
*SALINE WATER PURIFICATION TECHNOLOGY AT HOUSEHOLD LEVEL AND LOW-
COST DURABLE HOUSING TECHNOLOGY
FOR COASTAL AREAS OF BANGLADESH*

PROJECT INCEPTION REPORT



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1. INTRODUCTION

1.1 PROJECT BACKGROUND

Over the last few decades, climate change has been a much-discussed topic in the international arena. The impacts of climate change, including changes in precipitation patterns, elevated oceanic and atmospheric temperatures and exacerbated extreme weather events are affecting everyday life directly.

To address climate change and its impacts, an international treaty called “The United Nations Framework Convention on Climate Change (UNFCCC)” was adopted at the Rio Earth Summit in 1992. UNFCCC entered into force in March 1994 and launched negotiations to strengthen the global response to climate change, resulting in the adoption of the Kyoto Protocol in 1997 which binds developed countries to emission reduction targets. Parties to the Convention continue to meet regularly to take stock of the progress in implementing their obligations under the treaty and to consider further actions to address the climate change threat.

To mitigate climate change and to adapt to its impacts, UNFCCC’s continual negotiation process focuses on a number of topics. One of the topics is Climate Technology where the Parties discuss ways to promote and cooperate in the development and transfer of technologies which reduces GHG emissions.

In 2010, the COP 16 established the Technology Mechanism which consists of two bodies – a policy arm, Technology Executive Committee (TEC), and an operational arm, Climate Technology Centre and Network (CTCN).

The CTCN was established in December 2010, at the COP 16 in Cancun, Mexico. The Center (CTCN Secretariat) is located in the UN City in Copenhagen, Denmark and it is hosted by UNIDO and UN Environment. The CTCN consists of two parts: a center—a coordinating entity located in the UN City Copenhagen—and a worldwide network of organizations that delivers CTCN services—both virtually and actually. In short, the center operates the network, and together they constitute the CTCN.

CTCN promotes accelerated development and transfer of climate technologies at the request of developing countries for energy-efficient, low-carbon and climate-resilient development. It also provides technical assistance (TA) in response to requests submitted by developing countries via their nationally-selected focal points, or National Designated Entities (NDEs). Upon receipt of such requests, the Centre quickly mobilizes its global Network of climate technology experts to design and deliver a customized solution tailored to local needs.

In line with this opportunity, Bangladesh, one of the most vulnerable countries to climate change, submitted a request to CTCN on 12 September 2016 for technical assistance (TA) in designing and delivering saline water purifying technology and saline resistant low-cost

durable housing technology which are compatible and affordable at household level.

The Palli Karma-Sahayak Foundation (PKSF) is a not for profit organization established by the Government of Bangladesh. A part of PKSF's mandate is to enhance the capacities of the poor regarding the adverse impacts of climate change. However, a lack of technical knowledge hinders the identification and introduction of affordable climate-resilient housing and desalinization technologies.

Therefore, the government of Bangladesh, together with PKSF, has requested technical assistance from the CTCN to identify and support the use of appropriate technologies in these coastal communities.

1.2 PROBLEM STATEMENT

Bangladesh is a low-lying country comprising mainly of the delta of the Ganges and Brahmaputra rivers. Floodplains occupy 80% of the country, and the elevation of two-thirds of the nation is less than 5 meters above sea level, meaning that nearly 28% of Bangladesh's inhabitants live in coastal zones. With the unique geographical characteristic, climate change makes the country more exposed to climate risks such as floods, cyclones, and soil salinization. As a result, Bangladesh is highly vulnerable to climate impacts, affected by various different types of natural disasters and environmental issues, and unfortunately many of the issues hinder the development of Bangladesh.

In Bangladesh, the increasing salinity of soil and water in the coastal areas has emerged as a serious problem. The poor population is facing challenges due to the inadequate housing to cope with the climate change disaster as well as water scarcity caused by salinization of ground water and other water sources. Houses in coastal zones are often not built climate resilient due to lack of knowledge or funding.

[Water-related challenges] Salinity intrusion in the coastal areas increased significantly, while freshwater flow from upper riparian tributaries is gradually decreasing. As a consequence, land is becoming saturated with saline water and potable water is becoming scarcer, leading to shortages of drinking and irrigation water which can bring a change in aquatic ecosystems. Salinity in water has a severe impact on vulnerable groups including women and children of poor households and also cause for major health hazards including high blood pressure. To tackle this problem, installation of desalination plants and community ponds were sought and carried out. It had, however, limited impacts especially in the areas with low population density and in the time of disaster due to lack of technical capacity for the operation of the plant and 3-4 kilometers of long-distance walking to fetch the water. In addition, these plants are expensive, hence up-scaling and installing on a large scale is not an option.

