Country	Uzbekistan
Request ID#	2024000047
Title	Pre-feasibility study for groundwater desalination and resource recovery in Uzbekistan
NDE	The Agency of Hydrometeorological service (Uzhydromet) Mr. Khabibullayev Sherzod Khabibullakhujayevich, Director of the Uzhydromet Email: uzhymet@meteo.uz Address:72, 1st Bodomzor yuli str., Tashkent, 100052, Uzbekistan
Proponent	State Establishment "Institute of Hydrogeology and Engineering Geology" (HYDROENGEO) Dr. Bimurzaev Gany Amirgalievich, Director of the HYDROENGEO Email: gany82@mail.ru Address: 64, Olimlar str., Mirzo-Ulugbek district, Tashkent, Uzbekistan, 100071

Summary of the CTCN technical assistance

Uzbekistan is facing increasing water scarcity and high groundwater salinity, especially in agricultural and industrial areas. This technical assistance aims to address these issues by introducing climate-resilient groundwater desalination and resource recovery technologies tailored to local conditions.

The project includes feasibility assessment based on groundwater sampling and analysis, pilot system design, and technical, socioeconomic, and environmental evaluation. CO_2-utilizing or gas hydrate-based desalination technologies and mineral recovery from brine will be explored.

Gender mainstreaming is embedded through expert involvement, training, and inclusive engagement, with at least 5% of the budget allocated to gender-responsive actions.

The TA aligns with Uzbekistan's NDCs, National Adaptation Plan, and Water Sector Strategy, and contributes to SDGs 6 (Clean Water), 12 (Responsible Consumption), and 13 (Climate Action).

The results will support pilot deployment, regional replication, and development of follow-up proposals for international funding to scale up sustainable, climate-resilient water and resource management.

Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism
Name: Mr. Khabibullayev Sherzod Khabibullakhujayevich
Title: Director of the Uzhydromet

Date: 28.08.2025

Signature:

Proponent (signature of the Proponent is optional)
Name: Dr. Bimurzaev Gany Amirgalievich
Title: Director of the HYDROENGEO

Date: 28.08.2025

Signature:

UNFCCC Climate Technology Centre and Network (CTCN)
Name: Ariesta Ningrum
Title: CTCN Director

Date: 29.08.2025

Signature: 

1. Background and context

Uzbekistan faces increasing challenges related to water scarcity and environmental degradation, largely driven by its semi-arid climate, reliance on transboundary water sources, and inefficient water management systems. Groundwater is becoming an essential alternative source due to decreasing surface water availability, but much of it contains high salinity and mineral content, making it unsuitable for direct use without treatment.

At the same time, Uzbekistan's unique geological characteristics provide opportunities for extracting valuable resources—such as rare metals—from saline groundwater. However, these opportunities remain largely untapped due to the lack of advanced technologies and institutional capacity.

The Government of Uzbekistan has actively implemented national strategies such as the Uzbekistan 2030 Strategy and the Nationally Determined Contribution (NDC), which emphasize water security, climate resilience, and sustainable economic development. A number of policy and investment initiatives have been launched to modernize water infrastructure, improve groundwater management, and reduce soil salinity.

In this context, the proposed technical assistance aims to conduct a pre-feasibility study to identify and assess appropriate technologies for groundwater desalination and resource recovery. The study will lay the groundwork for future pilot-scale implementations and will support Uzbekistan's broader climate adaptation and mitigation strategies.

2. Problem statement

Uzbekistan faces increasing water scarcity due to its semi-arid climate, limited precipitation, inefficient irrigation systems, and heavy dependence on shared transboundary rivers. In response to these challenges, groundwater is being used more widely as an alternative source. However, a significant portion of groundwater is highly saline and contains valuable minerals, making it unsuitable for direct use without treatment.

Despite growing interest in desalination and resource recovery, Uzbekistan lacks the advanced technologies, institutional frameworks, and technical capacity needed to implement such systems. This limits the country's ability to secure potable water, recover valuable resources, and adapt to the impacts of climate change. There is an urgent need to identify appropriate and sustainable technologies that can be piloted and scaled under local conditions.

