Promoting climate adaptation by upscaling appropriate solar irrigation technology options for smallholder farmers in Ghana through innovative financing mechanisms, a conducive policy framework for technology regulation and tailored training modules

Closure Report for CTCN Technical Assistance

1. Basic information

Title of response plan	Promoting climate adaptation by upscaling appropriate solar irrigation technology options for smallholder farmers in Ghana through innovative financing mechanisms, a conducive policy framework for technology regulation and tailored training modules
Technical assistance reference number	AF-2021000106
Country / countries	Ghana
NDE organisation	Environmental Protection Agency (EPA), Ghana
NDE focal point	Mr. Joseph Amankwa Baffoe (Acting Director)
NDE contact information	jabaffoe@gmail.com
Proponent focal point and organisation	Dr. Antwi-Boasiako Amoah Deputy Director and National Adaptation Plan Project Coordinator Environmental Protection Agency (EPA), Ghana Email: aantwib@gmail.com / antwi.boasiakoamoah@epa.gov.gh
Designer of the response plan	EPA & CTCN
Implementer(s) of technical assistance	CARES Limited in association with INTEGRATION environment & energy GmbH
Beneficiaries	Government of Ghana, EPA and Ministry of Agriculture/Ghana Irrigation Development Authority
Sector(s) addressed	Renewable Energy and Agriculture Financing
Technologies supported	Solar Powered Irrigation Systems (SPIS) i.e., solar water pumps with crop-targeted efficient irrigation
Implementation start date	15/09/2022
Implementation end date	31/03/2025 (Estimated)
Total budget for implementation	USD 243,807
Description of delivered outputs and products as well as the activities undertaken to achieve them. In doing so, review the log frame of the original response plan and refer to it as appropriate	**Mandatory Deliverables:** • Detailed work plan • Monitoring and evaluation plan • CTCN Impact Description • Closure and Data Collection Report **Output 1:** • Kick-off Meeting and Stakeholder Mapping Report, containing a complete stakeholder list as well as a description of the Stakeholder Working Group (SWG), with name, position, institution, gender and role of each member.

	• Inception Meeting Report, with materials, list of participants disaggregated by gender, bibliography and planning of bilateral meetings held by the international expert in Ghana.
	• Agricultural and Irrigation Practices Assessment, including minutes of interviews, names of participants, type of meeting, themes treated, questions raised.
	• Minutes of the Stakeholder Working Group´s workshop, including materials, list of participants, photos and conclusions.
	• Guide to the most appropriate Solar Powered Irrigation Systems that could be efficiently and sustainably implemented for smallholder farmers in remote areas of Ghana, including a list of accredited suppliers and distributors.
	• Cost analysis of at least three of the technologies and system architectures presented.
	Output 2:
	• Report of the stakeholder meeting with list of participants, photos and materials used.
	• SWOT analysis of the access to financial mechanisms from smallholder farmers for the purchase of SPIS.
	• Needs of the farmers / needs of the financial institutions.
	• Business models targeting smallholder farmers for SPIS with their respective SPIS architecture.
	• Minutes of Stakeholder Business Model Validation Workshop.
	Output 3:
	• Minutes of a High Level Governmental workshop with photos, a list of participants, materials used, conclusions of the meeting.
	• Draft policy framework to set up a compliance standard and certification for solar irrigation technology, including:
	  ○ Definition of vision, mission, objectives, goals and guiding principles.
	  ○ Stakeholder consultations with the private sector, identifying the barriers to promotion of SPIS technology.
	  ○ Discussion of standards, certification, and financial incentives.
	  ○ Definition of actions that could help promoting an enabling environment.
	• Compiled feedback and comments on first draft of the policy framework.
	• Second draft of the policy framework.
	• Official workshop review report (TBD).
	• Compiled feedback and comments on revised draft of the policy framework (TBD).
	• Final draft of the policy framework (TBD).
	Output 4:
	• Draft Training modules designed and presented in webpage (TBD by EPA), with main reports and training modules uploaded to EPA website.
	• Meeting with the Stakeholder Working Group to validate the content of the webpage and finalise training modules (TBD).
	• Minutes of two meetings to disseminate knowledge about SPIS (TBD in Northern and Coastal Savannah), with the list of participants, photos, materials used.

