CTCN Technical Assistance

Request Submission Form

Guidelines:

This Request Submission Form should be completed by the organisation requesting technical assistance from the Climate Technology Centre & Network (CTCN) in collaboration with the National Designated Entity (NDE) of the country in question

The Form must be signed by the NDE. Please see updated contact list of NDEs here: http://unfccc.int/ttclear/support/national-designated-entity.html

The Form can be submitted as a Word file containing a digital signature or as a signed and scanned PDF file in combination with an un-signed Word file

For requests submitted by multiple countries, all the NDEs of the respective countries shall sign identical Forms before official submission to the CTCN

NDEs have the opportunity to submit CTCN requests in collaboration with National Designated Authorities (NDAs) for the Green Climate Fund (GCF) if targeting the GCF Readiness Programme.

Requesting country or countries:	Eswatini
Request title:	A feasibility study for the utilization of solar energy for sugarcane irrigation pumping to reduce GHG emissions from the use of carbon rich imported electricity for emerging commercial small cane growers in the Eswatini.
NDE	Mr. Bafana Simelane Ministry Tourism and Environmental Affairs Meteorology Department bafanasim@gmail.com PO Box 2652, Mbabane, Eswatini
Request Applicant:	Mr. Nelson Mavuso Director of Agriculture Ministry Agriculture Eswatini nelsonmavuso@ymail.com +268 7606 2612

Climate objective:

☐ Adaptation to climate change

☐ Mitigation of climate change

X Combination of adaptation and mitigation of climate change

Geographical scope:

☐ Community level

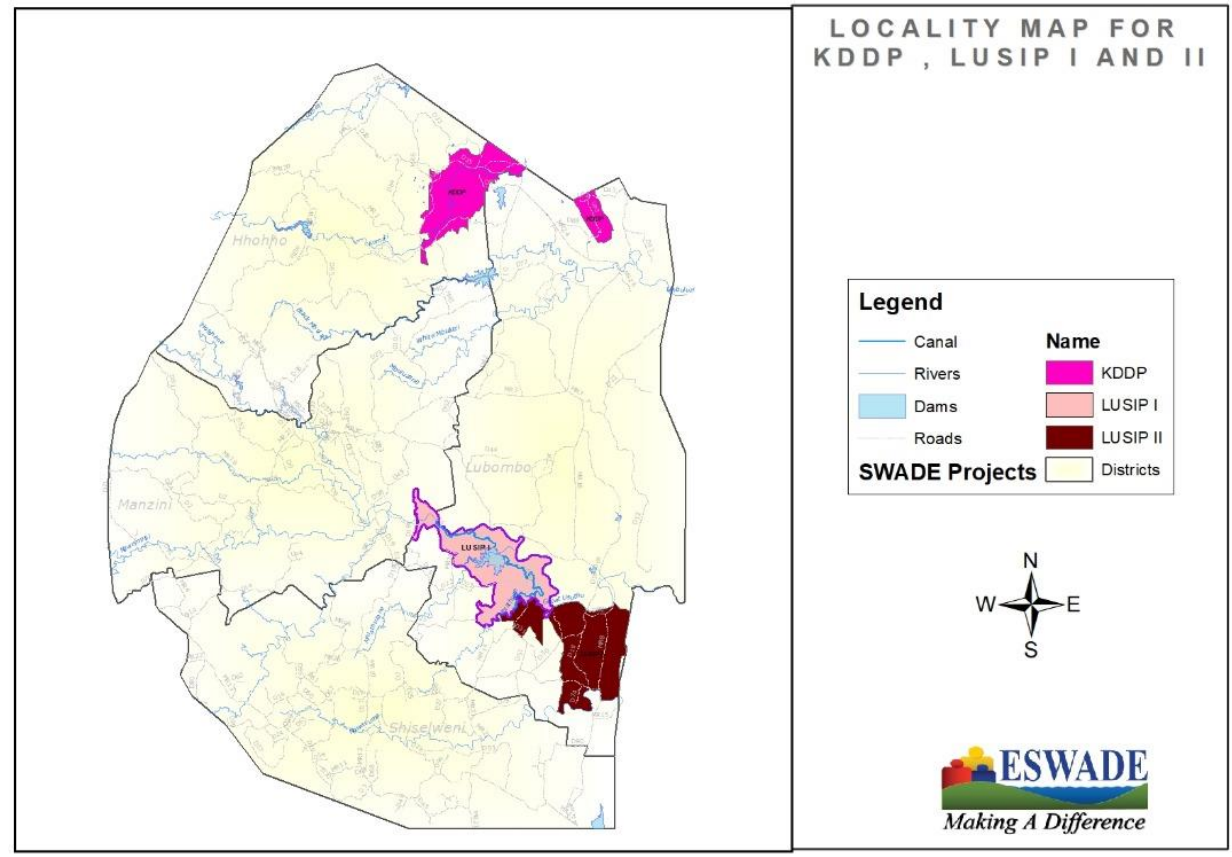
X Sub-national

☐ National

☐ Multi-country

If the request is at a sub-national or multi-country level, please describe specific geographical areas (provinces, states, countries, regions, etc.).

The geographic scope of the project is the core sugarcane growing areas of Eswatini encompassing the Malkerns area, the Komati Downstream Development Project (KDDP) area along the Komati River and the Lower Usuthu Smallholder Irrigation Project (LUSIP) along the Usutu River farmed exclusively by Eswatini Cane Growers Association member companies as shown in the map below.



Problem statement related to climate change (up to one page):

This section should answer the question "what is the problem?" Please summarise the problem related to climate change and/or the negative impacts of climate change in the country that the request aims to address.

The Kingdom of Eswatini is a landlocked country between South Africa and Mozambique. The country faces numerous challenges such as poverty, food insecurity, and climate-related disasters that include droughts, storms and floods. Government has introduced a range of policies and strategies to mitigate and adapt to climate change in an effort to reduce the negative impacts of climate change.

The economy of Eswatini is largely agro-based, making it more vulnerable to climate change. Climate change impacts in the agriculture sector are already being observed in the country. Livestock and crops production under rain-fed conditions have declined by over 30% on average over the last few farming seasons due to climate induced changes in rainfall patterns and increasing frequency of droughts.

One area of strategic economic vulnerability is the sugar production sector that is the most at risk from climate change induced changes to the climate and weather. Government has identified sugarcane as a strategic crop that can be utilized to alleviate poverty and associated effects especially in the poverty stricken areas of the Lowveld, with the necessary technical support to make viable businesses out of the endeavours.

To reduce the sugar sector's contribution to the country's Greenhouse Gas (GHG) status, a move to solar energy to drive critical parts of the sector has been prioritised by the Eswatini Sugar Association.

