must also be delivered as power point files. Also, please provide at least five high-resolution pictures in jpg format, capturing technical assistance. The pictures should illustrate how the TA has impacted the lives of the beneficiaries in particular and the communities in general.





Challenges

- Approximately 6 months delay at the start of the project due to elections. This caused a four-month push back on end date. The project team was able to speed up delivery due to responsive government counter-part, high engagement among technical and roadmap committee member, and well qualified and connected international and national teams.
- Changes in the Ministry during the project also resulted in a change of the CTCN NDE. Delays in this process were managed through good ministry backing and committee members remaining committed to the process.

Opportunities

- High commitment from the government and stakeholders provides an opportunity to further develop the concept notes prepared during the project. GGGI has mobilized USD 158K from the GGGI-Korea Trust fund to continue working on the concept notes with the aim to bring at least two toward financing.
- From GGGI's side, a newly signed Country Planning Framework with the Ministry of Climate Change and Environment Coordination creates further opportunities to support the implementation of the roadmap.

02

Prioritization Tool | Water and Waste Sector



Scoring Criteria



1. Legal, Regulatory, and Financial Landscape

- Is the **legal environment's** ready for this technology?
- Are there any clear **guidelines or regulations** for this technology?
- Do existing **financial structures** exist to invest in this technology in Pakistan? (i.e., Existing bankable projects? PPP? Targeted financing facilities?)
- Is there a **M&E framework** in place for this technology?
- Is there any existing opportunity for **private sector** investment in this technology?

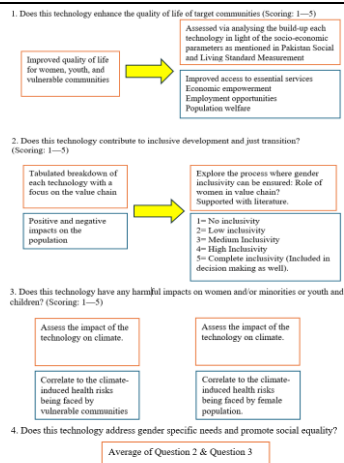
2. Economic and Technical Feasibility

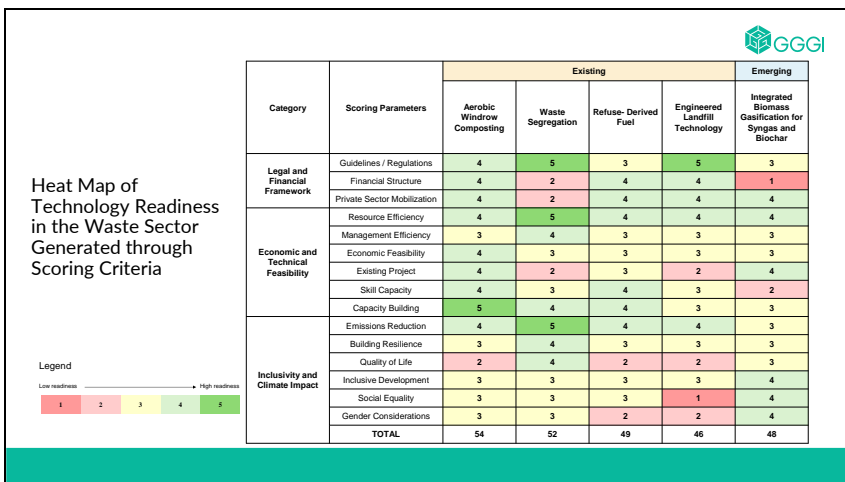
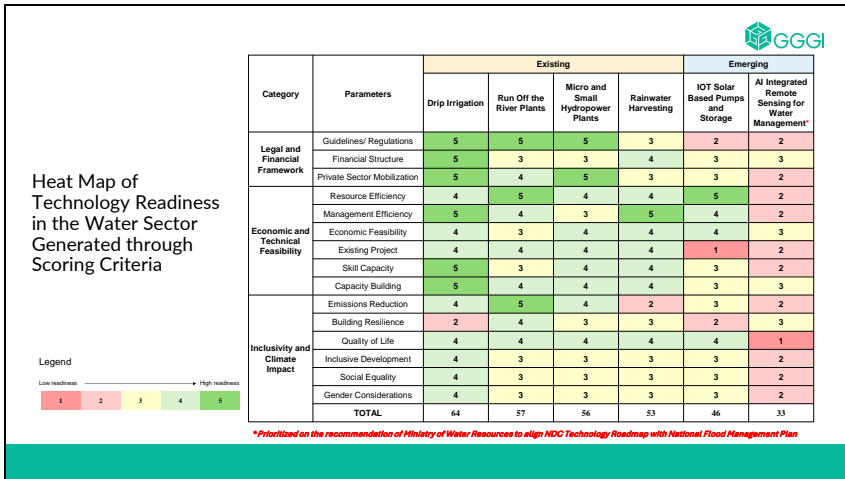
- Does this technology efficiently minimize the **use of energy and other resources**?
- Does this technology **promote efficiency** in the management and delivery of the water/waste sectors?
- Is this technology **affordable**?
- Do any **subsidies or tax reductions** exist for this technology?
- Is this technology **produced** in Pakistan?
- Is this technology **successfully in use** in Pakistan? or there is a potential for a pilot?
- Do the **skills** to implement and operate this technology exist in Pakistan?
- Does Pakistan have the capacity to inculcate **skills training** for this technology through its research and technology institutions?

