Technical Assistance Response Plan - Terms of Reference

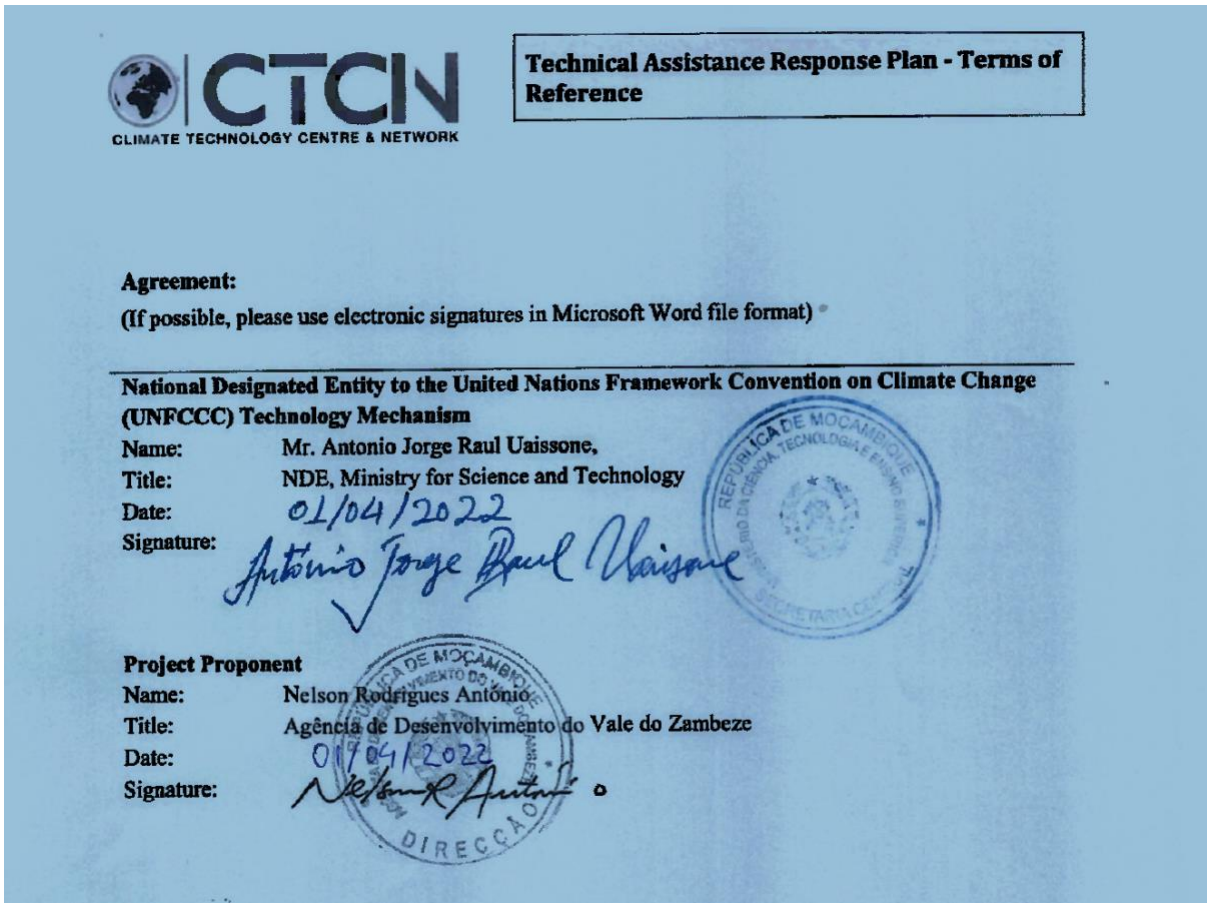
Country	**Mozambique**
Request ID#	**2022000005**
Title	Implementation of Water-Food-Energy nexus using digital technologies for local communities in Mozambique
NDE	National Designated Entity: Ministry for Science and Technology Focal point: Mr. Antonio Jorge Raul Uaissone E-mail: antonio.uaissone@mct.gov.mz Address: Av. Patrice Lumumba, 770, Maputo, Mozambique Telephone: +258 822 425530 Website: http://www.mct.gov.mz
Proponent	Nome da organização: Agência de Desenvolvimento do Vale do Zambeze Focal point: Nelson Rodrigues António, Technical and Financial Assistance Director E-mail:nelorod2006@gmail.com, Address: Tete, Av. da Liberdade nº 067, Telephone: +258843136792/ +258 86 4009461

Summary of Climate Technology Centre and Network (CTCN) technical assistance

The objective of this Technical Assistance is to develop a fit for purpose system for one selected farm in the including the Zambezi Valley in Mozambique that will include aquaponic, biodigester, bio composting, and hydraulic management systems (including water storage and solar pumping integrated systems for drip irrigation).

The TA will unfold through the following sequence of outputs:

1. Diagnose the need of the local farmers and benchmark international best practices
2. Develop a complete flowchart of the system that will include the collection and pumping of the water through photovoltaic system, the use of integrated reservoirs for fish production coupled with horticulture (Aquaponics), the generation of compost, and the generation of biogas and biofertilizers as well as organic food for the selected farm
3. Define a cost estimation of the fit-for-purpose system
4. Elaborate and disseminate training's materials and workshops



CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

Technical Assistance Response Plan - Terms of Reference

Agreement:

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

National Designated Entity to the United Nations Framework Convention on Climate Change (UNFCCC) Technology Mechanism

Name: Mr. Antonio Jorge Raul Uaissone,
Title: NDE, Ministry for Science and Technology
Date: 01/04/2022
Signature: António Jorge Raul Uaissone

Project Proponent

Name: Nelson Rodrigues António
Title: Agência de Desenvolvimento do Vale do Zambeze
Date: 01/04/2022
Signature: Nelson R António

Climate Technology Centre and Network (CTCN)

Name: Rose Mwebaza
Title: Director of CTCN
Date:
Signature:

1. Background and context

Notwithstanding the economic potential of Mozambique and the Zambezi Valley in particular, which translate into comparative and competitive advantages, the country has a high average illiteracy rate among the adult population compared to the average for the sub-Saharan region of around 53.6%, being higher in rural areas (65.7%) than in urban areas (30.3%) and more prominent in women (68%) than in men (36.7%) (IESE, 2015), this rate reduced to around 44.9% in 2015 with higher incidence in women (57.8%) compared to men in (30.1%) according to INE, which results in:

- Lack of capacity and technical knowledge for handling animal manure and other mechanisms that enable the production and/or sustainable use of renewable energies.
- Difficulty in disseminating and/or adopting sustainable technologies due to
  - **(i)** Absence of a local budget allocated to management committees or associations to increase the efficiency of the implementation of Climate Resilience programs;
  - **(ii)** Absence of a sustainable mechanism for the continuity of post-financing projects,
  - **(iii)** Absence of inter-institutional coordination and an integrated vision.
- Lack of basic information (about technical, environmental, economic, financial and social feasibility) on the technology diffusion process, which supports decision-making.

