CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

CTCN Technical Assistance
Request Submission Form

Guidelines:

- This Request Submission Form should be completed by the organisation requesting technical assistance from the Climate Technology Centre & Network (CTCN) in collaboration with the National Designated Entity (NDE) of the country in question
- The Form must be signed by the NDE. Please see updated contact list of NDEs here: http://unfccc.int/ttclear/support/national-designated-entity.html
- The Form can be submitted as a Word file containing a digital signature or as a signed and scanned PDF file in combination with an un-signed Word file
- For requests submitted by multiple countries, all the NDEs of the respective countries shall sign identical Forms before official submission to the CTCN
- NDEs have the opportunity to submit CTCN requests in collaboration with National Designated Authorities (NDAs) for the Green Climate Fund (GCF) if targeting the GCF Readiness Programme.

Requesting country or countries:	RWANDA
Request title:	**Proving the viability of Bugarama geothermal resources through geoscientific surveys and market survey for direct use applications.**
NDE	Rwanda Environment Management Authority (REMA), Faustin Munyazikwiye, Deputy Director General , fmunyazikwiyc@rema.gov.rw
Request Applicant:	Energy Development Corporation Limited (EDCL), Felix Gakuba, Managing Director, fgakuba@edcl.reg.rw; info@edcl.reg.rw

Climate objective:

☐ Adaptation to climate change
☒ Mitigation of climate change
☐ Combination of adaptation and mitigation of climate change

Geographical scope:

☒ Community level
☐ Sub-national
☐ National
☐ Multi-country

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

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

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

In Rwanda, energy sector plays a vital role in supporting socio-economic evolution and has a close connection to the growth of other economic sectors. The country has both renewable and non-renewable energy sources. Currently, the total installed capacity to generate electricity in Rwanda is two hundred twenty-one Megawatt (221 MW). By generation technology mix, 46.4 % is from hydrological resources, followed by thermal sources (fuel and peat) with 33.4%, methane gas (13.8%) and solar (2%). Energy policies of the country give special attention to the use of modern, clean and energy efficient technologies.

The climate action plan of Rwanda (known also as the Nationally Determined Contribution) outlines how the Government of Rwanda will cut or avoid emissions and adapt to climate change across many sectors. This includes, for example, decarbonising the energy sector by moving to renewables and improving energy efficiency, better land and water resources management, implementation of low carbon urban systems, disaster risk management, and early warning systems.

The energy sector scope goes beyond electricity and covers bio-products, including wood fuel, charcoal, and biogas, as well as petroleum products such as diesel, kerosene, liquid petroleum gas and natural gas like methane gas. Uwisengeyimana *et al.* (2017) pointed out that the total primary energy consumption in Rwanda, biomass contributes 85% of primary energy consumed of which wood provides a percentage of 57%, charcoal 23%, crop residues and peat of 5%. Non-biomass sources contribution is 14% of which petroleum products equal to 11% and electricity contribution is approximately 4%. The pollution from burning biomass and petroleum products is a major concern to the climate change in Rwanda.

Geothermal power is a clean, renewable, reliable and large-scale energy resource. There is an estimated potential of up to 100MW of geothermal power in Rwanda (JICA, 2015). Geothermal technology is known and could produce electricity at four times less the cost of diesel generated electricity currently in use in Rwanda. It could replace oil-fueled power plants which currently supply 38MW of electricity with high GHG emissions. Geothermal power has near zero emissions, making it eligible for carbon credits. It is a domestic resource, not shared with neighbouring countries like methane in Lake Kivu and hydropower on the Rusizi and Akagera Rivers, and has relatively small land use impact, unlike peat. The exploitation of geothermal energy, together with other renewable energy sources, will provide energy security, reduce energy costs and vulnerability to external economic shocks and ultimately promote economic development.

2f.

In addition, geothermal resources in Rwanda can be used as an alternative energy source for agricultural purposes. Local people also use hot springs as public spa, but further studies need to be done to evaluate their possible use in food and agriculture processes. (Gissurarson, M. and Georgsson, F.,2015).

