AFRICAN DEVELOPMENT BANK GROUP

SCALING UP RENEWABLE ENERGY PROGRAM IN LOW INCOME COUNTRIES

GEOTHERMAL ENERGY DEVELOPMENT

COUNTRY: UNITED REPUBLIC OF TANZANIA

May 2017

Table of Contents

LIST OF ACRONYMS

AfDB	African Development Bank
ADF	African Development Fund
ARGeo	African Rift Geothermal Development Facility
BGR	German Federal Institute for Geosciences and Natural Resources
CIF	Climate Investment Fund
CTF	Clean Technology Fund
DFID	Department for International Development (The United Kingdom)
DPs	Development Partners
ESIRSR	Electricity Supply Industry Reform Strategy and Roadmap 2014 – 2025
EWURA	Energy and Water Utilities Regulatory Authority
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GoT	Government of Tanzania
ICEIDA	Iceland International Development Agency
IP	Investment Plan
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
NDC	National Determined Contribution
NEP	National Energy Policy
PD	Project Document
PIU	Project Implementation Unit
PPG	Project Preparation Grant
PSMP	Power System Master Plan
REA	Rural Energy Agency
REF	Rural Energy Fund
SREP	Scale-up Renewable Energy Program
TANESCO	Tanzania Electric Supply Company Limited
TGDC	Tanzania Geothermal Development Company
UNEP	United Nations for Environment Protection

1. INTRODUCTION

Background Information

1.1 Tanzania envisions to transform itself into an industrialized middle-income country with a prosperous, globally competitive economy and a high quality of life in a clean and secure environment by 2025. This vision is reflected in the country's long-term Tanzania National Development Vision 2025, which identifies increased access to modern energy as one of the enabling conditions for socio-economic transformation.

1.2 Over the past two decades, Tanzania has made significant progress toward achieving and maintaining macroeconomic stability, becoming one of the best economic performers in Sub-Saharan Africa. According to the Bank of Tanzania, economic growth has held at about 7% per year since 2000. Despite such progress, economic growth has not translated into a corresponding reduction in poverty and, if the country is to achieve both significant poverty reduction and accelerated economic growth, access to sustainable and reliable energy is critical.

1.3 The demand for electricity in Tanzania is assumed to grow rapidly in the coming years as the country develops further. In 2016, Tanzania's total power installed capacity was around 1.35 GW from hydropower, thermal power and natural gas sources. Tanzania forecasts its annual power demand to increase by 71%, in 2020. This is in principle due to an estimated stable economy growth rate of 7% over the past years and the country's 2025 vision to reach middle-income status by 2025, the same year in which the country is expected to meet the targets embedded in SE4All action agenda

1.4 The Scaling-up Renewable Energy Program (SREP) Tanzania Investment Plan (IP) was endorsed by SREP Sub-Committee in September 2013. Two Investment Projects, namely the Geothermal Energy Development and the Renewable Energy for Rural Electrification Mini-Grids Projects were considered under the IP for which an indicative allocation of up to USD 50 million in SREP resources was endorsed, including USD 24.55 million[1] to the Geothermal Energy Development Project.

1.5 On March 13-14, 2013, AfDB and the British High Commission organized a two-day workshop focusing on geothermal development in Tanzania. The event gathered participants from government institutions, private sector, civil society, and development partners to discuss the existent the enabling framework for geothermal development in Tanzania. During the two-day workshop, participants came up with the following recommendations: On the legal and regulatory framework, the GoT must: (i) explicitly include geothermal energy as a development priority in its updated Energy Policy and the new Renewable Energy Policy, (ii) geothermal power must be considered as a viable supply source while updating the Power System Master Plan, (iii) prepare

[1] https://www-cif.climateinvestmentfunds.org/sites/default/files/SREP_Tanzania_Investment_Plan_Design.pdf. The amount was revised to USD 21.78 based on ongoing discussion relating to the SREP Cancellation Policy.

a Geothermal Act and associated regulations to guide the development of the sector and attract private investors. On the Institutional Framework, the participants recommend the GoT to: (i) establish a Geothermal Division within the Department of Energy in the Ministry of Energy and Minerals, to ensure that geothermal development is well integrated with energy development and receives the necessary attention, (ii) clarify the roles and responsibilities of the public and private sectors in various aspects of geothermal development, from resource exploration, to power development, and (iii) ensure that the Geothermal Division is appropriately staffed with competent experts. In terms of technical capacity, development partners noted that the in-country technical geothermal capacity is presently weak with only about eight trained specialists. It was recommended that if the geothermal potential is to be realized, human capacity for both public and private actors would have to be strengthened. Expertise is required in geothermal resource development, planning, power development, project finance, and project management and social and environment safeguards expertise. The Tanzania Geothermal Development Company (TGDC) was created in July 2014 with the mandate to oversee geothermal development in Tanzania.

1.6 Tanzania has about 15 geothermal sites spread all over the country with an estimated total untapped potential of 650 MW. Despite geothermal being a mature technology with significant track record established in the region and elsewhere, securing the required financing in order to allow the Government of Tanzania (GoT) to develop this potential – especially during the exploration phase which is also the riskier one – could lead to a significant transformation in the sector and greatly contribute to help Tanzania meeting future energy needs while delivering on the commitments made the Tanzania's National Vision 2025.