Measures or efforts to overcome major barriers:

- Improved research, implementation, dissemination, and adoption of innovative and sustainable technology.
- Establishment of adequate Training programs for Technicians (teachers, extension workers) of the different Sectors responsible for implementing the Technologies,
- Develop an efficient institutional mechanism, which optimizes the existing resources in the country, for the implementation of adaptation technologies.
- Prioritization and Provision of Adequate Financial Resources for different sectors and different levels of governance.
- Identification of a Financial Model that enables sustainable and continuous research as well as the Diffusion of Technologies.

2. Problem statement

Due to its geographic location, Mozambique is a country highly vulnerable to climate changes that are attributed to the long coastline, the existence of zones with altitude below sea level and inter-tropical convergence. In the period from 2018 to 2021, climate change manifests itself through extreme weather events such as Cyclone Idai (2019), Keneth (2019), Ana (2021), which caused 648 deaths, 1763 injuries, 273854 homes affected, 112 health units, 3984 classrooms destroyed, 376817 students affected and 770866 hectares of diverse crops were lost, droughts and floods associated with changes in temperature and rainfall patterns up to 279mm in 24 hours. The impact of extreme events is predicted to worsen in the future. This will affect the most vulnerable sectors which include agriculture, water resources and energy.

Future projections indicate that climate change will negatively affect productivity because of the deterioration of the production environment and, as a consequence, the region is highly dependent on agriculture and with a large part of the population in a situation of food insecurity.
Therefore, smart agricultural systems constitute all practices that help rural producers to restore degraded agro-systems and increase productivity, improve food security, adaptation and mitigation to climate change.

It is estimated that 80% of producers in the Central region of Mozambique, specifically in the Zambezi Valley, use motor pumps in the irrigation process, which significantly contributes to water pollution through the spillage of oils, lubricants and fuel. The use of fuels fossil (charcoal and firewood) contributes to atmospheric air pollution through the emission of greenhouse gases, without putting aside the massive use of inorganic fertilizers in the production process, with negative impacts on the environment and on the food chain of consumers. In turn, rural producers face a decline in productivity associated with seasonality of production and the lack of knowledge of integrated techniques, which translates into reduced incomes, increased greenhouse gas emissions, reduced carbon sequestration, and livelihoods are under pressure from loss of resilience.

3. Logical Framework for the CTCN Technical Assistance:

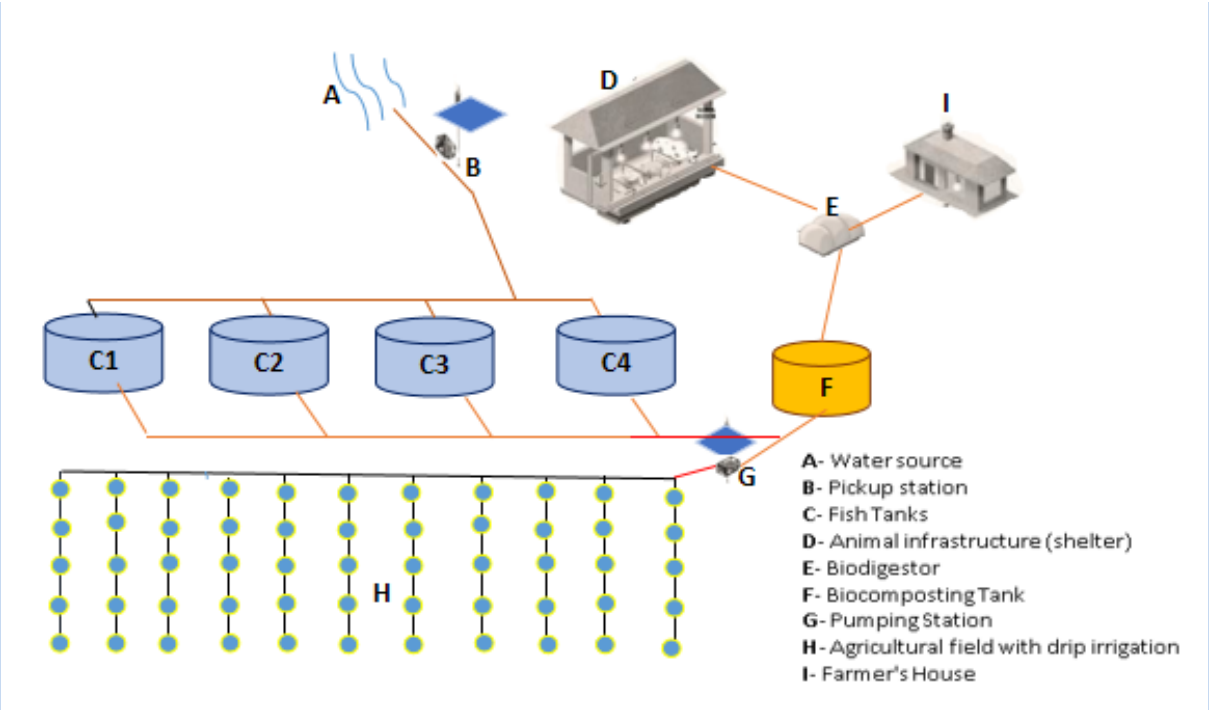
	Month[1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Goal: Develop a suitable system including 4 components: aquaponic, biodigester, bio composting, and hydraulic management systems (including water storage and solar pumping integrated systems for drip irrigation) in Moatize of the Zambezi Valley in Mozambique.															
Outcome: The results of the TA will include the benchmark of international best practices for similar holistic systems, the development of a complete flowchart of the system, the definition of the specifications of each technology, a cost analysis, and the elaboration of a detailed business model. Finally workshops and capacity building sessions as well as dissemination materials will be developed.															
Mandatory Output: Develop communication documents and implementation work plan															
Mandatory activities: *All implementers must undertake the following activities at the beginning and at the end of the CTCN technical assistance.* **Activity i**: A detailed implementation plan for all activities, deliverables, outputs, deadlines and responsible persons/organizations, including a gender study and an itemized budget for implementing the Response Plan. The detailed implementation plan and budget must be based directly on this Response Plan. **Activity ii**: Based on the work plan, a monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators should be developed to evaluate the timeliness and appropriateness of implementation. The indicators selected in the monitoring and evaluation plan should be aligned with the Closure and Data Collection Report template. This will enable the implementer to complete the CTCN Closure and Data Collection Report at the end of the technical assistance (please refer to Activity 1.4 and Section 14 of the Response Plan); **Activity iii**: A two-page description of the expected impact of the CTCN technical assistance prepared at the start of the assistance, updated at the end of the technical assistance (a template will be provided). **Activity iv**: A CTCN Closure and Data Collection report completed at the end of the technical assistance (a template will be provided).															

