Technical Assistance Closure Report

Closure Report for CTCN Technical Assistance

1. Basic information

Title of response plan	**Feasibility study for the utilization of solar energy for sugarcane irrigation pumping by emerging commercial small cane growers in Eswatini**
Technical assistance reference number	**2021000035**
Country / countries	**Eswatini**
NDE focal point and organisation	**Bafana Nicholus Simelane, Eswatini Meteorological Service**
Proponent focal point and organisation	**Mr. Nelson Mavuso, Director of Agriculture, Ministry Agriculture**
Designer of the response plan	**Climate Technology Centre and Network (CTCN)**
Implementer(s) of technical assistance	**MicroEnergy International GmbH**
Beneficiaries	The Eswatini Cane Growers Association, The Eswatini Sugar Association, farmers
Sector(s) addressed	**Agriculture, Energy**
Technologies supported	Solar PV Solar water pumps Solar powered irrigation systems (SPIS)
Implementation period and total duration in months	**March 2023 – June 2024 (15 months)**
Total budget for implementation	USD 141,420
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	**Output 1 – Preliminary assessment of farming communities and their energy needs and potential savings** Activity 1.1: Analyse the general landscape of small-scale cane growers in the Malkerns, KDDP and LUSIP cane farming areas and their solar irrigation context • Desk review on the current landscape of small-scale solar irrigation in Eswatini • Identification and mapping of key stakeholders • Conduction of seven (7) key stakeholder interviews with representatives of financial institutions, non-governmental organizations and local development institutions, the Eswatini Sugar Association and the Cane Growers Association • Small-scale farming and solar irrigation landscape report (Deliverable 1.1) Activity 1.2: Identify interested small-scale cane growers in the Malkerns, KDDP and LUSIP cane farming areas • Participation of local team in three (3) irrigation seminars organized by the Eswatini Sugar Association • Awareness raising among participants on solar irrigation systems for 149 farmers • Conduction of focus group discussions • Report on irrigation seminars (Deliverable 1.2) Activity 1.3: Assess the current infrastructure, activities, energy profiles and needs of interested cane growers

	• 66 relevant cane growers across three regions were pre-selected in collaboration with the Sugar Association and the Cane Growers Association • Analysis of their location, irrigation patterns, irrigation systems and pumping requirements • Report on infrastructure, energy use profiles and needs of interested small-scale sugarcane growers (Deliverable 1.3) Activity 1.4: Prioritize and select a few small-scale cane growers from each cane farming area based on their fit for using solar irrigation systems • 66 cane growers evaluated across three target regions based on their farm area, power requirements, ownership structure and capacity of solar systems (in those farms where solar power has already been installed) • Six (6) cane growers shortlisted across the three regions shortlisted based on the z-factor • Report on prioritized small-scale growers (Deliverable 1.4) **Output 2: Technical feasibility study** Activity 2.1: Undertake a technical feasibility study to solarise the irrigation systems of selected small-scale cane growers • Field visit and survey of six (6) shortlisted cane growers, assessing general information, existing infrastructure, pumping and irrigation requirements and electricity demand • Technical feasibility assessment report (D2.1) Activity 2.2: Develop a schematic design of an indicative system configuration for each small-scale cane grower • Technical sizing of solar PV system requirements for six (6) farms using Helioscope, and according to three different scenarios, providing system capacity, estimated annual energy production, performance ration and component requirements • Six (6) schematic designs of indicative solar irrigation systems according to three scenarios (D2.2) **Output 3: Identification of appropriate technologies and service providers** Activity 3.1: Identify and consult with four local and three international solar system developers • Pre-screening of 21 local, regional and international solution providers • Shortlisting and contacting nine (9) relevant solution providers based on experience with solar-powered irrigation systems and work within the local Eswatini context. Activity 3.2: Present a summary of their services, conditions and financing plans for each of the selected small-scale cane growers • Survey and direct consultations with six (6) local, regional and international technology providers • Technology provider assessment report (D3) Activity 3.3: Identify the most suitable technology setup and service provider for each of the small-scale cane growers

	• Comparative assessment of geographical outreach, experience, system costs, certifications, customer support and financing capabilities • Overview of suitable technologies, services and financing options provided by selected technology providers. **Output 4: Economic feasibility study** Activity 4.1: Conduct a cost analysis for each small-scale cane growers • Cost analysis for six (6) farms according to three scenarios considering the PV systems' CAPEX and OPEX Activity 4.2: Conduct a revenue/benefit analysis for each selected small-scale cane growers • Revenue analysis for six (6) farms according to three scenarios considering current electricity costs, estimations of savings potential, possibilities for feeding-in back to the grid and CO_2 Avoidance resulting from PV implementation. Activity 4.3: Prepare a cost-benefit assessment for each selected small-scale cane growers • Cost-benefit analysis for six (6) farms according to three scenarios considering levelized cost of electricity, net present value, payback period and cost-benefit ratio. • Economic feasibility assessment report (D4.1) Activity 4.4: Identify and develop potential financing models for farmers • Desk review of international case studies of successful financial products for the implementation of solar PV systems and other technology solutions in the context of agriculture financing • Stakeholder consultations with representatives of local financial institutions • One stakeholder workshop with 12 key stakeholders, including representatives of four local financial institutions • Individual stakeholder consultations with three (3) local financial institutions and one (1) local insurance provider to gather feedback on proposed financial mechanisms for cane growers • Brief on consumer mechanisms for the uptake of solar irrigation (D4.2) **Output 5: Development of favourable conditions for solar-irrigated cane farming in Eswatini** Activity 5.1 Develop Government-led policy guidelines and potential financing mechanisms • Desk review of international policy and financing mechanisms implemented to support the uptake of solar power, particularly solar-powered irrigation systems • Two (2) stakeholder meetings for the discussion of challenges and possible interventions for the