Project Rationale

1.7 In the United Republic of Tanzania, few people use modern and clean energy in their quotidian lives. Only 11% and 36% in rural and urban areas respectively have access to electricity, with 90% of the rural population using biomass[2]. Of the total electricity produced, 49.4% is from fossil fueled power plants and 50.6% from hydro[3]. To meet the energy demand and diversify its energy mix away from hydro and fossil-fuel based technologies, there is a need to produce additional power from renewable energy resources such as geothermal which is a promising technology for Tanzania. The cost of generation of geothermal power is competitive when compared to fossil fuel based generation and is not characterized by the intermittency issues associated with renewable technologies such as solar photovoltaic or wind. As such, it can serve as baseload generation and be is easily integrated into the country's grid.

1.8 The Tanzania's Energy Policy Act of 2015 has set up clear goals and objectives to utilization of renewable energy resources to ensure optimal benefits to the citizens and contribute towards transformation of the national economy. Geothermal has received significant attention nationwide from Development Partners (DPs) involved in the sector as proved by the number of initiatives that aimed at providing financial and technical assistance to conduct preliminary

[2] https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/Renewable_Energy_in_Africa_-_Tanzania.pdf
[3] http://www.ewura.go.tz/wp-content/uploads/2016/11/Corporate%20Business%20Plan%20%E2%80%93%202016-17.pdf

exploration. Such assistance confirmed the existence of exploitable resources in six highly promising sites so far identified in the country, with the Ngozi and Songwe sites being at more advanced stages in the development phase. With current data available based on the pre-feasibility studies carried out by Icelandic Development International Agency (ICEIDA), the Ngozi site alone could hold sufficient geothermal potential to allow the generation of up to 100 MW of electricity.

1.9 DPs have brought contribution in various forms, either through the deployment of financial assistance to fund different studies or through technical assistance to reinforce the technical capacity of Tanzanians. As of today, detailed surface studies for the Ngozi site are completed. The German Federal Institute for Geosciences and Natural Resources (BGR) conducted geophysical and geochemistry measurements, and surface geological investigations. The results of this study show include a conceptual model indicating a >200 ^{0}C geothermal reservoir beneath the Ngozi site with outflows mainly at Songwe, and the location of three temperature gradient wells. In addition to this study and under the supervision of United Nations for Environment Protection (UNEP), the Global Environment Facility (GEF) through the African Rift Geothermal Development Facility (ARGeo) and ICEAID, funded additional studies to establish the geothermal system model and selecting drilling targets for confirming the existence of a geothermal resource that could be exploited commercially. These studies concluded that Ngozi and Songwe are two distinct systems. The Japan International Cooperation Agency (JICA) is helping TGDC in capacity building by delivering training. The SREP has approved USD 0.7 million as a Project Preparation Grant (PPG) to be utilized for geothermal strategy, regulation and capacity development. The implementation of this PPG is expected to end in September 2017.

1.10 Although the development of geothermal energy is capital intensive, it has a very low and predictable running cost once the exploration phase is completed.

Justification for SREP Intervention

1.11 Geothermal power is a clean renewable source of energy that can provide reliable base-load power in countries and regions where the resource is available. As an indigenous renewable source of energy, geothermal confers important environmental benefits, and can also serve as a natural hedge against price volatility in tradable fossil-fuel commodities, thus stabilizing generation costs. Even though geothermal potential has been demonstrated in the country, and the need for electricity is urgent, experience worldwide shows that several barriers to investments in energy generation from this resource exist and in many occasions time goes by without meaningful action being taken. These barriers include: (i) high upfront exploration drilling and reservoir risk, (ii) high upfront investment costs in the construction of the steam field, (iii) availability of transmission access from road centers to geothermal sites, (iv) inadequate policy and legislation as well as institutional and regulatory framework that efficiently enable private sector involvement, and (v) long development time[4]. SREP will play a catalytic role in mitigating the upfront risk and

[4] Geotherm, 2006. Geothermal Energy as an Alternative Source of Energy for Tanzania.

act as a catalyzer in mobilizing additional resources to the development of geothermal power in Tanzania.

1.1 This project has the potential to be highly transformational as it will support the kick-start of serious public and private investments in geothermal technologies for on-grid generation and enhance the country's supply of power. In addition, this project could considerably contribute to an increase in access to energy services from a renewable source while partially mitigating the highly dependence on expensive fossil-fuel and hydro based generation that can be highly affected by the negative impacts of climate change (e.g. droughts). In fact, in Tanzania, climate change patterns are the main driver of water shortages that impact, among others, hydro-energy generation[5] capacity and increasingly cause challenges to the sector planners, leading to eventual power shortages.

1.2 SREP can play a key role in helping the country to de-risk the exploration phase of geothermal resources on the Ngozi site for a potential of 100 MW and mark the establishment of this promising technology in Tanzania. The success of the project could lead not only to the installation of a power plant with an estimated installed capacity of 100 MW to be dispatched through the national grid but create the conditions for the development of other geothermal sites in the country.