According to the Sustainable Energy for All Country Action Plan (2014)[1] the country is geographically well located to take advantage of solar radiation with over 2,000 kWh/m2/year available.

According to Eswatini's Third National Communication to the UNFCCC[2], daily maximum and minimum temperatures between 1961 and 2010 reveal that temperature extremes show patterns consistent with warming over most of the country in the last decade. The data suggest that the last two decades (1990s and 2000s) have been warmer compared to the 70s and 80s. Rainfall trends in the country points towards a decrease in the number of rainy days which has an implication on the intensity of rainfall events, river flows and dry spell duration. Apart from changes in total or mean summer rainfall, certain intra-seasonal characteristics of seasonal rainfall such as onset, duration, dry spell frequencies, and rainfall intensity as well as delay of rainfall onset has changed over the country.

The draft Green House Gas Inventory 2018 is currently under preparation, but preliminary data indicates that Eswatini's net GHG emissions in 2018 are estimated at 3240.10 $GgCO_2e$, where 48% of emissions come from the Agriculture, Forestry and Land Use (AFOLU) sector. The Energy sector contributes 40% of emissions, Waste contributes 11% and Industrial Processes and Product Use sector provides the remaining 1%. Eswatini's total GHG emissions have been steadily rising since 1990 primarily driven by increasing emissions from the AFOLU sector.

National obligations to reduce GHG emissions in line with the Paris Agreement and the Eswatini Nationally Determined Contributions (NDC), can be partially met by reducing the emissions linked with electricity usage for irrigation.

In an effort to reduce climate vulnerability and empower farmers with economically viable livelihoods that supports and builds upon an existing successful commercial sugarcane production agribusiness, the government of Eswatini established the Eswatini Water and Agricultural Development Enterprise (ESWADE) in 1999 to facilitate the planning and implementation of farmer owned and managed sugarcane farms. Since 1999, the Government through ESWADE has developed two major smallholder irrigation projects in the country, namely: (i) 6,500ha Komati Downstream Development Project (KDDP)[3] a US$ 142,857m irrigation project on the Komati River using water stored and made available from the Maguga Dam (funded by the ADB) and (ii) the 13,000ha Lower Usuthu Smallholder Irrigation Project (LUSIP)[4] a US$ 190,476m irrigation project using water diverted from the Usutu River and

[1] https://www.seforall.org/sites/default/files/Swaziland_RAGA_EN_Released.pdf
[2] https://unfccc.int/sites/default/files/resource/swznc3.pdf
[3] http://www.swade.co.sz/projects/kddp/index.php
[4] http://www.swade.co.sz/projects/lusip1/index.php

stored in the Lubovane Dam. These projects were developed with multi-donor funds from various international financial institutions including IFAD, EIB, and KwF.

Several other small-scale growers have been established, for example Malkerns cane growers, who are scattered in other river basins with direct abstractions from rivers.

Sugar related production accounts for 10% of employment (17% of formal private sector employment) and produces 700,000 tonnes sugar/yr, accounting for 74% of its agricultural gross domestic project (GDP).

Small-scale cane farmers clustered as Farmer Companies are all members of the Eswatini Cane Growers Association (ECGA), an organization established to serve and support cane growers through promoting, advocating and fostering their collective interests, sustainability and progress. The ECGA and the Eswatini Millers Association are equal shareholders (50% shareholders each) in the Eswatini Sugar Association (ESA).

The ESWADE cane projects in KDDP and LUSIP were initiated in response to these climate changes and increasing threats to rainfed farming. Eswatini is a water scarce country. The development of the KDDP and LUSIP areas has had the effect of increasing the nations GHG emissions (from land conversions and increased energy demands) and placing a strain on the nation's natural water resources. Water is the key driver and a critical input to sustainable sugarcane production. All sugarcane produced in Eswatini is irrigated due to the lack of sufficient rain in the cane growing areas[5]. Irrigation is the major water user in Eswatini as it takes up to 96% of total water consumption. The projections of climate change on water, as an input for agriculture, are that river flows will decline by around 40%, particularly with a warmer climate, thereby increasing its demand and reducing availability.

To empower rural farmers and uplift them out of poverty, the ESA and the ECGA have been facilitating the establishment of 16,596 ha (as of March 2020) of farmer managed irrigated cane in the Malkerns, KDDP and LUSIP areas producing 213,282t sucrose generating in the order of US$5.6m from sucrose sales. Farmer owned sugarcane companies have lifted rural households out of poverty and has the potential to contribute further to poverty alleviation provided operating costs can be managed and create additional jobs, income and growth.

ECGA members have more than tripled their share of sugar production in 20 years from 8% to 25%, by registering as farmer companies (FCs). In FCs, farmers return their customary land rights to the local chiefs and get shares of a company over an irrigation area (on average an FC is 80 –100 ha, up to 650 ha, it gathers 50 shareholders led by a board of directors and a manager runs its operations). Most shareholders collect dividends that contribute to their livelihoods.

The vast majority of the farmer owned sugarcane companies are connected to the national electricity grid with a cumulative peak electricity demand over 50MW. The electricity requirement for cane farming is focused on pumping water that is applied to cane fields through pressurised irrigation systems such centre pivots, sprinklers and drip.

[5] http://www.gov.sz/images/MNRE_PICS/National-Water-policy----Final--Document-Aug-2018-1.pdf

Combined with the increasing GHG emission tied to the carbon rich electricity from ESKOM, the ever increasing cost of grid electricity means that the energy costs of cane farmers are averaging over 24% of total operational costs, and rising steadily. Cane farmers with capacity to access finance have invested to protect their competitiveness. The majority of cane farmers (big and small) are looking for alternatives in the form of renewable energy to remain competitive whilst reducing their carbon footprint.

ECGA members face economic barriers to investment in new energy technologies and remain dependent upon electricity supplied by Eswatini Electricity Company (EEC) at a cost that increases annually. The Eswatini financial sector is not short of liquidity but banks are reluctant to take full risk exposure in renewable agri-energy investments as they lack the information/expertise for investment appraisal, credit scoring and assessing technical market risks (carrying out the due diligence is seen as difficult as licenses, environmental permits, land rights documents are needed).

In their latest application to the Eswatini Energy Regulatory Authority (ESERA), the EEC applied for a 5.7% year over year (y/y) increase in 2020 and 2021 after a government freeze on tariffs in 2019. The current Small Holder Irrigation Tariff (effective since April 2018) is:

Facility Charge (SZL/month) 1,837.99

Energy Charge (SZL/kWh) 0.9194

Demand Charge (SZL/kVA) 145.73

The EEC introduced a Time of Use tariff that many ECGA members take advantage of to manage their energy costs (http://www.eec.co.sz/myaccount/tariffs/index.php).