3. Logical Framework for the CTCN Technical Assistance:

	Month									
	1	2	3	4	5	6	7	8	9	10
***Objective**:* To contribute to addressing water scarcity and strengthen Uzbekistan's capacity for efficient resource utilization through the design of a pilot system and feasibility assessment based on groundwater desalination and resource recovery technologies.										
Outcome: The technical assistance will strengthen Uzbekistan's capacity for climate-resilient and sustainable groundwater use by identifying viable technologies for desalination and resource recovery. The pre-feasibility study will inform future pilot design and support long-term water security and low-emission development strategies.										
Mandatory Output: Project management										
Activity A: Pre-implementation A detailed work plan of all activities, deliveries, outputs, deadlines and responsible persons/organisations and detailed budget to implement the Response Plan. The detailed work plan and budget must be based directly on this Response Plan; Based on the work plan, a monitoring and evaluation (M&E) plan with specific, measurable, achievable, relevant, and time-bound indicators used to monitor and evaluate the timeliness and appropriateness of the implementation. The monitoring and evaluation plan should apply selected indicators from the Closure and Data Collection report template and enable the lead implementer to complete the CTCN Closure and Data collection report at the end of the assignment (please refer to item iv below and section 14 in the Response Plan). This M&E plan also includes a CTCN Impact Description formulated in the beginning of the technical assistance which will be revised in the Closure and Data Collection report once the technical assistance is fully delivered (templates will be provided). Furthermore, a gender evaluation and gender action plan (GAP) will be prepared and followed throughout the technical assistance (a template will be provided).[1]										
Activity B: Implementation A project steering committee will be formed, consisting of the implementing team (international and local consultants), the NDE, the project proponent(s), and CTCN. This project steering committee will meet at least on a bi-annual basis in order to report project progress and discuss any questions and challenges.										

[1] Additional information is available under Section 10 of the response plan.

Activity C: Post-implementation A Closure and Data Collection report completed at the end of the technical assistance (a template will be provided). Project-end communication and dissemination activities will be conducted in collaboration with the CTCN Secretariat, which will include: • Development of a press release • Delivery of a knowledge sharing webinar • Organization of a dialogue with financial institutions for potential follow-on support										
Mandatory deliverables: Deliverable A: Detailed work plan; M&E plan; gender assessment and gender action plan Deliverable B: Project Steering Committee meeting reports Deliverable C: Closure and Data Collection report; press release, webinar, dialogue with financial institutions	X X				X					X X
Output 1: Review of applicable desalination and resource recovery technologies in Uzbekistan										
Activity 1.1: Technology status and capacity assessment in Uzbekistan We plan to investigate whether any new technologies currently under development - including general aspects of desalination and resource recovery - exist, and review the technologies currently employed in Uzbekistan to assess their level. Based on the unique geographic, environmental, and economic conditions in Uzbekistan, we aim to propose the most suitable treatment technologies.										
Activity 1.2: Local survey in Uzbekistan (Groundwater characteristics) Field surveys will be conducted to identify areas with high project suitability by initially classifying regions where high-salinity groundwater is present and where significant amounts of CO_2 are generated, specifically targeting areas with insufficient water supply, high industrial demand, or groundwater rich in economically valuable elements. Sample composition analyses will be carried out concurrently by both domestic and international teams for cross-validation. If necessary, introductory training on fundamental analytical techniques will be provided to ensure data reliability. Currently, the Bukhara, Kashkadarya, and Navoi regions are considered strong candidates, and the final candidate sites will be determined by the Steering Committee.										
Activity 1.3: Desalination and resource recovery testing The results of the raw water composition analysis will be used to synthesize a simulated feedwater. Desalination technology will then be applied to this simulated water in order to obtain performance data and determine optimal desalination conditions (ensuring the produced water is suitable for use). Subsequently, resource recovery technology										

will be applied to the generated concentrate to selectively extract or properly classify the contained elements, leveraging in-house technology and equipment to secure efficient resource recovery conditions.										
Activity 1.4: Assessment of local applicability based on test results Based on the results of the composition analyses and simulated feedwater tests, a detailed analysis will be conducted to sequentially rank the optimal target sites, culminating in the final selection of the target site. (If necessary, the final candidate will be submitted as an agenda item to the Steering Committee.)										
Deliverable 1: Report of applicable desalination and resource recovery technology in Uzbekistan (by Activity 1.1) Summary of global technology review and best practices (by Activity 1.2) Site visit and raw water sampling report including test results (by Activity 1.3) Technology screening matrix with environmental and economic evalution (by Activity 1.4) Final assessment report with technology recommendations and site selection rationals				X						
Output 2: Design of pilot system for groundwater desalination and resource recovery										
Activity 2.1: System design review based on sample and test results We will review the results of the raw water characterization and laboratory scale testing conducted in Deliverable 1. Based on these results, we will construct a pilot system appropriate to the project site environment using gas hydrate-based desalination and mineral carbonation-based resource recovery technologies developed and owned by the project team. We will review the level of desalination to meet the requirements of the water users and propose appropriate treatment of the waste liquids generated after resource recovery.										
Activity 2.2: Conceptual design of process flow and site-specific layout This activity involves drafting a conceptual process flow diagram (PFD) that outlines the sequence of treatment stages (e.g., pre-treatment, desalination, resource recovery, brine handling). It will also include an initial layout of the system based on the assumed site characteristics.										
Activity 2.3: Pilot scale optimization based on CAPEX and OPEX analysis This activity will estimate the resource inputs (e.g., energy, chemicals, materials, land area) and calculate both capital expenditure (CAPEX) and operational expenditure (OPEX) to support feasibility assessment and pilot sizing. The results will be used to determine the most reasonable and sustainable pilot scale.										
Activity 2.4: Preparation of basic engineering documents for pilot construction										

