

Concept Note

Eswatini Energy Programme

Eswatini | African Development Bank (AFDB)

29 November 2018



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Concept Note

The Green Climate Fund (GCF) is seeking high-quality projects or programmes.

The Accredited Entity is encouraged to submit a concept note, in consultation with the National Designated Authority, to present a project or programme idea and receive early feedback and recommendation.

Project/Programme Title: Eswatini Energy Programme

Country(ies): Eswatini

National Designated Authority(ies) (NDA): Ministry of Tourism and Meteorology:

Accredited Entity(ies) (AE): African Development Bank (AFDB)

Date of first submission/
version number: [2018-07-31] [V.1]

Date of current submission/
version number [2018-07-31] [V.1]

Please submit the completed form to fundingproposal@gcfund.org
Please use the following naming convention in the subject line and the file name:
"CN-[Accredited Entity or Country]-yyymmdd"

PROPOSAL | 2017

A. Project / Programme Information (max. 1 page)			
A.1. Project or programme	<input type="checkbox"/> Project <input checked="" type="checkbox"/> Programme	A.2. Public or private sector	<input checked="" type="checkbox"/> Public sector <input type="checkbox"/> Private sector
A.3. Is the CN submitted in response to an RFP?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, specify the RFP:	A.4. Confidentiality¹	<input type="checkbox"/> Confidential <input checked="" type="checkbox"/> Not confidential
A.5. Indicate the result areas for the project/programme	<p><u>Mitigation:</u> Reduced emissions from:</p> <input checked="" type="checkbox"/> Energy access and power generation <input type="checkbox"/> Low emission transport <input type="checkbox"/> Buildings, cities and industries and appliances <input type="checkbox"/> Forestry and land use <p><u>Adaptation:</u> Increased resilience of:</p> <input checked="" type="checkbox"/> Most vulnerable people and communities <input type="checkbox"/> Health and well-being, and food and water security <input checked="" type="checkbox"/> Infrastructure and built environment <input checked="" type="checkbox"/> Ecosystem and ecosystem services		
A.6. Estimated mitigation impact (tCO₂eq over lifespan)		A.7. Estimated adaptation impact (number of direct beneficiaries and % of population)	
A.8. Indicative total project cost (GCF + co-finance)	Amount: USD 60.1 million	A.9. Indicative GCF funding requested	Amount: USD 18.9 million__
A.10. Mark the type of financial instrument requested for the GCF funding	<input checked="" type="checkbox"/> Grant <input type="checkbox"/> Reimbursable grant <input type="checkbox"/> Guarantees <input type="checkbox"/> Equity <input checked="" type="checkbox"/> Subordinated loan <input type="checkbox"/> Senior Loan <input type="checkbox"/> Other: specify _____		
A.11. Estimated duration of project/ programme:	a) disbursement period: b) repayment period, if applicable:	A.12. Estimated project/ Programme lifespan	25 Years
A.13. Is funding from the Project Preparation Facility requested?²	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Other support received <input type="checkbox"/> If so, by who:	A.14. ESS category³	<input type="checkbox"/> A or I-1 <input checked="" type="checkbox"/> B or I-2 <input type="checkbox"/> C or I-3
A.15. Is the CN aligned with your accreditation standard?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	A.16. Has the CN been shared with the NDA?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
A.17. AMA signed (if submitted by AE)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If no, specify the status of AMA negotiations and expected date of signing:	A.18. Is the CN included in the Entity Work Programme?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
A.19. Project/Programme rationale, objectives and approach of programme/project (max 100 words)	<p>The <i>Eswatini Energy Programme</i> includes five projects for the electricity sector in Eswatini. The programme contains both mitigation and adaptation components. The programme will enable Eswatini to reduce its carbon footprint by replacing carbon-sourced fuels with low-emission sources in its national energy balance. In addition, it will “climate proof” key infrastructure, under pressure from an increased frequency and intensity of droughts and storms. These phenomena are causing severe erosion leading to the collapse of transmission lines that supply electricity to economically vulnerable populations. This programme will allow the nation to strengthen its infrastructure to climate impacts and reduce its reliance on fossil fuels.</p>		

¹ Concept notes (or sections of) not marked as confidential may be published in accordance with the Information Disclosure Policy ([Decision B.12/35](#)) and the Review of the Initial Proposal Approval Process ([Decision B.17/18](#)).

² See [here](#) for access to project preparation support request template and guidelines

³ Refer to the Fund’s environmental and social safeguards ([Decision B.07/02](#))

B. Project / Programme details (max. 8 pages)

B.1. Context and Baseline (max. 2 pages)

The *Eswatini Energy Programme* is a suite of five climate related projects. The Programme's activities are divided into two categories: A **Mitigation** component, and an **Adaptation** component. Under the *mitigation* component, the programme will accelerate the nation toward its goal of low-emission, renewable energy delivery by reducing coal-based imports and delivering grid energy to new households, thus reducing burning of wood and charcoal. Under the *adaptation* component, it will build climate resiliency into vital infrastructure now being threatened by climate change. In addition to accelerating the nation toward these important objectives, the economic and environmental co-benefits of the project are significant; they include: strengthening of the livelihoods of highly vulnerable households (including women- and child-headed households), creating temporary jobs, and slowing the environmentally unsustainable trend of rapid deforestation.

Table 1: Eswatini at a glance

Population	GDP	Electricity Consumption
1,367,254 (2017)	\$ 3.7 billion (2017)	1,084 GWh (2016)

Eswatini is a small nation that it is often overlooked by developers and occasionally by DFIs. Despite this fact, the nation desires to take its role to reduce levels of GHG emissions from the electricity sector seriously. Eswatini's domestic energy production is 123 GWh and comes predominantly from four hydropower facilities. However, in 2016 the nation consumed 1,084 GWh, meaning it imported 961 GWh.⁴ Most of the imported generation comes from Eskom, in South Africa, which is heavily supplied by coal.

Mitigation Need: reduce Eskom imports and wood / charcoal burning

In order to reduce its carbon emissions from the electricity sector, Eswatini must address two primary objectives:

1. Reduce coal-dominated imports from Eskom. This objective can be met by adding low-emission, renewable generation plants to domestic electricity sources.
2. Reduce the use of traditional household fuels, especially wood, charcoal, and dung. This objective can be addressed through accelerating delivery of cleaner sources of electricity to rural populations through the national grid. This objective also serves other important goals of reducing deforestation and eliminating negative health effects of smoke inhalation and accidental household fires.