3. Inclusive Development and Climate Impacts

- Does this technology enhance the **quality of life** in target communities?
- Does this technology contribute to **inclusive development and just transition**?
- Does this technology have any **harmful impacts on women and/or minorities or youth and children**?
- Does this technology address **gender-specific needs** and promote social equality?
- Does this technology possess **emission reduction potential**?
- Does this technology contribute to building **resilience and adaptive capacity** in Pakistan?

Scoring Criteria for Gender and Social Inclusivity Assessment





03 Shortlisted Technologies | Water and Waste Sector


Shortlisted Water Technologies

| Current Standing | Water Sub-Sector | Shortlisted Technology | Rank |
|------------------|------------------|--|-----------------|
| Existing | Agriculture | Drip Irrigation | 1 st |
| | Hydropower | Run of the River Plants | 2 nd |
| | | Micro & Small Hydropower Plants | 3 rd |
| | Domestic | Rainwater Harvesting | 4 th |
| Emerging | Agriculture | IoT based Solar Pumps and Storage | 1 st |
| | | AI Integrated GIS and Remote Sensing for Water Management* | 2 nd |

Prioritized on the recommendation of Ministry of Water Resources to align NDC Technology Roadmap with National Flood Management Plan

Shortlisted Waste Technologies

| Current Standing | Waste Sub-Sector | Shortlisted Technology | Rank |
|------------------|-----------------------|--|------|
| Existing | Municipal Solid Waste | Aerobic Windrow Composting | 1st |
| | | Waste Segregation Facility | 2nd |
| | | Engineered Landfill Technology | 4th |
| | Plastic Waste | Refuse-derived Fuel | 3rd |
| Emerging | Agriculture Waste | Integrated Biomass Gasification for Syngas and Biochar | 1st |




04


Investment Concepts

| Water Sector | Waste Sector |
|--|---|
| <p>AI-Integrated Remote Sensing for Water Resource Management in Pakistan</p> <p>Objective: Project aims to establish an AI-integrated flood telemetry network across Pakistan.</p> <p>Implementing Partner: Ministry of Water Resources (MoWR)</p> <p>Description: The project will implement an advanced system of AI based telemetry stations to monitor real-time data and analyze data by using machine-learning models for more accurate flood forecasting, particularly in vulnerable regions of Sindh and Punjab.</p> <p>Benefits:</p> <ol style="list-style-type: none"> Improve flood prediction & early warning system Efficient water resource management Enhanced disaster preparedness Reduce economic losses Support climate resilience in Pakistan | <p>Harnessing Biochar Production and Utilization: Promoting Sustainable Agriculture and Circular Economy in Pakistan</p> <p>Objective: To address Pakistan's agricultural waste management challenges by converting crop residues into biochar.</p> <p>Implementing Partner: Ministry of Climate Change and Environmental Coordination (MoCC&EC)</p> <p>Description: Building on successful results of the pilot project, this project seeks to expand biochar production from agricultural waste at a commercial scale.</p> <p>Benefits:</p> <ol style="list-style-type: none"> Reduction in air pollutants resulting from crop residue burning. Reduction in GHG emissions Improve soil fertility and crop yield Improve agricultural sustainability and rural livelihoods |