Based on the finalized process and scale, a basic engineering design package will be developed, including process specifications, equipment list, material balances, and technical drawings. This package will serve as the technical foundation for future pilot implementation and procurement planning.										
Deliverables 2: Pilot System Design Report (for groundwater desalination and resource recovery in Uzbekistan) (by Activity 2.1) Pilot process flow configuration summary based on test results (by Activity 2.2) Conceptual process flow diagram (PFD) and site-specific layout (by Activity 2.3) Technical memo on CAPEX/OPEX and sizing analysis (by Activity 2.4) Basic engineering design package including specifications and drawings								X		
Output 3: Feasibility assessment of the pilot system and Scale-up project concept note										
Activity 3.1: Technical evaluation The technical evaluation aims to assess the feasibility and performance of the proposed pilot system for groundwater desalination and resource recovery in Uzbekistan. This assessment is based on the basic engineering design documentation and incorporates key technical parameters derived from prior test results and local site conditions. The technical evaluation includes, but is not limited to, the following activities, which may be adjusted depending on project progress: 1. Review of system configuration and process flow The proposed pilot system configuration and process flow diagram (PFD) are reviewed to ensure alignment with the characteristics of the local groundwater. This includes analysis of the unit processes (e.g., pre-treatment, desalination, concentrate handling), material balances, and the potential integration of resource recovery units. 2. Assessment of applicable scale and treatment capacity The appropriate scale of the pilot system is determined based on feedwater composition and estimated demand. System throughput, operational flexibility, and potential for scalability to other regions are analyzed. 3. Performance estimation System performance is estimated using laboratory-scale test data and design assumptions. Key indicators include salt rejection rate, product water quality, recovery rate, and concentrate volume. 4. Cost-performance comparison and preliminary optimization A preliminary evaluation is conducted to compare performance against CAPEX and OPEX, identifying trade-offs and optimization opportunities. Energy consumption, chemical requirements, and operational feasibility under field conditions are emphasized.										

5. Identification of technical risks and recommendations Potential technical risks—such as membrane fouling, operational stability, and climate resilience—are identified. Corresponding mitigation measures and improvement strategies are proposed to guide the subsequent demonstration phase and scale-up efforts. This technical evaluation provides a critical foundation for determining the viability of the pilot system and supports strategic decisions for its implementation in selected sites in Uzbekistan.										
Activity 3.2: Socioeconomic evaluation (Including gender considerations) The socioeconomic evaluation aims to comprehensively assess the broader social and economic impacts of the proposed pilot system for groundwater desalination and resource recovery in Uzbekistan. This evaluation will include, but is not limited to, the following core components, which may be adapted as the project progresses: 1. Assessment of socioeconomic benefits - Evaluate how the pilot system can contribute to improved water accessibility, reduced water-related costs, job creation, and improved livelihoods in the target areas. 2. Gender analysis and mainstreaming Strategy - Analyze how gender roles, responsibilities, and access to water resources may shift or improve as a result of project implementation. - Develop and evaluate specific strategies to promote gender equity throughout the project cycle. 3. Stakeholder Engagement and Social Acceptability Assessment - Identify and engage key stakeholders—including local authorities, communities, and vulnerable groups—to promote inclusive participation and enhance social acceptance. - Additionally, review and propose policy and institutional recommendations that support the replication of the pilot system in other regions. This evaluation will be conducted by local socioeconomic experts with relevant expertise, in close collaboration with the project implementation team.										
Activity 3.3: Environmental evaluation The environmental evaluation aims to quantitatively assess the potential environmental impacts of the proposed pilot system for groundwater desalination and resource recovery in Uzbekistan, and to evaluate the benefits of introducing										

climate technologies from a sustainability perspective. This evaluation includes, but is not limited to, the following core components, which may be expanded or refined depending on the scope and progress of the project: 1. Identification and Quantification of Environmental Impacts - Identify and assess potential impacts of the proposed desalination and resource recovery technologies on local ecosystems, water quality, soil, and air. - Special focus will be given to the environmental effects of brine (concentrate) treatment and discharge. - In addition, energy consumption and indirect emissions from system operation will be considered to evaluate the sustainability of the applied technologies. 2. Assessment of Environmental Co-benefits from Climate Technology Introduction - Evaluate how the proposed technologies can reduce the environmental burden compared to conventional water supply or resource development methods (e.g., large-scale groundwater extraction, RO-based desalination). - In particular, the evaluation will focus on contributions to climate change adaptation and improved access to drinking water, using both qualitative and quantitative methods. 3. Review of Regulatory and Policy Alignment - Examine the alignment of the pilot system with Uzbekistan's environmental regulations, water-related policies, and international climate commitments (such as the NDC). - Identify any necessary permits or environmental authorizations required for system deployment. 4. Identification of Environmental Risks and Mitigation Measures - Identify environmental risks associated with the process, including chemical usage and waste discharge, and propose appropriate mitigation strategies. This evaluation will be conducted by qualified environmental experts—either local or international—in close collaboration with the implementation team.										
Activity 3.4: Scale-up project concept note The implementing partner will provide a concept note for a scale-up project after concluding this TA project with the best available data and information generated from this project. Therefore, the guidelines to prepare this concept note are to be considered throughout all the activities listed above for better alignment of the deliverables with the requirements of the concept note. The concept note should also serve as a successful case for the other countries in the region to replicate the approach.										