[Climate vulnerable housing] Low-cost climate-resilient housing is another important issue. Due to the high level of poverty, many houses are made of low-quality local wood, and bricks made from a mixture of local sand and saline water, unable to withstand disasters such as cyclones or storm surges. In case of wooden buildings, the floor is raised up from the ground, and the roof is relatively large in triangular to avoid from being wet. During the rainfall

monsoon season, there are various housing problems such as collapsing walls and leaking water from the roof, while during the dry season making the structures fragile.

The National Determined Contribution (NDC) of Bangladesh submitted in 2015 has set a national target for 15% reduction in GHG emissions from BAU levels by 2030 with the aim of protecting population and also enhancing adaptive capacity and livelihood options. The NDC sets out adaptation priorities of the country which includes climate resilient housing, adaptation on local-level perspectives, and adaptation to climate change impacts on health.

TABLE: BANGLADESH’S ADAPTATION PRIORITIES (INDC, 2015)¹

ADAPTATION PRIORITY
<ul style="list-style-type: none"> - Improved early warning system for tropical cyclone, flood, flash flood and drought - Disaster preparedness and construction of flood and cyclone shelters - Tropical cyclones and storm surge protection - Inland monsoon flood-proofing and protection - Climate resilient infrastructure and communication - Climate resilient housing - Improvement of urban resilience through improvement of drainage system to address urban flooding - River training and dredging (including excavation of water bodies, canals and drains) - Stress tolerant (salinity, drought and flood) variety improvement and cultivation (including livestock and fisheries) - Research and knowledge management - Adaptation on local-level perspectives etc. - Adaptation to climate change impacts on health - Biodiversity and ecosystem conservation - Capacity building at individual and institutional level to plan and implement adaptation programmes and projects in the country

The Technology Needs Assessment (TNA) also, identifies saline water intrusion as a priority action to increase coastal zone vulnerability. To tackle this issue, desalinization of drinking water in coastal areas was selected as a prioritized adaptation technology for the water sector. According to the TNA, the upstream flows in the coastal rivers have been drastically reduced due to the construction and the operation of Farakka Barrage. This, in turn, resulted in an increase of saline concentration in the rivers outside and adjacent to polders during dry season. It is expected that finding and applying desalinization technologies for drinking water will reduce water-borne diseases, reduce salt intake and bring health benefits by helping to reduce high blood pressure of the inhabitants.

The Coastal Zone Policy, formulated in 2005, provides general guidance for management and development of the coastal zone in a manner that people from the coastal zone can pursue their lives within secure and conducive environment. It also identifies critical impacts of climate change and sea level rise, such as increased drainage congestion, reduced fresh

¹ Government of the People’s Republic of Bangladesh. 2015. Intended Nationally Determined Contributions (INDC).

water availability, disturbance of morphological processes, and increased intensity of extreme events and disasters.

The CTCN technical assistance is in line with the prioritized needs of Bangladesh by assessing technologies related to desalinization of water and durable housing for the coastal area of Bangladesh.

2. PROJECT OVERVIEW

2.1 OBJECTIVE

The objective of the Technical Assistance (TA) is to support the climate vulnerable coastal areas of Bangladesh and the Palli Karma-Sahayak Foundation (PKSF, the project proponent) with the identification and introduction of household level desalination technique(s) as well as low-cost salinity proofed housing option(s) in coastal areas of Bangladesh

The main outcomes of the TA will be i) identification and prioritization of technologies (a. climate-resilient housing, b. low-cost purification of saline water), ii) increased capacity of relevant stakeholders in technology transfer and operation, and iii) project concept designed to scale-up and attract investment for deployment of technologies.

2.2 OUTPUTS AND ACTIVITIES OF THE PROJECT

OUTPUT 1: ENGAGEMENT OF NATIONAL LEVEL AND DISTRICT LEVEL STAKEHOLDERS

Activity 1. National level inception workshop

This activity will launch a national level of inception workshop to ensure a mutual understanding of proposed activities, method for implementation and expected outputs from the CTCN technical assistance. Relevant stakeholders such as central and local government officers, public research institutes, NGOs, and etc.