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

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

Efforts have been made in the past to prevent the pollution from burning biomass and petroleum products by prioritising renewable energy sources including geothermal resource. The geothermal exploration in Rwanda started in the 1980s. Since then, there was different geoscientific studies, such as Chevron (2006), Jolie *et al.* (2009), KenGen (2010), Shalev *et al.* (2012), Gestur *et al.* (2014), JICA (2015), Gestur (2016), Tadesse *et al.* (2016), and GDC-Geo2D (2017) which have been carried out to explore geothermal resources in the country. These studies highlight two zones in Rwanda with the geothermal potential; the NW part (Karisimbi, Kinigi and Gisenyi geothermal prospects) and SW part (Bugarama geothermal prospect).

The Bugarama geothermal prospect in the south-western part of Rwanda can be subdivided into three geothermal fields: Mashyuza, Ruhwa and Bize. Geological structures in the Bugarama prospect are characterized by the presence of graben structures. The dominating feature is the SW-NE trending fissure/fault swarm making the western escarpment of the Bugarama graben which is an extension of the Rusizi graben of the East African Rift System. Geothermal manifestations such as hot springs, with maximum temperature of 52.0 °C and 55.4 °C at Mashyuza and Bize respectively, sinter deposits, and hydrothermal alterations are common in Bugarama prospect (JICA, 2015). The geochemistry of the water in Bugarama suggests the presence of a low-temperature geothermal system with a resource Temperature between 100 and 130°C (Newell et al., 2006). Six Temperature Gradient (TG) wells were drilled in Bugarama prospect, but only the temperature gradient of 46.5 °C/Km and 20.8°C/Km was only extractable from TG-04 and TG-06 respectively (Tadesse *et al.* 2016). Also, one TG well was drilled in Ruhwa, but abandoned when encountered with over-pressurised conditions. The water temperature of the discharging well at Ruhwa was 67.5°C.

Following a systematic review of geothermal studies carried out in the geothermal prospect of Bugarama, information gaps to be filled prior to siting exploratory wells were identified. Hence, additional geoscientific investigations need to be conducted to improve the understanding of the geothermal system in Bugarama and locate suitable sites for exploratory wells.

Specific technology[1] barriers (up to one page):

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

The technology barriers that hinder national efforts for the exploration and exploitation of geothermal resources are discussed in the following categories: technical barriers, financial and procurement barriers, capacity building, and geographical barriers.

Technical barriers

Availability of existing subsurface data is very important for the success of geothermal projects. Given that the geoscience related programs are recently introduced in Rwandan universities (e.g.: the first school of mining and geology started in 2015 at the University of Rwanda), and therefore few academic researches conducted to contribute in producing geoscientific data, there are geoscientific datasets which are scarce in Rwanda and Bugarama geothermal prospect in particular. For example, there are no detailed geological maps (e.g.: geological maps at 1/10 000 scale) available; geological maps covering the whole country at 1/250 000 and 1/100 000 scale are commonly used. Also, the hydrogeological data including water table maps, borehole data are rare and fragmented. Siting the TG wells and deciding what type of drilling technic, detailed data on geology and hydrogeology are necessary.

Also, public/private institutions handling geoscientific projects do not have well equipped geoscientific laboratories. The low level of collaboration between public/private institutions responsible for geoscientific projects intensify the challenge of the unavailability of geoscientific equipment in the country.

Financial barriers

Initial capital cost of geothermal energy is relatively high and this is hindering geothermal development in developing countries. Efforts have been made by funding institutions and development partners to overcome this barrier by putting in place funding mechanisms such as risk mitigation funds but there is still a need of financial assistance at the exploration stage.

Capacity building

[1] *"**any equipment, techniques, practical knowledge and skills** needed for reducing greenhouse gas emissions and adapting to climate change" (Special Report on Technology Transfer, IPCC, 2000)*

To develop the geothermal resources of Rwanda, and Bugarama in particular, educating and training Rwandans and make sure that they are used effectively in the interest of industry and of the society is very crucial. Geosciences related programs such as geology, geochemistry, geophysics, have only been introduced recently in local universities and there is scarcity of locally trained geoscientists. In addition, overreliance on foreign experts has raised the cost of geothermal projects.

Sectors:

Please indicate the main sectors related to the request:

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

Please add other relevant sectors:

Cross-sectoral enablers and approaches:

Please indicate the main cross-sectoral enablers and approaches

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

Technical assistance requested (up to one page):

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

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

- *Overall objective*

The overall objective of the technical assistance is to prove the viability of the Bugarama geothermal resources through geoscientific surveys and market survey for direct use applications that will lead to the development of a pilot phase to show the concept of geothermal direct uses within the western branch of the EARS.