[1] The project timeline can be adjusted according to the level of development of the participating country.

Mandatory Deliverables:															
i) Implementation plan	X														
ii) Monitoring and evaluation plan	X														
iii) Impact description document (initial and final version)	X														X
iv) Closure and Data Collection Report															X
Output 1: TA coordination mechanism established and inclusive stakeholder working group formed															
Activity 1.1: Map relevant stakeholders and establish a stakeholder working group The activity will identify relevant stakeholders among governmental institutions at the national and sub-national levels, agriculture, and water sectors, as well as renewable energy technology experts, private sector, civil society, academic institutions, and beneficiaries.															
Activity 1.2 Create a stakeholder working group for the implementation of the Technical Assistance The working group shall be limited in number (6-8 persons maximum) and shall maintain a gender balance and an adequate representation from vulnerable groups. It will provide a technical overview and a high-level guidance at every stage of the implementation of the technical assistance. This stakeholder working group will include at least the NDE and the project proponent and should involve high level decision makers (from the ministry of water, agriculture, and renewable energy for example), as well as representation of the future users of the system (farmers in the selected area) and governmental officer of the selected commune.															
Activity 1.3: Conduct an inception meeting with the stakeholder working group An inception meeting will be organised, in-person, in the presence of at least one international expert, to present the goals, milestones, anticipated deliverables, and the role of the stakeholder working group. Outcomes of the inception meeting will be fed into the implementation plan elaborated under Activity i of the Mandatory output.															
Deliverable:															
1.1 Stakeholder mapping report containing a complete stakeholder list.	X														
1.2 List of the members of the stakeholder working group with their name, position, respective entities, contact details, role, and sector of expertise.	X														
1.3 Minute of the inception meeting with photos, list of participants, material used for the implementation		X													
Output 2: Diagnose the need of the local farmers and benchmark international best practices															
Activity 2.1 Benchmark international best practices of this kind of holistic systems, including 4 components: aquaponic, biodigester, bio composting, and hydraulic management systems (including water storage and solar pumping integrated systems for drip irrigation)															

During this activity, the implementer will benchmark international best practices of smart-agriculture processes that capture and pump water through photovoltaic systems for integrated fish production reservoirs coupled with horticulture (Aquaponics) integrated with animal production units (cattle, swine, goats and chickens), for the production of biogas, bio fertilizers and organic compounds, globally but with a special focus on countries with similar socio-economic, geographic and climatic conditions. The objective of this exercise is to analyse whether such systems have already been built in the country or elsewhere, gather useful lessons learnt, identify potential risks or barriers to be taken into account during the design phase of the system.	
Activity 2.2 Assess the needs of the future users The implementer will organize an on-site data gathering to visit at least 20 farms: Moatize (04), Mutarara (01), Barue (01), Chimoio (01), Vanduzi (02), Susundenga (01), Nhamatanda (02), Dondo (01), Gorongosa (01), Caia (04) and Nicoadala (02), in order to understand the current practices in all the concerned sectors of this TA, including: - Energy needs of these farms by month and consumption pattern - Water needs of these farms by month and consumption pattern - Size of agricultural lands (hectares)/ variety of crops/ number of harvests per year - Nº of heads for animal farms /animal raised / food required per year in tons. - Losses suffered by year (for the crops and the animals) and reasons - Perspective of growth for the farms? - Nº of members of the family - Etc These activities shall enable the implementer to fully understand the context of the local farmers (which will be the baseline) and based on this baseline, understand their needs and expectations on energy, water, animal food which will directly impact the size of the water management system required, as well as the biodigester and bio-composting components. This on-site visit should also enable the implementer to start prioritizing the farm for which a fit-for-purpose system could be designed.	
Activity 2.3 Organize a stakeholder consultation meeting at local level to select the unique farm for which a fit-for -purpose system will be designed. Following the discussion held by the stakeholder working group, another meeting, in the presence of the future users will be organized to select from the list of 5 farms, the unique site for which a fit-for purpose system including the collection and pumping of the water through photovoltaic system, the use of integrated	

reservoirs for fish production coupled with horticulture (Aquaponics), the generation of compost, and the generation of biogas and biofertilizers as well as organic food will be designed. At the end of this meeting, one farm would have been consensually selected to benefit from a fit-for purpose system design.															
Activity 2.4 Map the selected farm The implementer will use existing satellites data, GIS, cadastral data, topographic analysis to map the area of the selected farm in a very precise manner. In case such data would not be available, the implementer would analyse the possible options (including the use of drones for example) to map the selected area.															
Deliverable:															
2.1 Technological benchmarking of most suitable international best practices		X													
2.2 a. Needs assessment of the future users of the technology. 2.2 b. Minute of the on-site visit 2.2 c. Excel gathering primary data			X												
2.3 Stakeholder consultation at local level to select the farm for which the holistic system will be designed.				X											
2.4 Mapping of the selected area				X											
Output 3: Develop a complete flowchart of the system that will include the collection and pumping of the water through photovoltaic system, the use of integrated reservoirs for fish production coupled with horticulture (Aquaponics), the generation of compost, and the generation of biogas and biofertilizers as well as organic food for the selected farm															
Activity 3.1 Draft the possible architecture of the system for the selected farm Based on the previous activities, the implementer will start to design the architecture of the expected system that would ensure the collection and pumping of the water through photovoltaic system**,** the use of integrated reservoirs for fish production coupled with horticulture (Aquaponics), the generation of compost**,** and the generation of biogas and biofertilizers as well as organic food as a fit-for -purpose system for the selected farm. The architecture of the fit-for-purpose system should include, at least, but not limited to, all the components defined in the graphic provided below.															