The programme and the participant list will be decided in consultation with the NDE and the PKSF.

Activity 2. District level kick-off meetings

This activity will hold district-level kick-off meetings in the districts of Bagerhat and Satkhira with potential participants from the national and local government as well as the non-

governmental sector. This meeting is to understand specific needs and situation of housing and salinization of the water. It is also to identify local stakeholders to collaborate during this TA and who will be the local champions to contribute to the sustainability of the outcome of this TA. Through these meetings, current local situation and on-going efforts on available technologies and barriers will be better understood and captured.

The deliverables from the first activity are the stakeholder engagement report and project inception report.

OUTPUT 2: IDENTIFICATION AND PRIORITIZATION ON THE MOST PROMISING AND LOW-COST DOMESTIC CLIMATE-RESILIENT HOUSING TECHNOLOGY SOLUTIONS FOR THE LOCAL CONDITIONS

Activity 1. Technology solution review and identification

The activity will be conducted through literature review on existing low-cost domestic climate-resilient housing technology solutions used in other countries and analyze their suitability and applicability in the context of coastal regions of Bangladesh. A set of 5 to 10 relevant technology solutions will be identified, which have potential relevance for the geophysical, social, economic and cultural context of coastal Bangladesh.

Activity 2. Field study

During this activity, the project team will perform a field study and surveys on the local residential environment, the status of building materials, production infrastructure and building systems. Along with this, the the project team attempts to meet relevant stakeholders in order to understand the local settings of Bangladesh. The local consultants recommended by the PKSf will participate in the planning and implementation of the field study. The location for the field visit will be decided in consultation with the local consultants, the PKSf and the NDE.

Activity 3. Description of technology options

This activity will review different technologies and develop a performance standard and criteria for optimal construction materials, considering the local residential environment. The PKSf and local consultants will be consulted during this activity.

Activity 4. Technology prioritization

This activity will prioritize a number of climate resilient low-cost climate technology solutions based on strategic prioritization criteria with guidance from the National Designated Entity, PKSf, and CTCN. The PKSf will provide review on the prioritized technology options.

Activity 5. Detailed information and instructions

For each of the prioritized solutions, this activity will provide greater depth of information, including detailed step by step instructions in English and Bengali and images for installing them, which can be adapted into learning materials that local actors and PKSf could utilize to conduct household level trainings for local community members.

The deliverables from these activities are as following:

- A fact-finding report on low-cost housing technology solutions implemented nationally and in other countries including a list of relevant stakeholders involved, information on local requirements and context for low-cost housing technology solutions, and a set of prioritization criteria for low-cost housing technology solutions
- Reports from consultations with stakeholders
- Recommendation for conceptual and operational design information along with features and minimum specifications such as building design, construction materials and building construction for low-cost housing technology solutions applicable for coastal Bangladesh

OUTPUT 3: IDENTIFICATION AND PRIORITIZATION OF THE MOST PROMISING AND LOW-COST TECHNOLOGIES FOR PURIFICATION OF SALINE WATER AT HOUSEHOLD LEVEL

Activity 1. Technology solution review and identification

This activity will identify a set of relevant technology solutions for purification of saline water at the household level, drawing from emerging and known approaches in other countries, which have potential relevance for the geophysical, social, economic and cultural context of coastal Bangladesh. This activity will include an analysis of the national / local circumstances in Bangladesh.

Activity 2. Field study

During this activity the project team will visit selected districts and intervention areas to understand the local settings of coastal Bangladesh, the cultural and economic setup, and severity of the problem. The project team aims to meet the different relevant public, governmental and non-governmental stakeholders and gain relevant experiences and practices. The local consultants recommended by the PKSf will participate during the planning and implementation of the field study. The location for field visit will be decided in consultation with the local consultants, the PKSf and the NDE.

Activity 3. Description of technology options

During this activity the project team will identify major water-related challenges of the target community and study socio-economic and cultural set-up of the community. Then, the

project team will review possible technology options for purification of saline water at the household level according to level of salt concentration and cross-check on the availability of cheaper options from freshwater harvesting.