| Water Sector | Waste Sector |
|---|--|
| <p>Innovative Irrigation Approaches and Enhanced Green Financing Options for Farmers</p> <p>Objective: Project aims to improve irrigation practices and reduce irrigation water losses for improved water resource management.</p> <p>Implementing Partner: Pakistan Council of Research in Water Resources (PCRWR)</p> <p>Description: The project will focus on infrastructure improvements like lining of canal system to reduce water losses as well as introducing improved irrigation practices and technologies. For enhanced adoption of technologies by farmers, financial institutions will be engaged to design and launch special credit lines for water scarce zones.</p> <p>Benefits:</p> <ol style="list-style-type: none"> Efficient water resource management for agriculture sector Enhanced capacity of farmers on climate smart agricultures Reduce economic losses associated with poor agriculture production in arid and semi-arid zones Enhanced capacity of Financial Institutions on climate-sensitive micro-finance options | <p>Develop a comprehensive strategy for mitigating methane emissions in the organic waste sector</p> <p>Objective: CCAC advertised opportunity to identify the necessary infrastructure and investments (such as composting, gasification, landfill gas technology) to support waste separation, diversion from landfills, and the development of circular economies</p> <p>Focal: Ministry of Climate Change and Environmental Coordination (MoCC&EC)</p> <p>Description: Drafting country's first national organic waste strategy informed by GHG emission inventory from organic waste, desk reviews and stakeholder consultation on practices for organic waste management, Methane mitigation measures and impacts on the organic waste sectors. Project also focuses on capacitating public sector stakeholders on opportunities and options for organic waste diversion and conducting feasibility studies for organic waste treatment options.</p> <p>Benefits:</p> <ol style="list-style-type: none"> Improved organic waste management Reduction in air pollutants resulting from mismanaged organic waste Reduction in GHG emissions Improve government capacity to achieve circular economy |




Thank you




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05

Annex

| Major Group | Group Score | Criteria | Score | Criteria Weightage | Technologies |
|--|-------------|--|----------------|--------------------|--------------|
| Legal, Regulatory, and Financial Landscape | 15 | Are there any clear guidelines or regulations for this technology? | (scale of 1-5) | 5% | Score WS |
| | | Do existing financial structures exist to invest in this technology in Pakistan? | (scale of 1-5) | 5% | Score WS |
| | | Is there an opportunity for private sector investment in this technology? | (scale of 1-5) | 5% | Score WS |
| Economic and Technical Feasibility | 30 | Does this technology efficiently minimize the use of energy and other resources? | (scale of 1-5) | 5% | Score WS |
| | | Does technology promote efficiency in the management and delivery of the waste sector? | (scale of 1-5) | 5% | Score WS |
| | | Is this technology affordable? | (scale of 1-5) | 5% | Score WS |
| | | Is this technology successfully in use in Pakistan? or there is a potential for a pilot? | (scale of 1-5) | 5% | Score WS |
| | | Do the skills to implement and operate this technology exist in Pakistan? | (scale of 1-5) | 5% | Score WS |
| Inclusive Development and Climate Impacts | 30 | Does Pakistan have the capacity to inculcate skills training for this technology through its research and technology institutions? | (scale of 1-5) | 5% | Score WS |
| | | Does this technology possess emission reduction potential? | (scale of 1-5) | 5% | Score WS |
| | | Does this technology contribute to building resilience and adaptive capacity in Pakistan? | (scale of 1-5) | 5% | Score WS |
| | | Does this technology enhance the quality of life in target communities? | (scale of 1-5) | 5% | Score WS |
| | | Does this technology contribute to inclusive development and just transition? | (scale of 1-5) | 5% | Score WS |
| | | Does this technology have any negative/positive impacts on women and/or minorities or youth and children? | (scale of 1-5) | 5% | Score WS |
| | | Does this technology address gender specific needs and promote social equality? | (scale of 1-5) | 5% | Score WS |

4. Impact Statement

The information in the table below will be used to communicate results and anticipated impacts of this technical assistance publicly. Please copy information from impact statement developed in the M&E Plan and update as relevant.

| | |
|------------------|--|
| Challenge | Pakistan is a developing nation facing a number of development challenges. The waste and water sectors of Pakistan are plagued with inefficiencies that hinder effective and inclusive management and delivery within both sectors, with the issues being exacerbated due to the climate crisis. This has led to a |
|------------------|--|

