

Monitoring & Evaluation (M&E) Plan and Impact Statement

Objective of the M&E Plan and Impact Statement:

This M&E Plan and Impact Statement was designed based on the Technical Assistance Response Plan to enable the Implementer to complete the Closure Report at the end of the assistance. Quantitative and qualitative indicators, which are specific, measurable, achievable, relevant, and time bound, were selected to monitor the Activities, Outputs and anticipated Outcomes of the TA.

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 focal point and organisation	Mr. Joseph Amankwa Baffoe Acting Director Environmental Protection Agency (EPA), Ghana jabaffoe@gmail.com
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 period and total duration	15/09/2022 – 14/12/2023 (15 Months)
Total budget for implementation	USD 243,807
Designer of the response plan	CTCN
Implementer of response plan	CARES Limited and INTEGRATION environment & energy GmbH

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
<p>Mandatory Output: Development of implementation planning and communication documents</p> <p>Activity (i): Detailed Work Plan Activity (ii): Monitoring and Evaluation (M&E) Plan Activity (iii): Impact Description Activity (iv): Closure and Data Collection Report</p>	<p>1. Detailed work plan completed and approved by CTCN for distribution. 2. Monitoring and Evaluation Plan and Impact Description completed, with indicators. 3. Closure and Data Collection Report completed at the end of the TA.</p>	<p>Detailed workplan of activities, deliverables, outputs, deadlines and responsible persons. Detailed budget to implement the Response Plan. M&E Plan discussed with technical team and submitted to CTCN.</p>	<p>Number of relevant documents presented to CTCN. Number of engagements with stakeholders.</p>	<p>Brainstorming meetings with experts at the start of the TA. Kick-off meeting with the CTCN and NDE. Sharing the workplan and other documents.</p>
<p>Output 1: Benchmark solar powered irrigation technologies suitable to smallholder farmers in Ghana and assess their respective cost-benefits.</p>	<p>Reports on the SPIS technologies suitable for smallholder farmers, with cost-benefit analyses.</p>	<p>Stakeholder Mapping Report Inception Meeting Report Agricultural and Irrigation Practices Assessment Report SPIS Guide and Cost Analysis Report</p>	<p>TA Closure Report updated as the work continues</p>	
<p>Activity 1.1: Map relevant stakeholders and establish a stakeholder working group</p>	<p>Stakeholders and Stakeholder Working Group (SWG) members.</p>	<p>Approx. 30 stakeholders identified through stakeholder mapping. Up to 8 participants sworn in to SWG; number of men and women to be gender-balanced. Anticipated number of direct and indirect beneficiaries as a result of the TA.</p>	<p>Stakeholder Mapping Report, containing stakeholder list and description of the SWG, including name, position, institution, gender and role of each member. TA Closure Report updated as the work continues.</p>	<p>Include government, private sector, civil society, academic sector, NGOs, farmers, academia, private sector, farming cooperatives, gender & youth associations. Dependent on the willingness to participate and availability of gender-balanced membership. Avoid SWG bias towards one Region.</p>

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
Activity 1.2: Conduct an inception meeting	1Nr. Inception Meeting held and number of participants.	Approx. 20 participants. List of existing relevant documentation requested. Plan for bilateral meetings with the main stakeholders.	Inception Meeting Report - Lists of participants (including name, position, institution, gender and role of each member) and bibliography.	CTCN (2), NDE (3), SWG members (8) and Implementers Team (6). Laws, regulations, draft standards, ongoing initiatives, programmes approved or under evaluation.
Activity 1.3: Desk analysis of agricultural and irrigation practices under a changing climate in Ghana to assess smallholder farmers' needs	Report on the diagnosis of agricultural and irrigation practices and assessment of smallholder farmers' needs in Ghana.	Requested data accessed and reviewed, including hydrological, meteorological, soil and crop data. 15 in-person interviews on irrigation practices completed. Regional maps of water availability, crops cultivated and water requirements, and matrix of irrigation systems being used in the Northern and Coastal Savannah regions. Cost-benefit analysis and investment levels required.	Agricultural and Irrigation Practices Report, including minutes of interviews, assessment of irrigation infrastructure (challenges, opportunities, best technologies, advantages, limits/bottlenecks, mistakes/failures and lessons learnt), climate change conditions and impacts on agriculture, and types of crops cultivated. TA Closure Report updated as the work continues.	NDE and project proponent support to access updated and relevant country-level data. Complete datasets may not be available. Interviews to be initiated while an international expert is in Ghana.
Activity 1.4: Organize a stakeholder workshop to introduce the SPIS to Ghana's future users, national officers, investors, and private sector	1 Day Workshop with the SWG and wider stakeholder audience. Number of participants.	Approx. 30 participants, including the 8 SWG members, NDE, CTCN and at least 1 international expert from the Implementer's team. Representatives of women, youth and vulnerable groups. Identified barriers to access to finance and uptake of SPIS by smallholders' farmers.	Minutes of the stakeholders' workshop, including list of participants disaggregated by gender, list of questions raised, materials used, etc. Contribution of views by users (smallholder farmers), providers (private sector) and government officers.	Understand the main factors of change required to create an enabling environment.