Methodologies applied to produce outputs and products	• Desk research and analysis of relevant policies and documents. • Stakeholder Mapping to identify key stakeholders. • Interviews and workshops with key stakeholders. • Cost and SWOT analysis for appropriate technologies. • Development of Business models targeting smallholder farmers for SPIS with their respective SPIS architecture, balancing the needs of farmers with the needs of the financial institutions. • Workshop discussions and training of trainers capacity building sessions with EPA and national officers, to disseminate knowledge about SPIS to smallholder farmers (TBD).
Reference to knowledge resources	During the project, reference was made to various TEC Briefs, Strategies and guidelines (Link to TEC knowledge database: https://unfccc.int/ttclear/tec/documents.html), in particular: • TEC Brief # 17 - Policy brief on enabling environments • TEC monitoring and evaluation framework.
Deviations	Due in the main to the presidential elections in Ghana, the activities noted above as TBD have yet to be completed, but are in preparation with the expected completion in early 2025.
Anticipated follow-up activities and next steps	Anticipated follow-up includes: • Review and update of the National Irrigation Policy (in progress), to better integrate SPIS and address the specific needs of smallholder farmers, address regulatory gaps and promote innovation through supportive legal and financial frameworks. • Conduct farmer awareness campaigns (TBD) to demonstrate SPIS benefits, promote the business models to the business community, farmer groups and other key stakeholders, and roll out cost-sharing and community-based financing models to enhance affordability and accessibility for smallholder farmers. Next steps: • Train agricultural extension officers and local technicians on SPIS installation, maintenance, and operation, eventually establishing regional SPIS support centres for technical assistance, spare parts, and training. • Establish demonstration farms to validate the three business models and prove their effectiveness in real-world conditions. • Develop and finalize supportive policies, including subsidies, tax incentives, and regulatory guidelines for SPIS installation. • Initiate partnerships with private sector players, NGOs, and community leaders to foster collaborative efforts. • Implement a centralized Monitoring & Evaluation (M&E) system to track SPIS adoption rates, performance, and user feedback. • Expand SPIS deployment across all regions, with a focus on water-scarce areas. • Introduce further advanced SPIS technologies, such as remote monitoring systems and automated irrigation controls (Internet of Things connectivity). • Continuously update policies based on M&E data and emerging global best practices. • Develop long-term maintenance programs and local manufacturing of SPIS components to ensure system sustainability.

2. Lessons learned

	Lessons learned	Recommendations
Lessons learned from the CTCN TA process	• Development of the Response Plan was undertaken by CTCN in collaboration with the NDE (EPA) and the MoA (GIDA), but a similar programme by UNEP also covered many aspects of the TA. • Establishment of the SWG at the outset of the TA enabled engagement with a broad range of stakeholders, but participation was sometimes limited, particularly due to poor internet connectivity for virtual meetings and key players absent due to political activities.	• Ensure transparency and coordination of planning between CTCN and the NDE and other branches of the UN. • Include dedicated conference facilities and internet packages within the budget to ensure better communications and account for electoral cycles in the scheduling of activities. Ensure compensation and allowances for workshop attendance are adequately funded.
Lessons learned related to climate technology transfer	• Communications at meetings and with individual stakeholders provided exchange of information and experience that was very beneficial to the TA, but the synergies with other programmes was not identified until late in the TA. • Stakeholders presented views of Ghana that indicated the difficulties of developing projects with rural communities and smallholders, particularly noting issues of security, a lack of commitment to and capacity for O&M and the difficulties for finance institutions to deal with smallholder farmers (Just a few of the key weaknesses of the agricultural sector in Ghana). • Government ministries can help to facilitate the implementation of SPIS programmes for sustainability, but they are severely constrained by their available budgets and staff capabilities. • SPIS can address the technical constraints facing smallholder farmers, enabling increased production in the face of climate change impacts, but is likely only suitable for higher value horticultural crops, with subsidies or where groups of farmers can be served by shared infrastructure.	• Ensure the Response Plan is fully coordinated with the efforts of other projects. • Invest in capacity building for beneficiary communities, particularly leadership, before piloting schemes, and raise awareness amongst financing institutions, to ensure long-term commitment and financial and organisational capabilities for O&M and M&E. • Ensure measures to support governance and regulatory bodies are implemented. • Target horticultural production; encourage the formation of farmer-based co-operatives and ensure the political support for subsidizing green investments.