	promotion of solar irrigation in Eswatini, one meeting with public sector stakeholders and one meeting with representatives of financial institutions • One (1) hybrid review workshop with key stakeholders for review and validation of guidelines • Bilateral stakeholder consultations with key stakeholders to validate guideline recommendations • Guidelines for policy and financing mechanisms for the solarization of irrigation systems for small-scale growers in Eswatini (D5)
Methodologies applied to produce outputs and products	• Stakeholder interviews and workshops • Focus group discussions • Statistical data analysis, using the Z-score to identify outliers within a data group • Baseline assessment survey of cane growers without solar-powered irrigation systems • Scenario analysis • Survey of technology providers • Comparative assessment of technology providers • SMA Solar Technology AG CO_2 Avoidance Calculation • Techno-economic assessment of renewable energy projects using the System Advisor Model (SAM)
Deviations	The technical assistance took place majorly without significant deviations in activities, outputs or products. The most relevant deviations where: • Six (6) solar system developers were assessed under Activity 3.2 of output 3, in contrast with seven (7) expected this due to the low responsiveness among the nine (9) relevant solution providers shortlisted • Support financial institutions
Anticipated follow-up activities and next steps	• Support the five shortlisted cane growers without a solar powered irrigation system to approach solution providers to size and install solar-powered irrigation systems (estimated timeline: one year after project completion). • Support FINCORP and other relevant local financial institutions to engage with cane growers through the cane growers association and the sugar association and to design a project pipeline to raise funding from international development cooperation organizations (estimated timeline: two years after project completion). • Support the establishment of a technical committee with key local stakeholders and members of the TA steering committee to oversee the promotion of solar irrigation systems in the country and the implementation of the relevant recommendations framed as

	part of the guidelines for policy and financing mechanisms for the solarization of irrigation in Eswatini (estimated timeline: six months after project completion). • Support ESERA (regulator) and EEC (utility) in raising awareness on the small-scale embedded generation framework and the piloting of a tariff for the net billing system (estimated timeline: two years after project completion). • Support the renewable energy association, the standards association, the regulator and the utility in the development of a certification program for solar installers (estimated timeline: two years after project completion).

2. Lessons learned

	Lessons learned	**Recommendations**
Lessons learned from the CTCN TA process	• The establishment of a project steering committee including CTCN, the NDE and key stakeholders and project beneficiaries increased local ownership of the project and facilitated stakeholder engagement • Collaboration with the NDE facilitated approaching local stakeholders, exchanging information and organization of events with local partners and facilitated exchange of information • The difference between expectations from key stakeholders and beneficiaries for the activities and deliverables from the TA and the ToR's requirements became a challenge when approaching key stakeholders.	• *Encourage the establishment of a project steering committee in the early stages of the project* • *Communicating to relevant stakeholders and members of the steering committee what are the expected outputs, activities and deliverables for projects* • *Continuous engagement with the NDE to ensure constant cooperation and collaboration with local stakeholders, thus making sure the project implementation is supported at every step by insights from project beneficiaries and key stakeholders*

	• Promoting the exchange between different public sector stakeholders, financial institution, cane grower organisations and local NGOs via stakeholder workshops helped raise awareness in the project, provided valuable insights to further adjust outputs to the local context and facilitated future stakeholder engagement processes	
Lessons learned related to climate technology transfer	• Implementing solar-powered irrigation systems for small and medium scale cane growers in Eswatini is both technical and economically feasible, as the available areas allow for the installation of systems that cover the farms yearly demand and there are already farms where this technology has been implemented or is under implementation phase. Furthermore, payback periods for these investments were estimated as an average of nine years, which can further decrease once a net billing system and other economic incentives are in place. • There is a general interest among cane growers in solar powered irrigation technology. Some cane growers have already implemented solar systems and approach financial institutions to inquiry about financing possibilities • An initial conception among project stakeholders was the idea of oversizing solar systems to generate additional revenue from electricity	• Support capacity building among cane growers and technology providers on the local embedded generation framework and the need to consult the utility requirements before installing solar -powered irrigation systems. • Support financial institutions via technical assistance to build in-house capacity on appraisal of solar loans and on the mobilisation of international funding (e.g. the Green Climate Fund) for the promotion of solar-powered irrigation systems • Support ESERA, EEC, the renewable energy association and other key stakeholders to pilot, finalise and enforce the small-scale embedded generation framework and the net-billing regulation, including the establishment of tariffs • Identify cane growers interested in acquiring solar powered irrigation systems and support the engagement with financial institutions and regional and international project developers and technology providers to support the solarisation of these farms under a programme.