2. PROJECT DESCRIPTION

Project Description

2.1 TGDC is considering the development of Ngozi geothermal to produce electricity into three phases. The project would fund the first two as follows: (i) exploratory test drilling to confirm the availability of geothermal resources for power generation, and (ii) installation of the steam gathering system. Upon completion of phase two, TGDC in partnership with AfDB and other DPs would tender out the construction, operation and maintenance of a 100MW geothermal power plant to an Independent Power Producer (IPP). The preferred bidder would be selected based on a transparent international competitive processes following AfDB procurement rules and procedures. The scope of the proposed project is limited to the financing by the GoT, the SREP and its DPs of the upstream activities involved in the exploration phase and the steam production of the Ngozi geothermal field.

2.2 The Ngozi field is situated directly south of Mbeya town in southwestern Tanzania at a triple junction of the East African rift and is about 2.5 km long and 1.6 km width. The active Ngozi volcano is part of the Rungwe Volcanic Province located at the Mbeya triple rift intersection of the Western and Eastern Branches of the East African Rift System. The primary geothermal features include thermal water discharges (up to 89 ºC) on the bottom of the Ngozi crater lake that are modelled as having come from a 232 ± 13 Cº geothermal reservoir.

[5] Climate Change and Water Resources for Energy Generation in Tanzania; Z. J .U. Malley

2.3 Detailed surface studies, including volcanology, geophysics, geochemistry, and hydrology are completed and five well drilling locations have been identified. All feasibility studies were completed in September 2016 by ARGeo under the supervision of UNEP. In this Phase of the project, the plan is to carry the exploratory drilling in which TGDC would drill 5 slim wells of up to 2.5km in increments of 4.3cm to 19 cm diameters and 2.5 km deep.

Project Objectives

2.4 The project has three main objectives: (i) to overcome the higher-risk exploration phase, (ii) develop skilled nation human capacity on management and technical development of the geothermal projects, and (iii) attract private and public investments through the preparation of the bidding and selection process for the conclusion of a 100 MW IPP.

2.5 With the financial and technical assistance delivered by DPs in the country, the detailed surface exploration has narrowed the exploratory drilling to Ngozi site. In fact, seven sites were previously identified as potential sites for the installation of geothermal power plants. However, the surface exploration results limited the expectations to the Ngozi site for the time being. This was based on the favorable outcomes in terms of the qualities associated with the geothermal reservoir in terms of chemistry properties.

2.6 As part of the SREP USD 700.000 Project Preparation Grant, TGDC hired Norton Rose Fulbright LLP, a consulting legal firm to help them advance on the legal, institutional and regulatory framework associated with geothermal development. The expected outputs of the assignment included: (i) national geothermal resource development strategy/policy and draft bill, (ii) legal and regulatory framework, (iii) institutional setup arrangements, (iv) partial risk guarantee facility template and operating guidelines, and (v) the monitoring and evaluation system manual for future projects.

2.7 JICA is assisting in addressing all human capacity requirements regarding the development of the project. For example, it is sponsoring three Tanzanian citizens. One is participating on a Master of Science in Geoscience in Japan and two others second is participating on a six month intensive course on geothermal exploration. More training is planned during the different stages of the project, including as well during the construction, operation and maintenance phases of the IPP.

Project Components

2.8 The project comprises of the following three components:

(i) **Exploratory Drilling Services and infrastructure development.** Comprising of physical work and acquisition for the drilling material for Ngozi site. Five slim holes of about 4.3cm to 19cm diameters and 2.5km deep will be drilled on Ngozi site with the objective of establishing the steam potential of the site. Data on the sub-surface will be integrated into the existing surface data which will enable TGDC to have a complete understanding of the geothermal reservoir that will enable the project to

then finalize the development of the field development and the steam gathering system.

(ii) **Soft Activities.** Comprised of capacity building, training, project administration, and management and logistics activities. The objective is to enable a number of Tanzanians to acquire the skills and competences required to handle most of the activities at the various stages of project development and implementation. This can include as well the hiring of additional professionals. This component will also include project administration, management and logistics activities.

(iii) **Consultancy Services**. Under AfDB's procurement rules and guidelines, two consultants were already hired under the SREP PPG to support the development of the project. These professionals include: (i) an individual consultant which aim was to provide technical assistant to TGDC in geothermal expertise, and (ii) Norton Rose Fulbright LLP to prepare enabling framework.

(iv) **Social infrastructure.** In addition to the above core activities, the project will implement a number of social infrastructure to reinforce the ownership of the project by people in the vicinity of the project. This may include, among others, the construction and/or rehabilitation of a school, a clinic as well as other relevant social infrastructure within the project area. Once completed, the full Environmental and Social Impact studies will provide more clarity on which this entails.

Brief Description of Expected Outcomes

2.9 Following the conclusion of the exploration phase and the steam gathering system, the Got will competitively tender out the construction of a geothermal power plant with an estimated capacity of 100 MW to be deployed in the form of an IPP. Once under operations, the expected outcomes will include:

(i) Improved power supply. The Project will develop geothermal steam fields that are capable of generating up to 100 MW to be added to the energy mix of the country where it can add up to 823 GWh per year to the grid based on high efficiency of 94% of geothermal plants.