| | |
|--|--|
| | <p>number of impacts such as environmental degradation and resource exploitation. The CTCN TA aims to address this challenge by leveraging technology to improve operations within both sectors through a collaborative, informed and inclusive process.</p> |
| CTCN Assistance | <ul style="list-style-type: none"> ● Water and Waste sector analysis and technology identification ● Develop Technology Roadmap for NDC implementation ● Gender, youth integration ● Four concept notes (water and waste respectively) for financing support, |
| Anticipated impact | <p>In achieving intended NDC mitigation and adaptation impacts in the waste and water sectors respectively, a sector analysis and technology identification will guide the strategic building of capacity and technology adoption along with priority steps within the Technology Roadmap. Gender and youth integration will ensure maximised socio economic co-benefits in terms of access to benefits such as emission mitigation , health improvement, jobs and environmental resilience.</p> |
| Co-benefits: Achieved or anticipated co-benefits from the TA | <p>Implementation of the Technology Roadmap is expected to generate green jobs and maintain or improve access to waste and water services.</p> <p><i>The process of the development and implementation of the NDC Technology Roadmap has achieved co-benefits in the form of improved stakeholder engagement through the formation of technology roadmap, waste and water committees which have led to the formation of the NDC Technology Roadmap for the Water and Waste Sectors. Four funding notes have also been developed. The project further aims to generate co-benefits through the implementation of the Roadmap and the formulated funding notes by contributing to emission mitigation, generation of green employment, finance mobilization, improved access and delivery in the waste and water sectors, improvement in cross-cutting sectors such as agriculture and disaster resilience.</i></p> |
| Gender aspects of the TA | <p>The Technology Roadmap for NDC implementation will integrate gender and youth, through technical assistance provided by national and international gender experts.</p> <p><i>The Technology Roadmap has ensured gender and youth inclusion integration across project activities and operations, including a gender assessment, which as a standalone assessment report was additional to the Response Plan. Gender analyses have been conducted for Pakistan’s waste and water sectors and feasibility analyses for the assessed technologies. Gender and social inclusion have also been incorporated as a key scoring criteria for the identified technologies. Gender inclusion was further ensured through the Gender Specialist. Additional gender aspects considered included gender and social inclusion among stakeholders participating in project events and activities, gathering gender-disaggregated data, ensuring gender inclusion in the development of 4 project funding notes. Gender considerations have also been a part of project socialization as the gender assessment was discussed at the UN Women Pavillion side event at COP29.</i></p> |

| | |
|---|---|
| <p>Anticipated contribution to NDC</p> | <p>The sectors – waste and water – and the technical analysis will be aligned with the NDC.</p> <ul style="list-style-type: none"> • <i>Improve efficiency and management in the waste sector through promotion of reuse and reduction of waste</i> • <i>Improve efficiency and management in the water sector</i> • <i>Promote technology-based interventions and mobilize climate finance</i> • <i>Promote women awareness and inclusion in waste and water sectors</i> |
| <p>The narrative story</p> | <p>To be completed upon completion of the project.</p> <p><i>Pakistan ranks as one of the most vulnerable nations to climate change. As a developing nation struggling with development challenges such as poverty, resource degradation and economic fragility, the climate crisis has further exacerbated its dire situation. The water and waste sectors in Pakistan are also vulnerable to the climate crisis and face significant hurdles which has led to inefficient management and inadequate delivery. To initiate action the country has prioritized the adoption of sustainable technologies to enable climate adaptation and improved resource management. The main challenges the country faces are inadequate capacity, lack of awareness and conclusion, and a lack of finance. The CTCN technical assistance addresses the noted barriers by ensuring stakeholder engagement and improved capacity, gender and social inclusion, comprehensive feasibility analyses for identified water and waste technologies and the development of 04 funding notes to mobilize climate finance for both sectors. The development of the NDC Technology Roadmap for the water and waste sectors through this process ensures progress towards improvement and climate adaptation through sustainable and suitable technologies in Pakistan. The Global Green Growth Institute (GGGI), as the lead implementing agency, supported the Ministry of Climate Change and Environment Coordination (MOCCAEC) in the delivery of the Response Plan. Additional funding was secured from the GGGI-Korea Trust Fund for further project preparation, which will run until August 2025 with aim to see at least two of the concept notes funded.</i></p> |
| <p>Contribution to SDGs</p> <p>A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/</p> | <p>SDG 6-Clean Water and Sanitation</p> <p>Contribution to 6: 6.1- Safe and affordable drinking water</p> <p><i>The NDC Technology Roadmap provides a comprehensive strategy for Pakistan’s water sector to leverage technology and ensure safe and affordable drinking water for its citizens. The Roadmap proposes three sustainable and low-carbon technologies for the country to prioritize.</i></p> <p>Contribution to 6: 6.4- Increase water use efficiency and ensure freshwater supplies</p> <p><i>The NDC Technology Roadmap identifies sustainable and low-carbon technologies for Pakistan’s water sector, aiming to improve the efficiency of the management and delivery of water resources, specifically in agriculture, domestic and hydropower. Additionally, the project has led to the development of 04 funding concept notes for Pakistan’s water sector, specifically to integrate AI into the flood</i></p> |

telemetry network across Pakistan and to improve irrigation practices to minimize water loss.