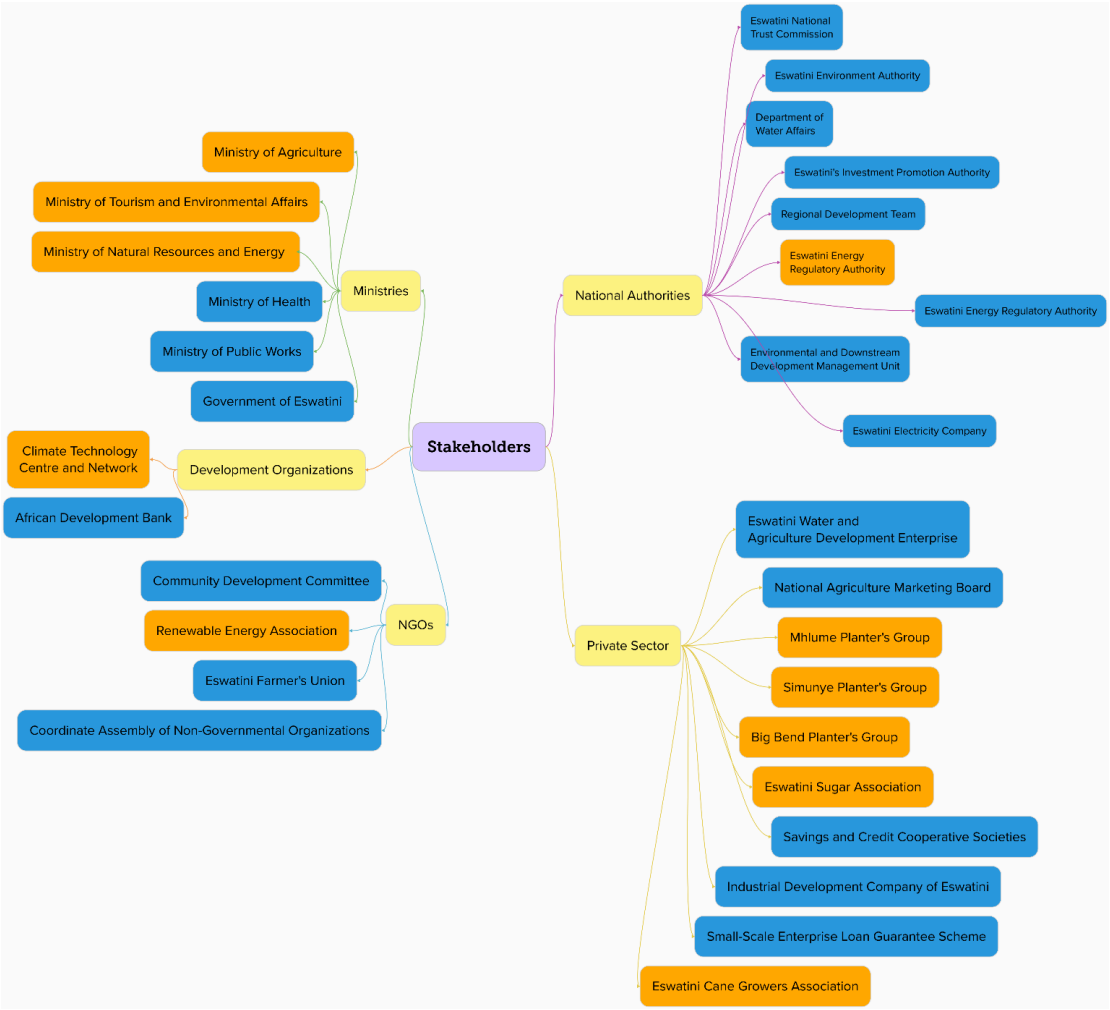
	supply, consultations with the national utility established that such oversizing should be discouraged, and that system design should be focused on self-consumption • There is a well-consolidated financial landscape. Local financial institutions are used to lending to cane growers under the context of agricultural loans, and they rely in institutions such as the cane growers association and the milling associations. Furthermore, local financial institutions are taking steps towards accreditation from the Green Climate Fund and establishing financing pipelines to securing funding to finance solar energy. • The regulatory framework to support the uptake of solar powered irrigation systems for cane growers is under development. Local institutions, including the utility (EEC) and the regulator (ESERA) have taken significant steps to set up mechanisms such as a wheeling framework and net billing as an incentive. However, these are still in development stages. Further support to these institutions might accelerate the establishment of such incentives, making the investment in solar power more attractive. • Consolidating groups of cane growers interested in acquiring solar-powered irrigation systems has the potential to reduce the perception of risks, facilitate the mobilisation	

	of funding and mobilise international solution providers. By clustering large groups of cane growers interested in solar power financial institutions can apply for international funding from international development organisations. A pipeline of projects would also allow for a competitive tendering process that can attract project developers with experience and who directly procure and install the solar components, thus reducing costs and ensuring quality	

3. Illustration of the TA and photos

For communication purposes, please provide 2-4 Power Point slides, including illustrations or charts, describing barriers, opportunities, methodology, activities, outputs and achieved results. The illustrations must be copied into the TA Closure report but must also be delivered as power point files. Also, please provide at least five high-resolution pictures in jpg format, capturing technical assistance. The pictures should illustrate how the TA has impacted the lives of the beneficiaries in particular and the communities in general.

Find below and attached as ppt



Capacity building and awareness raising at irrigation seminars

LUSIP

Malkerns

KDDP

CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

Methodology for the selection of case study farms

Preliminary list of growers

- Obtained in collaboration with **ESA** and **ECGA**
- Data from 68 farms received
- 42 without solar systems
- 24 with a solar system already installed