- *Anticipated groups of activities to be performed by the technical assistance*

The activities to be performed by the technical assiatance include :

➢ **Detailed geological and hydrogeological studies**

There is no detailed geological map for the geothermal prospect of Bugarama. A detailed hydrogeological investigation is very necessary in this geothermal prospect of Bugarama.

➢ **Geochemical studies**

The previous geochemical surveys focused on water chemistry from Mashyuza and Bize hot springs. The chemical analysis on the strontium and tritium isotopes from Bize and Mashyuza to know the resident time of the water springs is lacking. Chemical analysis of the surface and ground water in the area is also missing. Soil gas surveys were performed on a small scale and they need to be carried out on a bigger extent.

➢ **Shallow temperature mapping**

Shallow and deep hot aquifers might abound in Bugarama geothermal prospects as suggested by the frequent occurrence of low resistivity anomaly (< 10 Ohm-m) zones on TEM cross sections (Gestur, 2016). Also, shallow wells drilled for thermal gradient assessment in the area revealed relatively high temperature and up-flow zones at shallow depths (Gestur, 2016). Hence, a better comprehension of the shallow temperature and the circulation of subsurface hydrothermal fluids, both of which are characteristic features of the geothermal systems, in the area, will contribute to an improved understanding of the economic potential of the resource and to accurately site exploratory wells.

➢ **Geophysics**

The geothermal reservoir is accurately given by the integration of various data such as magnetic, gravity, seismic, MT and TEM data. It is better to explore Mashyuza, Bize and Ruhwa geothermal sites to have a better picture of the geothermal system in Bugarama prospect. To increase the level of confidence of the results an increased number of TEM/MT-soundings, gravity/magnetic and seismic data would be necessary. The proposed studies are very helpful to understand the nature, extent of the geothermal resource and upgrade the conceptual model of this geothermal system when integrated with other studies like geological, geochemical, temperature studies in the area.

➢ **Thermal Gradient (TG) Wells**

After modelling of combined data from geology and hydrogeology, geochemistry, geophysics and shallow temperature survey has delineated outflow zones; temperature gradient wells (100-300 m) are needed for gaining reliable information on the thermal gradient in the area and to locate anomalies which may indicate up-flow zones.

The goal after TG well survey is to propose sites for deep exploration wells whenever justified by data and model.

- **Market survey for direct uses**

The study should aim at exploring the possibilities that include but not limited to:

•Replacing biomass with geothermal energy for tea drying. The area is renowned for its many tea plantations, rice and drying factories. The national strategic plan for the energy sector emphasizes the need for drastically decreasing the industrial use of biomass.

•Fish farming and drying

•Analysing all the opportunities associated with direct use of the fluid (touristic and recreational and therapeutic) applications in this very attractive site.

- *Anticipated products to be delivered by the technical assistance.*

After an integrated geothermal conceptual model for the Bugarama geothermal prospect and a report on the market survey of direct use applications, the output to be delivered by the technical assistance would be a pilot plant for direct uses in the study area.

Expected timeframe:

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

The expected duration period for the requested technical assistance is 12 months.

	Task Name	Duration (Months)	Months											
			1	2	3	4	5	6	7	8	9	10	11	12
1	**Detailed geological and hydrogeological studies**	4												
1.1	Mobilization and initial data acquisition	2.5												
1.2	Data analysis, interpretation and reporting	1.5												
2	**Geochemistry (soil gas survey, fluid chemistry)**	4												
2.1	Mobilization and initial data acquisition	2												
2.2	Data analysis, interpretation and reporting	2												
3	**Shallow temperature mapping**	3												
3.1	Mobilization and initial data acquisition	2												
3.2	Data analysis, interpretation and reporting	1												
4	**Geophysics (Gravity and magnetic survey, MT and TEM survey, Passive seismic survey)**	4												
4.1	Mobilization and data acquisition	2.5												
4.2	Data analysis, interpretation and reporting	1.5												
5	**Geoscientific data integration, interpretation, conceptual model and reporting**	0.5												
6	**Technical review meeting/validation workshop/**	0.5												
7	**Thermal Gradient (TG) Wells**	5												
7.1	Mobilization and data acquisition	4												
7.2	Data analysis, interpretation and reporting	1												
8	**Geoscientific data integration, interpretation, conceptual model updating and reporting**	0.5												
9	**Market survey for direct uses**	3												

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

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

The equal involvement of men and women in decision-making in relation to geothermal exploration and development in the prospect of Bugarama will be ensured. In addition, when evaluating current capacities, in terms of on-going important research, and demonstration and development projects, gender-related topics will be considered. The gender balance in the sector will be determined and affirmative measures will be proposed to reduce gaps.