- **Collection and pumping of water through photovoltaic systems**: it will be done next to the artificial or natural water source for the integrated fish production reservoirs, by means of a pump powered by photovoltaic systems. In order to make irrigation management sustainable, the system will be automated through the installation of a soil sensor module /relay module using megatronics technology. It will allow for availability of water for watering animals, filling fish ponds and domestic consumption.

- **Integrated reservoirs for fish production coupled with horticulture (Aquaponics)**: the circular tanks will be used for raising fish and fertigating vegetables (tomatoes, onions, peppers, cucumbers, potatoes, lettuce and green beans), thus developing, technical capacity of rural producers and extension workers on construction and management of integrated systems. To complete the system, circular fish tanks will receive a hydraulic ram (CH) and the respective discharge valve (VD) that will be coupled to the drip irrigation system for the renewal and drainage of water from the interior

of the reservoir and to irrigate an area of 5000m^2 for vegetable production (tomatoes, peppers, cabbage, carrots) which allows the production of expected 9.1 tons of food and generating a revenue of 223,875.00MZN/cycle expected. ▪ **Animal production units, production of biogas, biofertilizers and organic compounds**: From the animals raised by the producers, in facilities (such as goat, pen, pigsty and aviaries), built locally, the manure will be re-used to feed fish and generate biogas, biofertilizers and production of organic compounds, as a form of manure management and reduction of greenhouse gas emissions. The biodigester will allow the monthly production of biogas. This biogas should allow the beneficiary to prepare at least three meals a day, which generates savings around 1,600.00 mts/month. It will also have a homogenization and biofertilizer tank, a purification and moisture removal system. At least one operational system will be designed, and in case that different configuration could be used, a maximum of 5 system designs will be produced.	
Activity 3.2: Conduct a stakeholder working group meeting A stakeholder meeting will be conducted, in-person, to discuss the draft design of the system in presence of the stakeholder working group and the owner of the farm. Based on these discussions, one architecture should be selected, and improvements should be done to this architecture design. The stakeholder working group will discuss, comment, prioritize, improve the design of the system, identify possible other needs, risks, opportunities that should be taken into consideration in the architecture of the system.	
Activity 3.3 Review the selected architecture The implementer will review the architecture based on the selected design and comments gathered during the previous consultation meeting and will circulate the revised version of the system to the stakeholder working group and owner of the farm for further review, comments, improvements, until reaching a consensual approval on the architecture of the system.	
Activity 3.4 Select appropriate technologies and elaborate fact sheets of each component of the system Once the architecture of the fit-for-purpose system will be approved by the stakeholder working group and the owner of the farm, the implementer will prepare fact sheet of all the components that are necessary to the system. For each component, the implementer will benchmark the best technologies (selecting brands and products).	

The results of this process will be synthetized under matrices that will clearly demonstrate which technologies could ensure the different functions defined in the architecture. The report will also rank the technologies based on the results of the technology fact sheets and comparative matrices. Finally, the report will recommend the use of, at least one and maximum 3 technologies with clear explanations for the reasons of this choice, for each of the component of the system.															
Activity 3.5 Organize a stakeholder consultation to select the technologies An in-person meeting will be held with the stakeholder working group and the owner of the farm to present the existing technologies that could be used for the implementation of the system. When different technologies are available, the implementer should explain the pros and cons of the different options. The objective of this workshop will be to identify and select which technology should be used in the fit-for purpose system designed for the selected farm. Based on this selection, the implementer will be able to start working on a detailed cost estimation of the system.															
Deliverable:															
3.1 Draft architecture of the system for the selected farm (up to 5 possible options)							X								
3.2 Minute of the stakeholder meeting minute with photos, materials, list of participants disaggregated by gender							X								
3.3 Review of the architecture of the system until it is consensually approved by the stakeholder working group and the owner of the farm								X							
3.4 Fact sheets of the technologies that should be used for each component of the system									X						
3.5 Minute of the stakeholder meeting minute with photos, materials, list of participants disaggregated by gender and the list of selected technologies for each component.									X						
Output 4: Define a cost estimation of the fit-for-purpose system															
Activity 4.1: Define cost estimation of the identified technologies under the configuration designed The cost estimation should include all the components of the system and provide the estimated costs per unit as well as implementation and maintenance cost in the selected area of Mozambique. The details of the cost should consider the remoteness of the area, the size and configuration of the system, the need of the farm. It should estimate the budget required to implement and operate the system composed by different component including the collection and pumping of the water through photovoltaic system**,** the use of integrated reservoirs for fish production coupled with horticulture (Aquaponics), the generation of compost**,** and the															

generation of biogas and biofertilizers as well as organic food. These include only for the solar powered irrigation system at least the following elements: - Cost of PV panels (per unit and at scale) - Cost of the pumps. - Cost of filtration, fertigation, water storage (if necessary) - Solar pump : unit and at scale - Pump controller - Electric cables - Pump installation - Monitoring equipment - Cost of maintenance (for each component a clear description of how often spare parts should be replaced and costs of these pieces) ? - Cost of installation - Cost of operation Same deep analysis will be done on the aquaponic component, the generation of compost, biogas, biofertilizers and organic food. This study will also include the annual savings expected (in energy and USD), the payback period in Mozambique. The cost analysis should be established for the full life period of the technology with the longest life period.															
Activity 4.2: Organize a workshop with the stakeholder working group and the owner of the farm An in-person meeting will be organized to present the results of the cost analysis and start reflecting around the best business models that could be used in order to finance the pilot.															
Activity 4.3: Design a business model in cooperation with the selected farm The implementer will work closely with the owner of the selected farm to define a suitable and sustainable financial model for the implementation and the operation of the system. This model will try to highlight the budget that would need to come from external sources and which costs (operation costs for example) should be assumed by the owner of the farm. This analysis will obviously take into account the benefits expected to be extracted from the products of the farm (less needs in animal food purchase, increase use of water which also impact the agriculture production and thus the revenues of the family), as well as the maintenance costs of the technology's component.															