Data cleaning and processing

- Disaggregation of data in four groups for assessment

1. Farmers with solar systems
2. Farmers in KDDP
3. Farmers in LUSIP
4. Farmers in Malkerns

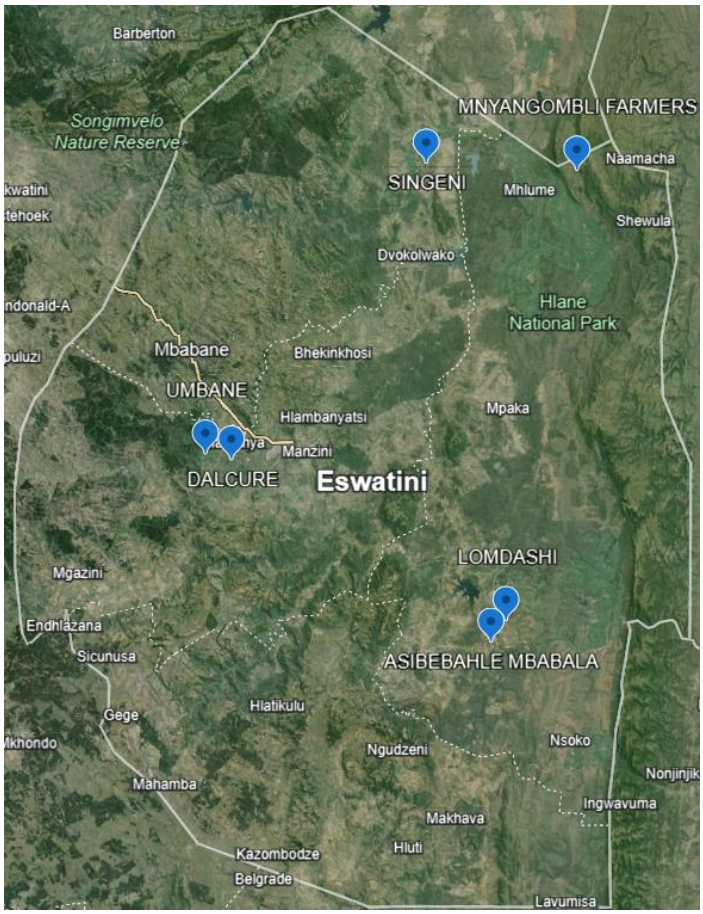
Assessment of farms

- Using the **Z-score** as a base for shortlisting
- Based on key parameters
  - Area of farm
  - Total power requirements for pumping
  - Number of pumps
  - Ownership structure
  - Capacity of solar system (for those who have solar)

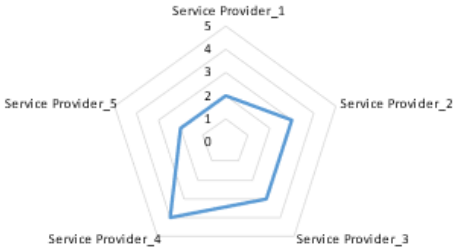
Shortlisting of farms

- **In KDDP and LUSIP**
  - Selection based on Z factor
  - Four cases shortlisted: two in KDDP and two in LUSIP
  - In each region one case with the largest Z factor and one with the largest negative Z factor
- **In the Malkerns**
  - Two cases shortlisted: One smallholder farmer with solar irrigation and a smallholder farmer without solar irrigation

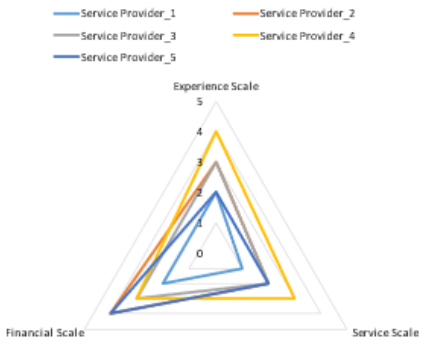
Data collection – farm assessment



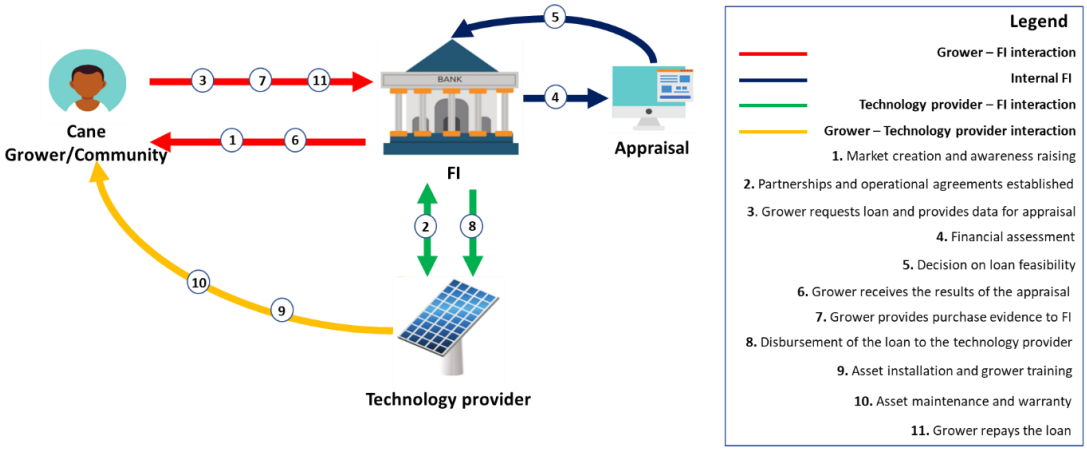
Comparative assessment of technology providers



Comparison of experience



Overall comparative



Step	Responsible Party	Activities
1	Financial institution	• Awareness raising and advertisement to attract potential borrowers • Select authorized technology providers and establish partnerships and operational agreements • Develop in-house capacity to conduct loan appraisal processes for granting SPIS finance
2		
3	Grower/growing community	• Fill-in appraisal questionnaires • Provide the necessary information for financial appraisal
4	Financial institution	• Conduct the loan appraisal for SPIS to assess system costs and savings potential from cane growers/growing communities • Determine the feasibility of granting the borrower a solar loan
5		
6	Grower/growing community	• Receive results from loan appraisal and take them to an authorized technology provider • Choose an asset based on the results of the loan appraisal and the proposal from the technology provider • Provide evidence of agreement from the supplier to FI (invoice, approval or proof from supplier)
7		
8	Financial institution	• Disburse the loan amount **to the authorized technology provider**
9	Authorized technology provider	• Installation of the asset and training of the grower/growing community on its use • Provide maintenance, replacement and warranty of the assets delivered to the grower
10		
11	Grower/growing community	• Repayment of the loan to the FI according to the established conditions

Stakeholder review workshop - Guidelines




4. Impact Statement

The information in the table below will be used to communicate results and anticipated impacts of this technical assistance publicly. Please copy information from impact statement developed in the M&E Plan and update as relevant.