It is important to understand the context of Eswatini's energy consumption. Three primary features are especially salient:

- 1) Eswatini imports are coal dominated and expensive. Typically, Eswatini can produce almost 30% of its own electricity. However, in 2016, just 14% was produced domestically, 3% was purchased from hydropower-based EDM in Mozambique and 83% was imported from Eskom, which produces 90% of its electricity using coal power plants. The shift toward Eskom was driven largely by a long drought and diminishing storage availability at domestic hydropower plants. One consequence was the 759,187,440 kg in CO₂ emissions from coal-based generation in the national mix. Another was the high cost of imported electricity. Typically, SEC would buy more electricity from EDM; however, during the 2016 fiscal year, SEC was forced to stop these purchases due to rising costs. EDM sells electricity in US Dollars, which gained significantly to the Eswatini *lilangeni*, driving prices up as local currency values fell.

SEC has traditionally secured electricity from four primary sources:

1. Domestic hydropower facilities, owned by SEC (Maguga, Edwaleni, Ezulwini, and Maguduza),
2. Domestic Ubombo Sugar Limited company in Eswatini
3. EDM hydropower in Mozambique
4. Eskom in South Africa – 90% coal sourced

As production shifts toward Eskom, the national energy mix emits more carbon. The following is an overview of Eskom's generation:

Table 2: Eskom's Generation Fuels and Percentages

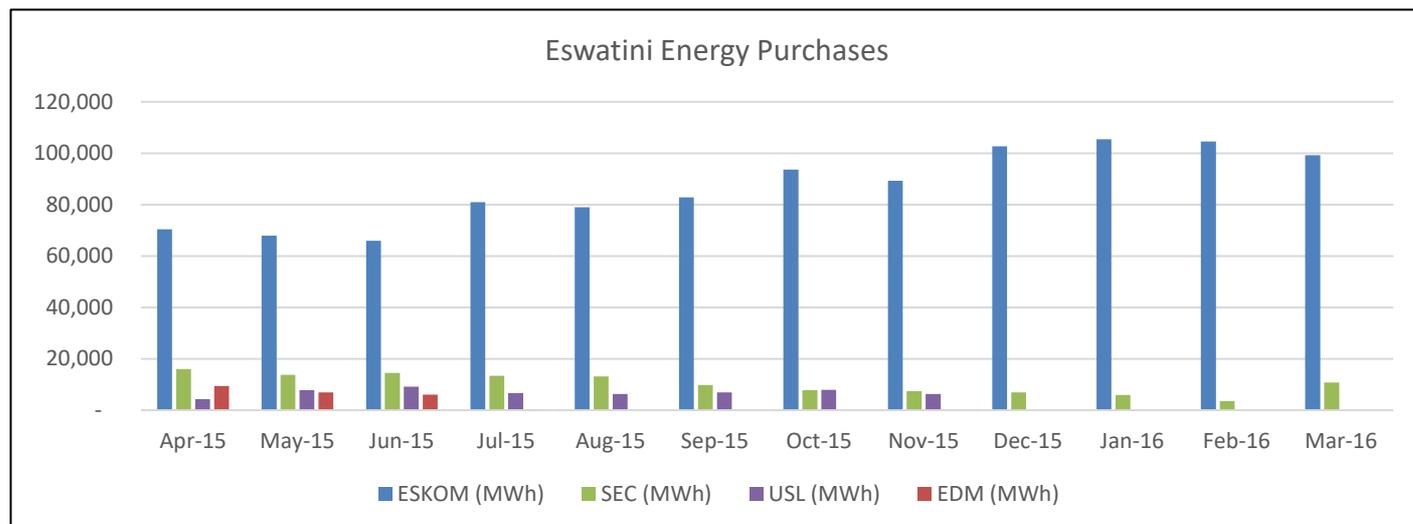
Fuel	Coal	Nuclear	Hydropower	Gas	Other
Mix Percentage	90%	5%	2%	1%	2%

Source: Center for Renewable and Sustainable Energy Studies⁵

⁴ SEC 2017 Annual Report

⁵ Center for Renewable and Sustainable Energy Studies, 2013, "Electricity," available at: <http://www.crses.sun.ac.za/files/services/schools/electricity/Electricity%20word%2013.pdf>. Accessed on May 15, 2018.

Figure 1: Eswatini's SEC Energy Consumption



Source: SEC

Table 3: Eswatini's annual electricity consumption generation mix (including imports), and CO₂ grid output⁶

Fuel	Hydropower	Coal	Nuclear	Gas	Sugar	Other
MWh	167,044	948,984	52,721	10,544	55,612	21,089
Mix percentage	13%	76%	4%	1%	4%	2%
Mt CO ₂ eq.	-	759,187	-	9,427	-	4,218

- 2) Rural residents rely on wood and charcoal fuel. The second salient feature of Eswatini's energy consumption patterns relates to rural fuel sources. On-grid vs. off-grid consumers are roughly divided along urban vs. rural population lines. The rural population of Eswatini represents 79% of the total. Less than 10% of rural dwellers have access to grid energy, in contrast to 45% of the nation overall.⁷ These realities drive rural use of traditional fuels, especially wood, charcoal, and paraffin. The UNEP estimates that Eswatini's primary fuel mix contains 66% traditional fuels,⁸ meaning that traditional-fuels consumption would total approximately 2,438 GWh and produce an additional 3.6 million tonnes of CO₂-eq over and above what is produced by modern methods, and that total CO₂-eq from energy may reach 4.4 million tonnes.⁹

$$772,832 \text{ (from electricity)} + 3,657,159 \text{ (from wood/biomass)} = 4,429,991 \text{ MT CO}_2\text{-eq.}$$

Table 4: Assumed values of CO₂ emissions per fuel type (Blue-Sky Model)

Wood	Coal	Diesel	SEC grid-delivered electricity
1.5 kg per kWh	0.800 kg per kWh	0.894 kg per kWh	0.62 kg per kWh consumed

The activities within the proposed programme have the potential to reduce this number by **29,273 MT of CO₂** annually; or **1.1 million MT** over the projects' lifetimes:¹⁰