3. Illustration of the TA and photos

Context: Agriculture and Rural Livelihoods in Ghana

- The agriculture sector employs 47% of the country's labour force, most of which are smallholder farmers, producing 80% of the country's food needs
- Agricultural productivity covers annual and perennial crops
- About 90% of farm holdings in Ghana are less than 2 hectares
- 90% of the population in semi-arid northern Ghana depend on rain-fed agriculture for their livelihoods
- Less than 20% of smallholder farmers have access to formal irrigation.

CARES

INTEGRATION environment & energy

Context: Smallholder Farming

- Agriculture in Ghana is predominantly smallholder, traditional and rain-fed with farm sizes <2ha
- Rainfall is impacted by climate change both in the north (uni-modal) and south (bi-modal)
- Smallholder farmers need assistance to switch to commercial agriculture and modern technologies for efficient use of scarce water resources, including:
  - Better infrastructure, equipment and inputs
  - Improved value chains (Storage, processing and marketing facilities).

CARES

INTEGRATION environment & energy

Context: Climate Change in Ghana

- Temperatures in Ghana are likely to increase by at least 3ºC by 2080
- The impacts will be shorter wet season, increased number of dry days, heatwaves and evapotranspiration, leading to increasing risk of droughts
- In parallel, an increase in rainfall intensity could raise the risks of flooding
- The changes will directly affect the demand and availability of water supply for agriculture, leading to decreased productivity and prolonged periods of food shortages
- The Government of Ghana has acknowledged the vulnerability of it's food systems to climate impacts and prioritized the need to build resilience of farmers, especially smallholders; initiating strategies including:
  - Climate Smart Agriculture and Food Security Action Plan (CSAFSAP)
  - Climate Smart Agriculture Investment Plan (CSAIP)
  - National Climate Change Policy (NCCP).

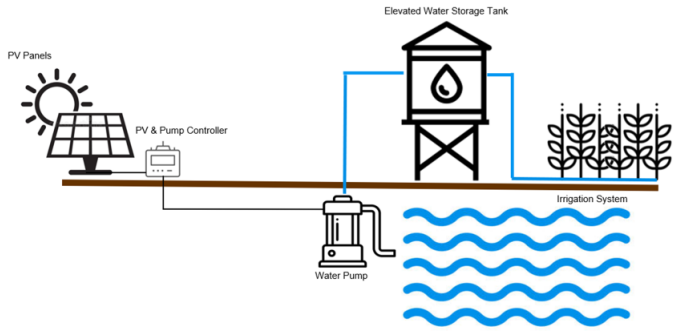
Context: SPIS Opportunities

The introduction of **Solar Powered Irrigation Systems (SPIS)**, as an adaptation intervention, addresses the water insecurity issues caused by climate change and secures benefits for productivity and profitability.

- Solar power provides reliable and affordable energy for irrigation, especially in remote rural areas where diesel fuel is expensive or there is no access to an electricity grid.
- Flexible and climate-friendly alternative energy source, with reduced CO_2 emissions
- Reducing capital costs for SPIS equipment make it a more viable adaptation option for smallholder farmers
- SPIS can also be low maintenance and have a relatively long lifespan.

Context: SPIS technologies

Basic Standalone System



SPIS consists of key components, including the electrical photovoltaic (PV) panels, pump and controller; combined with irrigation distribution and application infrastructure.

CARES

INTEGRATION environment & energy

Context: SPIS Constraints

Several barriers exist that constrain the uptake of SPIS by smallholder farmers in Ghana, including:

- High capital costs
- Lack of information and training on SPIS
- Few smallholder farmers have bank accounts or access to finance
- Absence of an integrated equipment supply chain and certification standards
- Insufficient enabling policies and institutional frameworks.

CARES

INTEGRATION environment & energy

Outputs: Technical Guides

CARES

INTEGRATION environment & energy

Outputs: Business Models

Community ownership model

Smallholders pool together as a community for putting up equity investment (up to 15%) and manage the systems on thier own to **eliminate margin of 3rd party operator**, while getting pressional support for larger repairs.