According to the Sustainable Energy for All Country Action Plan (2014)[6] there are untapped market opportunities (valued USD 13m in the sugarcane sector alone) for renewable energy investments (e.g. retrofitting of existing water pumps with Variable Speed Drives, adding solar power capacity and other power correction measures). Most ECGA members cannot directly invest in renewable energy for self-consumption or selling the surplus to the EEC as they cannot meet debt-equity requirements of banks to borrow the required capital and the modalities for selling excess power into the grid have yet to be legitimised by the Eswatini Energy Regulatory Authority.

There is limited awareness about the advantages of solar power across the cane farming communities but with ever increasing news coverage and the uptake of some farmers with solar powered irrigation systems many more farmers would like to participate. Supporting farmers to change from grid derived electricity to solar is seen as a way in which farmers can reduce their operational costs whilst reducing the sectors contribution to GHG emissions thus contributing towards achieving the UNFCCC Paris Agreement target of keeping the plants temperature at 1.5°C.

That together with the ever-increasing availability of diverse international funding for productive use energy systems, the ECGA, ESWADE and ESA would like to increase the coverage of solar PV as an

[6] https://www.seforall.org/sites/default/files/Swaziland_RAGA_EN_Released.pdf

alternative source of energy for irrigation systems whilst reducing the emissions associated with EEC supplied electricity.

Past and on-going efforts to address the problem (up to half a page):

This section should answer the question "what has been done or is currently being done to address the problem?" Please describe past and on-going processes, projects or initiatives implemented in the country or region to tackle the climate problem as described above.

This CTCN Application focuses on the national obligation to reduce the GHG emissions associated with the use of electricity (imported from South Africa).

To support the goal to reduce GHG emissions amongst others, the country has adopted the following policy frameworks: the National Climate Change Strategy and Action Plan (2014), the National Energy Policy (2003)[7], the National Energy Efficiency Policy (2019)[8], the National Energy Implementation Strategy (2009) and the Eswatini Energy Master Plan of 2018 – 2034[9] to scale up energy access through consideration of off-grid solutions and to introduce energy efficiency interventions which will support the country's drive towards industrialisation. An Independent Power Producer Policy (2016)[10] and Short Term Generation Expansion Plan (2018)[11] were put in place to promote the use of renewable energy and most notably, it promotes the introduction of Small Scale Embedded Generation (SSEG) and policy position 15 calls on government to "create a conducive investment environment taking cognisance of the particular needs associated with the financing approach and/or institution".

Furthermore, a regulatory authority for the energy sector was established called the Eswatini Energy Regulatory Authority to ensure sustainable access to affordable, reliable and modern energy.
The use of grid electricity to energise and operate irrigation equipment comes with linked GHG emissions derived from the generation of the electricity from predominately coal sources in South Africa that supplies around 80% of Eswatini's electricity[5].

Driven by the need to reduce the national GHG emissions to meet national and global goals, the ESA undertook an energy use survey of ECGA growers to determine their electricity linked GHG contributions. The average energy and power consumption over four years is presented below:

Tariffs	Annual energy/power consumption				
	2015/16	2016/17	2017/18	2018/19	Average
Access charge (kVA)	128	121	139	186	144
Demand charge (kVA)	117	104	113	112	112
Energy charge (kWh)	461,808	298,264	412,880	393,688	391,660
Average Energy charge (kWh/ha)	10,083	6,512	9,015	8,596	8,552

According to the ESKOM Integrated Report 2018[12], for each kilowatt hour of electricity produced by ESKOM, 1.03 $kgCO_2/kWh$ were generated.

[7] http://www.gov.sz/energy%20policy.pdf
[8] https://www.energycharter.org/fileadmin/DocumentsMedia/Other_Publications/EE-Eswatini2019.pdf
[9] http://sera.org.sz/administrator/files/1550235366.pdf
[10] http://www.sera.org.sz/administrator/files/1578991946.pdf
[11] http://sera.org.sz/administrator/files/1559738321.pdf
[12] https://www.eskom.co.za/IR2018/Documents/Eskom2018IntegratedReport.pdf

With 16,596 Ha of small cane growers consuming an average of 8,552 kWh/ha/yr the total electricity consumed amounts to some 141,928,992 kWh. With an emissions factor supplied from ESKOM of 1.03 kgCO2/kWh, GHG amount to around 146,186,861.76 $kgCO_2$/year.

These emissions are driven by the continuous use of carbon rich energy purchased from South Africa's electricity generator, ESKOM and distributed nationally by the EEC to run pumps and irrigation systems.

By converting the primary electricity source for the farms electricity needs to solar, the potential emissions saved from using carbon rich electricity from ESKOM, is 146.186 $GgCO_2e$.

According to Eswatini National Inventory Report 1990 – 2018, the total emission from the energy sector is estimated at 1,303.81 GgCO2e, thus an intervention to solarise ECGA growers energy demand would represent an 11% saving nationally on energy use and 4.5% of national CO_2e emissions.

As a co-benefit from displacing carbon rich electricity with clean electricity, ESGA farmers can expect to benefit from reduced electricity costs that currently account for around 24% of their annual operating costs and when net-metering is legitimised through statute or regulation, participating farmer companies could, in addition to sucrose sales, benefit from electricity sales to EEC.

ECGA farmers currently obtain their electricity from the national electricity supply company, the EEC. ECGA farmers have continuously complained that the cost of this EEC electricity along with other usage and access costs, is hampering their development and livelihood improvement goals. In response, the EEC have introduced changes to their tariff structure including a Time of Use Tariff (Figure 1). However, due to common farm operating procedures practiced by ECGA members, cane growers are unable to irrigate at night unless they have a centre pivot or drip system. Daytime irrigation allows for field personal to move irrigation equipment in accordance with their irrigation scheduling programme. Field personnel are not used at night due to overtime costs and safety.

Many ECGA members have expressed their disappointment over the Time of Use tariff structure as it continues to result in a high, relative to farm costs and profits, proportion of their operating expenditure and these views have been expressed to the management of the ECGA pleading with the management to find cheaper solutions to their current expenditure on electricity.