Deliverables 3.1: Feasibility Assessment Report for the Groundwater Desalination and Resource Recovery Pilot System (by Activity 3.1) Technical Evaluation Materials (by Activity 3.2) Socioeconomic Evaluation Materials, Gender analysis report (by Activity 3.3) Environmental Evaluation Materials Deliverables 3.2: Scale-up project concept note with the package of supporting documents, as applicable.										X
Output 4: Technical training and stakeholder exchange on groundwater treatment and resource recovery										
Activity 4.1: Steering committee formation and meetings (Twice) The Steering Committee will be composed of the implementing team (including international and local consultants), the National Designated Entity (NDE), the project proponent, and CTCN, and will convene semi-annually.										
Activity 4.2: Stakeholder training and technical workshops During the implementation of this project, key stakeholders will be re-identified and re-engaged to reflect the actual operating context. To enhance their understanding of relevant technologies, introductory training materials will be developed and training sessions will be provided. In addition, a practice-oriented technical workshop will be organized using the pilot system design materials, aiming to further strengthen stakeholders' technical capacity. During the final workshop, the Implementing Partner will identify and extend invitations to pertinent financing organizations, which will include Multilateral Development Banks (MDBs), UN agencies, government institutions, NGOs, and representatives from the private sector. Additionally, the GCF NDA, the Global Environment Facility focal point, and the Designated Authority of the Adaptation Fund may be informed of the results of this project to explore potential opportunities for scaling up initiatives following the project's completion.										
Activity 4.3: Final report and result dissemination Deliverables from Activities 1, 2, 3 and 4 will be consolidated into a final report, which will serve as the basis for preparing the final presentation materials. These materials will be shared with relevant stakeholders and presented through an in-person dissemination event.										
Deliverables 4:										
4.1 List of steering committee members, Minutes of the steering committee meeting	X				X					
4.2 Updated stakeholders list, introductory training materials(Gas hydrate, Mineral carbonation), Technical Training Materials (Practice-Oriented, Based on Pilot Design)					X					X
4.3 Final Report and Presentation materials										X

4. Resources required and itemized budget:

Activities and Outputs	**Input: Human Resources** *(Title, role, estimated number of days)*	**Input: Travel** *(Purpose, national vs. international, number of days)*	**Inputs: Meetings/events** *(Meeting title, number of participants, number of days)*	**Input: Equipment/Material** *(Item, purpose, buy/rent, quantity)*	**Estimated cost** *Please accumulate the costing at Activity and Output level and provide an estimated costing range for each activity and the total Response Plan*	
					Minimum	**Maximum**
Mandatory Output: Project Management						
Mandatory Activities: A: Pre-implementation B: Implementation C : Post-implementation	Please allocate 1-5 working days for each of the mandatory reports under Activities A-C					
Mandatory Output: Project Management	IE1: 15 days IE2: 15 days IE3: 15 days IE4: 15 days				4,180	4,645
Mandatory Activities: A: Pre-implementation B: Implementation C : Post-implementation	Please allocate 1-5 working days for each of the mandatory reports under Activities A-C				4,180	4,645
Output 1: Review of applicable desalination					77,482	86,091

and resource recovery technologies in Uzbekistan						
Activity 1.1: Technology status and capacity assessment in Uzbekistan	IE1: 15 days IE2: 15 days IE3: 15 days IE4: 15 days NE1: 5 days NE2: 5 days NE3: 5 days NE4: 5 days NE5: 5 days NE6: 5 days				9,085	10,095
Activity 1.2: Local survey in Uzbekistan (Groundwater characteristics)	IE1: 25 days IE2: 25 days IE3: 25 days IE4: 25 days NE1: 8 days NE2: 8 days NE3: 8 days NE4: 8 days NE5: 8 days NE6: 8 days	Local survey and basic training, international, 10days	local survey and basic training, 8 days	Sampling and Analysis	28,702	31,891
Activity 1.3: Desalination and resource recovery testing	IE1: 26 days IE2: 26 days IE3: 26 days IE4: 26 days			Desalination and resource recovery test	18,900	21,001
Activity 1.4: Desalination and	IE1: 16 days IE2: 16 days IE3: 16 days	Meeting, international, 10days	Results sharing and optimal site selection / PSC meeting, 8 days		20,793	23,104