Operator ownership model

3rd party investors form larger systems by pooling in small holder farmers to **achieve economies of scale**. The investor also operates the system and is responsible for O&M and tariff collection.

Shared ownership model

Farmers and 3rd party investors both bring in equity investment to **reduce (or posibility eliminate) debt financing** which is the major burden on tariffs. Additionally other entities (e.g. Government) can support by interest by-back schemes (as a form of subsidy).

CARES

INTEGRATION environment & energy

Outputs: Policy Framework

Outputs: Training Modules

Proposed Training Modules

- Introduction to SPIS
- Agriculture and SPIS
- Standards and Certifications
- System sizing of SPIS
- Commissioning and Installation
- Operation & Maintenance
- Financial Modelling
- Business Models for SPIS
- Access to Finance
- Policy Framework

Target Audience

- Policy Makers
- Investors
- Smallholder Farmers
- Service Providers

4. Impact Statement

Challenge	Although SPIS technology has been widely introduced in agriculture in some countries, it has not yet fully penetrated the Ghanaian market. Several barriers remain to its uptake, including accessible supply chains and viable financing. With about 90% of farm holdings in Ghana being less than 2 hectares in size, it is essential to aggregate (the mostly unbanked) smallholder farmers and implement scaled-up solar irrigation solutions that could potentially lower technology implementation and operation costs, and collectively address credit issues for financing. SPIS, run by renewable solar energy, could offer smallholder farmers with a longer-term solution for irrigation, whilst providing them with a means to adapt to rainfall variability and change. In addition, SPIS provide mitigation co-benefits that could better enable the financial viability of the technology. The Government of Ghana, mostly through the Ministry of Food and Agriculture – Ghana Irrigation Development Authority (GIDA) - has some policies and programmes in place for irrigation on which to build upon. However, these do not focus on solar powered irrigation systems and concentrate mostly on formal irrigation systems. Only about 20% of smallholder farmers in Ghana have access to formal irrigation programmes. There are about 57 small scale irrigation schemes (i.e., for smallholder farmers) across Ghana developed by GIDA, implemented using public funds. However, Government budgets are stretched and inadequate to address the water scarcity problem for smallholder farmers. Available funding is also used to maintain the existing public irrigation systems.
CTCN Assistance	The TA aimed to promote SPIS technology in Ghana, through innovative financing mechanisms, a conducive policy framework for technology regulation and tailored training modules; including: • Development of planning and communication documents • Benchmarking SPIS technologies suitable to smallholder farmers in Ghana and assessing their respective cost-benefits • Defining Business Models targeting smallholder farmers to adopt SPIS • Developing a Policy Framework on SPIS technology • Raising awareness on the benefits of SPIS through workshops, webpages and online training modules.
Anticipated impact	The following impacts are anticipated as a result of the technical assistance: • CI 2: Increased economic, health, well-being, infrastructure and built environment, and ecosystems resilience to climate change impacts (by increased resilience to drought) • CI 3: Anticipated number of direct and indirect beneficiaries (disaggregated by gender).

Co-benefits: Achieved or anticipated co-benefits from the TA	Apart from the core impact indicators above there are significant co-benefits anticipated as a result of the TA, as follows:
	• Environmental co-benefits:
	  ○ Energy savings
	  ○ Reduction of air-pollution.
	• Social co-benefits:
	  ○ Increased knowledge for climate change adaptation and mitigation
	  ○ Access to energy and water for rural households, for domestic and livestock use
	• Economic co-benefits:
	  ○ Increased food security and the improvement of livelihoods of local communities
	  ○ Job opportunities within local communities.