Challenge	Eswatini has identified sugarcane as a strategic crop to support poverty alleviation. Most farmer owned sugarcane companies are connected to the national electricity grid, which leads to GHG emissions and increasing operational costs. The implementation of solar irrigation systems represents an opportunity for sugar farming stakeholders to reduce their operational costs, protect their competitiveness while contributing to climate change mitigation in the country.
CTCN Assistance	• Landscape assessment of small-scale cane growers in Eswatini • Conduction of a technical and economic feasibility study on the opportunities for the introduction of solar irrigation systems for small-scale growers in Eswatini • Identification and development of potential financing models for the introduction of solar irrigation among small-scale cane growers • Support the development of policy guidelines for the promotion of solarized irrigation systems for sugarcane growers
Anticipated impact	• Technical and economic feasibility analysis for the introduction of solar irrigation systems for five small-scale sugarcane growers • Development of policy guidelines and financing mechanisms for the promotion of solar irrigation • At least five organizations from the governmental and non-governmental sector in Eswatini benefiting from the deployment of favorable conditions for solar-irrigated cane farming
Co-benefits: Achieved or anticipated co-benefits from the TA	• Contribution to the long-term reduction of GHG emissions from the agriculture sector • Increase in competitiveness of small-scale sugarcane growers in Eswatini

	• Increase access to finance for the implementation of solar irrigation systems • Clear recommendations to improve the policy and financial landscape for solar-powered irrigation systems in Eswatini
Gender aspects of the TA	The technical assistance incorporated gender considerations to assess the participation of women in areas that included: • The small-scale sugarcane sector • The sugar industry • Financial institutions • Non-governmental organizations • The public sector and regulatory bodies Furthermore, key activities and deliverables of the project included specific gender considerations to promote the participation of women in the small-scale sugarcane sector, these activities included the assessment of the small-scale farming and solar irrigation landscape and the development of guidelines for policies and financing mechanisms on solarization of irrigation systems for sugarcane growers.
Anticipated contribution to NDC	• By moving towards solar irrigation, cane farmers will move away from the consumption of electricity from the national grid, which is carbon rich, thus contributing to Eswatini's GHG reduction target of 5% by 2030 (compared to the baseline scenario) and to the achievement of low carbon and climate resilient development. • Solar irrigation also contributes to Eswatini's commitment to adopt mitigation measures in the agriculture, forestry and other land use sectors, including the reduction of energy intensity in the agriculture sector by 3% by 2030 (relative to 2010).
The narrative story	Agriculture plays a fundamental role in the economic development of Eswatini. Sugarcane contributes to 74% of the country's agricultural GDP and has been identified as a strategic crop for poverty alleviation. However, changes in rainfall

	patterns and an increase in the frequency of droughts call for the urgent implementation of climate change mitigation and adaptation solutions in the sector. Even though the deployment of irrigation systems contributes to the adaptation of farmers to the effects of climate change, irrigation systems are currently powered by the national grid, bringing about two major problems: an increase in the operation costs of cane farmers that negatively impacts the entire value chain, and an increase in the greenhouse gas (GHG) emissions from the sugarcane sector, as the electricity from the grid comes from carbon intensive sources, including coal and diesel. Within this context, the implementation of solar powered irrigation systems (SPIS) has the potential to decrease the costs of sugarcane farming while reducing the overall carbon emissions of the sector, further contributing to the mitigation of climate change and to the country's efforts in terms of poverty alleviation and economic development. The technical assistance "*Feasibility study for the utilization of solar energy for sugarcane irrigation pumping by emerging commercial small cane growers in Eswatini"* aimed to create an enabling environment for SPIS by: • Assessing the current landscape of SPIS for irrigation in Eswatini • Understanding the technical and economic feasibility of introducing SPIS to grid-tied sugarcane farms • Proposing possible end-user models and alternatives for the promotion of SPIS among cane growers • Formulating a series of recommendations for the creation of an enabling environment of SIPS via the elaboration of a series of policy and financial mechanisms guidelines for the promotion of SPIS.

	The technical assistance successfully provided the following results: • A detailed landscape assessment of the small-scale cane growers in Eswatini, including the mapping of key stakeholders for the solarization of irrigation systems and the identification of six (6) relevant farms for the conduction of the technical and economic feasibility study. • The technical and economic feasibility assessment of six (6) farms in Eswatini, establishing the PV system and area requirements to implement SPIS, and conducting a cost-benefit analysis of the deployment of these systems, including the calculation of key performance indicators (KPIs) associated to the SPIS investment. The results of these assessments are positive, indicating the technical and economic feasibility of solarizing sugarcane farms. • The identification of local, regional and international technology providers for SPIS in Eswatini. • The elaboration of a brief on consumer financing mechanisms with SPIS, discussed with local financial institutions. • The development of a set of guidelines on policy and financial mechanisms for the promotion of SPIS in Eswatini, featuring a series of key recommendations and interventions to create an enabling environment to promote the uptake of this technology. This document was discussed with local stakeholders from public, private and civil society sectors.
Contribution to SDGs A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/	• SDG 2 – Zero Hunger: The implementation of solar irrigation systems will support targets 2.3 “doubling agricultural productivity

	and incomes of small-scale food producers" and 2.4 "Ensuring sustainable food production systems and implement resilient agricultural practices that increase productivity and production" • SDG 7 – Affordable and Clean Energy: The introduction of solar energy within the context of agriculture in Eswatini will contribute to the achievement of targets 7.2 "Increasing substantially the share of renewable energy in the global energy mix" and 7.b "Expanding infrastructure and upgrading technology for supplying modern and sustainable energy services for all in developing countries" • SDG 9 – Industry, Innovation and Infrastructure: where the development of guidelines and financing mechanisms to promote access to solar irrigation will contribute to achieve targets 9.3 "Increase access of small-scale industrial and other enterprises to financial services" and 9.a "Facilitating sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support" • SDG 13 – Climate action: One of the main expected impacts from the technical assistance is the promotion of climate change mitigation and the reduction of GHG emissions from the sugarcane sector, thus contributing to achieve targets 13.1 "Strengthen resilience and adaptative capacity to climate-related hazards and natural disasters in all countries" and target 13.2 "Integrating climate

	change measures into national policies, strategies and planning”