(ii) Increase energy security. Electricity generated in the future from these fields would contribute to increase the energy security of the country which is still dependent on electricity imported from Uganda, Zambia and Kenya. In addition, a more diversified energy mix would strengthen the resilience of the power sector to future shocks such as hikes in fuel prices or below average rain patterns that could negatively impact the country's hydro power capacity.

(iii) Increase public and private investment. By validating the geothermal resource through drilling, the project will contribute downstream to capital mobilization from

both public and private investors, in an effort to build both the power plants but also the required auxiliary infrastructure. The project is expected to develop the Ngozi geothermal steam fields and create an enabling environment that is a prerequisite condition for the unlocking of funds from both public and private investors. The total contribution expected from private sector is estimated at USD 300 Million.

(iv) Beneficiaries. The project has a variety of beneficiaries both near the site but also at the country level. Tanzania households and businesses are expected to benefit through the future supply of clean and reliable green energy. The GoT will also be able to stimulate the development of Mbeya city and Mbeya district and create jobs that are urgently needed. In the area surrounding the project, local authorities and the population will benefit from the economic and social development opportunities that the project will bring while at the regional level, the project is expected to have transformational effects not only on Tanzania and its energy sector but also in the African Rift Valley Region.

3. FINANCING PLAN

Description of Project Costs

3.1 The total costs of the project are estimated at USD 90.00 million as presented in table 3 below. This amount was calculated following the pre-appraisal mission and can change during the appraisal mission which is tabled for the second semester of 2018.

Table 3: Project Cost Estimates by Component (in USD million)

COMPONENT	ESTIMATED COST
Component A: Exploratory Drilling	75.20
Component B: Soft Activities and Consultancy Services	7.00
Component C: Social Infrastructure plus Compensation to Project Affected People	7.80
Total	**90.00**

3.2 The total estimated cost does not include costs associated with the construction of the 100 MW envisaged power plant, which will be funded by the private sector once the steam gathering system and the bidding process for the IPP is completed.

Sources of Funding

3.3 The sources of funding and respective amounts provided hereunder are best estimates and may slightly change following appraisal. Following approval by AfDB's Board of Directors of the project, AfDB will in accordance with SREP rules and in the subsequent reporting period, inform the CIF Admin Unit of the final co-financiers and respective co-financing amounts.

3.4 Table 4 hereunder provides information on the sources of financing associated with the project. The SREP contribution will be divided in loan and grant instruments to ensure that the

breakdown between grant and non-grant resources as agreed during the conclusion of the SREP Tanzania Investment Plan is respected.

Table 4: Sources of Funding

SOURCE OF FUNDING	AMOUNT	%
SREP Grant	16.73	18.6%
SREP Loan	5.00	5.6%
AfDB	40.00	44.4%
AFIF	17.67	19.6%
GRMF	3.30	3.7%
GoT	7.30	8.1%
Total	**90.00**	**100%**

3.5 Table 5 provides an indicative breakdown of the funding to be committed by each financier of the project to each one of the three components. These amounts will be further discussed during the final appraisal and some small changes may still occur as a result of additional discussions among all relevant stakeholders.

Table 5: Indicative Contributions per Cost Component

COMPONENT	TOTAL COST		CONTRIBUTIONS					
			SREP G	SREP L	AfDB	AFIF	GRMF	GoT
A	75.20		15.00	5.00	34.80	17.10	3.30	0.00
B	7.00		1.73	0.00	4.70	0.57	0.00	0.00
C	7.80		0.00	0.00	0.50	0.00	0.00	7.30
Total	**90.00**		**16.73**	**5.00**	**40.00**	**17.67**	**3.30**	**7.30**

4. IMPLEMENTATION ARRANGEMENTS

Description of the Energy Sector

4.1 Tanzania has an enormous energy potential presented as follows: (i) small and large hydro (5.185GW), (ii) natural gas (57.25 Trillion Cubic feet), (iii) coal (1.2 billion tonnes of which 304 million tonnes are proven), (iv) biomass (500 MW) and (v) Geothermal (650MW), solar (> 200Wp/m^2). Other technologies such as wind, biofuels, tidal and ocean wave energies are currently being assessed in further detail.

4.2 Despite this potential, the primary energy consumption is dominated by biomass (85%), followed by oil & gas (9%), then electricity (5%), and from other renewable energies resources such as solar, small hydro and wind (1%). In May 2017, Tanzania's total power installed capacity from all resources (both on-grid off-grid) is about 1.5 GW. Thermal sources contribute the largest share with 954.4 MW (63%) and hydro contributes with 561.84 MW (37%). Off-grid total installed capacity is estimated at 76 MW and composed by 16 isolated small diesel plants and two gas power plants. In addition, Tanzania imports electricity from Uganda (10 MW), Zambia (5 MW) and Kenya (1 MW).