SDG 12- Responsible Consumption and Production

Contribution to 12: 12.4 – Responsible management of chemicals and waste

The NDC Technology Roadmap identifies sustainable and low-carbon technologies for Pakistan’s waste sector, aiming to improve its efficiency and management. The identified technologies, once implemented, will aim to reduce harmful gases and waste components into the air, water, and soil. Additionally, the project has devised two funding concept notes to address agricultural waste by converting crop residues into biochar and developing a comprehensive strategy to mitigate methane emissions in the organic waste sector.

SDG 13-Climate Action

Contribution to 13: 13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

The project contributes to strengthening resilience and adaptive capacity through climate smart technologies in the water sector. Additionally, the development of 04 funding notes for the water and waste sectors aim to inculcate improvement in both the management and delivery of the sectors, ensuring climate resilience.

Contribution to SDG 13 Climate Action, 13.2 - Integrate climate change measures into national policies, strategies and planning

The project has contributed to the attainment of 13.2 as the NDC Technology Roadmap has been provided official ownership by the Government of Pakistan (GoP) at the COP29 side event held to socialize the project and foster awareness. The gender assessment conducted as part of the TA was also presented at the UN Women pavilion at COP29..

| Indicator Please note indicators below highlighted as anticipated | Quantitative value <i>Numerals only; disaggregates must sum to the total</i> | Qualitative description <i>List the various elements corresponding to the quantitative value as well as timelines and responsible institutions</i> |
|--|--|---|
| Total number of events organized by proponents and implementing partners | 13 | Kick-off workshop Stakeholder sensitization workshop 04 waste committee meetings 04 water committee meetings 03 technology roadmap committee meetings The stakeholder sensitization workshop was included on the recommendation of the country to work with stakeholders and capacitate them with the information required to initiate the project. |
| Number of participants in events organized by proponents and implementing partners | 307 | Total number of people participating in project events. |
| a) Number of men | 50% women/men | Participant data to be sex disaggregated with a gender target <ul style="list-style-type: none"> Total: 260 |
| b) Number of women | 50% women/men | Participant data to be sex disaggregated with a gender target Total: 47 Note: The 50% target for women participation could not be attained due to the male dominated nature of the workplace and institutions in Pakistan. The country is currently working towards and improved gender participation rate and female inclusion, however, progress will take time as the country mitigates socio-cultural norms hindering female participation. |
| Number of climate technology RD&D related events | 13 | |

| | | |
|---|-----|--|
| Number of participants in climate technology RD&D events | 307 | Total number of people participating in project events. |
| a) Number of men | 260 | |
| b) Number of women | 47 | <i>Note: The 50% target for women participation could not be attained due to the male dominated nature of the workplace and institutions in Pakistan. The country is currently working towards and improved gender participation rate and female inclusion, however, progress will take time as the country mitigates socio-cultural norms hindering female participation.</i> |
| Number of training organized by proponents and implementing partners | 1 | <i>The stakeholder sensitization was organized with members from Pakistan's provinces to capacitate stakeholders with information required to initiate and conduct the project.</i> |
| Number of participants in trainings organized by proponents and implementing partners | 29 | |
| a) Number of men | 26 | |
| b) Number of women | 3 | <i>Note: The 50% target for women participation could not be attained due to the male dominated nature of the workplace and institutions in Pakistan. The country is currently working towards and improved gender participation rate and female inclusion, however, progress will take time as the country mitigates socio-cultural norms hindering female participation.</i> |
| Total number of institutions trained | 26 | <i>A total of 28 institutions from across Pakistan's provinces and regions were trained.</i> |
| a) Governmental (national or subnational) | 26 | <p><i>List the name of organisations trained here</i></p> <ul style="list-style-type: none"> ● <i>Azad Jammu & Kashmir Power Development Organization</i> ● <i>Public Health and Engineering Department, Muzaffarabad</i> |

| | | |
|--|--|--|
| | | <ul style="list-style-type: none"> ● Azad Jammu & Kashmir Agriculture Department ● Azad Jammu & Kashmir Environmental Protection Agency ● Azad Jammu & Kashmir Irrigation and Small Dams Department ● Azad Jammu & Kashmir Local government and Rural Development Department ● Balochistan Environmental Protection Agency ● Local Government and Rural Development Department Balochistan ● Public Health and Engineering Department Balochistan ● Gilgit baltistan Local Government and Rural Development Department ● Gilgit Baltistan PHE and Building Division ● Water and Power Department Gilgit Baltistan ● Environmental protection Agency, Gilgit Baltistan ● Pakistan Council of Research on Water Resources, Gilgit Baltistan ● Environmental Protection Agency, Khyber Pakhtunkhwa ● KP Economic Zones Development and Management Department ● Public Health and Engineering Department, Khyber Pakhtunkhwa ● Lahore Waste Management Company, Punjab ● Water and Sanitation, Punjab ● Environmental protection Agency, Punjab ● Public Health and Engineering Department, Punjab ● SEPA, Sindh ● Climate Change Cell, Sindh ● Department of Energy, Sindh ● Irrigation Department, Sindh ● Industries and Commerce Department, Sindh |
| <p>b) Private sector (bank, corporation, etc.)</p> | | <p>List the name of organisations trained here</p> |