resource recovery testing	IE4: 16 days NE1: 8 days NE2: 8 days NE3: 8 days NE4: 8 days NE5: 8 days NE6: 8 days					
Output 2: Design of pilot system for groundwater desalination and resource recovery					35,066	38,962
Activity 2.1: System design review based on sample and test results	IE1: 12 days IE2: 12 days IE3: 12 days IE4: 12 days			Desalination and resource recovery test	13,244	14,716
Activity 2.2: Conceptual design of process flow and site-specific layout	IE1: 38 days IE2: 38 days IE3: 38 days IE4: 38 days				11,040	12,267
Activity 2.3: Pilot scale optimization based on CAPEX and OPEX analysis	IE1: 17 days IE2: 17 days IE3: 17 days IE4: 17 days				6,087	6,764
Activity 2.4: Preparation of basic engineering documents for pilot construction	IE1: 12 days IE2: 12 days IE3: 12 days IE4: 12 days				4,694	5,216

Output 3: Feasibility assessment of the pilot system and Scale-up project concept note					64,102	71,225
Activity 3.1: Technical evaluation	IE1: 17 days IE2: 17 days IE3: 17 days IE4: 17 days NE1: 17 days NE2: 5 days NE3: 17 days NE4: 5 days NE5: 5 days NE6: 5 days	Meeting, International, 7 days	Meeting on Project Progress and Strategic Planning for Feasibility Assessment, 5 days		21,972	24,414
Activity 3.2: Socioeconomic evaluation (Including gender considerations)	IE1: 17 days IE2: 17 days IE3: 17 days IE4: 17 days NE1: 5 days NE2: 5 days NE3: 5 days NE4: 17 days NE5: 17 days NE6: 17 days				12,297	13,664
Activity 3.3: Environmental evaluation	IE1: 17 days IE2: 17 days IE3: 17 days IE4: 17 days NE1: 5 days NE2: 17 days NE3: 5 days				10,992	12,214

	NE4: 5 days NE5: 5 days NE6: 5 days					
Activity 3.4: Scale-up project concept note	IE1: 50 days IE2: 50 days IE3: 50 days IE4: 50 days NE1: 5 days NE2: 5 days NE3: 5 days NE4: 5 days NE5: 5 days NE6: 5 days				18,839	20,932
Output 4: Technical training and stakeholder exchange on groundwater treatment and resource recovery					44,092	48,991
Activity 4.1: Steering committee formation and meetings (Twice)	IE1: 10 days IE2: 10 days IE3: 10 days IE4: 10 days NE1: 8 days NE2: 8 days NE3: 8 days NE4: 8 days NE5: 8 days NE6: 8 days	Meeting & Local survey, international, 10days	Inception meeting(PSC meeting), 3days, local survey, 5days		18,221	20,246

Activity 4.2: Stakeholder training and technical workshops	IE1: 10 days IE2: 10 days IE3: 10 days IE4: 10 days NE1: 5 days NE2: 5 days NE3: 5 days NE4: 5 days NE5: 5 days NE6: 5 days				8,141	9,046
Activity 4.3: Final report and result dissemination	IE1: 7 days IE2: 7 days IE3: 7 days IE4: 7 days NE1: 5 days NE2: 5 days NE3: 5 days NE4: 5 days NE5: 5 days NE6: 5 days	Workshop, international, 7days	Technical Workshop and final in-person presentations, international, 5 days		17,728	19,698
Estimated range of costing for the entire Response Plan					224,922	249,914

5. Profile and experience of experts

Experts required	Brief description of required profile
International Experts	
Project leader (IE1)	- Master's degree or higher in materials science (e.g., materials synthesis, characterization), or equivalent professional experience

	- More than 10 years of experience in conducting various projects and working in the field of valuable resource recovery technologies - Experience in planning and organizing workshops and technical training sessions - Work experience in Uzbekistan is preferred - Excellent English writing and communication skills
Expert in Desalination (IE2)	- Master's degree or higher in environmental fields (e.g., water treatment, environmental conservation), or equivalent professional experience - More than 10 years of experience in conducting various projects and working in the field of valuable resource recovery technologies - Experience in planning and organizing workshops and technical training sessions - Work experience in Uzbekistan is preferred - Excellent English writing and communication skills
Expert in Process Design (IE3)	- Master's degree or higher in chemical engineering (e.g., process design and optimization), or equivalent professional experience - More than 10 years of experience in conducting various projects and working in the field of valuable resource recovery technologies - Experience in planning and organizing workshops and technical training sessions - Work experience in Uzbekistan is preferred - Excellent English writing and communication skills
Researcher in Resource recovery (IE4)	- Final-year undergraduate student or degree holder in materials science (e.g., materials synthesis, characterization), or a related field - Relevant academic training or internship experience in projects related to valuable resource recovery technologies - Excellent English writing and communication skills
National Experts	
Expert in Desalination (NE1)	- Master's degree or higher in engineering fields (e.g., water treatment, environmental conservation), or equivalent professional experience - More than 10 years of experience in implementing various projects and working in the field of high-salinity water treatment - Ability to review compliance with environmental regulations and policies, including analysis of permitting and approval requirements necessary for system operation