4.3 In 2010, the energy consumption was composed of residential consumers (72.5%), industrial consumers (14.4%), transport (5.8%), agriculture (4.2%) and others (3.1%)[6]. With political stability and economic policy reforms delivered over the last years, the country's economy is growing at a steady rate of 7% and expected to grow even faster in the future. Should the growing trend remain unchanged, demand for energy, which is a prerequisite for economic growth, is forecasted to reach an increase of 71% to 13.430 GWh over the next decade.

4.4 The Tanzanian National Energy Policy (NEP) was first put in place in 1992, reformulated in 2000 and again in 2015. The NEP aims at ensuring the effective management and enhance provision of adequate, reliable and affordable modern energy services to Tanzanians in a sustainable manner. The policy also provides comprehensive legal, regulatory and institutional frameworks for petroleum, electricity, renewable energies, energy efficiency as well as local content issues. To a large extent, the implementation of the NEP has resulted into achievement of the following: (i) the Energy and Water Utilities Regulatory Authority (EWURA) and its Act, (ii) the Rural Energy Agency (REA) and the Rural Energy Fund (REF), (iii) formulation of Standardized Power Purchase Agreements, (iv) operationalization of the Bulk Procurement System for petroleum imports, (v) formulation of the Electricity Act 2008, (vi) development of a Power System Master Plan 2009 – 2033, (vii) increase in power generation installed capacity from 891 MW in 2003 to 1,483 MW in 2014, (viii) increase in annual electricity consumption per capita from below 80 kWh in 2003 to 105 kWh in 2014, (ix) increase in electricity connection levels from below 10% in 2003 to 30% in 2015, (x) formulation of the Electricity Supply Industry Reform Strategy and Roadmap 2014 – 2025 (ESIRSR), and (xi) increase in natural gas discovery from 8 trillion cubic feet in 2003 to 55.08 trillion in March 2015.

4.5 The Electricity Act 2008, the EWURA Act which operational since 2006 as well as the ESIRSR are mainly aimed at aim at attracting the urgently required private capital with the objective of meeting the current and future demand for electricity, reducing public expenditure on Electricity Supply Industry (ESI) for operational activities; and increasing electricity connection and access levels. The intended major outcomes of the ESI Reform include: increased efficiency, quality services and goods, availability of affordable power, satisfaction of the client satisfaction of the business partners and their shareholders, increased transparency and competition; and abolition of subsidies in the electricity sub-sector.

4.6 REA promotes rural electrification programs through the REF whereas the Environment Management Act (2004), and the Public-Private Partnership Act (2010) aim at crowding in private sector investments in the development of energy projects.

4.7 It is within this framework that the GoT wants to increase the power supply in the country by capitalizing on the natural geothermal potential by achieving the objectives set by the Sustainable Energy for All (SE4All) agenda and to reach middle income status by 2025. Moreover, scale up the use of sustainable, reliable and clean energy will allow the country to diversify away from fossil fuels, biomass and hydro.

[6] National Energy Policy 2015

Description of the Institutional Arrangements

4.8 TGDC will be the Executing and Implementing Agency of the proposed project. TGDC was established in December 2013 and operationalized in July 2014 with the following mandate: (i) explore, drill and harness geothermal resources for power generation, (ii) promote direct applications, (iii) efficiently and effectively mobilize funds from both private and public sources for accelerating geothermal development in the country, (iv) to sell steam to state and private owned generation companies, (v) to manage geothermal fields for sustaining steam flow to generating plants owned by public and IPPs, (vi) participate in early power generation through wellheads either independently or in partnership with public or private investors.

4.9 The company will require technical and managerial assistance strengthening to implement the project. Accordingly, a technical assistant has been hired to assist into geothermal technical matters on a day-to-day basis especially on the procurement and implementation of the SREP PPG. The procurement, competitive international process followed the rules and guidelines of African Development Bank.

4.10 The Project Implementation Unit (PIU) will be established under TGDC to closely follow-up the implementation of the project in the field and in the office while maintaining a very close working relationship with the management consultant. Consultation meetings will be held on regular basis to ensure proper coordination among the two units.

4.11 The PIU will be adequately staffed and team will be composed of the following key staff: (i) project manager, (ii) geothermal expert, (iii) geologists, drilling engineers, reservoir engineers, (iv) geophysicists, (v) geochemistry, (vi) procurement expert, (vii) accountant/financial, and (viii) environmental and social expert. Other experts will be sources depending on the needs throughout the implementation of the project.

Procurement

4.12 A combination of goods, works and services will be procured as part of the proposed project. Procurement will be done in accordance with AfDB's procurement rules and guidelines that include the following: (i) Rules and Procedures for the Use of Consultants (July 2012 revision), and (ii) Rules and Procedures for Procurement of Goods and Works (July 2012 revision).

4.13 The International Competitive Bidding, the Least-Cost and Quality Based Selection methods will be used on the procurement of the project depending on the specific needs of each activity.

4.14 TGDC will be required to submit an initial Procurement Plan in form and substance acceptable to the Bank and shall be included in the financial documentation signed between both parties.