| | | |
|---|----|---|
| c) Nongovernmental (NGO, University, etc.) | | <i>List the name of organisations trained here</i> |
| Percentage of participants reporting satisfaction with CTCN training (from CTCN training feedback form) | | <i>Satisfied= 4+ on 5-pt scale</i> |
| Percentage of participants reporting increased knowledge, capacity and/or understanding as a result of CTCN training (from CTCN training feedback form) | | <i>Increased knowledge, capacity and/or understanding= 4+ on 5-pt scale</i> |
| a) Percentage of men | | |
| b) Percentage of women | | |
| Total number of deliverables produced during the assistance (excluding mission, progress and internal reports) | 10 | Sum total of all deliverables listed in Response Plan |
| a) Number of communication materials, including news releases, newsletters, articles, presentations, social media postings, etc. | 2 | <i>02 side events at COP29 for the socialization of NDC Technology Roadmap and UN Women Pavillion.</i> |
| b) Number of tools and technical documents strengthened, revised or developed | 4 | <p>04 Concept notes for the waste and water sectors are:</p> <ul style="list-style-type: none"> • AI-Integrated remote sensing for water resource management in Pakistan • Innovative irrigation approaches and enhanced green financing options for farmers. |

| | | |
|--|---|--|
| | | <ul style="list-style-type: none"> • Develop a strategy for mitigating methane emissions from the organic waste sector • Harnessing Biochar production and utilization: promoting sustainable agriculture and circular economy in Pakistan |
| c) Number of other information materials strengthened , revised or created (For example training and workshop reports, Power Points, exercise docs etc.) | 3 | <ul style="list-style-type: none"> • 01 Gender Assessment • 01 Water Sector Technology Assessment • 01 Waste Sector Technology Assessment |
| Total number of policies, strategies, plans, laws, agreements or regulations supported by the assistance | 1 | Pakistan Technology Roadmap for NDC implementation for Waste and Water sectors |
| a) Adaptation related | | |
| b) Mitigation related | | |
| c) Both adaptation- and mitigation related | 1 | Pakistan Technology Roadmap for NDC implementation for Waste and Water sectors |
| Anticipated number of policies, strategies, plans, laws, agreements or regulations proposed, adopted or implemented as a result of the TA | 1 | Pakistan Technology Roadmap for NDC implementation for Waste and Water sectors |
| a) Water related (adaptation) | | <i>List the type of documents anticipated to be proposed, adopted or implemented</i> |
| b) Waste related (mitigation) | | <i>List the type of documents anticipated to be proposed, adopted or implemented</i> |
| c) Both adaptation- and mitigation related | 1 | Pakistan Technology Roadmap for NDC implementation for Waste and Water sectors |

| | | |
|---|----------|--|
| <p>Anticipated number of technologies transferred or deployed as a result of CTCN support</p> | | <p>Subject to assessment. One concept note for Water and one concept note for Waste sector anticipated.</p> <p><i>Instruction: List the type of technologies supported by this assistance. Technologies must be identified from the CTCN taxonomy of climate sectors and technologies (download in pdf format and choose from column C): https://www.ctc-n.org/resources/ctcn-taxonomy</i></p> |
| <p>Anticipated number of collaborations facilitated or enabled as a result of technical assistance</p> | <p>4</p> | <p><i>One technology for each sector identified resulting in collaborations</i></p> |
| <p>a) Number of South-South collaborations</p> | <p>3</p> | <p><i>List the names of the organisations (excluding the CTCN or TA implementers)</i></p> <ul style="list-style-type: none"> ● <i>Federal flood Commission Pakistan</i> ● <i>Pakistan Council of Research on Water Resources</i> ● <i>National Rural Support Programme</i> |
| <p>b) Number of RD&D collaborations</p> | <p>1</p> | <p><i>List the names of the organisations (excluding the CTCN or TA implementers)</i></p> <ul style="list-style-type: none"> ● <i>Korean Green New Deal Fund</i> |
| <p>c) Number of private sector collaborations</p> | | <p><i>One per sector</i></p> <p><i>List the names of the organisations (excluding the CTCN or TA implementers)</i></p> |
| <p>Number of countries with strengthened National System of Innovation as a result of CTCN support</p> | <p>1</p> | <p><i>Pakistan</i></p> |
| <p>Insert any additional indicators here</p> | | |

| | | |
|--|--|--|
| | | |
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Annex 1 Technical assistance data collection

Indicators which have been monitored in addition to the proposed indicators below may be added at the end of table A. Non-relevant indicators should be left blank.