	- Resident of Uzbekistan with strong understanding of the Paris Agreement, Nationally Determined Contributions (NDC), and/or National Adaptation Plans (NAP) - Excellent English writing and communication skills
Expert in Climate change (NE2)	- Master's degree or higher in environmental fields (e.g., environmental impact assessment of applied technologies), or equivalent professional experience - More than 10 years of experience in evaluating environmental improvements resulting from the adoption of climate technologies - Proven ability to identify and quantitatively assess environmental impacts, evaluate environmental improvements from climate technology adoption, and review environmental risks and mitigation measures - Resident of Uzbekistan with strong understanding of the Paris Agreement, Nationally Determined Contributions (NDC), and/or National Adaptation Plans (NAP) - Excellent English writing and communication skills
Expert in Resource recovery (NE3)	- Master's degree or higher in engineering fields (e.g., resource recovery), or equivalent professional experience - More than 10 years of experience in conducting various projects and working in the field of resource recovery - Ability to review compliance with environmental regulations and policies, including analysis of permitting and approval requirements necessary for system operation - Resident of Uzbekistan with strong understanding of the Paris Agreement, Nationally Determined Contributions (NDC), and/or National Adaptation Plans (NAP) - Excellent English writing and communication skills
Gender expert (NE4)	- Master's degree in gender studies or a related field with a focus on gender issues - More than 5 years of experience in gender research or gender equality policy management - Resident of Uzbekistan with a good understanding of the Paris Agreement, Nationally Determined Contributions (NDC), and/or National Adaptation Plans (NAP) - Excellent English writing and communication skills
Socio-economic analysis expert / Communication expert (NE5)	- Master's degree or higher in social or economic analysis, or equivalent professional experience - Expert with more than 10 years of experience in social and economic analysis - Strong communication skills preferred; fluency in Uzbek, Russian, English, and Korean is an advantage - Resident of Tashkent, Uzbekistan with a good understanding of the Paris Agreement, Nationally Determined Contributions (NDC), and National Adaptation Plans (NAP), and the available and prepared for frequent and long-term travel

Financial analysis expert (NE6)	- Master's degree or higher in financial analysis, or equivalent professional experience - Expert with more than 10 years of experience in financial analysis - Resident of Uzbekistan with a strong understanding of the Paris Agreement, Nationally Determined Contributions (NDC), and National Adaptation Plans (NAP) - Excellent English writing and communication skills

6. Intended contribution to impact over time

The proposed technical assistance is expected to contribute to long-term environmental, social, and economic impacts by enabling the application of climate-resilient technologies for groundwater desalination and resource recovery in Uzbekistan. Through the introduction and adaptation of context-appropriate desalination and resource recovery technologies, the project will:

1. **Enhance water security** in regions affected by water scarcity and salinity, particularly in industrial and agriculturally important areas. This will reduce dependency on unsustainable groundwater extraction practices and diversify water supply sources.
2. **Support low-carbon and climate-resilient development** by demonstrating alternatives to conventional high-energy-intensity water treatment technologies. The application of CO_2-utilizing or gas-hydrate-based methods aligns with Uzbekistan's NDC goals and national adaptation priorities.
3. **Enable circular resource use** by recovering valuable elements from brine concentrate, turning waste streams into economic opportunities—especially relevant in mineral-rich regions.
4. **Build local technical capacity** through training, technology transfer, and stakeholder engagement, creating a foundation for scaling the solutions across the country.
5. **Strengthen institutional collaboration** between national stakeholders, technical agencies, and international partners, promoting long-term cooperation in climate technology development and deployment.

Over time, the successful implementation and demonstration of the pilot system is expected to pave the way for broader replication across similar high-salinity and water-stressed regions in Uzbekistan, contributing directly to national sustainable development goals and global climate commitments.

7. Relevance to NDCs and other national priorities

The proposed technical assistance is aligned with Uzbekistan's Nationally Determined Contributions (NDCs), which emphasize climate change adaptation, efficient water resource management, and the deployment of environmentally sound technologies.

