NDC Technology Roadmap for Water and Waste Sector

Summary End-of-Project Slides

DATE: November30 , 2024

01 Process Overview

Prioritized Technologies

WATER

Subsector	Technology
Agriculture	Drip Irrigation (Existing)
	IoT based Solar Pumps and Storage (Emerging)
	AI Integrated GIS and Remote Sensing for Water Management (Emerging)
Hydropower	Run Off the River Plants (Existing)
	Micro & Small Hydropower Plants (Existing)
Domestic	Rainwater Harvesting

WASTE

Subsector	Technology
Municipal Solid Waste	Aerobic Windrow Composting (Existing)
	Waste Segregation (Existing)
	Engineered Landfill Technology (Existing)
Agriculture Waste	Integrated Biomass Gasification/Pyrolysis for Syngas and Biochar (Emerging)
Plastic Waste	Refuse-derived Fuel (Existing)

Three committees were formulated to enable data/information sharing, and feedback support for developing the roadmap

Technology Roadmap Committee

Contribution

1. Finalization of scoring criteria for the selected technologies
2. Generation, and finalization of the outline for the Technology Roadmap
3. Created an enabling environment

Committee gathered two times

Key Participants:

1. Federal:

-Science & Technology; Industries & Production
-PCRET; PCSIR

2. Provinical:

-Provincial EPDs
- Science & Technology
-Information Technology

3. Participants from Research, Academia, and Educational Institutions.

Water Committee

Contribution

1. Selection of Agriculture, Hydropower, and Domestic as the sub-sectors under scrutiny
2. Provided a baseline, and situational analysis, along with the gaps that will be addressed via the integration of the water-based technologies.
3. Gave overview on provincial and regional level governance, along with capacity-based challenges, and recommendations for the integration of the technologies

Committee gathered four times

Key Participants:

1. Federal:

-MoCC&EC; MoWR; PBS; FFC

2. Provinical:

-Provincial EPDs
-Representatives from Irrigation
-Representatives from Energy
-Representatives of WASA

3. Individual Experts, and Academia with their expertise revolving around the sub-sectors of Agriculture, Hydropower, and Domestic

Waste Committee

Contribution

1. Selection of Municipal Solid Waste; Agricultural Waste, and Plastic Waste as the sub-sectors under scrutiny
2. Provided a baseline, and situational analysis, along with the gaps that will be addressed via the integration of the waste-based technologies.
3. Gave overview on provincial and regional level governance, along with capacity-based challenges, and recommendations for the integration of the technologies

Committee gathered four times

Key Participants:

1. Federal:

-MoCC&EC; Food Security; PBS

2. Provinical:

-Provincial EPDs
- Representatives from Agriculture
-Representatives from Waste Management

3. Individual Experts, and Academia with their expertise revolving around the sub-sectors of Municipal Solid Waste; Agricultural Waste, and Plastic Waste

Challenges

- Approximately 6 months delay at the start of the project due to elections. This caused a four-month push back of 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

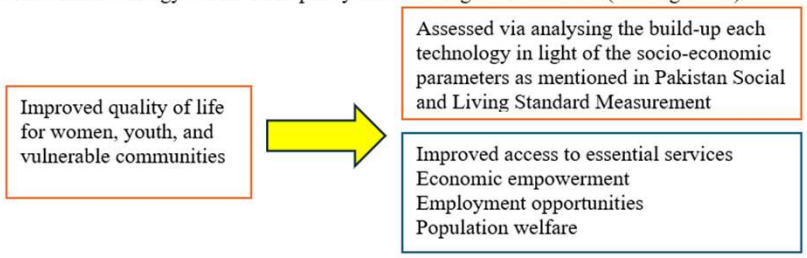
- Does this technology efficiently minimize the **use of energy and other resources**?
- Does this technology **promote efficiency** in the management and delivery of the water/waste sectors?
- Is this technology **affordable**?
- Do any **subsidies or tax reductions** exist for this technology?
- Is 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

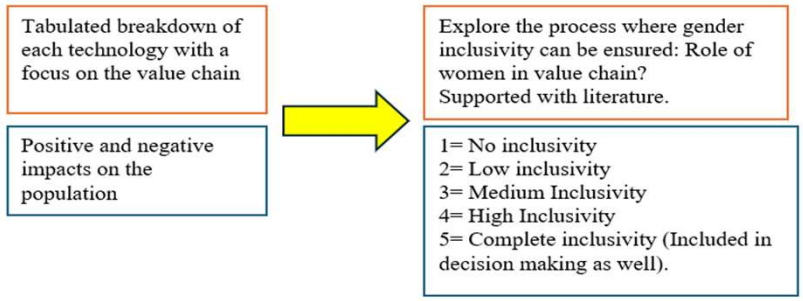
- Does this technology enhance the **quality of life** in target communities?
- Does this technology contribute to **inclusive development and just transition**?
- Does this technology have any harmful impacts on **women and/or minorities** or **youth and children**?
- Does this technology address **gender-specific 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

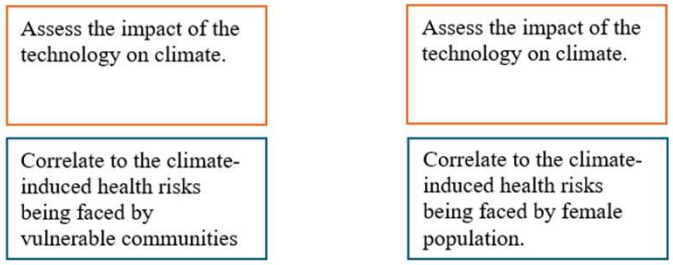
1. Does this technology enhance the quality of life of target communities (Scoring: 1—5)