The following potential indicators, suggested by CTCN, are proposed:

- Number and percentage of women and men who attend planning and participatory consultation meetings for the development of Bugarama Geothermal Resource;
- Number of men and women in decision making and or leadership positions in project planning process;
- Number and percentage of men and women in climate technology user groups, cooperatives, committees, utilities.

The technical assistance will set out a pathway for the development of geothermal resources in Bugarama geothermal prospect with the primary objective of mitigating domestic greenhouse gas emissions, but that will also have other economic, environmental, social and cultural co-benefits with an emphasis on gender equality. These co-benefits could include: increased energy sovereignty as a result of reduced dependence on oil; reduced costs in a context of increasing fossil fuel prices; smoothing out fluctuations in electricity generation by using other complementary renewable energies; potential job creation by the national energy industry, sensitive to gender issues; and the promotion of a culture of sustainable development among the population.

For more information you can find guidelines on the CTCN's website here:
https://www.ctc-n.org/technologies/ctcn-gender-mainstreaming-tool-response-plan-development

Further reading on gender can be found on the CTCN website here:
https://www.ctc-n.org/technology-sectors/gender

Key stakeholders:

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

Stakeholders	Role to support the implementation of the technical assistance
National Designated Entity	**Rwanda Environment Management Authority (REMA):** To promote and ensure the protection of the environment and sustainable management of natural resources through decentralized structures of governance and seek national position to emerging global issues with a view to enhancing the well-being of the Rwandan people.
Request Applicant	**Energy Development Corporation Limited(EDCL):** - Increase investment in development of new energy generation projects in a timely and cost-efficient manner to expand supply in line with EDPRS and other national targets; -Develop appropriate transmission infrastructure to evacuate new plants and deliver energy to relevant distribution nodes; -Plan and execute energy access projects to meet the national access targets.
Please add as many stakeholders and lines as required.	**Ministry of Infrastructure (MININFRA):** To initiate programs aimed at increasing access to affordable energy, water and sanitation, and transport infrastructure and related services for the population. **Ministry of Local Government (MINALOC):** ensures the coordination of good governance and high quality territorial administration programs that promote economic, social and political development throughout the nation. **Ministry of Agriculture and Animal Resources (MINAGRI):** To initiate, develop and manage suitable programs of transformation and modernization of agriculture and livestock to ensure food security and to contribute to the national economy. **Rwanda Development Board (RDB):** Fast tracking economic development in Rwanda by enabling private sector growth.

Alignment with national priorities (up to 2000 characters including spaces):

Please describe how the technical assistance is consistent with national climate priorities such as: Nationally Determined Contribution, national development plans, poverty reduction plans, technology needs assessments, Low Emission Development Strategies, Nationally Appropriate Mitigation Actions, Technology Action Plans, National Adaptation Plans, sectorial strategies and plans, etc.

Reference document *(please include date of document)*	***Extract*** *(please include chapter, page number, etc.).*
Intended Nationally Determined Contribution (INDC) for the Republic of Rwanda (*November 2015*).	Low carbon energy mix: Establishment of new grid connected renewable electricity generation capacity (**Page 14**). Green industry and private sector development: Establishment of Eco-industrial park of Green Industry complex (**Page 20**).
Technology Needs Assessment and Technology Action Plans for Climate Change Mitigation and Adaptation (*November 2012*).	National priority: With reference to strategies and policies related to the development, technologies as geothermal, Kivu methane gas, biogas and hydropower at different scales are part of priorities in Rwanda (**Page 57**)
Nationally Appropriate Mitigation Actions (*3 June 2015*)	Future generation capacity in Rwanda is primarily expected to consist of a mix of generation from hydro, diesel/HFO, methane, peat, solar, and imports. Though there is planning for additional generation form geothermal, biogas, and solid waste-based sources (AfDB, 2013a). Geothermal, methane, and solar are seen as abundant domestic energy resources. For geothermal there is envisioned a future with 70 MW of test and production scale generation, and a potential of 300 MW long term (REG, 2015b). For methane-based generation the short-term plan is to have total generation capacity of 50 MW, with a long-term potential of 350 MW for Rwanda's share of the resource at Lake Kivu (REG, 2015c). Solar generation based on photovoltaics (PV) is in principle limited only by land availability and the ability for the grid to balance all sources of generation against each other and demand. (**Chapter 8, Page 133 and 134**)