Table 1: EEC Time-of-Use Tariff 2020/2021

TOU TARIFFS	T1	T2	T3	T4
	TOU at MV at HV network	TOU at MV	TOU at LV	TOU small irrigation < 100 kVA
Facility Charge E/month	5 040.80	2 426.04	1 824.99	1 551.25
Demand Charge E/kVA	156.65	164.09	172.31	146.47
Access Charge E/kVA	58.36	61.14	58.61	54.57
Energy – Low Demand - Peak E/kWh	1.6812	1.7266	1.7569	1.5186
Energy – Low Demand - Standard E/kWh	1.1992	1.2301	1.2508	1.0885
Energy – Low Demand - Off-Peak E/kWh	0.9695	0.9934	1.0096	0.8833
Energy – High Demand - Peak E/kWh	4.7611	4.9035	4.9983	4.2507
Energy – High Demand - Standard E/kWh	1.4679	1.5116	1.5407	1.3115
Energy – High Demand - Off-Peak E/kWh	0.9695	0.9934	1.0096	0.8833

T1- For any large customer supplied at Medium Voltage (MV) but directly from a High Voltage (HV) substations
T2 – For any large customer supplied at Medium Voltage (MV)
T3 – For any large customer supplied at Low Voltage (LV)
T4 – For small holder irrigation up to 100Kva

According to the March 2020 edition of the ECGA quarterly newsletter[13], members of the association reported that electricity costs are the biggest production cost for sugarcane farmers accounting for about 24% of total cost. The main reason is cost escalations that have exceeded 70% over the last 6 years. The ECGA has called upon growers "to improve the efficiency of power usage while simultaneously increasing yield". This call for improved efficiency has prompted the ECGA to seek technical support for the introduction of renewable energy systems for members of the ECGA, through an assessment of solar power as a core daytime electricity supply and examining the various approaches that could be taken to provide cheaper and emissions free electricity to growers.

In a 2017 report from the United Nations Conference on Trade and Development entitled Small-Scale Sugar Cane Growing In Swaziland[14], farm operation costs were reported by cane growers to be high and affecting profit margins ECGA farmers. The introduction of solar energy will reduce energy costs and make the farming enterprises more profitable with a co-benefit of reducing GHG emissions associated with the grid electricity.

According to the 2014 Swaziland Renewables Readiness Assessment[15] published by the International Renewable Energy Agency (IRENA), historical electricity consumption by sector, 22% of consumption is from the agriculture sector.

Specific technology[16] barriers (up to one page):

This section should answer the questions "what are the technology barriers that hinder national efforts described above" and "how will the CTCN technical assistance complement these efforts?" Building upon the problem statement and taking into consideration the existing efforts described above, please describe the specific technology barriers encountered by the requesting applicant to identify, assess or deploy climate technology(ies) in an effort to address the problem statement. The described barriers should be within the scope of the requested CTCN technical assistance (described in the section below).

In the 2017 Technology Needs Assessment (TNA) for Climate Change Mitigation Barrier and Enabling Framework Report for Swaziland[17] identified a number of barriers to adopting solar energy as a source of electricity.

i. Purchasing cost: Stakeholders identified most notably the relatively high cost of purchasing the equipment without supportive lending options from financiers and ensuring competent and reliable installers installed it correctly. Furthermore, the high interest rate for borrowing

[13] http://www.ecga.co.sz/images/March2020NewsletterFinal.pdf
[14] https://unctad.org/system/files/official-document/poitcdcomd28.en.pdf
[15] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2014/IRENA_RRA_Swaziland_2014.pdf
[16] *"**any equipment, techniques, practical knowledge and skills** needed for reducing greenhouse gas emissions and adapting to climate change" (Special Report on Technology Transfer, IPCC, 2000)*
[17] https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2019/03/swaziland-mitigation-baef-report.pdf

commercial money (15-17%) and need for collateral as asked for by banks, make it difficult for farmers to get loans to buy this technology out right.

ii. Local solar system designers and suppliers: In addition to securing viable finance, ECGA farmers face the challenge of securing professional system design services nationally. Although some renewable energy companies have started operations in Eswatini such as WattsUp Solar[18] and SolSun[19], their capacity to evaluate and design systems for hundreds of potentially new customers is limited by human and financial resources. South African based companies operating in the country are emerging, eg the Renewable Resources Company (TRRC) and Repower Africa. These companies are backed by technical experts and finance to provide turnkey solutions using a variety of financing options.

iii. Access to international energy finance: ECGA farmers and the ECGA management have limited capacity to secure international energy finance through the preparation of successful funding proposals. Local capacity in the private sector does exist but there are costs involved that the ECGA is unable to secure through its internal budgeting arrangements.

iv. Institutional capacity: The ECGA and ESA lack institutional capacity to manage the roll out of a geographically wide solarisation of farms project. A dedicated turnkey solution provided by a system supplier or developer would benefit their institutional capacity whilst still allowing them to be involved and guide the project.

Sectors:

Please indicate the main sectors related to the request:

☐ Coastal zones	☐ Early Warning and Environmental Assessment	☐ Human Health	☐ Infrastructure and Urban planning
☐ Marine and Fisheries	☐ Water	X☐ Agriculture	☐ Carbon fixation
X☐ Energy Efficiency	☐ Forestry	☐ Industry	X☐ Renewable energy
☐ Transport	☐ Waste management		

Please add other relevant sectors:

Cross-sectoral enablers and approaches:

[18] https://wattsupsolar.co.sz/
[19] https://solsuncompany.com/

Please indicate the main cross-sectoral enablers and approaches

☐ Communication and awareness	X☐ Economics and financial decision-making	☐ Governance and planning	☐ Community based
☐ Disaster risk reduction	☐ Ecosystems and biodiversity	☐ Gender	

Technical assistance requested (up to one page):

Founded on the problem statement, past/on-going efforts and technology barriers, please describe the requested technical assistance. The technical assistance should clearly contribute to mitigation or adaptation to climate change as described in the problem statement and contribute to overcome the specific technology barriers.

Within a clearly defined scope, the description of technical assistance should be structured into the following:

- *Overall objective*
- *Anticipated groups of activities to be performed by the technical assistance*
- *Anticipated products to be delivered by the technical assistance.*

Please note that the CTCN facilitates technical assistance and is not a project financing mechanism.

Overall objective
To contribute towards the national goal of reducing GHG emissions from the use of carbon rich imported electricity through the provision of solar energy for irrigation systems for emerging commercial small-scale cane growers in the Eswatini.