1. Lavumiza 10 MW Solar PV plant
2. Southern Transmission line for reinforcement and new connections

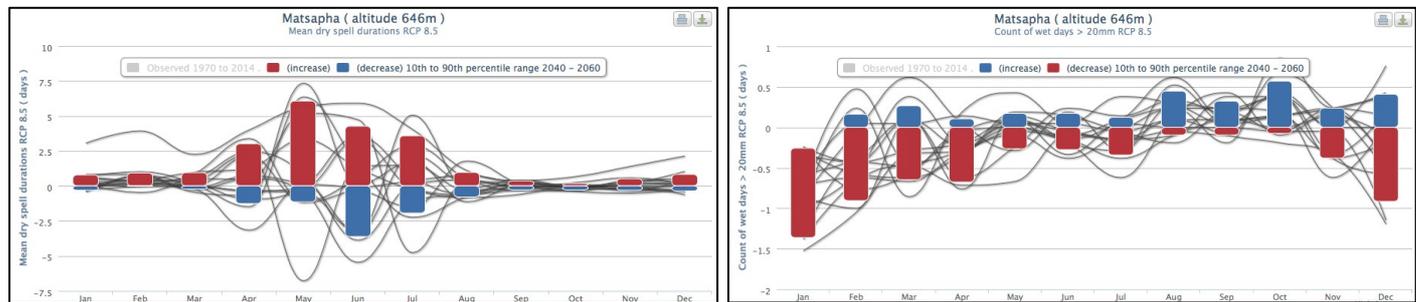
Adaptation Need

Because of its small size, Eswatini has done little to contribute to the causes of climate change; it therefore experiences the effects in a disproportionate manner. The country is witnessing increased average temperatures and long periods of drought according to a recent FAO report.¹¹ Additionally, intense storm events often preceded by severe drought, have become increasingly common. As a result, some of the nation's energy infrastructure (especially transmission lines and reservoirs) have been placed in danger or deteriorated. Deep ravines, called "dongas" are forming under line towers and reservoirs are filling with silt. If additional damage occurs (which is likely), the economic effects would be far costlier than introducing adaptive measures now.

Furthermore, as the following graphics from the *Climate Information Platform* illustrate, Eswatini is projected to see longer periods of drought during dry season months, and an increase in heavy rains (greater than 20 mm) once the wet season begins. The figures also illustrate an anticipated longer dry season followed by a shorter, more intense rainy season. These climate phenomena will exacerbate the

current threats of dongas encroaching transmission towers and of accelerated reservoir siltation, threatening service interruptions and limiting domestic hydropower production.

Figure 2: RCP 8.5 projections of average dry-spell durations and count of wet days (>20mm) for Eswatini at national airport



Source: Climate Information Platform¹²

Climate phenomena have prompted three activities within this programme:

1. Repair the dongas that threaten transmission lines, protecting service and climate-proofing assets
2. Dredge a hydropower storage reservoir, preserving flow rates for hydropower production during peak hours
3. Rehabilitate a hydropower plant to restore a low-carbon energy source

Once completed, these *adaptation* components will lock in a discounted climate *benefit* of over **US \$70 million**, over a business as usual scenario for the life-cycle of the assets and will directly *benefit* over **703,000 people, 52% of the nation's population**.

Programme Fit with National Priorities

The projects contained in the programme are near-term energy sector priorities, developed by the Energy Ministry and SEC, which directly reflect the nation's energy policy. These policies include:

1. Ensuring access to energy for all
2. Ensuring security of energy supply
3. Ensuring environmental and health sustainability

Furthermore, according to the nation's INDC, "[Eswatini's] contribution is to double the share of renewable energy in the national energy mix by 2030, relative to 2010 levels." The INDC goes on to say that the government intends to increase the use of grid-connected renewable technologies with fuel sources such as solar and other low-emission options.¹³

Barriers

Several specific barriers keep Eswatini from fully achieving their low-emission energy goals. One, is the lack of financial resources, on behalf of the utility, to afford to implement many of the solutions at hand. A related barrier is the current tariff regime, which is not based on cost of service delivery. A third, mentioned above, is the climate risk that extreme conditions have placed on some essential infrastructure. A fourth is the lack of electricity access for much of the population of the nation; without access, village customs of burning wood and other inefficient fuels lead to significant carbon output and deforestation, among other concerns.

A primary barrier keeping Eswatini from fully achieving its clean power goals is a lack of resources to adequately maintain existing assets in the face of climate change *and* expand access through new renewable sources and additional transmission and distribution networks. According to the Statements of Comprehensive Income (2016), profits for SEC were USD 7.6 million and USD 5.1 million for the past two

⁶ A figure of .800 kg CO₂ per kWh of coal-produced electricity was used, per: <http://blueskymodel.org/kilowatt-hour>.

⁷ African Development Bank, 2014, Swaziland Country Strategy Paper

⁸ UNEP, "Energy Consumption and Production, Swaziland," available at https://wedocs.unep.org/bitstream/handle/20.500.11822/20595/Energy_profile_Swaziland.pdf?sequence=1&isAllowed=y. Accessed on May 17, 2018.

⁹ A figure of 1.5 kg CO₂ per kWh of wood-produced energy was used, per: <http://blueskymodel.org/kilowatt-hour>.

¹⁰ There is discrepancy regarding the figure of CO₂ per unit of electricity. For example, Gold Standard, 2015, <https://www.goldstandard.org/blog-item/carbon-pricing-what-carbon-credit-worth>, uses an emission factor of 0.34 kg CO₂/kWh for wood fuel, 0.34 kg CO₂/kg for hard coal, and 0.27 kg CO₂/kWh for diesel fuel.

¹¹ Matthew Leete, Beau Damen and Andrea Rossi, Bioenergy and food security project, Eswatini Country Brief, FAO, 2013.

¹² Climate Information Platform, available at http://cip.csag.uct.ac.za/webclient2/datasets/swaziland-cmip5/#nodes/cmip5-anomalies?folder_id=39&extent=109278, accessed July 23, 2018.

¹³ Swaziland Intended Nationally Determined Contribution, 2015, available at <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Swaziland/1/Swaziland%27s%20INDC.pdf>. Accessed May 20, 2018.

years (as a parastatal organization, the national government has a claim on 100% of company profits). These margins are not sufficient to sustain investment in new assets.