A. Output and outcome indicators

B. Core impact indicators

Please fill in the tables for anticipated impacts of the CTCN assistance. Every technical assistance should contribute to at least one of the indicators below. For guidance on how to report on core indicators see the [‘M&E Guidance Document for TA Implementers’](#).

| | | |
|---|---|---|
| Core indicator 1 | Anticipated metric tons of CO₂ equivalent (CO₂e) emissions reduced or avoided as a result of CTCN TA | |
| | <i>Please add your calculations in word or excel format as an Annex to this Closure Report, where applicable.</i> | |
| | Anticipated metric tons of CO ₂ e reduced or avoided as a result of the TA on annual basis | Anticipated metric tons of CO ₂ e reduced or avoided as a result of the TA in total |
| Quantitative value <i>(emissions reductions)</i> | <i>Total number (numerals only, no rounding or abbreviations)</i> | <i>Total number (numerals only, no rounding or abbreviations)</i> |
| Unit | tCO ₂ e | tCO ₂ e |

| | | |
|---|--|--|
| <p>GHG assessment boundary (project emissions)</p> <p>Identify expected post-TA activities, associated effects and assess boundary for quantification of GHG emission reductions</p> | | |
| <p>Baseline emissions</p> <p>Describe baseline scenario, baseline candidates, emission factors and emissions calculated</p> | | |
| <p>Methodology</p> <p>Explain the method or process of verifying the indicator and how data was gathered</p> | | |
| <p>Assumptions</p> <p>Describe assumptions made during calculation and quantification of GHG reductions</p> | | |

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|--|---|
| <p>Core indicator 2</p> | <p>Anticipated increased economic, health, well-being, infrastructure and built environment, and ecosystems resilience to climate change impacts as a result of technical assistance</p> <p><i>Please provide a qualitative description of the anticipated impacts on the categories below</i></p> |
| <p>Infrastructure and built environment</p> <p>Anticipated increased infrastructure resilience (avoided/mitigated climate induced damages and strengthened physical assets)</p> | <p>The TA has enabled the development of the NDC Technology Roadmap for the water and waste sectors, identifying sustainable and low-emission technologies for each sector. The TA has also enabled development of 04 funding notes. The funding notes for the water sector include AI-integrated remote sensing for water resource management in Pakistan and innovative irrigation approaches and enhanced green financing options for farmers. The funding notes for the waste sectors include the development of a strategy to manage methane emissions from organic waste and management of agricultural waste by converting crop residue to biochar. The identified technologies, when adopted, along with the implementation of the projects will ensure mitigation of climate induced damages and strengthened physical assets. Improved technologies and project interventions will enable improved management of resource such as water and use of waste.</p> |
| <p>Ecosystems and biodiversity</p> <p>Anticipated increased ecosystem resilience (areas with increased resistance to climate-induced disturbances and with improved recovery rates)</p> | <p>The technologies identified in the Technology Roadmap for the water and waste sectors will offer ecosystems and biodiversity benefits. Once adopted, the technologies for the water sector will work towards efficient use of water resources and minimal water loss. 04 project funding notes will also contribute to ecosystem and biodiversity resilience. Anticipated waste sector projects on agricultural crop residue waste conversion to biochar will lead to reduction of air pollution and emissions along with improvements in soil fertility, restoring its natural state. Similarly, the anticipated project for the water sector aims to improve irrigation practices and reduce irrigation water losses which will provide an alternative to overuse of water resources.</p> |
| <p>Economic</p> | <p>The technologies identified in the Technology Roadmap for the water and waste sectors, once adopted, will provide</p> |