Anticipated groups of activities to be performed by the technical assistance

1. Undertake a feasibility study of the opportunities to solarise the irrigation systems of small-scale cane growers in the Malkerns, KDDP and LUSIP cane farming areas
2. Consult with four local (and three South African) solar system developers[20] and present a summary of their services, conditions and financing plans
3. Undertake a preliminary assessment of the solar energy needs for each farming company based on historical energy use profiles and develop a ranking system to prioritise farmer companies that would benefit the most from reduced energy costs for each farmer company
4. Undertake a solar design assessment to provide an indicative system configuration for each farming company, ie electricity demand, number of solar modules of specified generation capacity (W), inverter specifications, existing pump motor and pump changes required
5. Prepare cost estimates for each applicable farming company that covers the equipment (delivered to Eswatini) and installation costs (local experienced construction and installation firms)

[20] For example locally: WattsUp Solar (https://wattsupsolar.co.sz/), SolSun (https://solsuncompany.com/), SolarXgen (http://solarxgen.co.za/solarxgen-eswatini-swaziland/), the Renewable Resource Company (https://renewableresources.co.za/), the Repower Africa (https://www.repowerafrica.co.za/)

6. Develop policy guidelines for the Government of Eswatini to promote solarized irrigation systems for sugar cane growers
7. Develop financing instruments to support this application of technology
8. To prepare a generic funding proposal that includes the full variety of funding proposal requirements, eg theory of change, productive use opportunities

Anticipated products to be delivered by the technical assistance

1. A feasibility report on the opportunities to solarise small-scale sugarcane grower farms in the Malkerns, KDDP and LUSIP areas
2. A report on the energy use profiles of all small-scale sugarcane growers
3. A report on the best approach to take between small individual solar plants vs few large scale solar plants feeding into the grid (through a review of the ESERA regulations and consultations with EEC and ESERA)
4. A report on the farmer company specific solar system considered to be most appropriate to each individual farm
5. A report on the installed cost for each farmer company
6. A report on the mapping of potential funds and funders or developers for a solar irrigation project
7. A report on a generic funding proposal description

Expected timeframe:

Please indicate the expected duration period for the requested technical assistance. Please note CTCN technical assistance is limited to a maximum duration of 12 months.

Four (4) to six (6) months

Anticipated gender and other co-benefits from the technical assistance:

Please describe the activities with gender linkages as well as the anticipated gender and other co-benefits (e.g. biodiversity, economic, social, cultural, etc.) that are likely to be generated as a result of the technical assistance.

For more information you can find guidelines on the CTCN's website here:

https://www.ctc-n.org/technologies/ctcn-gender-mainstreaming-tool-response-plan-development

Further reading on gender can be found on the CTCN website here:

https://www.ctc-n.org/technology-sectors/gender

The ECGA, ESA, REASWA and Department of Energy concur that the overall project objective of introducing solar irrigation pumping to emerging sugarcane farmers under the ECGA family will not have any inequities with respect to gender. Solar energy is considered to be beneficial for improving the profitability of cane farming by resource poor farmer companies as well as contributing towards reducing the GHG footprint irrigation pumping currently includes whether they are men or women. The project objective would ensure gender equity by involving men and women equally.

Solarisation of the electricity needs for the farmer companies will benefit women as some 1,997 women participate in cane farming, often as part of a larger group or company. There are 2,919 male members. ECGA reports that the individual farmer companies' membership consists largely of women who are always actively engaged in sugarcane business as most men are employed either in local industries or in the South African mining sector. Any resulting funded project must ensure that this gender dynamic is strengthened and supported to achieve gender equity with the cane growing sector.

Farmer company representation of women is strongly encouraged by the ESA, ECGA and ESWADE to ensure inclusivity of important members of rural farming societies to earn an income or contribute through labour or other farming tasks.

Currently within the solar sector in Eswatini, there are very few women participating in installing or maintaining solar systems. The project will raise awareness of solar and service suppliers will be required to support greater women's participation.

Women farmers and entrepreneurs will, through the development of a gender action plan during writing of funding proposals, be encouraged and targeted to participate in the project.

Key stakeholders:

Please list the stakeholders who will be involved in the implementation of the requested CTCN technical assistance and describe their role during the implementation (for example, government agencies and ministries, academic institutions and universities, private sector, community organizations, civil society, etc.).

Stakeholders	Role to support the implementation of the technical assistance
National Designated Entity	Mr. Bafana Simelane Ministry Tourism and Environmental Affairs Meteorology Department Eswatini
Request Applicant	Mr. Nelson Mavuso Director of Agriculture Ministry Agriculture Eswatini nelsonmavuso@ymail.com +268 7606 2612
The Chief Executive Officer Dr Sipho Nkambule The Eswatini Cane Growers Association (ECGA) PO Box 273	**Eswatini Cane Growers Association (ECGA)** As the Request Applicant, the ECGA will provide support to the CTCN expert and facilitate any requests the expert maybe require. The ECGA as representative of the core beneficiaries can arrange farmer visits and provide interpreter services if needed.

Mbabane Eswatini Southern Africa T: +268 2404 3561 W: ecga.co.sz E: Dr Sipho Nkambule drsipho@ecga.co.sz	The ECGA can provide information and data related to all its members.
The Chief Executive Officer Dr Phil Mnisi The Eswatini Sugar Association (ESA) PO Box 445 Mbabane Eswatini Southern Africa T: +268 2411 7600 W: esa.co.sz E: Dr Phil Mnisi mnisip@esa.co.sz	**Eswatini Sugar Association (ESA)** The ESA is the main administrative body representing all cane growers (large scale to small scale) and millers in the country. The ESA will provide technical and logistical support to the TA to ensure the TA is able to travel to and meet with ECGA growers. The ESA possess all the production data of the sugar sector and can provide relevant data as needed by the TA
ECGA Farmer Companies	The Farmer Companies (beneficiaries), represented by the ECGA, can support the CTCN expert with the collection of relevant data regarding farm operations and technical details on energy use, financial statements, irrigation systems and any other data requested.
Renewable Energy Association of Eswatini (REASWA)	REASWA is the designated entity mandated to support renewable energy deployment in the country. They can provide the TA with access to relevant government and civil society stakeholders.
The Eswatini Electricity Company (EEC)	The EEC is the country's main provider of grid electricity. The EEC can provide support to the TA on technical issues related to the introduction of solar and any potential grid-tied solutions the TA may propose.
The Ministry of Natural Resources and Energy (MNRE) Energy Department	The MNRE Energy Department is responsible for policy and overall oversight of the electricity supply industry. In 2018, the MNRE promulgated the National Energy Policy 2018 (NEP). The policy sets out the following objectives: (a) Ensuring access to modern energy services for all; (b) Enhancing employment creation; (c) Ensuring

	security of energy supply; (d) Stimulating economic growth and development; (e) Support the development of renewable energy resources for a target of 50% of the electricity generation mix; and (f) Ensuring environmental and health sustainability. The NNRE Energy Department can provide the TA with policy and legal information relating to the introduction of renewable energy to ECGA farmers.
Eswatini Energy Regulatory Authority (ESERA)	The ESERA are the mandated institution to oversee and regulate the energy mix in the country. They actively encourage renewable energy projects. The ESERA can provide the TA with support and background information relating to their regulations and mandate regarding renewable energy development.