Specifically, the project supports the following national priorities:

1. **Climate Adaptation through Water Security** The project directly addresses growing water scarcity challenges by enabling access to alternative water sources through groundwater desalination, contributing to the country's water resilience objectives under the NDC and national adaptation strategies.
2. **Low-Emission, Climate-Resilient Technologies** By introducing CO_2-utilizing or gas hydrate-based desalination technologies, the project contributes to the transition toward low-emission, climate-resilient water infrastructure in line with Uzbekistan's climate technology roadmap.
3. **Sustainable Resource Management** The recovery of valuable elements from concentrate/brine streams supports the sustainable use of natural resources, contributing to the national circular economy agenda and sustainable development goals (SDGs).
4. **Capacity Building and Technology Transfer** Through technical training and stakeholder engagement, the project builds institutional and human capacity to implement climate technologies, which aligns with Uzbekistan's national strategies for science, innovation, and green technology uptake.

In addition, the project contributes to Uzbekistan's **National Adaptation Plan (NAP)** and **Water Sector Development Strategy**, particularly in supporting decentralized, energy-efficient, and climate-responsive water treatment solutions in vulnerable regions.

8. Linkages to relevant parallel on-going activities:

The proposed technical assistance builds upon and complements several national and international initiatives related to water security, sustainable resource use, and climate resilience in Uzbekistan. Key linkages include:

1. **Uzbekistan's National Water Sector Development Strategy (2020–2030)** The project aligns with ongoing national efforts to improve water governance, promote efficient use of water resources, and implement innovative water treatment solutions, especially in water-stressed regions.
2. **Nationally Determined Contributions (NDC) Implementation Projects** The proposed activities reinforce other climate adaptation efforts currently underway in Uzbekistan under its NDC, particularly those related to water resource adaptation and decentralized treatment technologies.
3. **UN and Donor-supported Programs** This project can complement initiatives led by organizations such as UNDP, GIZ, ADB, and the World Bank that support water access, rural infrastructure, and climate adaptation in Uzbekistan. It may offer technical synergies or site-based collaboration opportunities.
4. **Ongoing Bilateral and Regional Research Collaboration** The technical assistance also draws on prior and ongoing collaboration between Korean institutions (e.g., KITECH) and Uzbek stakeholders, particularly in research on high-salinity water treatment, CO_2 utilization, and mineral recovery.

By ensuring strategic alignment and avoiding duplication, the project is designed to enhance coordination and maximize the impact of broader national and international efforts aimed at addressing climate-related water and resource challenges in Uzbekistan.

9. Anticipated follow up activities after this technical assistance is completed:

Upon completion of the technical assistance, a series of follow-up activities will be pursued to ensure the continuity, replication, and upscaling of the outcomes achieved during the project. Key anticipated follow-up activities include:

1. **Pilot System Deployment and Demonstration** Based on the feasibility assessment and engineering design completed during this TA, the full-scale pilot system will be constructed and operated at the selected site(s), allowing field-level performance validation and public demonstration.
2. **Replication in Other Regions** The results and lessons learned from the pilot implementation will be used to replicate the model in other high-salinity or water-stressed regions across Uzbekistan.
3. **National Policy and Investment Linkages** The outcomes will inform relevant government agencies and donors to support the integration of climate-resilient desalination and resource recovery technologies into national water and resource strategies.
4. **Capacity Expansion and Institutional Engagement** Continued training, stakeholder engagement, and technical support will help strengthen institutional capacity and prepare the ground for long-term programmatic interventions.
5. **Proposal Development for Scaling-Up** Building on this TA, a full project proposal (e.g., for GCF, GEF, KOICA, or other bilateral donors) will be prepared to secure funding for large-scale deployment.

10. Gender and co-benefits:

Imbedded in design of the activities:	A gender mainstreaming approach is fully embedded in the design of this technical assistance. In accordance with CTCN requirements, a gender expert will be assigned to conduct a comprehensive gender analysis and develop a Gender Action Plan (GAP) that will guide implementation throughout the TA period. The gender mainstreaming approach will include the following components: 1. **Analysis of Gender Disparities** The project will assess gender disparities in the context of access to water resources, technical training, and decision-making processes. Socio-economic and institutional barriers to women's participation in the water and environmental sectors will be identified. 2. **Gender-disaggregated Data Collection:** Gender-disaggregated data will be collected during stakeholder mapping, training, and participation tracking to ensure that the project addresses the specific needs, roles, and responsibilities of different gender groups. 3. **Adaptive and Gender-responsive Design:** The TA will be implemented using inclusive strategies that support the active engagement of women and marginalized groups. Project activities such as training, workshops, and pilot demonstrations will be designed to empower women and promote their participation in climate technology fields. 4. **Gender and Innovation Ecosystem:** By introducing climate-resilient water technologies and resource recovery processes, the TA aims to create opportunities for women to participate as technicians, operators, and potentially entrepreneurs in water and environmental sectors. 5. **Gender Budgeting:** At least 5% of the overall TA budget will be allocated to gender-responsive activities, including training programs, expert analysis, community outreach, and monitoring of gender-related outcomes. This gender-inclusive approach will be operationalized through specific activities outlined in Section 3 of the Response Plan, including gender-responsive stakeholder engagement, capacity building, and policy dialogue.
Gender and co-benefits intended as result of the activities:	The CTCN technical assistance is expected to result in the following gender-specific and broader co-benefits: 1. **Gender-related Benefits** Improved water access in underserved regions will reduce the time and physical burden on women traditionally responsible for household water collection. Women's participation in technical training and water governance will be enhanced through targeted engagement efforts, contributing to gender equity in climate-related sectors. 2. **Environmental Co-benefits** Sustainable management of groundwater and proper brine handling will prevent ecosystem degradation, reduce soil salinization, and support local biodiversity conservation. 3. **Social and Health Co-benefits** Better access to safe water will improve community health and reduce vulnerability to climate-induced water stress, especially in remote and marginalized areas. 4. **Economic Co-benefits** Resource recovery from concentrate streams may lead to the development of local value chains, creating