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
<p>Activity 1.5: Elaborate a guide of the solar irrigation and improved irrigation technology systems most suitable to smallholder farmers in Ghana</p>	<p>Guidance document on the most appropriate SPIS for smallholder farmers in Ghana. List of accredited suppliers and distributors.</p>	<p>Recommended SPIS designs that are the most suitable for the smallholder farmers, by region, with a special focus on the Northern and Coastal Savannah (≥ 3 SPIS architectures that could be efficient and sustainable in remote areas of Ghana). Lists of local suppliers and distributors providing certified products and already working (successfully) in West Africa.</p>	<p>SPIS Guidance Document and certified suppliers list. TA Closure Report updated as the work continues.</p>	<p>Only certified suppliers and distributors will be listed, whose products are aligned with international standards and the quality of components is guaranteed.</p>
<p>Activity 1.6: Cost analysis of the SPIS and improved irrigation architectures</p>	<p>Cost analysis of the technologies and system architecture identified above</p>	<p>≥ 3 cost estimates for the recommended SPIS design configurations.</p>	<p>Cost Analysis Report TA Closure Report updated as the work continues</p>	
<p>Output 2: Define a business model targeting smallholder farmers for the use of Solar Powered Irrigation Systems in Ghana</p>	<p>Different models analysed, including the “pay-per-use” model</p>	<p>“Pay-per-use” and other models defined and explained to both farmers and financial institutions.</p>	<p>TA Closure Report updated as the work continues</p>	
<p>Activity 2.1: Organize a stakeholder meeting with representative of local smallholder farmers as well as financial institutions</p>	<p>1 Day Workshop held with stakeholders. Number of participants.</p>	<p>Approx. 30 participants from local smallholder farmers, national officers and NGOs. SWOT analysis of the smallholders’ access to financial mechanisms for purchase of SPIS Needs of the farmers / needs of the financial institutions.</p>	<p>Minutes of the workshop with list of participants disaggregated by gender, photos, materials used. Meeting Report, including SWOT analysis and needs assessment.</p>	<p>Workshop discussions:</p> <ul style="list-style-type: none"> • Most suitable business model(s) for smallholders to access affordable finance • Ways to mitigate investment risks for financial investors.

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
Activity 2.2: Define business model(s) that would enable the use of SPIS by smallholder farmers in Ghana	Business models analysed, including the “pay-per-use” model.	1-3 business models defined for long-term sustainability: <ul style="list-style-type: none"> • “Pay-per-use” model • Other options based on needs. 	Business Models Report. TA Closure Report updated as the work continues.	
Activity 2.3: Business model validation workshop	1 Day Workshop with SWG, smallholders and financing sector. Number of participants.	Approx. 30 participants, including local smallholder farmers, NGOs, national officers, with both women and youth are represented, and ≥1 international expert. Draft business models explained to Stakeholders.	Minutes of the workshop. Validation Report. TA Closure Report updated as the work continues	
Output 3: National framework on solar powered irrigation technology	Policy framework to set up a compliance standards and certification	National Policy Framework Report	TA Closure Report updated as the work continues	
Activity 3.1: High level governmental meeting	Meeting in presence of the ministries, MDAs, MMDAs and other governmental bodies. Number of participants,	1 Day Meeting with representatives. Approx. 30 participants and 3 technical support/admin staff. Defined framework policy vision and mission, policy objectives and goal, and principles to guide the implementation of the policy.	Examples of “mission and vision” defined in other RE frameworks in Africa. Minutes of meeting.	
Activity 3.2: Stakeholder consultation with the private sector (solar tech providers, distributors)	Workshop held, with the draft detailed national framework presented and explained. Number of participants.	1Nr. workshop with stakeholders from the private sector, including solar technology providers and distributors. Approx. 20 participants.	Minutes of workshop, including photos, list of participants disaggregated by gender, materials used and conclusions.	Identified barriers faced by the private sector to promote SPIS. Standards, certification and financial incentives discussed. Defined actions to help promote an enabling environment.