Alignment with national priorities (up to 2000 characters including spaces): *Please describe how the technical assistance is consistent with national climate priorities such as: Nationally Determined Contribution, national development plans, poverty reduction plans, technology needs assessments, Low Emission Development Strategies, Nationally Appropriate Mitigation Actions, Technology Action Plans, National Adaptation Plans, sectorial strategies and plans, etc.*	
Reference document (please include date of document)	**Extract** (please include chapter, page number, etc.).
Intended Nationally Determined Contribution (INDC)	*Direct alignment and contribution to NDC implementation is required for all CTCN technical assistances. Please include a direct reference to the INDC/NDC document (chapter, page number, etc.).* The 2015 Eswatini Intended Nationally Determined Contribution (INDC)[21] to global climate action under the UNFCCC aims for renewable energy resources up to 50% of the energy mix by 2022. The Government of Eswatini remains committed to the NDC and aware of the importance of making the energy sector more resilient to the impacts of climate change. Eswatini is currently developing its next NDC with support from the NDC Partnership's Climate Action Enhancement Package and the UNDP's Climate Promise initiative. Within the INDC commitment under agriculture is the following contributions supporting this application (p3): • Increase the contribution of agriculture to economic development, to support both food security and exports

21 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Eswatini%20First/Eswatini%27s%20INDC.pdf

	In terms of mitigation, the INDC commits the country to (p4): • Implement small scale, decentralized renewable energy technologies to improve energy access in rural areas. One of Eswatini's commitments to renewable energy referenced in the INDC is the (p5): • Doubling the share of renewable energy in the national energy mix.
The Third National Communication to the UNFCCC	The Third National Communication to the UNFCCC[22] states on p139 that the major renewable energy targets of the Government are: • The installation of solar water heaters in 20% of all public buildings by 2014; • The development of solar water heater standards by 2012; • The establishment of fiscal incentives to promote renewable energy by 2013; and • The establishment of a demonstration centre for renewable energy technologies by 2015.
Technology Needs Assessment (TNA)	Eswatini completed its TNA in 2016 and 2018. The TNA provided input into the development of Eswatini's NDC report, and all the technologies prioritized by the TNA were included in the NDC. The 2016 TNA prioritised solar water pumping as a technology (p20) Table 6 of the TNA 2016, presents the criteria for prioritization for the power generation category in the energy sector. Solar energy was ranked 3rd in priority. Several specific barriers are reported to keep Eswatini from fully achieving their low-emission energy goals. One is the lack of affordable access to financial resources by a developer (farmer) to afford to implement solar irrigation. A related barrier is the climate risk that extreme conditions have placed on some essential infrastructure exposing grid supplied electricity as vulnerable in the event of failure.
National Adaptation Plans	None
Nationally Appropriate Mitigation Actions	None

[22] https://unfccc.int/sites/default/files/resource/swznc3.pdf

Eswatini Energy Masterplan	The MNRE published the Eswatini Energy Masterplan 2034[23] which was developed with support from the International Renewable Energy Agency (IRENA). The Energy Masterplan 2034 recognises that grid extension may not be the least cost solution for electrifying the entire country and communities and it will be necessary to establish distributed (off-grid) systems where they are suited and have sufficient demand. The Masterplan aims to reduce dependency on imported coal derived electricity from South Africa.
National Energy Policy Implementation Strategy (NEPIS)	In 2009 the Ministry of Natural Resources and Energy (MNRE) developed a NEPIS to address energy issues as they relate to all national energy development activities. The Strategy advocates for an enabling environment for the diversification of energy access and cost reductions, for large and small users. Amongst other things it called for the development of renewable energy action plans and targets. The NEPIS provides the following support for this application: • Government will support programmes promoting the utilisation of renewable energy resources for electricity production (3.3.5). • Government will carry out investigations and promote efficient and environmentally sound technologies for the utilisation of indigenous resources for electricity production (3.3.5). • Government will carry out investigations and promote efficient and environmentally sound technologies for the utilization of indigenous resources for electricity production (3.3.6). • Government will develop a renewable energy information program and establish and maintain an appropriate renewable energy information system (3.4.4). • Appropriate financing mechanisms will be investigated and facilitated (3.4.5). • The capacities of development agencies, which promote and implement sustainable programmes on renewable energy, will be strengthened (3.4.6). • Government will encourage a wider use of solar water heaters for residential and commercial buildings through promotional means and support for private sector initiatives (3.4.9). • Government will investigate opportunities for increased local power generation and will endeavour to take advantage of the availability of cheap power in the region through the SAPP (5.1.4).

[23] http://sera.org.sz/administrator/files/1550235366.pdf

National Climate Change Policy (NCCP)	In the 2016 National Climate Change Policy[24], under the section 4.1.3 Energy security, the following policy objectives are identified: • Diversifying energy supplies and diminishing dependence on limited traditional energy sources. • Enhancing research and development, innovation, diffusion and deployment of renewable energy technologies. • Accelerated deployment plans and incentives for renewable energy such as mini hydro, solar, wind and geothermal.

Development of the request (up to 2000 characters including spaces):

Please describe how the request was developed at the national level and the process used by the NDE to approve the request before submitting it (who initiated the process, who were the stakeholders involved and what were their roles?) and describe any consultations or other meetings that took place to develop and select this request, etc.

This application was developed with the full support of and in consultation with the ESA, ECGA and representative farmer companies. Discussions with both the ESA and ECGA were held to elaborate and agree on the core objectives of the application.

COVID19 restrictions applied by the Government of Eswatini, made holding in person consultations with farmers difficult to arrange. So instead a sample of three farmers already using solar energy for their cane irrigation needs were contacted and visited by ESA and ECGA officials. Technological and economic barriers reported in the TNA were discussed with the farmers but each farmer reported that such barriers, that almost certainly exist, were over come through the engagement of professional solar system suppliers, installers and financiers. Two farmers opted for a rent-to-own option for their installation while one farmer paid cash for his. The respective installer continues to be of great assistance to the farmers by providing support as needed when the farmer has questions or problems.

The ECGA, as the representative of small cane farmers, and with a detailed knowledge of each farm and farmer company, confirmed that the roll out of the proposed technology across all farmer companies would be welcomed and should present little resistance from such farmers as they welcome any initiative that reduces their monthly electricity pumping costs and supports broader national objectives on reducing GHG emissions from their operations.

The MNRE Energy Department are supportive of this application as they see it as beneficial to the farmer companies to reduce the associated emissions from existing grid electricity supplies, reduce electricity bills and improve farmer company profitability.