4.15 The following procurement documents will be subject to prior review and approval by AfDB before promulgation: (i) general procurement notices, (ii) invitation for expression of interest, (iii) requests for proposals including the shortlist, (iv) bidding documents, (v) evaluation bidding reports, (vi) reports on the evaluation of consultants' technical proposals, (vii) final reports on evaluation of consultants' proposals, including recommendations for contract award, minutes of negotiations, and (viii) duly initialled contracts.

Financial Management Arrangements and Audit

4.16 **Disbursement**. Resources of the grant and loans will be disbursed according to the procedures set forth in AfDB's Disbursement Handbook. The disbursement of funds will be conditional upon the entry in force of the Loan and Grant Agreements between AfDB and the GoT. The most appropriate methods for this project are anticipated to include: (i) direct payment against large value contracts concluded by project management and duly approved by AfDB; and (ii) payment through a Special Account for meeting small value contracts and recurrent expenses. The beneficiary shall comply with the procedures outlined in the Bank's Disbursement Handbook at all times.

4.17 AfDB has conducted an assessment of the adequacy of the financial management system of the TGDC based on Bank's Financial Management Implementation Guidelines. The assessment concluded that the overall risk of the country is *"Moderate"*.

4.18 In line with the Paris Declaration on Aid Effectiveness and the Accra Agenda for Action, the project will substantially make use of the country's financial management systems. The overall responsibility of financial management (including budgeting, accounting system, and internal control, treasury management/flows of funds, financial reporting and external audit arrangements) rests with General Manager of TGDC. The Implementing Agency will include, among others, a project coordinator, an accountant and a procurement specialist that shall implement all activities of the Project.

4.19 The Audit arrangement will entail the Project preparing and submitting financial statements within three (3) months after the closure of every financial year. The project audit will be conducted by the Controller and Auditor General or a Private Audit firm. The audit report, complete with a Management Letter, will be submitted to the Bank not later than six months after the end of the financial year.

Environmental and Social

4.1 In line with the AfDB's Integrated Safeguards System and Operational Safeguards (2013), the exploration phase of the program is likely to cause site-specific environmental and social impacts similar to those of Category 1 projects[7].

[7] Operations likely to cause significant environment and social impacts.

4.2 The exploration phase will require the establishment and/or rehabilitation of access roads and actual drilling of test holes which are likely to induce adverse environmental and social impacts. The drilling entails slim holes meaning that the area affected will be smaller as this would mean a smaller rig. It is also expected that the access roads required for the test sites will require relocation of people. A preliminary assessment shows that a total of 445 persons may be affected by the project. As such, a full Resettlement Action Plan will be required under the provisions of the Bank's Policy on Involuntary Resettlement.

4.3 Comprehensive and practical risk management and adaptation measures are being integrated into the project design and implementation plans. As per AfDB's rules, public consultations will be undertaken during the conclusion of the Environmental and Social Impact Assessment (ESIA)[8] studies, the Environmental and Social Management Plan and the Stakeholder Engagement plan to ensure that all risks are properly identified and managed.

4.4 The site is located on a mountainous region which is mainly used for agricultural activities. As such it is not expected that there will be physical displacement caused by the actual test drilling, however, it is likely that drilling will induce economic displacement. Nevertheless, due to the minimal land take, significant impact on the communities are not expected. The access roads are, however, expected to have more significant impact on the community in terms of physical and economic displacement. Based on the preliminary Environmental and Social Impact Assessment, a total of 427 persons are expected to be affected. AfDB's resettlement rules make it compulsory that all affected people are fairly compensated by the GoT before any disbursement related to the project can be made.

4.5 It is expected that this project will enhance gender and social aspects through a gender assessment that outlines specific actions to enhance gender equality and empowerment. In addition, under the capacity building component, resources will be allocated to ensuring that in-house capacity related to gender mainstreaming is enhanced. The project will support TGDC in developing a Gender Policy and an Action Plan that will require the appointment of a gender focal point. Furthermore, the Environmental and Social Impact Assessment studies will include an assessment on gender and on climate change mainstreaming to ensure these dimensions are adequately captured and included in project design.

4.6 The project is expected to create approximately 228 skilled jobs and 75 unskilled jobs. Aside from direct employment opportunities, the project will also result in indirect employment opportunities, including those from small, medium, and microenterprises seeking to cater to TGDC's operations.

Risks and Mitigations Measures.

4.7 Given the existence of detailed surface exploration studies on the Ngozi site as well as the technological advancement in the field of geothermal exploration, the overall project risk is

[8] The study will cover all relevant direct and indirect cumulative and associated impacts which will be identified during the different phases of the project, including any specifically covered in: (i) biodiversity and ecosystem services; (ii) pollution prevention and control, GHG, utilization of hazardous materials and resource efficiency; and (iii) labor conditions, health and safety.

considered to be moderate. The key categories related to sector strategy, technical design of the project and institutional capacity are all rated moderate, given the evolving structure of the power sector in Tanzania and the technical design of the project.