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
Activity 3.3: Draft policy framework to set up a compliance standards and certification for solar irrigation technology	Draft policy framework to set up compliance standards and certification for SPIS	1Nr. Draft policy framework including: (i) Introduction (ii) Policy statements (iii) Standards and certification for SPIS technologies (iv) Financial incentives (v) Compatibility with existing legislation.	Draft Policy Framework Report	
Activity 3.4: Circulate first draft of the policy framework and collect official feedback	First Draft policy framework circulated	Official feedback and comments received from governmental organisations and SWG members within 2 weeks.	Compiled feedback and comments on first draft.	
Activity 3.5: Conduct an official review workshop with the concerned national ministries, governing authorities and to the stakeholder working group	First Draft policy framework Review Workshop. Number of participants, with both women and youth represented.	First Draft policy framework reviewed and ready for further action. Approx. 20 participants (≥25% are women).	Workshop Review Report, officially approved.	
Activity 3.6: Incorporate comments and develop second draft of the policy framework	Second Draft policy framework.	Policy framework incorporating official feedback and comments from First Draft and Review Workshop.	Second Draft policy framework Report	
Activity 3.7: Circulate second draft and collect official feedback	Second Draft policy framework circulated	Official feedback and comments received from governmental organisations and SWG members within 2 weeks.	Compiled feedback and comments on second draft.	
Activity 3.8: Incorporate comments and develop final draft of the policy framework	Final Draft policy framework.	Policy framework incorporating official feedback and comments from second Draft.	Final Draft policy framework Report. TA Closure Report updated as the work continues	

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
<p>Output 4: Capacity training to raise awareness on the benefits of solar pumping irrigation systems for smallholder farmers in Ghana</p>	<p>Training sessions developed and presented to groups Number of participants and positive feedback on training</p>	<p>10 modules developed. 3 training workshops presented.</p>	<p>TA Closure Report completed at the end of the work</p>	
<p>Activity 4.1: Design the comprehensive training modules targeting smallholder farmers and investors</p>	<p>Training modules on SPIS.</p>	<p>10 training modules on SPIS, including:</p> <ul style="list-style-type: none"> • Overview of SPIS technologies for smallholders. • Cost benefits of SPIS. • Promotion of business models and financing options, credit instruments and investment risk analysis. • Policy framework. • Role of certifications and standards. • Implementation, installation and training modalities, O&M and M&E. • Guide of providers and suppliers. • Step by step architecture and use of SPIS. • Benefits on food security and resilience to climate change • One other, dependent on the identified gaps, needs and focus. 	<p>Draft Training Modules</p>	

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
Activity 4.2: Validation of the training modules through a meeting with the stakeholder working group	Workshop with SWG. Number of participants.	1 Day Workshop 8 participants, plus NDE and Implementer's experts	Minutes of the validation meeting and revised training modules.	Translation into a local language, once approved and if considered necessary by the SWG
Activity 4.3: Creation of a webpage about SPIS to be hosted in the Environmental Protection Agency	Webpage hosted in EPA website. Meeting with SWG to validate content. Number of participants.	1Nr. Webpage, including SWG comments, launched and operational. 8 participants, plus NDE and Implementer's experts	Minutes of meeting with the list of participants disaggregated by gender, photos, materials used	
Activity 4.4: Dissemination of the Training Modules through a 3 stakeholder's workshop	In-person stakeholder workshops. Number of participants.	3 workshops for the following groups: <ul style="list-style-type: none"> • Approx. 25 smallholder farmers, NGOs and Academia • Approx. 25 private sector, suppliers and providers • Approx. 15 EPA and national officers. 	Workshop Reports TA Closure Report	
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 mitigation 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 adaptation beneficiaries		
Number of adaptation-and mitigation beneficiaries		<p>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.</p> <p>Reference:</p> <ul style="list-style-type: none"> • ~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)-