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 Please note indicators below highlighted as **anticipated**	**Quantitative value** Value and unit	**Qualitative description** List the various elements corresponding to the quantitative value as well as timelines and responsible institutions
Number of communication and outreach activities conducted by proponents and implementing partners to showcase CTCN support	Six (6) communication and outreach activities hybrid and/or on-site with key project stakeholders Eleven (11) online steering committee meetings throughout 15 months	Three in-person awareness raising and information sessions with cane growers on the project, including the conduction of focus group discussions with cane growers, organized as part of irrigation seminars organized by the Eswatini Sugar Association • One seminar in the Malkerns • One seminar in Mhlume • One seminar in Siphofaneni One hybrid policy stakeholders meeting One hybrid financial stakeholder meeting One project closing workshop and review of the guidelines on policy and financing mechanisms
Number of participants in the events above	• 149 (irrigation seminars) • 10 (policy stakeholder meeting) • 14 (financial stakeholder meeting) • 29 (project closing workshop)	

a) Number of men	• 117 (irrigation seminars) • 6 (policy stakeholder meeting) • 10 (financial stakeholder meeting) • 22 (project closing workshop)	
b) Number of women	• 32 (irrigation seminars) • 4 (policy stakeholder meeting) • 4 (financial stakeholder meeting) • 7 (project closing workshop)	
Number of training sessions and capacity strengthening activities		*List the title of the training sessions and capacity strengthening activities*
Number of people who received the training		
a) Number of men		
b) Number of women		
Total number of institutions trained	*List total number here*	
a) Number of research organisations, laboratories and universities		*List the name of organisations trained here*
b) Number of private companies		*List the name of organisations trained here*
c) Number of cities and local government		*List the name of organisations trained here*
d) Number of communities		*List the name of organisations trained here*
e) Number of ministries		*List the name of organisations trained here*
f) Number of specialised governmental institutions		*List the name of organisations trained here*
g) Number of non-profit organisations		*List the name of organisations trained here*
Percentage of participants reporting satisfaction with CTCN training (from CTCN training feedback form)		*Satisfied= 3+ on 5-pt scale* *Indicate breakdown of categories here based on the results of the CTCN training feedback forms*

Percentage of participants reporting increased knowledge, capacity and/or understanding as a result of CTCN training (from CTCN training feedback form)		*Increased knowledge, capacity and/or understanding= 3+ on 5-pt scale* *Indicate breakdown of categories here based on the results of the CTCN training feedback forms*
a) Number of men		
b) Number of women		
Total number of deliverables produced during the assistance (excluding mission, progress and internal reports)	Ten (10) deliverables	• One Small-scale farming and solar irrigation landscape report (Deliverable 1.1) • One report on irrigation seminars (Deliverable 1.2) • One report on infrastructure, energy use profiles and needs of interested small-scale sugarcane growers (Deliverable 1.3) • One report on prioritized small-scale growers (Deliverable 1.4) • One technical feasibility assessment report (D2.1) • One set of six (6) schematic designs of indicative solar irrigation systems according to three scenarios (D2.2) • One technology provider assessment report (D3) • One economic feasibility assessment report (D4.1) • One brief on consumer mechanisms for the uptake of solar irrigation (D4.2) • One set of guidelines for policy and financing mechanisms for the solarization of irrigation systems for small-scale growers in Eswatini (D5)
a) Number of tools and technical documents strengthened, revised or developed	Three (3) technical documents	• One technical feasibility assessment report (D2.1) • One set of six (6) schematic designs of indicative solar irrigation systems according to three scenarios (D2.2)

		• One economic feasibility assessment report (D4.1)
b) Number of other information materials strengthened, revised or created (For example training and workshop reports, Power Points, exercise docs etc.)	Three (3) information materials	• One report on prioritized small-scale growers (Deliverable 1.4) • One set of materials for irrigation seminars • One presentation for the project closing workshop
Total number of policies, strategies, plans, laws, agreements or regulations supported by the assistance	*List total number here*	
a) Adaptation related		
b) Mitigation related	One (1) set of recommendations in the form of guidelines for policy and financing mechanisms	• One set of guidelines for policy and financing mechanisms for the solarization of irrigation systems for small-scale growers in Eswatini (D5)
c) Both adaptation- and mitigation related		*List the type and name of documents supported*
Anticipated number of policies, strategies, plans, laws, agreements or regulations proposed, adopted or implemented as a result of the TA		
a) Adaptation related		*List the type of documents anticipated to be proposed, adopted or implemented*
b) Mitigation related		*List the type of documents anticipated to be proposed, adopted or implemented*
c) Both adaptation- and mitigation related		*List the type of documents anticipated to be proposed, adopted or implemented*
Anticipated number of technologies transferred or deployed as a result of CTCN support	**Two (2) technologies transferred as a result of CTCN support**	Solar PV Solar water pumps
Number of South-South collaborations enabled during or through CTCN TA support		*List the names of the organisations (excluding the CTCN or TA implementers)*
Number of climate technology RD&D related outreach activities		
Number of participants in climate technology RD&D related workshops and events		*Disaggregate by country*
a) Number of men		
b) Number of women		
Anticipated number of cooperative research, development, and demonstration programmes facilitated as a result of CTCN TA		

Number of countries with strengthened National System of Innovation as a result of CTCN support	**One (1) country**	• Eswatini
Number of organisations engaged through CTCN support	**Seventeen (17) engaged**	Public sector organisations • Ministry of agriculture • Eswatini Standards Authority (SWASA) • Eswatini Energy Regulatory Authority (ESERA) • Eswatini Electricity Company (EEC) • Ministry of Economic Planning and Development • Department of Meteorology, climate change unit • Ministry of Natural Resources and Energy • Ministry of Finance Private sector organisations • Eswatini sugar association (ESA) • Eswatini cane growers association (ECGA) • Cane growers Civil society organisations • Renewable Energy Association (REASWA) Financial institutions • FINCORP • Eswatini Bank • SEDCO • First National Bank • Eswatini Bank • The Royal Eswatini Insurance Company
Insert any additional indicators here		