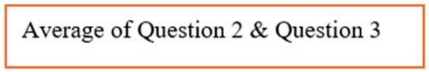
2. Does this technology contribute to inclusive development and just transition? (Scoring: 1—5)



3. Does this technology have any harmful impacts on women and/or minorities or youth and children? (Scoring: 1—5)



4. Does this technology address gender specific needs and promote social equality?



Heat Map of Technology Readiness in the Water Sector Generated through Scoring Criteria

Category	Parameters	Existing				Emerging	
		Drip Irrigation	Run Off the River Plants	Micro and Small Hydropower Plants	Rainwater Harvesting	IOT Solar Based Pumps and Storage	AI Integrated Remote Sensing for Water Management*
Legal and Financial Framework	Guidelines/ Regulations	5	5	5	3	2	2
	Financial Structure	5	3	3	4	3	3
	Private Sector Mobilization	5	4	5	3	3	2
Economic and Technical Feasibility	Resource Efficiency	4	5	4	4	5	2
	Management Efficiency	5	4	3	5	4	2
	Economic Feasibility	4	3	4	4	4	3
	Existing Project	4	4	4	4	1	2
	Skill Capacity	5	3	4	4	3	2
	Capacity Building	5	4	4	4	3	3
Inclusivity and Climate Impact	Emissions Reduction	4	5	4	2	3	2
	Building Resilience	2	4	3	3	2	3
	Quality of Life	4	4	4	4	4	1
	Inclusive Development	4	3	3	3	3	2
	Social Equality	4	3	3	3	3	2
	Gender Considerations	4	3	3	3	3	2
	TOTAL	64	57	56	53	46	33

Legend

Low readiness → High readiness

1	2	3	4	5

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

Heat Map of Technology Readiness in the Waste Sector Generated through Scoring Criteria

Category	Scoring Parameters	Existing				Emerging
		Aerobic Windrow Composting	Waste Segregation	Refuse- Derived Fuel	Engineered Landfill Technology	Integrated Biomass Gasification for Syngas and Biochar
Legal and Financial Framework	Guidelines / Regulations	4	5	3	5	3
	Financial Structure	4	2	4	4	1
	Private Sector Mobilization	4	2	4	4	4
Economic and Technical Feasibility	Resource Efficiency	4	5	4	4	4
	Management Efficiency	3	4	3	3	3
	Economic Feasibility	4	3	3	3	3
	Existing Project	4	2	3	2	4
	Skill Capacity	4	3	4	3	2
	Capacity Building	5	4	4	3	3
Inclusivity and Climate Impact	Emissions Reduction	4	5	4	4	3
	Building Resilience	3	4	3	3	3
	Quality of Life	2	4	2	2	3
	Inclusive Development	3	3	3	3	4
	Social Equality	3	3	3	1	4
	Gender Considerations	3	3	2	2	4
	TOTAL	**54**	**52**	**49**	**46**	**48**

Legend

Low readiness → High readiness

1	2	3	4	5

03

Shortlisted Technologies | Water and Waste Sector

Shortlisted Water Technologies

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

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
AI-Integrated Remote Sensing for Water Resource Management in Pakistan	**Harnessing Biochar Production and Utilization: Promoting Sustainable Agriculture and Circular Economy in Pakistan**
Objective: Project aims to establish an AI-integrated flood telemetry network across Pakistan. **Implementing Partner**: Ministry of Water Resources (MoWR) **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. **Benefits**: i. Improve flood prediction & early warning system ii. Efficient water resource management iii. Enhanced disaster preparedness iv. Reduce economic losses v. Support climate resilience in Pakistan	**Objective:** To address Pakistan's agricultural waste management challenges by converting crop residues into biochar. **Implementing Partner**: Ministry of Climate Change and Environmental Coordination (MoCC&EC) **Description:** Building on successful results of the pilot project, this project seeks to expand biochar production from agricultural waste at a commercial scale. **Benefits:** i. Reduction in air pollutants resulting from crop residue burning. ii. Reduction in GHG emissions iii. Improve soil fertility and crop yield iv. Improve agricultural sustainability and rural livelihoods

Water Sector	Waste Sector
Innovative Irrigation Approaches and Enhanced Green Financing Options for Farmers	**Develop a comprehensive strategy for mitigating methane emissions in the organic waste sector**
Objective: Project aims to improve irrigation practices and reduce irrigation water losses for improved water resource management. **Implementing Partner**: **Pakistan** Council of Research in Water Resources (PCRWR) **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. **Benefits**: i. Efficient water resource management for agriculture sector ii. Enhanced capacity of farmers on climate smart agricultures iii. Reduce economic losses associated with poor agriculture production in arid and semi-arid zones iv. Enhanced capacity of Financial Institutions on climate-sensitive micro-finance options	**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 **Focal**: Ministry of Climate Change and Environmental Coordination (MoCC&EC) **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 feasibilities for organic waste treatment options. **Benefits:** i. Improved organic waste management ii. Reduction in air pollutants resulting from mismanaged organic waste iii. Reduction in GHG emissions iv. Improve government capacity to achieve circular economy

Pakistan Council of Research in Water Resources

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
		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
Inclusive Development and Climate Impacts	30	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