Note: The information in the table below will be used by the CTCN for public communication of the achieved and expected results of the Technical Assistance through the CTCN website www.ctc-n.org and other communication channels. See for example: https://www.ctc-n.org/sites/www.ctc-n.org/files/benin_a_ag_forestry.final_.pdf

Impact Statement	
Challenge	<p>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.</p> <p>The Government of Ghana, mostly through the Ministry of Food and Agriculture – Ghana Irrigation Development Authority - 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 19.7% 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 Ghana Irrigation Development Authority, 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.</p>
CTCN assistance	<p>The TA aims to introduce Solar Powered Irrigation Systems (SPIS) technology in Ghana, using lessons learnt to formulate an enabling environment roadmap and M&E framework for nationwide roll-out; including:</p> <ul style="list-style-type: none"> • Development of Implementation Planning and Communication Documents • Benchmark Solar Powered Irrigation Technologies Suitable to Smallholder Farmers in Ghana and Assess their Respective Cost-Benefits • Define a Business Model Targeting Smallholder Farmers for the Use of Solar Powered Irrigation Systems in Ghana • National Framework on Solar Powered Irrigation Technology • Capacity Training to Raise Awareness on the Benefits of Solar Pumping Irrigation Systems for Smallholder Farmers in Ghana
Anticipated impact	<p>The following anticipated impact indicators will be assessed as a result of the technical assistance:</p> <ul style="list-style-type: none"> • 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)
Anticipated co-benefits from the TA	<p>Apart from the core impact indicators above there are significant co-benefits expected over the project lifetime from the TA and the Team intends to assess and quantify the following:</p> <ul style="list-style-type: none"> • Environmental co-benefits: <ul style="list-style-type: none"> • Energy savings • Reduction of air-pollution • Social co-benefits: <ul style="list-style-type: none"> • Increased knowledge for climate change adaptation and mitigation • Access to energy and water for rural households, for domestic and livestock use • Economic co-benefits: <ul style="list-style-type: none"> • Increased food security and the improvement of livelihoods of local communities

Impact Statement	
	<ul style="list-style-type: none"> • Job opportunities within local communities.
Gender aspects of the TA	<p>Past experiences show that there are significant benefits of solar pumping solutions for women. It allows the women farmers to become net producers, generate income from market sales and substantially increase their household nutrition intake and food security (Burney et al., 2009). Also, gender characteristics play an important role in terms of energy decision-making (IRENA, 2016).</p> <ul style="list-style-type: none"> • The TA supports achieving gender equality and the empowerment of all women and girls by the inclusion of gender in all the intended outcomes. • A gender analysis will be conducted for stakeholder participation. • The SWG will be gender balanced. • Gender benefits will include identifying and addressing challenges and barriers for women (and youth) in accessing small-scale irrigation systems and solar water pumping in food crop cultivation.
Anticipated contribution to NDC	<ul style="list-style-type: none"> • 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	<p>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.</p> <p>The objective of the technical assistance is 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 a sustainable business model that targets 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 shall:</p> <ul style="list-style-type: none"> • Benchmark Solar Powered Irrigation Technologies Suitable to Smallholder Farmers in Ghana and Assess their Respective Cost-Benefits • Define a Business Model Targeting Smallholder Farmers for the Use of Solar Powered Irrigation Systems in Ghana • National Framework on Solar Powered Irrigation Technology • Capacity Training to Raise Awareness on the Benefits of Solar Pumping Irrigation Systems for Smallholder Farmers in Ghana
Contribution to SDGs	<p>The TA is expected to contribute to the following Sustainable Development Goals (SDGs):</p> <ul style="list-style-type: none"> • SDG1 End poverty in all its forms everywhere <i>Improving production through Solar Powered Irrigation Systems (SPIS) will increase incomes for rural farmers.</i> • SDG2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture <i>Improving production through SPIS will ensure food security and improved quality of life for farmers.</i> • SDG7 Ensure access to affordable, reliable, sustainable, and modern energy for all <i>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.</i> • SDG13 Take urgent action to combat climate change and its impacts

Impact Statement

By replacing inefficient old pumps powered by fossil fuels with PV solar power, CO₂ 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.