During this activity, the total cost of the system / m3 will be calculated. It will be compared to the resources of the owner of the farm and adjusted until the business model matches the needs of the farmers and their ability to pay.															
Activity 4.4: Business model Validation workshop During the validation workshop, the draft business model will be explained to the restrictive working group, as well as the representatives of the financing sector. The objective of this meeting will be to present the business model to local financial institutions to understand whether this model could be approved by the financial institutions or if some efforts should be made to reduce part of the risk and reach the financial institution support in testing the system in the selected farm. Following the meeting, should any changes need to be applied to the business model to consider comments received during the workshop, the changes will be made, and the revised business model will be circulated to the stakeholder working group for review and the owner of the farms and the financial institutions that demonstrated interest in this initiative.														
Deliverable:															
4.1 Cost estimation of the fit-for purpose system										X					
4.2 Minute of the workshop										X					
4.3 Draft business model											X				
4.4 Minute of the workshop with the financial sector representatives												X			
Output 5: Elaborate and disseminate training's materials and workshops															
Activity 5.1: Prepare 3 sets of dissemination materials to spread knowledge about SPIS and the "pay as you irrigate model" to the users, to the investors and to the municipal officers **1/ Dissemination materials targeting users (smallholder farmers)** The focus of this dissemination material will be to present to the smallholder farmers the advantage of the holistic system, as well as the way the technology and business model designed could be used to support the implementation of the system. It is expected that this material will be a brief video (1mn / 1mn30). The narrative will be in Portuguese with subtitles in English. This material will be diffused during the stakeholder consultation planned in activity 5.2 and will also be delivered in an electronic version will be delivered to the NDE under the format of their choice (iCloud, WeTransfer, usb key, else).														

Dissemination materials to investors This material should be a PowerPoint designed in English with a presentation of the technology and its advantages, and a detailed description of the business model. This material will be targeting investors, banking institutions, and the private sector specialized in irrigation and solar energy. This material will be printed in 25 copies and distributed to the main investors/banking institutions and private sector present during the workshop planned in activity 5.3. **Dissemination material to national and municipal officers** This material will be a report connecting the Technical Assistance with the national priorities of the countries. It will describe the benefits of the technology on the nexus Climate Change, food security - water management, and women empowerment. It will also present a summary of the previous report and explain why this system including different component is relevant for smallholder farmers in Mozambique, and finally the business model that could be used by smallholder farmers. Finally, this report will also include a section on the next steps that should be taken by the government to scale up this technology within the country, including enabling environment considerations (need for a framework, standards and certifications of the technology, etc.). This report will be printed in 8 copies (one for each member of the stakeholder working group) and an electronic version will be delivered to the NDE under the format of their choice (iCloud, WeTransfer, usb key, else). **Strategy for the use of these 3 materials** Along with the material will come a dissemination strategy explaining how each material should be used and for which target population it has been created. The strategy will more specifically focus on the way to use the video prepared for the users: it will provide details on the channels to which it should be diffused, as well as the time of diffusion, along with an estimated cost of these options. The strategy won't be printed and only forwarded in an electronic format to the stakeholder working group.															
Activity 5.2: Organize a stakeholder consultation targeting smallholder farmers A stakeholder consultation meeting will be organized to introduce the system and the business model to the smallholder farmers of Zambezi Valley in Mozambique. The implementer will explain to the local farmers how the system works, what are the expected impact of the technology, how it could increase the resilience of the users, and provide food security. The implementer will answer any questions from the smallholder farmers. Invitations to this stakeholder consultation will be sent at least 10 days before the event and will be posted through different channels to ensure youth, women, farmers, youth, and all citizens of the Zambezi Valley															

in Mozambique are informed. 30 participants are expected during this workshop and the presence of at least one international expert is requested.														
Activity 5.3: Organize a stakeholder consultation workshop targeting the investors, private sector, and banking institutions A stakeholder consultation meeting will be organized to introduce the business model to the private sector and banking institutions of the country. The implementer will explain to the investors / financing entities how the business model has been designed. The implementer will answer any questions from the private sectors and banking institutions. Invitations to this stakeholder consultation will be sent at least 10 days before the event and will be posted through different channels to ensure a gender consideration. It is expected that the implementer will request the support of the NDE and Project Proponent to approach these stakeholders. Around 25 participants are expected for this workshop in the presence of at least one international expert.														
Activity 5.4: Organise a training to Municipal and National officers A training will also be organized in the capital or in Zambezi Valley (to be defined) in the presence of the national and municipal relevant officers, including the ministry of agriculture, ministry of environment, ministry of water uses and protection, and else. During this workshop the technical assistance will be briefly explained, and the pilot projects will be communicated. Irrigation technologies functionalities will be explained to them, and the manual designed in activity 6.1 will be shared. The objective of this training is to create the capacity for these leaders to promote efficient irrigation technologies to the local farming communities. Around 20 participants are expected in the presence of at least one international expert.														
Deliverable:														
5.1 a Dissemination material targeting the users 5.1 b Dissemination materials targeting the investors 5.1 c Dissemination materials targeting the national officers 5.1 d Dissemination strategy and planning.											X			
5.2 Minutes of the stakeholder consultation workshop with pictures, and a list of participants disaggregated by gender as well as materials used if any.												X		
5.3 Minutes of the stakeholder's consultation with the private sector and banking institutions with pictures, and a list of participants desegregated by gender as well as materials used if any.												X		
5.4 Minutes of the training to municipal and national officers with pictures, and a list of participants desegregated by gender as well as materials used if any.													X	

4. Resources required and itemized budget:

Provide an indicative summary of the necessary resources and detailed budget required to implement the technical assistance of the CTCN, including monitoring and evaluation activities, with the help of the following table. It is important to note that a minimum of 1 per cent of the budget must be explicitly aimed at gender-specific activities related to technical assistance (see Section 10 for more information on gender). Once the response plan is completed, the Climate Technology Centre (CTC) will select the implementers responsible for implementing the response. *The CTCN and the chosen lead implementer will need to agree on a detailed activity-based budget.*

A detailed version of the budget is included in a separate Excel sheet submitted along with the present document.