Gender aspects of the TA	Since women often provide the majority of agricultural labour and are frequently responsible for water collection, there are significant benefits of solar pumping solutions for women. SPIS reduces the burden of manual water collection and provides women farmers the capability to become net producers, generate income from market sales and substantially increase their household nutrition intake and food security. Also, gender characteristics play an important role in terms of financial decision-making and the servicing of loans. The TA supported the achievement of gender empowerment and equality by the inclusion of women and girls in the Stakeholder Working Group and invitation of representatives from women's and youth groups; their contributions are captured in the outputs. The stakeholder mapping and selection of SWG members and attendees at all workshops ensured that participation was as gender balanced as possible and the outputs identified the specific challenges and barriers for women (and youth) in accessing SPIS technologies for food crop cultivation.
Anticipated contribution to NDC	Through promoting low-emissions food crop cultivation, the TA will contribute to Ghana's Nationally Determined Contribution (NDC) to the Paris Agreement by contributing to achieving Ghana's NDC target of reducing agricultural GHG emissions below projected business-as-usual (BAU) levels and supporting the NDC target for deploying SPIS technologies.
The narrative story	The Government of Ghana has constrained resources, both in meeting the gap between formal and informal irrigation systems but also in the capacity and skills required for the uptake of solar powered irrigation systems. A structured technical solution accompanied with the skill sets and financing approach for smallholder farmers will support the Government of Ghana overcome the barriers listed above and address water scarcity issues for its smallholder farmers whilst also addressing food security issues faced by the country and reducing pressures on its increasingly scarce water resources and key ecosystems. The objective of the technical assistance was to promote smallholder farmers' adaptation to climate change by establishing a sustainable and efficient means of irrigation through the assessment of technology options that could be used in Ghana, the design of sustainable business models that target accessible financing for smallholder farmers, and the formulation of a policy framework for the use of Solar Powered Irrigation System (SPIS) which are the conditions for the establishment of an enabling environment for the uptake and scale up of the technology in Ghana. To achieve this objective, the TA undertook the following: • Benchmark SPIS technologies suitable to smallholder farmers in Ghana and assess their respective cost-benefits • Defined business models targeting smallholder farmers for the adoption of SPIS • Developed a National Policy Framework for SPIS technologies • Raised awareness on the benefits of SPIS for smallholder farmers and created opportunities for capacity development through the production of training modules.
Contribution to SDGs A complete list of SDGs and their targets is available here: https://sdgs.un.org/goals	The TA is anticipated to contribute to the following Sustainable Development Goals (SDGs): • SDG1 End poverty in all its forms everywhere *Improving production through Solar Powered Irrigation Systems (SPIS) will increase incomes for rural farmers.*

	• SDG2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture *Improving production through SPIS will ensure food security and improved quality of life for farmers.* • SDG7 Ensure access to affordable, reliable, sustainable, and modern energy for all *By promoting the roll out of SPIS, the TA is improving the availability of affordable, reliable, sustainable, and modern energy and increasing the share of renewable energy produced.* • SDG13 Take urgent action to combat climate change and its impacts *By replacing inefficient old pumps powered by fossil fuels with PV solar power, CO_2 emissions will be reduced, energy savings will be made and air pollution avoided.* *SPIS infrastructure will provide resilience to climate change impacts of drought, increased temperatures, wind and consecutive dry days.* *Direct and indirect beneficiaries will benefit from enhanced awareness and knowledge and an enabling environment roadmap for nationwide implementation.*

Annex 1 Technical assistance data collection

Please add quantitative and qualitative values for the indicators selected in the M&E plan and monitored throughout the technical assistance in the tables below. Indicators which have been monitored in addition to the proposed indicators below may be added at the end of table A. Non-relevant indicators should be left blank.

A. Output and outcome indicators

Indicator	Quantitative value	Qualitative description
Total number of events organized by proponents and implementing partners	13	Kick-off and Inception meetings (2) SWG meetings (5) Workshops (3 + 3 TBD)
Number of participants in events organized by proponents and implementing partners	250	Ghanaian
a) Number of men	190	
b) Number of women & youth	60	
Number of climate technology RD&D related events		
Number of participants in climate technology RD&D events		
a) Number of men		
b) Number of women		
Number of training organized by proponents and implementing partners		2 dissemination workshops TBD
Number of participants in trainings organized by proponents and implementing partners		60 TBD
a) Number of men		
b) Number of women & youth		
Total number of institutions trained	23	NDE, Proponent and institutions represented on the SWG
a) Governmental (national or subnational)	7	EPA, MoFA, GIDA, GSA, NDPC, MoE, MESTI
b) Private sector (bank, corporation, etc.)	6	Agricultural Development bank (ADB), ARP Apex Bank, Dizengoff Ghana Limited, RDF Ghana, Pumptech, Ghana Agribusiness Chamber
c) Nongovernmental (NGO, University, etc.)	10	UNEP, Peasant Farmers Association of Ghana, Women in Agriculture Platform, University of Energy and Natural Resources (UENR), SNV, Farmer's Organization Network of Ghana, GiZ, Renewable Energy Association of Ghana, Abantu, Centre for International Forestry Research
Percentage of participants reporting satisfaction with CTCN training	100%	Zero negative responses during and after workshops