Activity 4. Technology prioritization

During this activity the project team will review different technologies and compare them considering the local context. Then, the project team will file the best experiences and findings on the technologies, for purification of saline water at the household level, implemented nationally and internationally, including a list of relevant stakeholders being involved, information on the local requirements, context for purification of saline water at household level, and prioritization criteria for technologies of purification of saline water at household level. The PKSf and local consultants will be consulted during this activity.

Activity 5. Detailed information and instructions

During this activity the project team will provide greater depth of information for each of these prioritized solutions, including a detailed cost estimation and detailed step by step instructions in English and Bengali and images for applying them in the field, which can be adapted into learning materials that local actors and PKSf could utilize to conduct the training of household level local community members.

The deliverables from these activities are as follows:

- An analysis of the national / local circumstances in Bangladesh.
- Fact-finding report on technologies for purification of saline water at the household level implemented nationally and in other countries including a list of relevant stakeholders involved, information on the local requirements and context for purification of saline water at household level, and prioritization criteria for technologies for purification of saline water at household level according to level of salt concentration
- Reports from consultations with stakeholders on prioritized technology according to local water and economic situation
- Conceptual and operational design information along with features and minimum specifications for technologies for purification of saline water at household level applicable for coastal Bangladesh along with predicted efficiency and predicted operation cost (*in English and Bengali*)

OUTPUT 4: CAPACITY BUILDING OF COMMUNITIES ON PROPOSED TECHNOLOGY SOLUTIONS AND IDENTIFICATION OF POSSIBLE SITES FOR FUTURE PILOT PROJECT

Activity 1. Training workshop

Based on the identified technology solutions, this activity will design and provide training which will be held in Dhaka for 2 days, in cooperation with PKSf and DoE for 40 to 50 relevant stakeholders (including government officials, researchers, experts, technicians etc.)

to ensure that the technology is transferred to the appropriate target beneficiaries using the right training technique.

Activity 2. Pilot site identification

This activity will identify appropriate sites for piloting of the proposed solutions, in cooperation with PKSf and DoE.

The deliverables from these activities are as following:

- Set of training materials used during the training
- Training report describing the topics covered, participants, outputs, challenges, and successes
- List of potential sites for piloting of the proposed solutions

OUTPUT 5: SUPPORT TO IDENTIFYING FINANCING OPPORTUNITIES TO UPSCALE THE DEPLOYMENT OF TECHNOLOGIES IDENTIFIED

Activity 1. Development of private sector engagement strategy

This activity will develop a strategy for mobilizing sustainable funding for the identified technologies, based on the findings and products produced through activities 1 to 5. Especially, the activity will create a connection with possible interested private sector actors for the deployment of these technologies. Considering the extensive project experience of the project proponent in the targeted region, identifying private sector actors will be carried out in collaboration with the project proponent.

Activity 2. Development of rationale for GCF involvement

Since participation of GCF is crucial in attracting private investors, this activity will develop a rationale for GCF involvement.

Activity 3. Development of general concept document to present to development aid agencies and private investors

In order to introduce the project to different stakeholders, this activity will prepare a project concept document. Then, consultation and presentation will be conducted based on the document.

The NDE and the project proponent will be consulted during the development of the project concept document. Also, the engagement strategy of the development aid agencies and private investors will be developed together with the project proponent and the NDE to reflect national/sectoral development plan or priorities.

Activity 4. Development of GCF concept note

Considering the circumstances where private investment is difficult to mobilize, an approach for developing a public project will be suggested. A GCF concept note will be developed as follows:

- Consult with relevant stakeholders including Ministry of Finance (the National Designated Authority of the GCF), the NDE, PKSf, and etc. on the project scope, objectives, beneficiaries, involved stakeholders and preferable Accredited Entity (AE)
- Design a large-scale project concept under the guidance of the relevant stakeholders and develop a GCF concept note in accordance with the guidance and template provided by the GCF

Approach to the preferable AE to consult on the project concept and develop a private engagement strategy to create connection.

Activity 5. Stakeholder consultation workshop

This activity will be to hold a workshop for presenting the final outcome of the TA and the project concept to the relevant authorities and partners. This will also be the occasion to receive feedback on the project concept from the relevant stakeholders for further revision.

The deliverables from these activities are as follows:

- General project concept document (GCF format or other format based on the discussion with stakeholders)

2.3 ORGANIZATION OF THE PROJECT

PROJECT TEAM

To implement the CTCN TA project, the project team is comprised of skilled experts from various fields of climate change policy, climate resilient housing technology, low-cost saline water purification technology, capacity building and networking, global cooperation, finance strategy, and communication.