Activities and Outputs	**Input: Human resources** *(Title, role, estimated number of days)*	**Input: Travel** *(Purpose, national vs. international, number of days)*	**Inputs: Meetings and events** *(Meeting title, number of participants, number of days)*	**Input: Equipment and resources** *(Item, purpose, buy/rent, quantity)*	**Estimated cost (US $)** *Please indicate the cumulative cost of the activities and outputs and provide an estimated cost range for each activity and the entire Response Plan.*	
					Minimum	**Maximum**
Mandatory Output: Development of the work plan and related communication documents	I1: 7 days I3: 5 N1: 7 N2: 6	/	/	/	7,000	7,100
Output 1: TA coordination mechanism established and inclusive stakeholder working group formed						
Activity 1.1	I1: 2 N1: 4 N2: 2	/	/	/	2,000	2,200
Activity 1.2	I1: 5 N1: 5 N2: 2	/	/	/	3,500	3,900
Activity 1.3	I1: 5 days I2:1	One international experts travelling for	One workshop planned for the	/	13,500	13,700

	I3: 5 I4:1 I51 I6:1 N1: 5 N2: 2	the workshop planned for the inception meeting with the stakeholder working group at 2,000 USD including the DSA and flights for 5 days.	inception meeting with the stakeholder working group at 4,500 USD per workshop, all inclusive, including the venue but also the transportation allowance for the participants.			
Output 2: Diagnose the need of the local farmers and benchmark international best practices						
Activity 2.1	I1: 2 days N1: 1	/	/	/	5,000	5,200
Activity 2.2	I1: 5 days I3: 5 I4:5 I5:5 I6:2 N1: 5 N2: 5	1 international experts travelling to assess the needs of the farmers at 2,000 USD including the DSA and flights for 5 days. 15 local travels at 100 USD /travel.		/	16,000	16,500
Activity 2.3	I1: 5 days I2: 1 I3: 1 I4:1 I5:1 I6:1	One international travel for the stakeholder consultation meeting at local level to select the unique farm for	One workshop at 6,000 USD/workshop all inclusive.	/	16,000	16,500

	N1: 5 N2: 1	which a fit-for - purpose system will be designed at 2,000 USD including the DSA and flights for 5 days. 25 local travels as transport allowances of the participants.				
Activity 2.4	I1 : 10 N1: 5	One international travel to map the local farms at 2,000 USD including the DSA and flights for 5 days. 10 local travels at 100 USD/Day.	/	/	8,500	9,000
Output 3: Develop a complete flowchart of the system that will include the collection and pumping of the water through photovoltaic system, the use of integrated reservoirs for fish production coupled with horticulture (Aquaponics), the generation of compost, and the generation of biogas and biofertilizers as well as organic food for the selected farm						
Activity 3.1	I1: 5 days I3: 5 I4:5 I5:5 I6:5 N1: 5 N2: 1	/	/	/	13,500	13,700

Activity 3.2	I1: 5 days I3: 1 I4:1 I5:1 I6:1 N1: 5 N2: 1	1 international travels to present the possible architecture of the system to the stakeholders at 2,000 USD including the DSA and flights for 5 days. 25 local travels at 100 USD/Day.	One workshop at 6,000 USD/workshop all inclusive.	/	16,000	16,200
Activity 3.3	I1: 5 days I3: 5 I4:5 I5:5 I6:5 N1: 5 N2: 1	/	/	/	13,500	13,700
Activity 3.4	I1: 10 N1: 2	/	/	/	5,000	5,400
Activity 3.5	I1: 5 days I3: 1 I4:1 I5:1 I6:1 N1: 5 N2: 1	One international travel to select the technologies at 2,000 USD including the DSA and flights for 5 days. 25 local travels at 100 USD/Day.	One workshop at 6,000 USD/workshop all inclusive.	/	16,000	16,200

Output 4: Define a cost estimation of the fit-for-purpose system						
Activity 4.1	I1: 5 I2:15	/	/	/	10,000	10,000
Activity 4.2	I1: 5 I2:1 N1: 5 N2: 1	One international travel to organize a workshop with the owner of the selected farm at 2,000 USD including the DSA and flights for 5 days. 10 local travels at 100 USD/Day.	One workshop at 4,500 USD/workshop all inclusive.	/	11,500	11,700
Activity 4.3	I1: 5 I2:15 N1: 5	1 international travels to design the financial model with the selected farm at 2,000 USD including the DSA and flights for 5 days. 5 local travels at 100 USD/Day.	/	/	13,000	13,500
Activity 4.4	I1: 5 days I2: 5 I3: 1	1international travels to validate the business model 2,000	One workshop at 6,000	/	17,000	17,400

	I4:1 I5:1 I6:1 N1: 5 N2: 1	USD including the DSA and flights for 5 days. 25 local travels at 100 USD/Day.	USD/workshop all inclusive.			
Output 5: Elaborate and disseminate training's materials and workshops						
Activity 5.1	I1: 2 days I2: 2 I3: 2 I4:2 I5:2 I6:2 N1: 5 N2: 1	/	/	/	7,000	7,200
Activity 5.2	I1: 1 days N1: 5 N2: 1	2 local travel at 100USD/travel	One workshop at 6,000 USD/workshop all inclusive	/	7,000	7,900
Activity 5.3	I1: 1 days N1: 5 N2: 1	2 local travel at 100USD/travel	One workshop at 6,000 USD/workshop all inclusive	/	7,000	7,900
Activity 5.4	I1: 1 days N1: 5 N2: 1	2 local travel at 100USD/travel	One workshop at 6,000 USD/workshop all inclusive	/	7,000	7,900
				Estimated cost range for the entire Response Plan (US$)	**215,000**	**225,000**