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_2, equivalent emissions reduced or avoided as a result of the TA **on annual basis**	Anticipated metric tons of CO_2, equivalent emissions reduced or avoided as a result of the TA **in total**
Quantitative value	Between 3,996 and 23,977 per year (year 1) Between 27,972 and 167,839 per year (year 7)	Between 111,888 and 671,356 (year 7)
Unit	Tons of CO_2 equivalent per year	Tons of CO_2 equivalent
Methodology Explain the method or process of verifying the indicator and how data was gathered	The anticipated tons of CO_2 equivalent per year were calculated using the SMA CO_2 Avoidance Methodology. This methodology assumes that CO_2 emissions will be avoided when replacing use of the electricity grid in Eswatini, which is powered by fossil fuels. The CO_2 avoidance is calculated using the CO_2 factor, which indicates how much CO_2 is produced for every kilowatt hour of electricity generated in the country ($kgCO_2/kWh$), this value is multiplied with the yearly electricity generated by the designed PV systems According to the International Energy Agency (IEA). The Emission Factor in Eswatini in the year 2023 was 0.0316 kg CO_2/kW The yearly ranges were estimated based on the results of the five farms without solar PV selected in the technical assessment, estimating the CO_2 reduction associated with the installation of solar power in these farms. The total number of emissions avoided was divided by the total area of sugarcane cultivated, resulting in the estimated CO_2 per hectare of sugarcane cultivated in a solarized farm. The lower limit assumes that an area of five farms equivalent to the ones shortlisted in the technical assessment are solarized per year, while the upper limit assumes that 30	This calculation follows the same approach for estimating the tons of CO_2 equivalent avoided as the yearly value over a period of seven years. The lower limit assumes that, only an area equivalent to the five farms selected in the TA are solarized per year, over a period of seven years. The upper limit assumes that 30 farms with an area similar to the ones selected in the TA are solarized per year, solarizing the sugarcane farms at this rate would lead to solarizing 59,082 hectares of sugarcane after 7 years, which is the total area where sugarcane is cultivated at the country level

	farms of a similar size are solarized per year.	
GHG assessment boundary Identify expected post-TA activities, associated effects and assess boundary for quantification of GHG emission reductions	The boundaries set for yearly GHG emission reductions within the established timeline of seven (7) years are dependent on several factors • The support to the local utility and regulator to develop a supportive framework to solar powered irrigation systems • The support to financial institutions to mobilize international funding and design attractive financial products that increase the affordability of solar-powered irrigation systems • The scale up of the uptake of solar-powered irrigation systems. In this case, the boundaries set are the solarization of between 5 and 30 farms per year, with an average area of 283 hectares per farm, accounting for small and medium scale farms.	The boundaries set for GHG emission reductions within the established timeline of seven (7) years are dependent on several factors • The support to the local utility and regulator to develop a supportive framework to solar powered irrigation systems • The support to financial institutions to mobilize international funding and design attractive financial products that increase the affordability of solar-powered irrigation systems • The scale up of the uptake of solar-powered irrigation systems. • The capacity of local solution providers to procure and install solar-powered irrigation systems In this case, the boundaries set are the solarization of 30 farms after 7 years (5 yearly) with an average area of 283 hectares per farm as a lower limit, and the solarization of 210 farms after 7 years (30 per year) an area equivalent to all the hectares of sugarcane cultivated in Eswatini (59,082 hectares) as an upper limit.
Baseline candidates Define alternative technologies or practises used in baseline calculation to represent possible alternatives to the project activities	The established baseline candidates are the five farms selected as part of the technical assistance that have not yet installed solar powered irrigation systems. This sample included small and medium scale farms, with a minimum area of 47 hectares and a maximum of 632, for an average size of 283.	The established baseline candidates are the five farms selected as part of the technical assistance that have not yet installed solar powered irrigation systems. This sample included small and medium scale farms, with a minimum area of 47 hectares and a maximum of 632, for an average size of 283.
Baseline emissions Describe baseline scenario and emissions calculated	The baseline emissions were estimated as the tons of CO2 that can be avoided yearly by solarizing an area equivalent to the five farms selected in the TA (1,419 hectares) over a year, as a consequence to replacing the consumption of grid electricity. The lower limit estimations lead to 3,996 tons of CO2 avoided in year	The overall baseline estimations were estimated as the cumulative avoided emissions over a period of 7 years, which would take to solarize all the hectares where sugarcane is cultivated in Eswatini under the rate assumed in the upper limit estimations (30 farms – 8,514 hectares solarized per year).

	one (with 5 farms solarized) and 27,972 tons of CO2 avoided in year seven (with 35 farms solarized) An upper limit was provided assuming 30 farms (8,514 hectares) are solarized per year. The upper limit estimations lead to 23,977 tons of CO2 avoided in year one (with 30 farms solarized) and 167,839 tons of CO2 avoided in year seven (with 210 farms solarized)	The lower limit estimations lead to 111,888 tons of CO2 avoided over a period of seven years. The upper limit estimations lead to 671,356 tons of CO2 avoided over a period of seven years.
Assumptions Describe assumptions made during calculation and quantification of GHG reductions	• 0.0316 kg CO_2/kW avoided when replacing grid electricity with solar PV in Eswatini. • Solarizing an area of 1,419 hectares of sugarcane per year under lower limit estimations • Solarizing an area of 8,514 hectares of sugarcane per year under higher limit estimations • Providing solar power to all the sugarcane farms in Eswatini after a period of 7 years under upper limit estimations	• 0.0316 kg CO_2/kW avoided when replacing grid electricity with solar PV in Eswatini. • Solarizing an area of 1,419 hectares of sugarcane per year under lower limit estimations • Solarizing an area of 8,514 hectares of sugarcane per year under higher limit estimations • Providing solar power to all the sugarcane farms in Eswatini after a period of 7 years under upper limit estimations