A consortium was set up to implement this project. It is comprised of three (3) organizations with different specialties: The Green Technology Center (GTC), the Korea Institute of Civil Engineering and Building Technology (KICT), and Glory & Tech.

Since its establishment, the GTC-K has engaged with broad ranges of public, private and finance partners and built expertise in climate technical cooperation with developing countries by carrying out climate technology project development for financing engagement including GCF's project preparation facility (PPF), master plans, feasibility studies and organizing capacity building workshops. GTC-K will take the lead on the project with partner institutions—Korea Institute of Civil Engineering and Building Technology (KICT) and Glory & Tech Co., Ltd. (GAT)—that have technical expertise in assessing, piloting and deploying

low-cost climate-resilient housing and saline water purification technologies in developing countries.

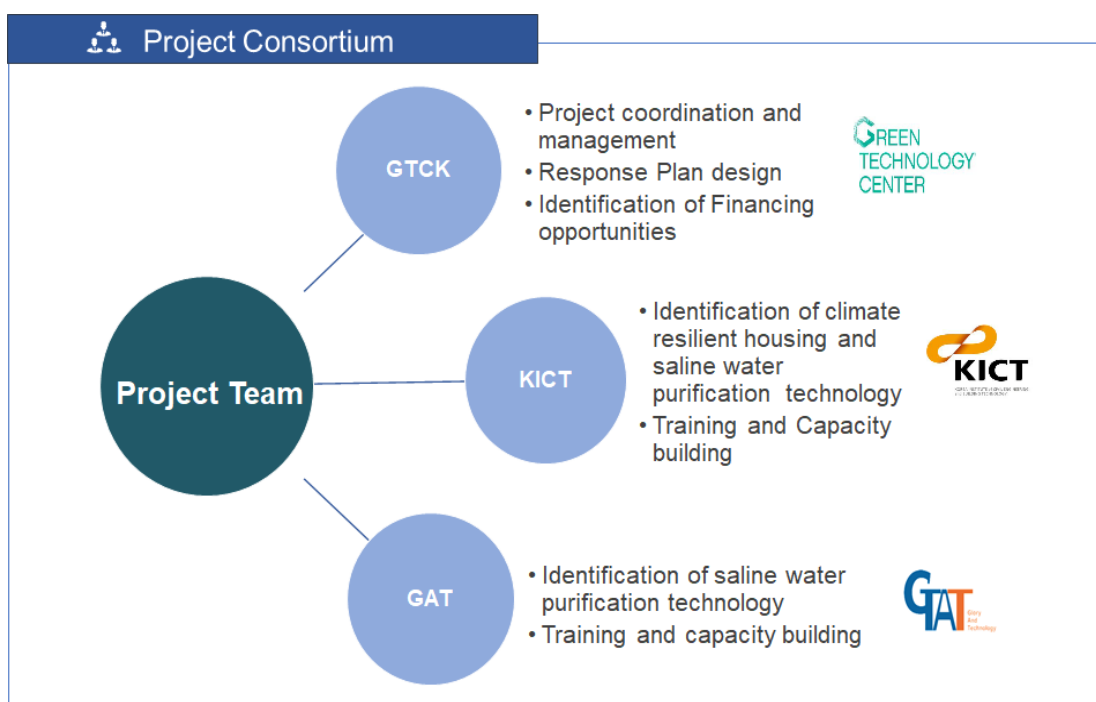
From the KICT, two (2) sub institutes will carry out the project.

The Building and Urban Research Institute of KICT emphasizes contributions to public development and quality of life enhancement by conducting research and development on buildings and cities for sustainable human habitat, structural stability, and high-performance energy saving materials, energy conservation, and resource management. It has established a foundation to create a new building culture that develops: institutions, policies, methods, products, evaluation techniques, and advanced technology applications. The Building and Urban Research Institute has involved in various projects with developing countries, such as 'Enhancing thermal properties of Mongolian housings (2015 GGGI), A Study on the standards of the salt resistant cement for saline damage prevention (2009-2010 KICT, Ssangyong Cement) , Energy-saving rural housing development project in Uzbekistan (2017 KICT, UZ materials), project of solar control window technology appropriate for the climate characteristics of Vietnam(2017 MOST in Vietnam), etc. These experiences will contribute to 'Technical Assistance for Saline water purification technology at a household level and low-cost durable housing technology for coastal areas of Bangladesh' in developing and disseminating affordable technology for enhancement of housing quality in Bangladesh.