	economic opportunities for both women and men, particularly in rural and mining-adjacent regions. 5. **Capacity and Institutional Co-benefits** The project will strengthen institutional capacity for gender-responsive climate technology deployment, laying the groundwork for sustainable, inclusive climate adaptation programs.

11. Main in-country stakeholders in implementation of the technical assistance activities:

In country stakeholder	Role in implementation of the technical assistance
National Designated Entity (Uzhydromet)	The NDE serves as the primary liaison between Uzbekistan and the Climate Technology Centre and Network (CTCN). Its role involves coordinating the technical assistance process, ensuring that the project aligns with national climate goals and policies. The NDE is also responsible for facilitating communication among stakeholders, securing necessary approvals, and assisting in integrating the outcomes of the technical assistance into national strategies.
Request Applicant (HYDROENGEO)	HYDROENGEO, as the request applicant, is responsible for the on-ground execution of the technical assistance. This includes providing technical expertise, overseeing pilot project implementation, and managing local resources. HYDROENGEO will work closely with the NDE and other stakeholders to ensure the smooth operation of the project and to adapt technologies to local conditions. Additionally, HYDROENGEO will monitor and report on project progress, including the collection and analysis of data from pilot demonstrations.
Ministry of Water Resources	This ministry will support the technical assistance by providing regulatory guidance and sharing relevant data on water resources. It will help align the technical assistance with Uzbekistan's water management policies and provide insights into the feasibility and scalability of water treatment technologies in the national context.
Local Water Management Authorities	Local authorities will assist in implementing pilot projects by offering access to specific sites and supporting data collection. They will also facilitate community engagement and support in operating the technologies introduced during the pilot phase.
Environmental Protection Agency	This agency will oversee environmental assessments to ensure that the introduced technologies comply with national environmental regulations. They will also play a role in evaluating the environmental impact of resource recovery and water treatment technologies.

Local Communities and Farmers	Engaging local communities and farmers is crucial for project success, as they are directly impacted by water scarcity and soil salinization. They will participate in training sessions, provide feedback on technology effectiveness, and help promote sustainable practices in water use and resource recovery.

12. SDG Contributions:

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)
1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	The project addresses water scarcity and salinity issues by introducing climate-resilient groundwater desalination technologies in underserved and high-demand regions.
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	
	7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	
	7.3 - By 2030, double the global rate of improvement in energy efficiency	
	7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
	7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	
11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	By recovering valuable elements from brine concentrate and reducing waste discharge, the project promotes resource efficiency and circular economy principles in water treatment.
13	Take urgent action to combat climate change and its impacts	
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	The project contributes to climate adaptation by enhancing resilience to water stress and supporting the use of low-emission technologies.
	13.2 - Integrate climate change measures into national policies, strategies and planning	
	13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	
	13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing	

	countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

13. Classification of technical assistance:

Please tick off the relevant boxes below	*Primary*	*Secondary*
☐ 1. Decision-making tools and/or information provision	■	☐
☐ 2. Sectoral roadmaps and strategies	☐	☐
☐ 3. Recommendations for law, policy and regulations	☐	■
☐ 4. Financing facilitation	☐	■
☐ 5. Private sector engagement and market creation	☐	■
☐ 6. Research and development of technologies	■	☐
☐ 7. Feasibility of technology options	■	☐
☐ 8. Piloting and deployment of technologies in local conditions	☐	■
☐ 9. Technology identification and prioritisation	■	☐

14. Monitoring and Evaluation process

Upon contracting of the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. The monitoring and evaluation plan must include specific, measurable, achievable, relevant, and time-bound indicators that will be used to monitor and evaluate the timeliness and appropriateness of the implementation. The CTCN Technology Manager responsible for the technical assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by the (i) NDE about overall satisfaction level with the technical assistance service provided; and (ii) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance. Furthermore, the NDE together with the project proponent(s) will complete a periodic post-implementation form to track the impact of the activities beyond the technical assistance end date.