5 Profile and experience of experts

Experts required	Brief description of required profile
International experts	
Team leader and expert in smart agriculture (I1)	- Team Leader and expert in agriculture, smart agriculture, irrigation, biogas - Master's in agriculture, water management, climate change adaptation, agriculture engineer, or similar. - At least 10 years of experience in the nexus agriculture, irrigation, food security. - At least 5 references demonstrating experience in the design and implementation of irrigation system, biogas system, aquaponic system, composting systems in developing countries. - Experience in capacity building, organizing workshops and capacity building - Experience in managing complex projects in the presence of various stakeholders. - Previous experience in Africa or in Mozambique will be valued. - Fluency in English is mandatory, Portuguese is a plus. Qualified women candidates are highly encouraged to apply.
Economist (I2)	- Master or above in economy, finance, management of companies, international economics, agriculture economics, renewable energy economics, water economics - Minimum of 10 years' experience in designing business models - At least 5 references in the Pay as you use model. - At least 3 experiences in developing business models for the agriculture sector - Previous experience in Africa or in Mozambique will be valued. - Fluency in English is mandatory. Portuguese is an added value Qualified women candidates are highly encouraged to apply.
Expert in solar irrigation powered system (I3)	- Master or above in solar energy, solar irrigation system, water management, agricultural engineer, food production, or affiliate - Minimum of 10 years' experience in irrigation for agriculture purposes - At least 5 references in designing solar water powered systems in developing countries. - Previous experience in Africa will be valued - Fluency in English and Portuguese is a plus. The same expert(s) can be proposed to cover various profiles define under I3 to I6 if they can demonstrate the expected experience and expertise. Qualified women candidates are highly encouraged to apply.
Expert in biogas system (I4)	- Master or above in biogas, agricultural engineer, food production, or affiliate - Minimum of 10 years' experience in biogas plant at design and implementation stage. - At least 5 references in designing small-scale biogas plants in developing countries.

	- Previous experience in Africa will be valued - Fluency in English and Portuguese is a plus The same expert(s) can be proposed to cover various profiles define under I3 to I6 if they can demonstrate the expected experience and expertise. Qualified women candidates are highly encouraged to apply.
Expert in Aquaponics (I5)	- Master or above in aquaponics, agricultural engineer, food production, or affiliate - Minimum of 10 years' experience in biogas plant at design and implementation stage. - At least 5 references in designing small scale aquaponics plants in developing countries. - Previous experience in Africa will be valued - Fluency in English and Portuguese is a plus The same expert(s) can be proposed to cover various profiles define under I3 to I6 if they can demonstrate the expected experience and expertise Qualified women candidates are highly encouraged to apply.
Expert in the generation of compost, biofertilizers as well as organic food (I6)	- Master or above in biogas, agricultural engineer, food production, or affiliate - Minimum of 10 years' experience in the elaboration of biofertilizers, organic food, compost - At least 5 references demonstrating experience in elaboration of biofertilizers, organic food, compost - Previous experience in Africa will be valued - Fluency in English and Portuguese is a plus The same expert(s) can be proposed to cover various profiles define under I3 to I6 if they can demonstrate the expected experience and expertise Qualified women candidates are highly encouraged to apply.
National experts	
Agriculture expert (N1)	- Master or above in agriculture, food production, water management, agricultural engineer, or affiliate - Minimum 8 years' experience in water management in Mozambique or East Africa. - At least 5 experiences in irrigation in Africa. - Presence in Mozambique desired or availability to travel frequently and for long periods. - Fluency in Portuguese is mandatory. Good level of English is valued. Qualified women candidates are highly encouraged to apply.
Gender Expert – (N2)	A Master's or Bachelor's degree specialising in gender studies or other related field from a recognized university. At least 8 years of experience in mainstreaming gender benefits in development programs. Knowledge of energy efficiency and building sectors highly desirable. Qualified women candidates are highly encouraged to apply.

5 Intended contribution to the expected impact of the technical assistance

The objective of the technical assistance is to identify the best existing technology to implement a water-food-energy nexus for one selected commune of the Zambezi region. The technology will include 4 components:

- Aquaponic
- Biogas
- Composting and
- Hydraulic management

The implementation of such system could have the following benefits;

- The establishment of agro-system units that will increase the resilience of the country to the effect of climate change
- Reduction of GHG emissions through the use of biogas and clean energy
- Reduction in the use of inorganic fertilizers
- Impact on the management of water resources through the implementation of efficient irrigation systems
- Increase food and nutrition security
- Income generation through the establishment of integrated production systems per beneficiary

The technical assistance will select the best technologies for each component of the system, set up the specifications of each technology, design the complete flowchart of the system.
It is expected that with these results, the country will be able to leverage other sources of funding to test and pilot the system and in a second time, scale-up the technology to other location in Zambezi, and in the country.

6 Relevance to NDCs and other national priorities

The present Technology concept is consistent with Mozambique's climate priorities as, according to the **Estratégia Nacional de Adaptação e Mitigação de Mudanças Climáticas (ENAMMC) 2013-2025**, it is aligned with the need to reduce vulnerability to the impacts of Climate Change. According to this National Strategy, mitigation is already beginning to be recognized as an opportunity, with references in the Energy Strategy (carbon tax and promotion of the use of endogenous energy resources, which should promote clean and renewable sources), and the Policy on Biofuels, Biofertilizers and Organic Agricultural Products.
It is also aligned with the **NDC,** recently updated in November 2021, as one of the main sector of priority is agriculture, and as well as improving the capacity for integrated water resources management including building climate resilient hydraulic infrastructures;

According to the **Gender, Environment and Climate Change Strategy**, low carbon mitigation and development constitutes an opportunity for Mozambique to get involved in global efforts to reduce GHG emissions through the definition of national mitigation priorities to promote the low carbon economy that they will depend on the ability to mobilize technological resources at affordable prices and the necessary financial resources.

According to the **Plano Estratégico para Desenvolvimento do Sector Agrário (PEDSA – 2011-2020)**, most of the priorities that have been identified for water management are addressed through the construction and rehabilitation of infrastructure (increase access and capacity to capture , storage, treatment and distribution of water, explore technologies to improve water availability, build agro-hydraulic infrastructures in the main surface courses and small, easily maintained dams for irrigation and animal drinking purposes). Also, according to this instrument, the strategic actions identified for

the agriculture sector consist of increasing the resilience of agriculture and livestock through the diversification and introduction of cultures that are more resistant to the variation of climatic parameters, improving agricultural production and productivity through the availability of technologies and inputs suitable for Climate Change, develop programs and national action plan for soil conservation and nutrition (conservation agriculture), improve and expand technical assistance to producers in terms of intervention quality, promote aquaculture as an alternative means to a decrease in the quantity of fish and increased demand, improve the quality of information and the capacity of small-scale fishing, reinforce measures for the control and management of fishing activities, guaranteeing access to clean technologies in order to guarantee the renewal and maintenance of stocks.