A related barrier is the current electricity tariff regime in Eswatini. Each year SEC presents a rate case to SERA, the regulator, typically requesting tariffs that reflect the costs of delivering electricity. For their part, the regulator seeks to cushion the customer against inflationary pressures, in balance with the need to incentivize new investment. While increases have been granted, they are below the rate at which business costs are rising, according to the most recent Annual Report.¹⁴ SEC's petitions have resulted in some rate increases, but there remains a historical gap to plug.

As has been established, climate change related phenomena are threatening portions of the infrastructure of the electricity grid in Eswatini. The required costs to repair the damages are keeping the LEC from doing other, more forward-looking work, of integrating additional renewable generation sources, and extending the grid to households that are not yet served.

A final barrier is the lack of access to grid-supplied electricity. A lack of access continues the harmful practice of using wood (among other fuels), for lighting, cooking and heating in unserved villages. The practice can be economically damaging to vulnerable households, has negative environmental impacts, and threatens the health of thousands. Traditional wood biomass is still the major energy source in Eswatini, meeting 66% of the national energy demand. Furthermore, between 2002 and 2012, wood fuel production and charcoal production increased by 25% and 50% respectively; in 2015, charcoal production amounted to 34 ktoe.¹⁵

The growing trend of using wood for fuel imposes significant costs on African households and economies, with an estimated opportunity cost of 3% of regional annual gross domestic product (GDP)—including avoidable spending on solid fuels, time losses due to firewood collection, the economic costs of increased mortality and morbidity burdens, and the environmental and climate costs of deforestation and carbon dioxide emissions.¹⁶ Finally, the trend also has severe impacts on health and productivity. Smoke emissions, or Household Air Pollution (HAP), is a serious health problem now responsible for the deaths of nearly 600,000 Africans each year.¹⁷ These health impacts fall largely upon women, as they experience higher personal exposure than men, though the absolute burden is larger among men due to underlying disease rates.

B.2. Project / Programme description (max. 3 pages)

The Programme's five projects are divided into two Output components: A *Mitigation* component, and an *Adaptation* component. Two *mitigation* projects reduce Eskom imports and wood/charcoal burning. Three *adaptation* projects climate-proof essential infrastructure.

Output 1, Mitigation: Reduce Eskom imports and wood/charcoal burning.

1. **Activity 1.1** New construction of the Lavumiza Solar P.V. power station, a 10 MW facility. Cost: USD 13.9 million. This new facility will replace 10 MW of imported, coal-produced power with domestic, renewable energy, moving Eswatini toward their national objectives of obtaining energy from fully renewable sources, and energy independence. Financing gaps are being researched, as is co-financing. A concessionary loan is requested from GCF to bridge the gap. When completed the new facility will eliminate 12,129,231 kg/year of CO₂-eq, by reducing over 16 million kWh of Eskom imports. The value of this activity is summarized in the following table:

Table 5: Lavumiza's Benefits

Lifetime Benefits of Lavumiza Solar PV Plant					
New low-emission electricity / yr.	CO ₂ eq. reduced	Value of CO ₂ Savings	Job Creation	Job-years	Savings over imports
16,846,154 kWh	303,230 MT	US\$ 14,557,927	US\$ 332,500	190	US\$ 84,015,000

2. **Activity 1.2** Southern Grid 132kV line. Cost: USD 35.2 million. This transmission line will connect the Lavumiza Solar plant (above) with hundreds of small villages and several large villages, including Hluthi, Mhlosheni, Nhlanguano, and Mankayane. The transmission line will connect up to 44,352 residents. Assuming these households replace their biomass fuels with grid-delivered electricity, the total reduction of carbon emissions from the new line will be over 12 million kg CO₂-eq per year, or 303 million kg

¹⁴ SEC Annual Report 2017

¹⁵ UNEP, "Energy Consumption and Production, Swaziland," available at https://wedocs.unep.org/bitstream/handle/20.500.11822/20595/Energy_profile_Swaziland.pdf?sequence=1&isAllowed=y. Accessed on May 17, 2018.

¹⁶ Kammilla, Srilata; Kappen, Jan Friedrich; Rysankova, Dana; Hyseni, Besnik; Putti, Venkata Ramana. 2014. *Clean and improved cooking in Sub-Saharan Africa: a landscape report*. Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/164241468178757464/Clean-and-improved-cooking-in-Sub-Saharan-Africa-a-landscape-report>. Accessed May 23, 2018.

¹⁷ World Health Organization, "Burden of Disease from Household Air Pollution for 2012," available at http://www.who.int/phe/health_topics/outdoorair/databases/FINAL_HAP_AAP_BoD_24March2014.pdf?ua=1. Accessed June 1, 2018.

CO₂ over the course of the asset's lifespan. This includes reducing line losses by nearly 1%, leading to a reduction of over 10 GWh of consumption per year.

Outcome 2, Adaptation: "Climate-proof" essential infrastructure

- Activity 2.1** Rehabilitate dongas along Camden-Edwaleni-Maputo 400kV transmission lines. Cost: USD 621,435. The ground underneath the pylons will be reinforced with a retaining wall and drainage (see photos below). Funding is being pursued due to the rapid development of these ravines, in recent years. The climate rationale behind the request is the changing patterns of the drought/intense-rain cycle in the nation. Eswatini (and Lesotho) appears to be uniquely vulnerable to this climate change threat due to particular soil composition combined with the emerging climate pattern. Grant funding is requested for this aspect.



- Activity 2.2** Dredge the Minkhomo Reservoir. Cost: USD 3.4 million. The reservoir supplies the Edwaleni and Maguduza hydropower stations. Rapid siltation build-up has been caused by climate threats similar to those that have created the dongas. Longer and more intense periods of drought have been followed by increasingly heavy rains, which have resulted in the accelerated filling of the reservoir. As silt builds in the reservoir, less water is held for hydropower generation, causing the need for additional power to be purchased from Eskom. Storage capacity in the reservoir is especially important during peak season, as Eskom power is most expensive during this time. Even during years of average rainfall, storage levels in the reservoir are low during peak season, heightening the need for additional storage. A hydraulic dredging will be performed, the cost of which is USD 2,086,463; grant funding is requested.

Additionally, a grant is being requested, in the amount of USD 1,330,105, to establish a maintenance fund. AfDB will manage the fund, releasing monies to SEC only when an equal amount is deposited into the fund. This should enable the fund to grow, over time, at an appropriate interest rate, preserving it for long-term use.