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| <p>Anticipated increased economic resilience (e.g. less reliance on vulnerable economic sectors or diversification of livelihood)</p> | <p>avenues for revenue generation and economic resilience for the communities involved. Identified technologies for the water sector will improve agricultural productivity while allowing efficient water resource management, allowing communities to reap economic benefits. Additionally, waste sector technologies allow recycling of waste and sustainable management along with the production of by-products that can be sold. The 04 funding notes for the water and waste sectors will also contribute to increased economic resilience. The project note for AI-integrated remote sensing for water resource management in Pakistan aims to establish an AI-integrated flood telemetry network across Pakistan. This will lead to improved flood prediction and provision of early warning systems and enhanced disaster preparedness which will reduce economic losses associated with disasters. The project note for the waste sector aims to convert agricultural waste in the form of crop residue to biochar at a commercial scale which will allow further income generation.</p> |
| <p>Health and wellbeing Anticipated increased health and wellbeing of target group (e.g. improved basic health, water and food security)</p> | <p>The identified technologies for the water and waste sectors noted in the Roadmap have completed an extensive feasibility analysis to assess their performance in various aspects, including social and environmental. The technologies have been prioritized as they are both sustainable and environmentally friendly. The technologies will provide health and wellbeing benefits as they pose no harm to health or the environment, and ensure improved management and delivery in both sectors. Additionally, the development of 04 project notes for the water and waste sectors also holds health benefits. The project note for the waste sector aims to convert agricultural waste in the form of crop residue to biochar at a commercial scale which will lead to a reduction in emissions and air pollution, offering improved health for communities involved. Another funding note for the development of a strategy to manage methane emissions from organic waste also aims to reduce emissions and ensure environmental safety. The project note for improved irrigation practices aiming to reduce irrigation water losses for improved water resource management will work towards improving agricultural output in arid and semi-arid zones, ensuring improved access to food and basic services.</p> |

| Core indicator 3 | | Anticipated number of direct and indirect beneficiaries as a result of the TA | |
|---|--|---|--|
| | | Quantitative value | Means of verification |
| Total beneficiaries | | <i>Total number</i> | |
| Number of adaptation beneficiaries | BAHAWALPUR DISTRICT: 815,202 SARGODHA DISTRICT: 785,698 HYDERABAD DISTRICT: 761,793 MIRPUR KHAS DISTRICT: 267,833 JAFFARABAD DISTRICT: 98,761 NASIRABAD DISTRICT: 106,952 | | <i>Values obtained from 2023 Pakistan Census as made available by Pakistan Bureau of Statistics.</i> |
| Number of mitigation beneficiaries | | | <i>Describe calculation methods and assumptions made</i> |
| Number of adaptation-and mitigation beneficiaries | | | <i>Describe calculation methods and assumptions made</i> |

| Core indicator 4 | | Anticipated amount of funding/investment leveraged (USD) as a result of TA (disaggregated by public, private, national, and international sources, as well as between anticipated/confirmed funding) | | |
|------------------|-------------------------------------|--|---|--|
| | Quantitative value confirmed in USD | Quantitative value anticipated in USD | Qualitative description | Methods |
| | | | <i>List the institutions, timelines, and description or title of the investment</i> | <i>Describe methods used for quantificatio</i> |

| | | | | <i>n of funds leveraged</i> |
|---|--|---|---|---|
| Total funding | <i>Total number in USD (numerals only, no rounding or abbreviations)</i> | USD 59,958,000 | | |
| Anticipated amount of public funding mobilized from national/domestic sources | | | | |
| Anticipated amount of public funding mobilized from international/ regional sources | | <p>GGGI-Korea Trust fund already mobilized USD 158000. for project development</p> <p>AI Integrated Remote Sensing for Water Resource Management in Pakistan: USD14.5M + USD39.5M</p> <p>Improved Irrigation Approaches and Enhanced Green Financing Options for Farmers: USD5.0M</p> <p>Develop a comprehensive strategy for mitigating methane emissions in the organic waste sector: USD800,00</p> | <p>Funding secured through Korean Green New Deal Fund to build upon the 04 funding notes for the water and waste sectors.</p> <p>In addition to this GCF scale-up for nationwide approach</p> | <p>1. Water Flood Telemetry value calculated by MoWR and ADP on the basis of the Readiness Assessment done in partnership between these two entities.</p> <p>2. GGGI Calculation based on past projects.</p> <p>3. Communicated by UNEP, and CCAC.</p> |
| Anticipated amount of private funding mobilized from national/domestic sources | | | | |

| | | | | |
|---|--|--|--|--|
| Anticipated amount of private funds mobilized from international/regional sources | | | | |
|---|--|--|--|--|

Annex 2 (for internal use – to be filled in by the CTCN)

CTCN evaluation

This section will be completed by the relevant CTCN Technology Manager.

- Evaluation of the timeliness of the TA implementation as measured against the timeline included in the response plan;
- Evaluation of TA quality as defined in the response plan;
- Overall performance of the Implementers;
- Overall engagement of the NDE and Proponent;
- Lessons learned on the CTCN process and steps taken by the CTCN to improve.