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** *Please provide a **qualitative** description of the anticipated impacts on the categories below*
Infrastructure and built environment Anticipated increased infrastructure resilience (avoided/mitigated climate induced damages and strengthened physical assets)	The installation of solar irrigation systems at the five (5) prioritized small-scale cane growers will contribute towards the mitigation of climate change and the increase of climate resilience within the sector The technical assistance will boost capacity building of key stakeholders as well as the implementation of a quality assurance framework for solar products and for the installation of solar systems, leading to an increased in the overall quality of solar products in the market
Ecosystems and biodiversity Anticipated increased ecosystem resilience (areas with increased resistance to climate-induced	The conduction of the economic feasibility study will support the scale-up of solar irrigation systems, thus reducing the use of carbon-rich electricity from the national grid and reducing carbon emissions.

disturbances and with improved recovery rates)	
Economic Anticipated increased economic resilience (e.g. less reliance on vulnerable economic sectors or diversification of livelihood)	The economic feasibility study will contribute towards the adoption of solar irrigation systems, thus reducing operational cost from small scale cane growers by moving away from the increasing costs of grid electricity. The implementation of financial support mechanisms for solar powered irrigation systems, as well as the promotion of financial products tailored to the needs of local farmers will increase the affordability of the technology and increase its uptake.
Health and wellbeing Anticipated increased health and wellbeing of target group (e.g. improved basic health, water and food security)	The adoption of solar irrigation systems will increase food security at the national level and reduce reliance on the national grid for water supply

Core indicator 3	**Anticipated number of direct and indirect beneficiaries as a result of the TA**		
	Direct beneficiaries	**Indirect beneficiaries**	**Means of verification**
Adaptation related			*Describe calculation methods and assumptions made*
Mitigation related	Seventeen local institutions engaged as part of the technical assistance Public sector organisations • Ministry of agriculture • Eswatini Standards Authority (SWASA) • Eswatini Energy Regulatory Authority (ESERA) • Eswatini Electricity Company (EEC) • Ministry of Economic Planning and Development • Department of Meteorology, climate change unit	• 500 cane growers/growing communities in Eswatini	• Institutions engaged as part of the technical assistance that will benefit from knowledge products, promoted stakeholder cooperation and upcoming initiatives • Number of cane growers as reported by the Eswatini Sugar Association

	• Ministry of Natural Resources and Energy • Ministry of Finance Private sector organisations • Eswatini sugar association (ESA) • Eswatini cane growers association (ECGA) • Cane growers Civil society organisations • Renewable Energy Association (REASWA) Financial institutions • FINCORP • Eswatini Bank • SEDCO • First National Bank • Eswatini Bank • The Royal Eswatini Insurance Company Five (5) farms/farming communities where the technical and economic feasibility of implementing solar powered irrigation systems was conducted and resulted positive.		
Both adaptation-and mitigation related			*Describe calculation methods and assumptions made*

Core indicator 4	**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 Value and currency	**Qualitative description** List the various elements corresponding to the quantitative value as well as expected timelines and responsible institutions	**Methods** Describe method use for quantification of funds leveraged including assumptions made and attention paid to causality, attribution and avoidance of double-counting
Total anticipated amount of funding/investment mobilised or leveraged (USD) as a result of the TA	• USD 5.75 million (lower limit) • USD 32.00 million per year (upper limit)	• USD 0.5 million in subsequent technical assistance for stakeholders, in the form of support for financial institutions, support for quality assurance framework development and further support to cane growers to mobilize funding and procure SPIS • USD 5.25 million equivalent to the CAPEX of implementing solar powered irrigation systems in the five farms without PV systems implemented in the technical assistance (lower limit). • USD 31.50 million equivalent to the CAPEX of implementing solar powered irrigation systems in 30 farms (upper limit)	• Estimations based on the cost of similar technical assistance assignments and on the technical assistance needs identified as part of the elaboration of policy and financial mechanism guidelines for the promotion of solar irrigation in Eswatini. • Cost estimations based on the CAPEX calculated for the five (5) solar powered irrigation systems evaluated as part of the technical and economic feasibility assessment for the lower limit. • Cost estimations based on the CAPEX calculated for the five (5) solar powered irrigation systems evaluated as part of the technical and economic feasibility assessment and extrapolated to thirty (30) solar powered irrigation systems for the upper limit.
Anticipated amount of **public funding** mobilised from **national sources** (USD)			
Anticipated amount of **public funding** mobilised from **international and**		• USD 0.3 million in subsequent technical assistance for stakeholders	• Technical assistance channeled to local public sector institutions.

regional sources as a result of the TA			
Anticipated amount of **private investment** mobilised (in USD) from **national sources** as a result of the TA		• USD 2.625 million in loans for cane growers to support the solarization of five farms (lower limit) • USD 15.750 million in loans for cane growers to support the solarization of thirty farms (upper limit) • USD 1.575 million own capital of cane growers/grower communities to invest in the solarization of five farms (lower limit) • USD 9.450 million own capital of cane growers/grower communities to invest in the solarization of thirty farms (upper limit)	• 30% of the solar systems' CAPEX assumed as own capital from cane growers/communities. • 50% of the solar systems' CAPEX assumed as loans from local financial institutions.
Anticipated amount of **private investment** mobilised (in USD) from **international and regional sources** as a result of the TA		• USD 0.2 million in subsequent technical assistance for stakeholders • USD 1.050 million in subsidies for solar systems for the solarization of five farms (lower limit). • USD 6.30 million in subsidies for solar systems for the solarization of thirty farms (upper limit).	• Technical assistance channeled to cane growers and local financial institutions. • 20% of the solar systems' CAPEX assumed as subsidies for solar-powered irrigation systems from international development cooperation agencies.

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.