- Activity 2.3** Rehabilitate Mbabane hydropower station, a 500kW facility. Cost USD 7 million. Initially built in the 1960s, this facility was used and maintained until recently when soil erosion has caused a rupture of the penstock feeding the turbines, and siltation has filled the reservoir. The climate rationale is two-fold. First, the rehabilitation is an adaptation response to soil erosion caused by the climate phenomenon mentioned previously. Second, the ability to bring this plant back online will offset over 2.6 million kWh annually, of power purchased from coal-based Eskom, creating an additional yearly mitigation effect of nearly 2 million kg of CO₂. The cost of the rehabilitation is estimated at USD 7 million. Since the project will receive a user-pays revenue stream, a concessionary loan of USD 2 million is requested to update the plant; the remaining USD 5 million is the cost of the new penstock and reservoir dredging and is requested as a grant. A draft financial model is attached.

The programme falls into ESS Category B: All projects are undertaken at existing facilities; the Lavumiza solar plant being the sole exception. The new transmission line will run along existing easements as the pathway currently supports smaller-capacity lines.

Theory of Change

The goals of the national government are to reduce coal-based and wood / charcoal energy consumption, and "climate proof" essential infrastructure. These goals include reducing the nation's vulnerability to climate change, increasing energy access to vulnerable communities, and accelerate low-emission energy integration into the grid system. They will be achieved by addressing three primary steps. First, financial barriers must be overcome to address both adaptation and mitigation concerns. Financial barriers are significantly responsible for holding back the SEC from achieving greater electricity delivery, beginning with rural villages, and from accelerating the development of new solar generation facilities. Therefore, the proposed partnership with GCF, and the facilitating role this proposal will play to attract additional capital, will be paramount in overcoming these capital constraints. Second, additional low-emission energy sources must be provided. These includes domestic renewable generation sources (activity 1.1), and the transmission wires necessary to deliver low-emission power to rural areas (activity 1.2). Third, system resiliency needs to be addressed (Outcome 2). Activities 2.1, 2.2, and 2.3 will upgrade vital, but vulnerable aspects of Eswatini's electricity system.

Institutional Factors

There are several legal entities that will be involved implementing the projects. The electricity supply industry in Eswatini is dominated by two state owned entities, namely the Swaziland Electricity Company (SEC), which is the monopoly transmitter, distributor and supplier of

electricity, and the Swaziland Energy Regulatory Authority (SERA), which is responsible for the regulation of electricity tariffs and quality of supply. To comply with the national legal and regulatory framework, the SEC is the *implementing agency* for the program.

Agencies

Swaziland Electricity Company (SEC): The Swaziland Electricity Company Limited is engaged in the business of generation, transmission and distribution of electricity in the country. Customers include agricultural, industrial, commercial and residential households. SEC is governed by the four enabling pieces of legislation namely; The Electricity Company Act, 2007, The Energy Regulatory Act, 2007, The Electricity Act, 2007 as well as the Public Enterprises Unit (Control and Monitoring) Act, 1989.

Swaziland Energy Regulatory Authority (SERA): Swaziland Energy Regulatory Authority is a statutory Energy Regulatory Body established through the Energy Regulatory Act, 2007 (Act No.2 of 2007). The Mandate of SERA is the administration of Electricity Act, 2007 (Act No.3 of 2007), with the primary and core responsibilities of exercising control over the electricity supply industry (ESI) and regulation of generation, transmission, distribution, supply, use, import and export of electricity in Eswatini. It is also responsible for the regulation of electricity tariffs and quality of supply and services. The Electricity Act requires that prices are regulated in accordance with a defined and approved tariff methodology.

Ministries

In addition to the agencies and parastatal involved, four national ministries will coordinate to ensure financial close, commissioning, and operation of the projects.

- **Ministry of Natural Resources and Energy.** Minister: Hon. Senator Jabulile Mashwama; Principal Secretary: Mrs Winnie T. Stewart. This ministry creates energy policy and is part of the approval process for all SEC development.
- **Ministry of Finance.** Minister: Senator Martin Dlamini; Principal Secretary: Mr. Bheki Bhembe. This ministry oversees the national budget, and will be responsible for project disbursements, as well as legal compliance for government debt levels (budgetary headroom), etc.
- **Ministry of Tourism and Environmental Affairs.** Minister: Hon. Jabulani Mabuza; Principal Secretary: Emmanuel Dlamini, who is also the GCF Focal Point for Eswatini. The Ministry of Tourism and Environmental Affairs (MTEA) has been mandated to manage the environment and ensure that climate change adaptation and mitigation issues are addressed. The Department of Meteorology (MET) has been tasked to handle climate change issues. The SEC will need to work closely with the Environment division to ensure project plans comply with environmental regulations.
- **Ministry of Economic Planning and Development:** Minister: Hon. Prince Hlangusemphi; Principal Secretary: Bertram B. Stewart.

Electricity Act of 2007 contains a series of electricity licensing bylaws to which implementing actors must comply.

The Accredited Entity

The accredited entity is the African Development Bank. The Bank is very well positioned to help drive the required change in the key ministries and agencies within Eswatini. The Bank is internally coordinated, offering a unified service to Eswatini's government. One division, the Green Growth team, targets projects with a strong environmental component. The other division, working on energy projects in the country, is working closely with Green Growth, to support delivery of the projects listed above.

As the accredited entity, funds will be transferred from GCF to AfDB; AfDB would then disburse funds in line with the development timeline of the project, and under the supervision of the Bank's project division. AfDB projects are implemented by the executing agency (SEC) according to agreed schedules and procedures. Supervising implementation enables the Bank Group to make sure the physical realization of the project is progressing smoothly. AfDB's project divisions review the physical progress and monitor achievement of development objectives, working in close coordination with the borrower and the executing agencies. AfDB disburses the loan for approved expenditures, as and when provided in the loan agreement upon necessary justifications.

When required, AfDB makes its disbursements through the country's National Treasury. The ministry of energy requests the funds for the specific project and sends the money to SEC for implementation. For the repayment of loans, SEC would send debt service payment to ministry of finance, who would then forward to AfDB for payment to GCF.

To effectively oversee the entire project management process, the Bank is working directly with the SEC. Initial meetings, facilitated by SEC and the Bank, with each of the key ministries (energy/natural resources, finance, environment and tourism/meteorology) were very positive. All agencies are enthusiastic about the various outcomes, and furthermore are working together to provide the institutional support for project development. The SEC has formed a Task Team, made up of one representative from each ministry. The representative has been delegated by the ministry's Principal Secretary. The Team has been tasked with two primary responsibilities: 1) to review the project's development, gathering required facts and data and offering input; and 2) to communicate the project's process and development back to the various ministries.