Regarding saline water purification technology, the Environmental and Plant Engineering Research Institute of KICT and the Glory & Tech will work together to conduct a technology review.

Environmental and Plant Engineering Research Institute of KICT realizes various government policies and initiates research projects that help develop technologies to mitigate damage from natural disasters and resolve social issues. It has conducted benchmarking and concluded research agreements (MOUs) with well-known global research institutes and actively promotes academic exchanges for researchers that help find solutions to issues of a global nature. It has promoted basic and original research projects as well as convergence research projects in efforts that have successfully produced World's Best Technology (WBT). Environmental and Plant Engineering Research Institute develops core technologies to realize a creative economy, conducts research related to SOC on North Korea, and supports Korean led ODA.

Glory & Tech Co., Ltd. (GAT) is a private corporation founded in 2016 to solve problems related to water and energy of developing countries and operates various water and energy projects in countries including Cambodia, Myanmar, Vietnam, Mongolia, and the Philippines. GAT operates small-scale community water supply facilities in around 50 locations and school/village water supply facility in 10 locations in Cambodia, as well as school/village water supply facilities in Vietnam, Myanmar, Mongolia, and the Philippines. GAT possesses various types of filtering technologies for treating raw water such as groundwater, river water, and lakes into suitable drinking water according to water quality standards, and possesses desalination technologies based on RO, CDI, and ion exchange resins.



INVOLVED INCOUNTRY STAKEHOLDERS

In country stakeholder	Role in implementation of the technical assistance
Ministry of Environment	<i>Line ministry overseeing the implementation of the TA activities</i>
Ministry of Finance (Economic relations division)	<i>National Designated Authority (NDA) for GCF. Important stakeholder in scaling up the TA by supporting the submission of the GCF concept note.</i>
Department of Environment	<i>National Designated Entity (NDE), main direct beneficiary of the TA and main counterpart in the implementation of the TA</i>
Palli Karma-Sahayak Foundation (PKSF)	<i>Proponent and main direct beneficiary of the TA. Important role in scaling up the TA through financial support.</i>
Department of Public Health Engineering (DPHE)	<i>Responsible for water supply and sanitation in small towns and rural areas.</i>
Local Government Engineering Department (LGED)	<i>Responsible for planning and implementation of local level rural, urban and small-scale water resources infrastructure.</i>
Bangladesh University of	<i>Possessing expertise in civil engineering, BUET could provide advice on appropriate local</i>

Engineering and Technology(BUET)	<i>housing techniques.</i>
Bangladesh Rural Advancement Committee (BRAC)	<i>Being the largest NGO in the world, BRAC could provide advice on experience in conducting a similar project in the coastal area.</i>
House Building Research Institute (HBRI)	<i>A research institute on housing problems, innovation in construction materials, technology, and planning, able to provide advice on appropriate local housing techniques.</i>
Nowabnki Gonomukhi Foundation (NGF)	<i>A non-profit management organization accelerating finance for rural community poor people and supporting government agencies with experience in implementing desalination projects.</i>

2.4 WORK PLAN

	Activities	Month														
		12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
Output 1.	1.1 Detailed desk study															
Development of Response Plan	1.2 Inception mission in Bangladesh															
	1.3 Development of Response Plan															
	Output 2.	2.1 National level inception workshop														
Stakeholder Engagement	2.2 District level kick-off meetings															
	Output 3.	3.1 Technology solution review and identification														
Climate resilient housing technology solutions	3.2 Field study															
	3.3 Description of technology options															
	3.4 Technology prioritization															
	3.5 Detailed information and instructions on the prioritized solutions															
	Output 4.	4.1 Technology solution review and identification														
Purification of saline water technology solutions	4.2 Field study															
	4.3 Description of technology options															
	4.4 Technology prioritization															
	4.5 Detailed information and instructions on the prioritized solutions															
Output 5. Capacity Building	5.1 Training															
	5.2 Pilot site identification															
Output 6. Identifying financing opportunities	6.1 Development of private sector engagement strategy															
	6.2 Development of rationale for GCF involvement															
	6.3 Development of general concept document															
	6.4 Development of GCF concept note															
	6.5. Stakeholder consultation and presentation															
Output 5. Final Report	7.1 Final report															