Background documents and other information relevant for the request:

[24] https://info.undp.org/docs/pdc/Documents/SWZ/Swaziland%20Climate%20Change%20Policy%202016%20Final.pdf

- *Please list all relevant documents that will help the CTCN analyse the context of the request and national priorities. Please note that all documents listed/provided should be mentioned in this request in the relevant section(s), and that their linkages with the request should be clearly indicated. For each document, please provide web-links (if available) or attach to the submission form. Please add any other relevant information as required.*
- *Please indicate if this request has been developed with the support of the CTCN Request Incubator.*

In a study commissioned by the EU under the "Sustainable Energy for All" Initiative (SE4ALL) - Eastern and Southern Africa "*ES-0104: A Study for Sustainable Energy Investment in Agriculture Value Chains in Swaziland*"[25] in 2018, it suggested there is "limited awareness about solar power in Swaziland. Farming companies are not aware of the potential of solar power beyond micro roof top solar systems.

Supporting potential projects likes of which proposed in this report will contribute significantly to their awareness and to increase confidence in solar PV as an alternative source of energy for irrigation system. An effective mechanism to operationalize the solar PV promotion for farming will be through projects which will provide the needed demonstration effect to provide the needed customer assurance and buy-in from stakeholders such as banks and solar EPCs. This will provide the necessary momentum for replication, without future external support." Since the time of that report, installations of solar systems have taken place with accompanying press coverage thus exposing more people to the potential benefits of solar farming. The ECGA already has a number of solar irrigation members who have expressed satisfaction with their solar systems as a means to manage their energy costs. Such farmers have been advocating within their farming groups for a wider and faster adaptation of solar which has triggered this TA application with the CTCN.

The 2018 National Energy Policy (NEP) aims to ensure security of supply, stimulate growth especially with private sector participation. The Ministry of Natural Resource and Energy (MNRE) implements the Energy Regulatory Act and Electricity Act of 2007 setting the obligation to hold licenses for the generation, transmission, operation, distribution, supply, off-grid and mini-grid supply, import or export of electricity, it has regulated the procurement of new capacities. EEC tariffs make large customers (mostly industrial and large commercial) pay true cost-reflective tariffs at peak time during high demand season.

Energy regulator ESERA is currently studying the cost of service. The Energy Master Plan 2018 aims to reduce dependency on imported electricity and on primary fuels. Under its preferred future scenario, 676 MW of domestic capacity are required to meet the projected demand and to provide adequate reserves by 2034 (demand is expected to increase from 1,270 GWh in 2014 to 2,648 GWh in 2034). Eswatini's Nationally Determined Contribution to global climate action under the UNFCCC aims for renewable energy resources up to 50% of the energy mix by 2022.

The SE4All Country Action Plan 2014[26] identified potential investments with internal rates of return (IRR) above 12% (the cut-off opportunity cost of capital in Eswatini according to African Development Bank (AfDB)), with solar power projects at IRR 16-18%. The National Energy Policy Implementation

[25] https://ec.europa.eu/transparency/regdoc/rep/3/2019/EN/C-2019-7845-F1-EN-ANNEX-1-PART-1.PDF
[26] https://www.seforall.org/sites/default/files/Swaziland_RAGA_EN_Released.pdf

Strategy (NEPIS, 2018) calls for a policy framework to develop renewable energy, namely a long-term programme and deployment of net metering countrywide from 2021 to 2026-2031. ESERA and EEC with USAID support started to evaluate the capacity of the Eswatini electricity network to absorb intermittent renewables. An Eswatini Independent Power Producer (IPP) Policy[27] was published in 2015 and a number of IPPs have been awarded. ESERA supported by the African Legal Support Facility (ALSF) intends to develop standardised Purchase Power Agreement and other contracts.

OPTIONAL: Linkages to Green Climate Fund Readiness and Preparatory Support

The CTCN is collaborating with the GCF in order to facilitate access to environmentally sound technologies that address climate change and its effects, including through the provision of readiness and preparatory support delivered directly to countries through their GCF NDA. These actions are in line with the guidance of the GCF Board (Decision B.14/02) and the UNFCCC, particularly paragraphs 4 and 7 of 14/CP.22 that addresses Linkages between the Technology and the Financial Mechanisms[28].

The CTCN is therefore implementing some of its technical assistance using GCF readiness funds accessed via the country's NDA. Any application for GCF support, including the amount of support provided, is subject to the terms and conditions of the GCF and should be developed in conjunction with the NDA.

Please indicate whether this request has been identified as preliminarily eligible by the NDA to be considered for readiness support from the GCF.

☐ Initial engagement: The GCF NDA of the requesting country has been engaged in the design of this request and the NDA will be involved in the further process leading to an official agreement for accessing GCF readiness support.

☐ Advanced engagement (preferred): The GCF NDA of the requesting country has been directly involved in the design of this request and is a co-signer of this request, the signature indicating provisional agreement to use readiness national funds to support the implementation of the technical assistance.

NDA name:

Date:

Signature:

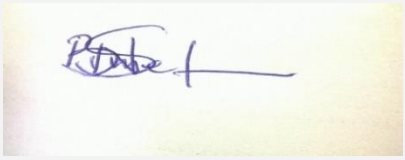
Monitoring and impact of the assistance:

By signing this request, I affirm that processes are in place in the country to monitor and evaluate the technical assistance provided by the CTCN. I understand that these processes will be explicitly identified

[27] http://www.sera.org.sz/administrator/files/1578991946.pdf
[28] https://unfccc.int/files/meetings/marrakech_nov_2016/application/pdf/auv_cop22_i8b_tm_fm.pdf

in the CTCN Response Plan and that they will be used in the country to monitor the implementation of the technical assistance following standard CTCN procedures.

I understand that, after the completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short, medium and long-term impacts in the country.

Signature:	
NDE name:	Mr Bafana Simelane
Date:	14 May 2021
Signature:	

THE COMPLETED FORM SHALL BE SENT TO THE CTCN@UNEP.ORG

The CTCN is available to answer all questions and provide guidance on the application process.