7 Links to relevant parallel activities:

Despite the various strategies and policies to reduce the adverse effects of climate change at central level, the Zambezi Valley Development Agency within the scope of the implementation of research projects by action (IPA) developed pilot initiatives from 2017 to 2021 in Modern technologies for effluent treatment and water reuse in fish farms; Use of hydraulic ram for pumping water as an alternative to the shortage of electricity and fuel in rural areas; Establishment of homemade units for the transformation of biodegradable waste into organic compounds in the suburban environment and Construction of biodigesters for the production of biogas and biofertilizers. In addition to supporting the implementation of the innovation project to increase water productivity and food security resistant to climate change in small-scale agriculture in the central region of the country (APSAN-Vale).

8 Anticipated follow-up activities after this technical assistance is completed:

It is expected that following the implementation of this TA, the country , and more specifically the Zambezi Velley and the selected farm will manage to leverage the funds to implement a pilot of the fit-for purpose designed system.

9 Benefits in terms of gender and co-benefits:

Imbedded into the design of the activities:	The activities of this project will focus on rural producer associations in the Zambezi Valley region, where, in light of the principle of gender equality expressed in article 36 of the Constitution of the Republic of Mozambique, for this project will be given a special attention to women in vulnerable situation (Women chief of families or widows, unemployed women), for that will be: • Establish and guarantee the full functioning of Gender Units in the associations with the support of the gender units established in the Educational Institutions (Unizambeze, UCM, ISPM, ISPS), for that will be defined and trained a staff with a profile and skills appropriate to the attributions of the respective unit; • Ensure the dissemination, monitoring, evaluation and regular reporting of the degree of implementation of the Gender Strategy and its Action Plan; • Establish and publicize incentives aimed at attracting and retaining women in the association and in the technology transfer process • Focus on interventions to promote gender equality and women's empowerment in order to guarantee their full participation in the production, conservation, processing and marketing of the harvested product; • Sensibilization of local communities to create community committees for sustainable management of natural resources, encouraging the participation of women in the respective structures.

Gender and co-benefits of the activities:	The technical assistance will address the following problems: i. Water scarcity and long drought periods as a result of climate change ii. Low financial conditions of Mozambican women iii.Non integration of women in the energy x water x food nexus The project values the contribution of gender balance in all the stages of the project, from the design to the implementation. The stakeholder working group will consider gender and try to be equitably composed by men and women.

10 Main national stakeholders in the implementation of the technical assistance activities:

National Stakeholder	**Function in the implementation of the technical assistance**
National Designated Entity	National Monitoring of the progress of the project and alignment with the nation targets in climate change.
Designated Authority	National Monitoring of the progress of the project and alignment with the nation targets in climate change.
Project Proponent	Local Mobilization ensuring the buy in of the project by the local and national government, financial and progress reporting, quality Check of the results achieved and correction if needed, data collection, Monitoring and evaluation
Higher Education Institutes (ISPM, Uni Zambeze)	Research and extension development, establishment of smart unit technologies, diffusion of technologies for implementation in other regions
Economic Activity Distrital Services (SDAE) – extensionitas	Support in the establishment of smart unit technologies, diffusion of technologies for implementation in other regions
University of Deflt (Netherlands)	Technical support if needed and training of students
Selected commune	Beneficiary of the results of the TA
Private sector	Raising awareness on the selected technologies for the creation of national market
NGO, youth and women association	Act as representative of the civil society
Farmers Delegate	Spoken person on behalf of the community of farmers.

11 Contribution to the SDGs:

Goal:	**Sustainable Development Goal**	**Direct contribution from CTCN TA**
1	End poverty in all its forms everywhere	Yes, the project aims at designing a biogas- aquaponic- composting -

		hydraulic system that should impact the revenues of the smallholder farmers. Mozambique is dependent on agriculture to ensure its food security. More efficient models for the agriculture sectors can also improve the quality of life of smallholder farmers, including women and youth. The TA will focus one rural area of the Zambezi valley.
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Yes, the project aims at designing a biogas- aquaponic- composting - hydraulic system that should impact the revenues of the smallholder farmers. Mozambique is dependent on agriculture to ensure its food security. More efficient models for the agriculture sectors can also improve the quality of life of smallholder farmers, including women and youth. The TA will focus one rural area of the Zambezi valley.
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote lifelong 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	Yes, the project includes an hydraulic component with the objective to better manage the use of water.
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	Yes, biogas will be used as part of the system.
	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	Yes, biogas will be a key component of the system.
	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	
13	Take urgent action to combat climate change and its impacts	*All technical assistance should indicate relevance to SDG 13 and at least one of the following targets (13.1 to 13.b).*
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	The system should provide a sustainable model for the agriculture sector in Mozambique which could increase the resilience of the populations at times of drought and ensure food security as well.
	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	Many trainings are planned to ensure that the future users understand the benefit of the system. The private sector could also be involved at some point.
	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	The pre-feasibility, if successful could leverage additional source of funding for the implementation of a pilot.
	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	

12 Classification of technical assistance:

Please tick the relevant boxes below	Primary	Secondary
☐ 1. Decision-making tools and/or information provision		
☐ 2. Sectoral road maps and strategies		
☐ 3. Recommendations for legal reforms, policies and regulations		
☐ 4. Financing facilitation		
☐ 5. Private sector engagement and market creation		
☐ 6. Research and development of new technologies	X	
☐ 7. Feasibility of technology options	X	
☐ 8. Piloting and deployment of technologies in local conditions		
☐ 9. Technology identification and prioritization	X	

Please note that all CTCN technical assistance contributes to strengthening the capacity of in-country actors.

13 Monitoring and evaluation process

Upon contracting the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. This 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) THE COUNTRY on overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer on the experience and knowledge gained through the technical assistance; and (iii) the CTCN Director on the timeliness and appropriateness of the activities and outputs.

Abbreviations and acronyms

CFC	Climate Finance Centre
CIS	Commonwealth of Independent States
CTCN	Climate Technology Centre and Network
EBRD	European Bank for Reconstruction and Development
EU	European Union
GCF	Green Climate Fund
GHG	Greenhouse Gases
HVAC	Heating, Ventilation and Air Conditioning
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NDE	National Designated Entity
SNiP	Construction Norms and Regulations of the Soviet Union
TA	Technical Assistance