Table 6: Risk Ratings Summary

Risk Category	Rating	Mitigation Measures
1. Political and Governance	Moderate	Tanzania is one of the oldest and strong democracies in Africa where local and central government are freely elected. Moreover, the country is known for respecting its commitments to international agreements such as the one emanating from COP 20 as evidenced from its National Determined Contributions (NDCs). Change in leadership is not expected to have negative impacts on the Project.
2. Macroeconomic Stability	Moderate	The Tanzanian economy has been growing fast in the last years due to, among others, strong economic policies and structural reforms adopted. To name some of them, one may include: (i) improvement on the ease doing business, (ii) public investment in infrastructure such as energy and transport, and (iii) inflation control and monetary & fiscal stability.
3. Sector Strategies and Policies	Moderate	The Norton Rose Fulbright law firm is designing the geothermal energy policy, legal and regulatory framework and the monitoring and evaluation manual. The risk associated to the geothermal strategies and policies are therefore rated moderate. In addition, the existing legal and regulatory framework surrounding the mobilization of private sector investment in the country in general, and in the energy sector in particular, is considered adequate and therefore, mobilization of resources for the construction of the power plant should be possible.
4. Technical Design of Project	Substantial	The feasibilities studies have narrowed the drilling exploration to Ngozi geothermal field is promising. The slim well drilling is expected to lead, on a first phase, to produce steam capable of allowing the generation of 30 MW of electricity. If successful, then the project will move to drill larger and deeper wells to produce steam for development of up to a total of 100 MW. This phased approach will aim at removing uncertainty and will allow planning to move forward in a more informed way
5. Institutional Capacity for Implementation and Sustainability	Substantial	In addition to local experts trained in Tanzanian Universities and abroad, JICA, World Bank, and ICEAID are all involved in strengthening TGDC capacities. If needed, TGDC will fill the capacity gap with international experts to be able to achieve the objectives set by the project.
7. Fiduciary, Environment and Social	Moderate	AfDB has a history of involvement with the GoT as well as its national entities on the implementation of other projects. The GoT is well familiar with AfDB's Environment and Social requirements and the experience gained in other projects will be used to mitigate any risks that may emerge in this front.

5. SREP INVESTMENT CRITERIA

5.1 SREP is expected to spur a transformational change that will lead Tanzania towards a low greenhouse gas emissions development pathway by harnessing part of the country's renewable resources. Tanzania has a geothermal potential, estimated at around 650 MW of generation capacity. Lately, however, as Tanzania deals with the effects of climate change, severe droughts have revealed hydropower generation to be unreliable.

5.2 **Increased installed capacity from renewable energy sources.** The project is expected to contribute downstream to the development of geothermal generation capacity of up to 100 MW. This capacity could lead to the generation of 823.4 GWh of electricity per year and 24,702 GWh over the life of the power plants assuming an availability factor of 94% and an average power plant of 30 years.

5.3 **Increased access to energy through renewable energy sources.** If the geothermal potential is successfully established and as a result new and additional power generation assets are added to the Tanzania power system, one can expect an increase in the level of power being injected into the Tanzania power grid. While the project is not expected necessarily to contribute directly to an increase in energy access - as power flowing in the grid is fungible - the project fits well the with the GoT's plans in terms of expanding the share of population with access to non-fossil-fuelled electricity and to address the current power deficit in the country. The power output of the power plant could be sufficient to power around 234,160 households.

5.4 **Low emission development.** By mainstreaming this technology into the country's energy system and assuming that the alternative would be to construct thermal power capacity, the project may contribute downstream to a reduction in Greenhouse gas emission of 555,590 tCO2/MWh per year and 16,667,700 tCO2/MWh over 30 years[9].

5.5 **Affordability and competitiveness of renewable sources**. The cost of geothermal ranges between USD 2.8 to USD 5.5 million per MW installed and thus the average levelized cost of energy for geothermal power plants is currently around 0.062 per kWh.[10] The levelized cost of fossil-fuel based power generation in Tanzania is currently estimated at around USD 0,169 per kWh. Thus, geothermal energy is affordable, reliable and competitive with existing sources of power generation in the context of Tanzania.

5.6 **Productive use of energy.** Supply of electricity will improve living standards and stimulate economic activities such as the appearance of new businesses and services. In addition,

[9] The CO2 emission saving is calculated assuming grid emission factor of approximately 0.6 tons of CO2e/MWh
[10] Geothermal Handbook: Planning and Financing Power generation; World Bank

being base load, the additional power will have the potential to boost transformative industry, service delivery and encourage youths to start their businesses.

5.7 **Economic, social and environmental development impact:** The shortage of electricity supply in the Mbeya region where Ngozi is located is hampering the social and economic development of the region despite the abundant and unexploited agricultural, fishing, and natural resources. Mbeya's weather couples with its fertile volcanic soil could enable the region to produce large amounts of food crops such as maize, rice, bananas, beans, cassava, potatoes, soya nuts and wheat. The region already produces a few cash crops such as coffee, tea and cotton. The Lake Malawi located in the west border of the Mbeya region has great potential for fishing. Mbeya has also a variety of mineral deposit including gold, ion, limestone, marble, travertine, kaolin, copper, salt and gemstones which remain unexplored. Thus, the development of a base-load and productive power plant will promote the: (i) increase the productive use of electricity across households, businesses and social facilities, (ii) contribute to reduce GHG emissions, (iii) increase in agriculture, fishing, and mineral extraction, (iv) development of manufacturing as well as small and medium industries, (v) the development of a tourism industry, (vi) job and wealth creation, and (vii) increase in public safety in serviced areas due to street lighting.