Percentage of participants reporting increased knowledge, capacity and/or understanding as a result of CTCN training	100%	Zero negative responses during and after workshops
a) Percentage of men	100%	
b) Percentage of women	100%	
Total number of deliverables produced during the assistance (excluding mission, progress and internal reports)	11	
a) Number of communication materials, including news releases, newsletters, articles, presentations, social media postings, etc.	5	Mandatory deliverables: • Detailed work plan • Monitoring and evaluation plan • CTCN Impact Description • Closure and Data Collection report
b) Number of tools and technical documents strengthened, revised or developed	3	Output 1 Deliverables Report: • Stakeholder mapping and Stakeholder Working Group (SWG), including name, position, institution, gender and role • Inception meeting minutes, materials, list of participants and photos • Bibliography of documents • Minutes of individual bilateral meetings • Diagnosis of smallholder agricultural and irrigation practices and needs in Ghana • Stakeholder workshop minutes, materials, list of participants etc. • Guide to most appropriate SPIS for smallholders in Ghana, list of accredited suppliers and distributors, potential configurations and cost analysis. Output 2 Deliverables Report: • Minutes of the stakeholder meeting, list of participants, photos and materials • SWOT analysis of the smallholders' access to financial mechanisms for SPIS • Three Business models tailored to the needs of the farmers / financial institutions targeting smallholder farmers for SPIS with their respective SPIS architecture • Minutes of stakeholder workshop. Output 3 - National Policy Framework for SPIS • Minutes of meetings with government and stakeholders and private sector, photos, participants, materials and conclusions • Defined guiding principles, vision and mission, objectives and goals • Identified barriers faced by the private sector to promote SPIS • Discussion of compliance standards, certification and financial incentives • Defined actions to help promote enabling environment • Compiled feedback and comments on first, second drafts and final policy framework. Output 4 - Awareness and Training Modules • Ten training modules • Webpage, to be hosted by EPA website • Minutes of SWG validation meeting and dissemination to EPA and national officers (TBD) • Minutes of two dissemination meetings (TBD) with smallholder farmers, NGOs,

		academia and private sector suppliers of SPIS; one each in the northern and coastal savannah, list of participants, photos and materials.
c) Number of other information materials strengthened, revised or created (For example training and workshop reports, Power Points, exercise docs etc.)	3	• Fact sheets (5) • SPIS system sizing tool • SPIS finance model
Total number of policies, strategies, plans, laws, agreements or regulations supported by the assistance	1	
a) Adaptation related	1	National Policy Framework for SPIS
b) Mitigation related		
c) Both adaptation- and mitigation related		
Anticipated number of policies, strategies, plans, laws, agreements or regulations proposed, adopted or implemented as a result of the TA	1	
a) Adaptation related	1	Update of National Irrigation Policy
b) Mitigation related		
c) Both adaptation- and mitigation related		
Anticipated number of technologies transferred or deployed as a result of CTCN support	19	• Water efficiency • Connection of isolated grid • Community-based energy services • Water pumping • Solar water pumps • Solar PV • Off-grid systems • Irrigation • Rice cultivation • Soil management • Integrated nutrient management • Soil moisture monitoring • Fertilizer management • Pest and insect control • Improved cultivation techniques • Crop diversification and new varieties • Crop rotation • Irrigation efficiency and information systems • Soil moisture conservation techniques
Anticipated number of collaborations facilitated or enabled as a result of technical assistance	13	
a) Number of South-South collaborations	13	UNEP, UENR/RCEES, Dizengoff Ghana Limited, RDF Ghana, Pumptech, PFAG, WiAP, SNV, FONG, GiZ, REAG, Abantu, CIFR
b) Number of RD&D collaborations		
c) Number of private sector collaborations	3	Dizengoff Ghana Limited, RDF Ghana, Pumptech
Number of countries with strengthened National System of Innovation as a result of CTCN support	1	Ghana

B. Core impact indicators

Please fill in the tables for anticipated impacts of the CTCN assistance. Every technical assistance should contribute to at least one of the indicators below. For guidance on how to report on core indicators see the 'M&E Guidance Document for TA Implementers'.