Risk Analysis

Financial and operational risks apply to certain projects within the portfolio. Two of adaptation-related projects (rehabilitating dongas, dredging of the Mkhinkomo reservoir) do not face risks, in the traditional sense, in that the requested financing would come in the form of a grant. However, these projects do reflect the socio-economic risk of the possibility of delays in program implantation, which would lower the *economic* returns on the projects.

The Lavumiza Solar generation facility, the transmission line installations, and a portion of the Mbabane hydropower plant do face financial risks, which are outlined here.

Lavumiza PV:

This 10 MW project is being developed for government (SEC) ownership and faces a risk structure that is entirely borne by government. Project design, construction and commissioning may affect the expected value of the project in material ways. These risks may be slightly heightened as this will be the first significant Solar PV generation source that SEC has integrated into its network. Revenue and operational risks are also fully retained by the SEC, which will be operating a Solar PV plant for the first time. Revenue risks relate primarily to tariff expectations and collection issues; these risks are assumed to be low given the experience SEC has in these areas. By the time a full proposal is submitted, the financing of the project will be clear.

Southern 132kV transmission line:

The transmission line project will be fully designed, built, operated and maintained by SEC. Therefore, the government will retain the risks of the project. The risk profile is therefore similar to that outlined above. The line faces design and construction risks, perhaps especially so because of the linear nature of the infrastructure. However, land acquisition risks are mitigated, as this 132 kV line will follow the corridor of a series of existing 11 kV lines. Still, the line stretches over 50 km, and land acquisition risks may be a factor. During the social-environmental impact assessment, it may be discovered that additional payments are required for land purchases, or for diversions away from the intended pathway. Revenue and operational risks are considered relatively small given the experience of LEC in operating and maintaining transmission lines. Finally, the financing risks are being partly addressed through this proposal, the AfDB, and other funders.

Mbabane hydropower:

The rehabilitation of this small hydropower plant will require both loan and grant funding. As currently conceived, a grant is being requested for USD 5 million, representing costs associated with climate change impacts at the site, and a loan for the remaining costs of USD 2 million, representing non-adaptation related plant upgrades. As with the two previously mentioned projects, the hydropower plant will function as an SEC generation site, meaning the SEC (or government) will bear the risks. Revenue and operational risks appear to be the most prominent, and these are viewed as low given the incentives for SEC to generate and sell power via plant operations. Revenue collection may be viewed as a risk as well, though this is bundled with the other projects in the programme.

B.3. Expected project results aligned with the GCF investment criteria (max. 3 pages)

Expectation of Impact

Mitigation core indicator: Reduces CO₂-eq by 1,132,009 MT.

The five projects presented represents a reduction in CO₂ atmospheric release in the amount of 1,132,009 MT over the lifetime of the assets. The breakdown of the CO₂ eq. reduction is presented in Table 3 below. (A more sophisticated analysis will be accomplished for the full proposal.)

Adaptation core indicator: 703,881 direct beneficiaries, 52% of national population.

The adaptation-oriented projects (donga rehabilitation (Activity 2.1) the Mkhinkomo dredging activity (Activity 2.2), and the Mbabane hydropower), add resiliency to the nation’s energy infrastructure, and will directly benefit 703,881 people. In the case of rehabilitating the dongas, benefits come in the form of uninterrupted service. In the case of dredging the Mkhinkomo reservoir and repairing the Mbabane hydropower plant, benefits come from lower pricing for peak-electricity, especially during the dry season.

The following is a breakdown of the various project components. In the first column, for each project the reduction of CO₂ equivalents is given in kg for the projects’ lifetime. The second column indicates the direct beneficiaries of the project, and the last column the percentage of the national population that will benefit.

Table 6: Carbon equivalents avoided and direct beneficiaries

**EXPECTED IMPACTS:
MITIGATION AND ADAPTATION CORE INDICATORS**

	Activity	CO₂ Mitigated lifetime (MT)	Direct beneficiaries	% of Population
MITIGATION ACTIVITIES	Lavumiza 10 MW Solar	303,231	703,881	52%

ADAPTATION ACTIVITIES	Southern –132kV line	635,541	47,000	3%
	Donga Rehabilitation	8,488	65,800	4.90%
	Minkhomo Reservoir	136,676	703,881	52%
	Mbabane Hydropower	48,073	703,881	52%
	Totals	1,132,009	771,886	

The various projects will mitigate further climate change by:

- locking in an annual 859,862 MWh of low-emission energy that will otherwise be supplied by high-emission sources, by installing one low-emission generation plants and rehabilitating two others.
- Bringing lower-emission energy to 10,000 new households
- Scaling up low-emission energy supply through grounding new policies and procedures designed to incentivize investment
- Reducing deforestation in Eswatini, preserving carbon sinks.

The projects will contribute to climate resilient development by:

- Reducing the vulnerability of 10,000 households through new grid service.
- Locking in climate resilient measures for key long-lived infrastructure, which benefits 150,000 households.
- Reducing vulnerability of women- and child-headed households who must gather wood for fuel.
- Strengthening awareness of need for climate-resilient long-lived infrastructure by engaging planners, engineers and financiers in process of upgrading assets.

Impact Related to Investment Criteria

The programme's activities will accelerate a consumption shift toward sustainable, low-emission energy, reduce dangerous deforestation rates, and place vulnerable women- and child-headed households on a development track that will significantly empower these underserved demographics.

Paradigm shift: There are several paradigm shifts embodied in the execution of the projects. One is to scale-up the use of low-emission energy more broadly across the nation through the delivery of grid power: a shift *from* charcoal and wood fuels. For example, the new 132 kV line will add 2000 new households per year to grid power, for the next several years. Another is the scale-up of additional forms of low-emission energy, such as wind and solar, as the newly developed institutional mechanisms to develop and maintain such projects are tested and improved. For example, by proving the concept of the Lavumiza solar facility, the institutional pathways will be cleared for additional projects. As mentioned above, the political will is aligned to increase the availability of low-emission power generation; however, the institutional and financial capacities are lagging.