5.8 In addition, the project will play a central role in stimulating the creation, over the long-term, of a local geothermal economy. At the same time, and if the exploration drilling is successful, it could mark the beginning of an expansion cycle for TGDC's business model and role it plays in the wider energy sector in the country. This could contribute in the future for additional installation of generation assets from renewable energy sources, namely in geothermal, in a sustainable and environmentally friendly way.

5.9 **Economic and Financial Viability.** Geothermal is an affordable and reliable technology with predictable running costs with levelized costs discounted over a project life cycle which is 20 to 30 years. The project is expected to be economically and financially viable for the following reasons:

i) It will contribute to address two types of barriers that are preventing private investment in the sector: (a) high upfront investment costs and risks associated with exploration drilling, and (b) long development time without generation of revenues. By addressing these barriers, the GoT will enable IPPs to be competitively involved in the development of geothermal power generation.

ii) SREP will provide grant and loan contributions whereas AfDB and the GoT will provide grant and capital contributions respectively to finance the exploration phase of the Ngozi site and confirm steam availability. Once confirmed, the GoT will hold a

resource that can be used for the generation of clean power and mark the transformation of a sector that is currently in its infancy in the country.

5.10 **Leveraging of additional resources.** For every USD 1 of SREP resources deployed in the project, a total of USD 3.13 is expected to be leveraged from other sources, including AfDB and the GoT. If one would take into account the estimated amount to build the power plant, a total of USD 300 million would be raised in addition to USD 68.27 million. If one accounts this amount, for every USD 1 of SREP resources deployed, a total USD 16.9 would be leveraged from other sources.

5.11 **Co-benefits of renewable energy scale-up.** Geothermal energy is clean, affordable, and reliable and can be used as base load. In the context of Tanzania, the project comes at the right time as the country needs to diversify its energy mix, lower its generation costs and respect its commitments expressed in the country's Nationally Determined Contributions (NDC). Co-benefits of the scale-up of geothermal energy in the country include, among others, the following: (i) creation of local jobs, (ii) create potable water facilities for the community in the vicinity of the project, (iii) reduction of fuel imports leading to smaller amounts allocated under the national budget, (iv) avoidance of greenhouse gas emissions.

6. SREP RESULTS FRAMEWORK

6.1 Table 7 presents the SREP Core Indicators and targets.

Table 7: SREP Results Framework

INDICATORS	Without Power Plant	With Power Plant
Annual Electricity Output in GWh	0.00	823
Increased Public and Private Investment (in USD million)	68.27	390.00
Number of people with improved access to electricity (men/women)	0.00	549,888 / 595,712
GHG emissions avoided in tons CO2 equivalent (annual/lifetime) tons/MWh	0.00	555,590 / 16,667,700[11]

Monitoring and Evaluation

6.2 The project will be implemented over a period of 60 months from funding effectiveness, meaning that all procurement activities and disbursements should be completed during this timeframe. Supervision will be undertaken in accordance with AfDB's rules and procedures and will start soon after signature of the SRE loan and SREP grant agreement and be extended until the last repayment date. The coordination of these supervision missions will be done by TGDC in

[11] Over a lifetime of 25 years.

collaboration with the Ministry of Energy and Minerals, the Ministry of Finance and Planning and AfDB.

6.3 TGDC will regularly monitor implementation of the project in accordance with the agreed contractual obligations that shall be put in place prior to any disbursements from the SREP and AfDB. In addition, the financial agreements to be signed between AfDB and TGDC will provide for periodic submission of financial management reports, work-plan, financial and technical audit reports.

7. INDICATIVE TIMELINE

7.1 Table 8 presents an indicative timeline for the finalization of the project's appraisal, approval, effectiveness and disbursement.

Table 8: Indicative Timeline

ACTIVITY	DATE
Appraisal	May 2017
Approval by AfDB Board of Directors	November 2017
Effectiveness	January 2017
First Disbursement	March 2018

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 The high risks and costs associated with proving geothermal potential is one of the key barriers facing the industry, especially in the developing world. The Geothermal Project Development in Tanzania will significantly contribute to finalize the exploration phase in the most promising geothermal site in the country and develop a steam gathering system. This would contribute significantly to address the barriers currently impeding involvement of private sector actors in the sector.

8.2 In addition, geothermal technology is a clean and reliable source of energy that would help Tanzania relying less and less in other polluting sources of energy. SREP can play a catalytic in helping Tanzania advancing the development of its geothermal resources and contribute to a transformation in the energy sector.

8.3 The AfDB and the GoT invite the SREP Sub-Committee to approve a SREP grant of USD 16.73 million and a SREP concessional loan of USD 5 million at a service charge of 0.1% and a tenor of 40 years including a grace period of 10 years.

<u>Annex 1</u>: Tanzania Geothermal Sites location