Core indicator 1	**Anticipated metric tons of CO_2 equivalent (CO_2e) emissions reduced or avoided as a result of CTCN TA**	
	Anticipated metric tons of CO_2e reduced or avoided as a result of the TA **on annual basis**	Anticipated metric tons of CO_2e reduced or avoided as a result of the TA **in total**
Quantitative value *(emissions reductions)*		
Unit	tCO_2e	tCO_2e
GHG assessment boundary (project emissions) Identify expected post-TA activities, associated effects and assess boundary for quantification of GHG emission reductions		
Baseline emissions Describe baseline scenario, baseline candidates, emission factors and emissions calculated		
Methodology Explain the method or process of verifying the indicator and how data was gathered		
Assumptions Describe assumptions made during calculation and quantification of GHG reductions		

Core indicator 2	**Anticipated increased economic, health, well-being, infrastructure and built environment, and ecosystems resilience to climate change impacts as a result of technical assistance**
Infrastructure and built environment Anticipated increased infrastructure resilience (avoided/mitigated climate induced damages and strengthened physical assets)	
Ecosystems and biodiversity Anticipated increased ecosystem resilience (areas with increased resistance to climate-induced disturbances and with improved recovery rates)	
Economic Anticipated increased economic resilience (e.g. less reliance on vulnerable economic sectors or diversification of livelihood)	
Health and wellbeing Anticipated increased health and wellbeing of target group (e.g. improved basic health, water and food security)	

Core indicator 3	Anticipated number of direct and indirect beneficiaries as a result of the TA	
	Quantitative value	**Means of verification**
Total beneficiaries	Direct: 250 Indirect: 2,500	Attendance records at meetings, workshops, training and other stakeholder engagements during the TA. Estimates of the number of smallholder farmers made aware of SPIS technologies and financing options as an adaptation tool after the TA, to minimize the impacts of climate change on their agricultural activities and/or as a mitigation tool to reduce the emission of greenhouse gases from their irrigation pumping activities.
Number of adaptation beneficiaries	16,000	Estimates of the potential number of farmers who may consider SPIS as a mitigation tool after the TA, to reduce the emission of greenhouse gases from their irrigation pumping activities. This number is assumed to be affected by the TA intervention as mitigation beneficiaries, including people trained by peer trainers or individuals who benefit from the technology transfer network set up by the TA
Number of mitigation beneficiaries		
Number of adaptation-and mitigation beneficiaries	16,000	Estimates of the potential number of farmers who may consider SPIS as an adaptation tool after the TA, to minimize the impacts of climate change on their agricultural activities and/or as a mitigation tool to reduce the emission of greenhouse gases from their irrigation pumping activities. Reference: • ~0.5 million smallholders irrigate using buckets, watering cans and small pumps (Namara, Gebregzlabher et al, 2013), • 160,000 smallholder farmers irrigate using small pumps (AgWater Solution Project surveys, 2010)

Core indicator 4	Anticipated amount of funding/investment leveraged (USD) as a result of TA (disaggregated by public, private, national, and international sources, as well as between anticipated/confirmed funding)			
	Quantitative value confirmed *in USD*	**Quantitative value anticipated** *in USD*	**Qualitative description**	**Methods**
Total funding				
Anticipated amount of public funding mobilised from national/domestic sources				
Anticipated amount of public funding mobilised from international/ regional sources				
Anticipated amount of private funding mobilised from national/domestic sources				
Anticipated amount of private funds mobilised from international/regional sources				

Annex 2 (for internal use – to be filled in by the CTCN)

CTCN evaluation

This section will be completed by the relevant CTCN Technology Manager.

- Evaluation of the timeliness of the TA implementation as measured against the timeline included in the response plan;
- Evaluation of TA quality as defined in the response plan;
- Overall performance of the Implementers;
- Overall engagement of the NDE and Proponent;
- Lessons learned on the CTCN process and steps taken by the CTCN to improve.