UN environment programme | CTCN UN Climate Technology Centre & Network

CTCN Technical Assistance: Pakistan Technology Roadmap for NDC Implementation

Seventh global dialogue and investment-focused event,
Climate Week in Yeosu, Republic of Korea, 22 April 2026

Tomoko Furusawa, Head of PALO
UNEP Climate Technology Centre and Network (CTCN)

Case Study – Pakistan: Enabling Mitigation in Waste & Water Sectors

Context & Challenge

- Pakistan faces **significant inefficiencies in waste and water sectors**, exacerbated by climate change
- Limited capacity, weak coordination, and **lack of bankable projects for climate finance**
- High mitigation potential in:
  - Organic waste (methane emissions)
  - Agricultural residues
  - Water-energy nexus (irrigation, flood systems)

CTCN Intervention

- Development of **national Technology Roadmap for NDC implementation**
- Sector focus:
  - Waste (methane mitigation, circular economy)
  - Water (efficiency, climate resilience)
- Implemented by Global Green Growth Institute (GGGI)

Key Outputs

- National Technology Roadmap
- Sectoral technology assessments (waste & water)
- 4 investment-ready concept notes for scale-up

From Technology Roadmap to Bankable Mitigation Investments

Bridging Technology → Finance (Core Value of CTCN TA)

Investment Pipeline Developed

- Biochar production from agricultural residues
- AI-integrated water resource management systems
- Climate-smart irrigation solutions
- Methane mitigation strategy for organic waste

Financing Outcomes

- Investment pipeline identified
- Initial funding mobilized through:
  - Korean Green New Deal Fund (KGNDF)
- Pathway towards:
  - Scaling into national-level programmes
  - GCF concept notes

Enabling Factors

- Strong government ownership (Ministry of Climate Change)
- Structured stakeholder coordination mechanism (13+ events, 300+ participants)
- Integration of **policy + technology + finance**

Key Lessons for Scaling Industrial Mitigation

Linking Sectoral Technologies to Finance is Critical

- Technology identification alone is insufficient
- Early development of **bankable concept notes accelerates investment**

Industrial Mitigation Opportunities in "Non-traditional" Sectors

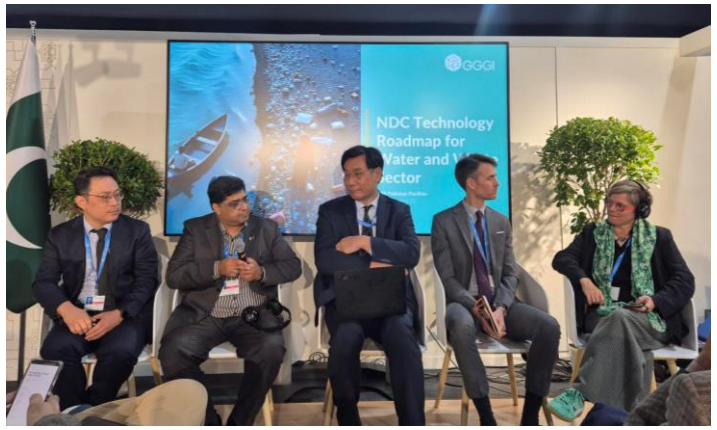
- Waste → methane reduction, **circular economy**
  - Agriculture-waste → **biochar**, value chains
- Water systems → energy efficiency, resilience

Role of CTCN as an Enabler

- De-risking early-stage investments
- Connecting countries with Technology providers & Financial partners
- Translating NDCs into **implementable investment pipelines**

Replication Potential

- Model applicable to other developing countries & cross-sector industrial decarbonization pathways



The GGGI presented this project during COP29 in 2024.

Belem Technology Implementation Programme mandates for CTCN

10/CP.30, 17/CMA.7

- Global in session dialogues starting 2027 (TEC and CTCN) - para 10
- Regional dialogues in conjunction with regional forum for NDEs in 2027 (CTCN in collab with TEC) - para 16
- Thematically align regional dialogues with the topic of in-session dialogue - para 17
- Demand-driven programmatic capacity building efforts in support of TIP elements - para 19
- Support matchmaking and partnership building to advance climate tech implementation in developing countries - para 20

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UN Climate Technology Centre & Network

UNFCCC_CTCN
UNFCCC.CTCN
Climate Technology Centre Network

CTCN Secretariat
UN City, Marmorvej 51
DK-2100 Copenhagen, Denmark
www.ctc-n.org
ctcn@un.org