Annex 1: Eswatini Green Climate Fund Country Programme - National Priorities

Table 1. National priorities by GCF thematic area[29]

Thematic Area	**Main National Priorities**
Mitigation	Renewable energy Energy efficiency, including buildings and vehicles Low emission transport systems Petrol/ethanol blending Sustainable municipal waste management Forest management, including fire management Afforestation and reforestation
Adaptation	Integrated water resources management Climate smart agriculture Adaptable varieties/breeds and diversification Climate-proofing of existing and planned infrastructure Access to Potable Water, Sanitation and Hygiene Landscape management / Ecosystem restoration and management Biodiversity conservation Improved disaster management system, including early warning
Cross-cutting	Agroforestry Wetland restoration and protection Land use management

Table 2. National priorities by GCF impact areas

Thematic Area	**Impact Area**	**Main National Priorities**
Mitigation	Energy generation and access and energy efficiency	Renewable energy (hydropower, solar photovoltaic, wind) Energy efficiency (buildings) Reduced consumption of non-sustainable biomass Cleaner cookstoves
	Transport	Low emission transport systems

		Energy efficient vehicles Petrol/ethanol blending
	Buildings, cities, industries and appliances	Energy efficient buildings Sustainable municipal waste management
	Forest and land use	Forest protection and management Afforestation and reforestation (including in urban areas and industrial forestry) Grazing land management Integrated fire management
Adaptation	Health, food and water security	Integrated water resources management (including water harvesting and conservation) Access to Potable Water, Sanitation and Hygiene
	Livelihoods of people and communities	Climate smart agriculture Introducing adaptable varieties/breeds and diversification Effectiveness of pest, disease and weed management practices Micro and drip irrigation Strengthening of extension and agricultural advisory services
	Infrastructure and built environment	Climate-proofing of existing and planned infrastructure (Improving infrastructure design) Access to Potable Water, Sanitation and Hygiene Sustainable municipal waste management
	Ecosystems and ecosystem services	Landscape management Ecosystem restoration and management Biodiversity conservation Alien invasive species management
	Early warning systems	Modernization of meteorological, hydrological and agricultural observation networks Early warning systems (including floods)
Cross-cutting		Agroforestry Wetland restoration and protection Land use management / Sustainable utilisation of land and water resources

		Enabling environment: National Irrigation Development Plan, Mainstream climate change in agricultural policy, strategy, programmes and initiatives…

Annex 2: Images of cane growing in Eswatini

Figure 2: Example of a Centre Pivot irrigation system

Figure 3:Example of a pump station

Figure 4: Example of the electricial controls for an irrigation system

Figure 5: Discharge pipe to irrigation system

Figure 6: Cane under sprinkler irrigation

Figure 7: Example of a local solar array installed on a chicken house for cane irrigation (Hully Farm)

Figure 8: Example of a local ground based solar array for cane irrigation (Wiggy Wright Farm)

Figure 9: Example of a local ground based solar array for cane irrigation (Makamba Dad Farm)

Annex 3: Site Visit Reports

In preparation for this application, a limited survey of some existing cane growers that have converted to solar were visited. All farmers were extremely happy about the systems they had installed and the money they were saving from converting from grid electricity to solar as well as the environmental benefits of doing so. They all urged the ECGA and ESA to support all cane farmers with converting to solar power.

Site Survey Report

Date: 03/06/2021	**Farm:** L.A Hully Farm
Time: 09:00 am	**Contact person:** Mr. Hully Jr

Farm Style: Crop and Poultry	**Hectares:** 85 ha
Location: Malkerns	**Contact Details:** (+268) 7602 0333

Solar System

System	Supplier	Power generation	Date of Commission	Connection type	Panel size
Growatt Systems	TRRC (Eswatini)	100 kw	November 2020	Direct	390 Kw

System Usage

Daily power	Power Consumption	Battery Storage		Power Usage	App data
80-100 kW	85-100 kW Daily	N/A		Pump Irrigation	YES

Financials

Investment cost	Cost per KW	Method of finance	Supplier SLA (Service Level Agreement)	Period payable	Power Cost Per Kw 2020-2021 Investment
E1m Est	Free /Sunlight	Self-purchase /Bank	Yes / Lease agreement	Finance over 4 years	E10,000.00

Electricity Costs

Monthly Power Cost	Monthly access Charge	Monthly Power consumption	Peak Charge	Cost Per Kw	Monthly Power usage cost reductions
E50,000.00	E2,500.00	Peak Demand Charge	Yes	E2,4	N/A

Solar Power Generation

Monthly cost	Monthly access charge	Monthly Power consumption	Peak Charge	Cost Per Kw Power generation	Monthly Power usage Cost reduction
Loan & SLA	N/A	60-100 KW	N/A	Free (sunlight)	Cost flow Neutral

Site Survey Report

Date: 03/06/2021
Time: 10:30
Location: Malkerns
Farm Style: Banana /sugar Plantation

Farm: Wiggy Wright Farm
Contact person: Mr. Wiggy Wright
Contact Details: (+268) 7603 5659
Hectares: 60+- Ha

Solar System

System	Supplier	Power generation	Date of Commission	Connection type	Panel size
Growatt System(Sa)	Re Power (SA)	69-80 kW	November 2020	Direct	390 kW

System Usage

Daily Power	Power Consumption	Battery Storage		Power Usage	App data
49-89 kW	60-80 kW Daily	N/A		Pump irrigation	YES

Financials

Investment cost	Cost per KW	Method of finance	Supplier Service Level Agreement	Period payable	Power Cost Per Kw 2020-2021 Investment
E1m Est	Free /Sunlight	Cash/ Self finance	Yes	N/A	E10,000.00

EEC Costs

Monthly Power Cost	Monthly access Charge	Monthly Power consumption	Peak Charge	Cost Per Kw	Monthly Power usage cost reductions
E50,000.00	E2,500.00	Peak Demand Charge	Yes	E2,4	N/A

Solar Power Generation

Monthly cost	Monthly access charge	Monthly Power consumption	Peak Charge	Cost Per Kw Power generation	Monthly Power usage Cost reduction
N/A	N/A	60-100 kW	N/A	Free (sunlight)	60%-89%

Site Survey Report

Date: 03/06/2021
Time: 12:00
Location:
Farm Style: Sugar cane plantation

Farm: Makamba Dad Farm
Contact person: Mr. Ndzebele
Contact Details: (+268) 7602 3282
Hectares: +- 85 ha

Solar System

System	Supplier	Power generation	Date of Commission	Connection type	Panel size
Growatt System(Sa)	TRRC (Eswatini)	69-80 kW	November 2020	Direct	390 kW

System Usage

Daily Power	Power Consumption	Battery Storage	Power Generation	Power Usage	App data
49-89 kW	60-89 kW Daily	N/A	80 kW	Pump irrigation	YES

Financials

Investment cost	Cost per KW	Method of finance	Supplier Service Level Agreement	Period payable	Power Cost Per Kw 2020-2021 Investment
E900k Est	Free /Sunlight	Supplier financed	Yes	Rent to own 5 years	E10,000.00

EEC (Eswatini Electricity Company)

Monthly Power Cost	Monthly access Charge	Monthly Power consumption	Peak Charge	Cost Per Kw	Monthly Power usage cost reductions
E50,000.00	E2,500.00	Peak Demand Charge	Yes	E2,4	N/A

Solar Power Generation

Monthly cost	Monthly access charge	Monthly Power consumption	Peak Charge	Cost Per kW Power generation	Monthly Power usage Cost reduction
E21,000.00	N/A	60-100 kW	N/A	Free (sunlight)	60%-89%