Sustainable development:

Environmental co-benefits: Wood gathering practices, to ensure household fuel supplies, have contributed to deforestation in Eswatini. As mentioned, fuel wood accounts for 66% of Eswatini's total energy use; and consumption is rising. This trend has placed forests under pressure. The use of wood fuels in sub-Saharan Africa accounts for up to 1% of global greenhouse gas emissions and 6% of global black carbon, an important additional driver of climate change because it both absorbs solar radiation in the atmosphere and deposits soot on snow and ice surfaces. By providing households with lower-emission energy, the new 132 kV line will help reduce these deforestation trends.

Social co-benefits: Over time, the new grid-level connections outlined above, are expected to lead to other important developmental behaviors including the use of low-emission cooking and lighting materials, and a reversal of deforestation efforts. These developmental behaviors should lead to positive economic behavior as children have adequate time to attend school, lighting for homework, and women increase their opportunity for additional economic activity. These behavioral trends were positively proven in a recent study, conducted in nearby Lesotho. The study was conducted by the Lesotho Electricity Company in the village of Pitseng, which had been recently connected to grid-power. It showed that most households took full advantage of their new opportunity. Though unscientific in its methodology, the study demonstrated that over time, households gradually adopted low-emission cooking methods (using electric stoves), consistently used electric lighting for evening activities such as homework, and some women purchased sewing machines to launch small businesses from their homes. Uptake of refrigeration and household heaters was also evident.

A recent World Health Organization (WHO) survey on the global burden of disease shows that nearly 600,000 Africans die annually and millions more suffer from chronic illnesses caused by air pollution from inefficient and dangerous traditional cooking fuels and stoves. This tragic and avoidable first-order public health crisis disproportionately harms women and children. Moreover, cooking with wood, charcoal, crop waste, dung, coal, and potentially dangerous and polluting modern fuels, such as kerosene, also imposes tremendous direct costs on

economies and households in Sub-Saharan Africa (SSA) and contributes to a wide range of negative environmental and climate change effects.¹⁸

NOTE: The use of efficient cookstoves has received a great deal of attention in the literature. We agree that efficient cookstoves provide for reduced fuel wood consumption and produce associated health and environmental benefits. However, efficient cookstoves seem to be an intermediate solution, possibly provided until grid service reaches communities, and modern electricity can be used for cooking and heating. When possible, we believe that grid extension represents a more permanent solution.

Needs of the recipient: The burden to gather fuel for cooking, heating, and lighting, falls primarily on women and children. This activity can, and often does, take women away from other, more economically profitable, opportunities such as employment or even farming. Children often must miss school to gather wood or farm waste to use for household fuel. When children are the orphaned heads of households, the burden is especially severe, as siblings take turns alternatively attending school versus gathering necessary fuel for the home. Furthermore, wood is increasingly scarce, forcing those who gather wood to spend more time, and traveling greater distances to collect it. Besides opportunity costs, many find themselves in danger at wood gathering sites.¹⁹

Country ownership: The projects contained in the program are the near-term energy sector priorities, taken from a project pipeline, which has been developed by the Energy Ministry and SEC, and directly reflect the nation’s energy policy. These include: 1) ensuring access to energy for all, 2) ensuring security of energy supply, and 3) ensuring environmental and health sustainability.

Efficiency and effectiveness:

Apart from receiving financial assistance, as requested in this proposal, the activities herein would be significantly delayed. The opportunity to accelerate the implementation of each activity creates an efficiency that cannot be realized without the proposed funds. Additionally, the role played by the AfDB as accredited entity, shifts the burden of project vetting, financial disbursement, project monitoring, and evaluation away from the GCF to the extent deemed appropriate. Finally, the adoption of pipeline projects to include in this proposal means that projects are “ready to be” and will not be delayed by bureaucratic approvals.

C. Indicative financing / Cost information (max. 3 pages)

C.1. Financing by components (max ½ page)

Component	Indicative cost (USD)	GCF financing		Co-financing		
		Amount (USD)	Financial Instrument	Amount (USD)	Financial Instrument	Institutions
1. Lavumiza solar PV	13,900,000	4,400,000	Gap financing: (loan)	9,500,000	Loan	SEC/AfDB/WB/Local Bank
2. Southern Tx line 132kV	35,158,601	3,500,000	Loan	31,658,601	Loan	SEC/AfDB/WB/Local Bank
3. Donga repair	621,435	621,435	Grant	0		
4. Dredging at Mkokomo Reservoir	3,416,568	3,416,568	Grant	0		
5. Rehabilitation of Mbabane hydropower	7,000,000	7,000,000	Grant (\$5 m) / loan (\$2 m)	0	Loan	
Indicative total cost (USD)	60,096,603	18,930,003		41,158,601		

C.2. Justification of GCF funding request (max 1 page)

Rational for GCF funding: GCF funding is being requested to bridge a financing gap that exists between the funding limits available from traditional sources, and what’s needed to accelerate the implementation of the projects. Each of the financial institutions listed below is available to provide funding. However, each also has availability limits due to the broad service obligations of the various entities. Therefore, participation by multiple institutions will be required. This will allow the GCF to play a leveraged role, “crowding in” co-financing from a variety of sources, that would otherwise not be able to mobilize toward these projects, due to a lack of overall project funding.

Private financial institution availability: Financial institutions in Eswatini remain inadequate to support rapid, or significant, infrastructure investment. Part of the problem is a shortage of available financing with the long-term maturities required for infrastructure investment.

¹⁸ African Clean Cooking Energy Solutions Initiative, 2014, Clean and Improved Cooking in Sub-Saharan Africa: A Landscape Report, World Bank, Washington DC, 2014.

¹⁹ World Health Organization, “Burden of Disease from Household Air Pollution for 2012,” available at http://www.who.int/phe/health_topics/outdoorair/databases/FINAL_HAP_AAP_BoD_24March2014.pdf?ua=1. Accessed June 1, 2018.

Another issue is the small relative size of Eswatini's economy. With a total GDP of just USD 3.12 billion, and only four private banks, there are few resources to support infrastructure investment. Still, there is some capital available; we anticipate that local institutions will be able to provide approximately USD 10 million toward the overall programme.

SEC funding availability: The SEC is primarily an electricity transmission and distribution operator. As such, it maintains a commitment to expand its connection service in both urban and rural areas. During each of the past two years the commitment has been for 15,000 households to be connected annually; these goals have largely been achieved. Therefore, the new connections from this programme will be in addition to the business as usual case.