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Biochar in Pakistan

Case Study

Diana Quezada, Senior Officer

22/04/26

From Waste to Value: GGGI support to unlocks Pakistan's Biochar Potential

1 NDC Technology Road Map for Waste Sector

Identifying the need

- Selection of subsectors and sub-listing of technologies
- Prioritization of 5 technologies
- Roadmap development

2 Pre-Feasibility Readiness

Assessing the potential

- Technical and financial feasibility of Biochar as a climate-smart solution

3 National Biochar Accelerator Program

Scaling up bankable projects

- Replicate experiences from the Philippines
- GGGI supported the private sector to link its industrial-scale biochar plants to VCM carbon credits by supporting international verification via puro.earth.

4 Pakistan LT-LEDS

GGGI developed a pre-feasibility study to upscale biochar technology in Pakistan

Study's Characteristics

- The study focused on **carbon markets and climate finance** opportunities for **Pakistan's waste agricultural sector**
- Integration of existing interventions leveraging biochar, expanded through **technical feasibility assessment** and **stakeholder inputs.**
- Informed through a **market assessment and financial modelling** for carbon and non-carbon revenue sources.
- Financed via the **Korea Green New Deal Trust Fund (KGNDTF)** from the MoEF

Ministry of Economy and Finance

Main Outcomes

Feedstock Availability Assessment
Mapping consistency and reliability analysis of potential waste streams

Domestic Biochar Market Landscape
Analysis spanning production to end-user segments for biochar and bio-products

Legal and regulatory readiness mapping for the production and utilization of biochar

Stakeholder Identification and Engagement to address knowledge and systematic gaps and ensure collaboration

Financial feasibility and revenue stream analysis for biochar production in Pakistan to identify value chains

Pakistan's domestic biochar market is nascent but rapidly expanding

POTENTIAL

National Biomass Potential
~230 Bn tonnes/yr
Agricultural, livestock & forestry residues combined

Crop Residue (2024-25)
142 MT produced
49 MT collected at 35% efficiency; 93 MT wasted

Animal Waste (2024-25)
392 MT total
98 MT collectable at 25% efficiency

Supply Reliability
CV 2.97% (crops)
High reliability across 2020–25; CV 4.74% for livestock

Top Province
Punjab — 105 MT/yr
Highest crop residue; best biochar production site

Best Feedstock
Wheat straw & bagasse
High carbon, low ash, compatible with pyrolysis

CURRENT MARKET

Agriculture share of GDP
23.5% of GDP
37% of national labour force; primary biochar end-market

Crop Yield Improvement
+12–15%
From NRSP biochar pilot; fertiliser use cut by 30–35%

Renewable Energy Target
30% by 2030
ARE Policy 2019; biochar/biomass explicitly included

Biomass Energy Potential
11,000 MW
From 5 major crops; 15,000 MW projected by 2034-35

Private Investment (IBI)
USD 100,000
Awarded Jan 2024 for climate resilience biochar project

Women in Agriculture
68% of workforce
72M rural women — key beneficiaries of biochar adoption

Pakistan holds significant potential for financially viable biochar production

A 20 MT/day CHP pyrolysis facility benchmarked against the Philippines ALCOM model represents the optimal minimum viable scale.

CAPEX
0.76
US$ million

OPEX
0.34
US$ million/year

PRODUCTION
1,844
tons/year

TOTAL REVENUE
0.79–1.15
US$ million/year

CARBON REVENUE
0.34
US$ million/year

NON-CARBON REVENUE
0.16–0.52
US$ million/year

Strategic alignment to national policies

NDC 3.0
50% GHG reduction target

LT-LEDS
Identification of low-carbon pathways and related investment strategies to upscale the opportunities identified in the NDC roadmap work.

Updated National Climate Change Policy

Pakistan Green Taxonomy

Regional expansion

Replicate lessons learned in scaling up biochar science and other co-benefits from the Philippines

- ✓**Capacity building**
- ✓ **Knowledge sharing**
- ✓**Policy incentives**
- ✓**Financing and de-risking**

GGGI

19th Floor Jeongdong Bldg. 21-15,
Jeongdong-gil, Jung-gu, Seoul,
Republic of Korea 04518

www.gggi.org
@gggi_hq
@GGGIHQ

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@gggi_hq
@GGGIMedia