According to the Statements of Comprehensive Income (2016), profits for SEC were USD 7.6 million and USD 5.1 million for the past two years. Amortized grants during the past five years averaged USD 1.1 million. It is assumed that SEC will be in a position to re-invest its annual profits into the projects that are listed within the proposal, meaning an availability of approximately \$6 million per year, for this, a two-year capital expenditure plan.

Government of Eswatini funding availability: As mentioned, the Government of Eswatini has funded SEC approximately USD 1.1 million over each of the past five years. In October of 2017, the Government announced a new bond issuance totalling USD 12.5 million, specifically for infrastructure. Moving forward, it is assumed that the government will be able to offer approximately USD 1 million per year, to facilitate new connections, including both transmission and distribution construction. More may be unrealistic due to a fiscal crisis from declining SACU revenues and significant short-term debt now coming due. According to the Government of Eswatini's "*Budget Speech, 2015*" total debt also remains a binding constraint to long-term development plans. Though the current stock of debt stands at just 16% of GDP, 60 percent of domestic debt is in short-term treasury bills with one-year maturities. Total debt is USD 527 million.

Multi-lateral Banks: The African Development Bank and World Bank are also possible capital providers. However, these institutions are often restricted in the total amount that can be allocated to a particular nation. These limits are in place due to the number of client nations, and the broad needs for funding. Levels of allocation for the activities under this programme have not yet been determined, but the projects are being researched as investment targets. Still, we believe that multi-lateral banks can provide a total of USD 20 million to the Programme.

Alternative funding models: Alternative funding models include three other options. One is to increase the portion of funding from AfDB, placing a greater percentage of debt on that institution. This would likely delay the start dates for all projects under this proposal, as several tranches of funds would need to be approved, over time. A second alternative is to look to the local banking sector for full financing. However, banks are not accustomed, or often able to provide the amounts of capital required; this pathway would significantly slow the progress of project development. A third alternative is to delay the projects until the government budget can allocate the needed funds. This would delay project start dates perhaps indefinitely, extending the roll out of pipeline projects well into the future. None of these three options is attractive.

Eswatini has only recently graduated from least developed country status according to the UN Policy and Analysis Division, with a GDP per capita of USD 3200 (9,900 PPP). Though this level of development manages to characterize Eswatini as a lower-middle income country, poverty is widespread, and entangles over 63% of the population. As a result, there is little margin for developing new programs, or for successfully managing structural damage due to climate change.

Grant financing is being requested for the three *climate adaptation* projects: donga repairs, reservoir dredging, and hydropower rehabilitation. The adaptation projects are required to fully recover electricity infrastructure from the climate change experienced by the country. The case is made that apart from climate change, these adaptations would not be necessary. As Eswatini has done little to contribute to climate change, the nation is hopeful that donor organizations might assist in helping the country adapt to its effects.

C.3. Sustainability and replicability of the project (exit strategy) (max. 1 page)

Technical sustainability will be ensured through the use of adaptation strategies that have relatively low levels of technical complexity and limited requirements for ongoing maintenance, and that are built on technical and scientific capacity within the country. The donga rehabilitations will be conducted with local labour, and landscaping methods that have been proven effective for the soils of the region and the emerging drought-flood cycles that the region is experiencing. These include drainage mechanisms, and tree planting to eliminate erosion. The Solar PV generation plans are being prepared and vetted by experienced Solar PV EPC contractors. The technical sustainability of the design of the generation site will be confirmed during the drafting of the full proposal. The transmission line designs will be carefully sited to avoid, as much as possible, sites that have a predilection to donga expansion. Where this appears to be a danger, additional landscaping, drainage and re-forestation efforts will be included.

Environmental sustainability is a cornerstone of the project design. The Solar PV site will reduce reliance on imported energy that is now primarily produced from coal. The new transmission line connects multiple villages (2000 households per year), now burning wood and charcoal, to electricity sources that are far cleaner, produced with a generation mix that will be increasingly supplied with low-emission sources, as Eswatini expands its renewable sites.

Institutional sustainability will be ensured by fully involving national institutions and engaging local institutions. A stakeholder introduction has already taken place in Eswatini. During this introduction program sponsors met with all relevant ministries and agencies, to build support for the program, and listen to concerns. Additionally, a cross-ministry task force has been established that features participation from all relevant ministries (as described previously). This task force is on schedule to meet monthly during the project preparation stage, to refine the project components and proposal drafts, and to communicate important updates to their line ministries. The project team is also in regular communication with other stakeholder groups.

Social sustainability will be ensured through the active and direct involvement of the populations impacted by, or at risk from, the planning, implementation, management and monitoring of all projects in the program. SEC will follow its normal procedure for access and land acquisition for linear infrastructure, and any other land requirements. Project designers are also exploring additional project components, especially around the transmission line project, that would enhance the value of new grid connections. These components include specialized tariffs and/or connection charges for vulnerable households, and electric cook stoves to enhance the chances of uptake of grid electricity for cooking purposes.

Financial sustainability is dependent on the various partners, including private parties, GCF, AfDB, and others to provide the necessary debt, equity, and guarantees for project success.

Repayment of GFC loans will take place with the AfDB collecting money from SEC and making payments to GCF. As currently conceived all loans would have terms of ten years, and an interest rate of 2%. To help secure the low interest rate, the AfDB would place GCF in a senior position for all loans. AfDB is pursuing other sources of capital (World Bank and Development bank of South Africa), and is also willing to explore various loan guarantee mechanisms.

C.4 Engagement among the NDA, AE, and/or other relevant stakeholders in the country (max ½ page)

The NDA and a representative from the Accredited Entity (the African Development Bank) held a meeting on March 19, 2018. The project sponsor (SEC) was also in attendance. During the meeting the list of projects was discussed, as was the appropriate alignment across government sectors. The NDA embraces the project list and is currently highly involved in generating broad stakeholder support, gathering required data, and assisting with project refinement. The project sponsors remain in regular communication with the NDA, as does the Accredited Entity. Additionally, the NDA is part of the monthly task force meetings, that are hosted by the SEC (the NDA either participates personally or sends a delegate).

D. Supporting documents submitted (OPTIONAL)

- Map indicating the location of the project/programme
- Diagram of the theory of change
- Financial Model
- Pre-feasibility Study
- Evaluation Report of previous project