Law n°48/2018 of 13/08/2018 on environment	The State has the obligations to promote effective energy use. While discharging such obligations, it focuses on the following: 1° to promote the use of renewable energy; 2° to promote effective energy use; 3° to promote the use of other types of energy which may replace that derived from wood (**Page 31**).
Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development (*October 2011*)	**Low Carbon Development / Mitigation** Geothermal power generation: Geothermal power is a clean, renewable, reliable and large-scale energy resource. There is an estimated potential of up to 700MW of geothermal power in Rwanda and this would exceed domestic electricity demand by 2020 if implemented. It uses known technology and could produce electricity at four times less the cost of diesel generated electricity currently in use in Rwanda. It could replace oil-fueled power plants which currently supply 38MW of electricity and result in high GHG emissions and are vulnerable to oil price spikes. Geothermal power has near zero emissions, making it eligible for carbon credits. It is a domestic resource, not shared with neighbouring countries like methane in Lake Kivu and hydropower on the Rusizi and Akagera Rivers, and has relatively small land use impact, unlike peat. Geothermal energy, together with other renewable energy sources, will provide energy security, reduce energy costs and vulnerability to external economic shocks and ultimately promote economic development (**Page 6**).
Vision 2020 (*July 2000*)	**Infrastructure development** **Energy:** Inadequate and expensive electricity supply constitutes a limiting factor to development. Wood is the source of energy for 99 % of the population, which leads to massive deforestation and soil destruction. Imported petroleum products consume more than 40% of foreign

4f.

	exchange. Rwanda will therefore increase energy production and diversify into alternative energy sources. To achieve this, Rwanda has considerable hydroelectric potential, in addition to large deposits of renewable methane gas in Lake Kivu, estimated at 60 billion cubic metres. In rural areas direct solar energy or photovoltaic energy can be used, whilst up to 1/3 of 155 million tons of peat deposit is currently exploitable. Rwanda projects that by 2020, at least 35 % of the population will be connected to electricity (up from the current 6%) and the consumption of wood will decrease from the current 94% to 50% of national energy consumption (**Page 20**).
Guidelines to mainstream climate change adaptation and mitigation in the energy and infrastructure sector (*September 2011*).	Climate Change Impacts and Vulnerability Issues for hydropower sector: • Prolonged droughts, which were a result of Climate Change, reduced the water levels significantly both in the rivers and the Lakes. This affected power generation forcing the government to increase thermal electricity generation, with its accompanying negative environment effects and high cost per unit of power. • Increased outages and load shedding negative impact on economic growth • Less capital available to diversify power generation options (cogeneration, wind, geothermal and small hydropower) • Climate Change also is likely to affect infrastructure for energy production, transmission and distribution. The transmission systems of electric utilities may experience a higher rate of

	failure, with attendant costs. This phenomenon will greatly affect energy security and economic development activities (**Page 40**).
Energy Sector Working Paper (*June 2011*)	Rwanda aims to develop 310 MW of geothermal electricity. By using the calculations, a 310 MW Geothermal CDM programme could offset an estimated 1.8 million tCO2e. At USD 10 per tonne, this would be worth USD 18 million per year, minus transaction costs. At present, Rwanda needs to develop technical capacity in geothermal power, this is critical for the sustainable development of geothermal resources. This can be gained through developing relevant university courses and overseas training, both at universities and in industrial placements. The UNU-GTP, KenGen and the Geothermal Development Company are investigating the possibility of setting up a permanent regional short-course in geothermal energy. Before national capacity is developed, experts from abroad will need to be brought in. It is important that these experts develop the national capacity whilst implementing projects (**Chapter 7, Page 43**).

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

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

The UN Environment Climate Technology Center and Network (CTCN) announced a technical assistance for direct use applications of geothermal resources on 1 November 2018. Direct utilisation of geothermal resources is one-way countries can meet their greenhouse gases reduction quotas since it will displace the use of biomass and fossil fuels. It is also great for fighting hunger and poverty by enhancing the livelihoods of communities living in geothermal-rich localities.

In a side-event held during the ARGeo-C7 conference, CTCN gave details of this technical assistance for countries. CTCN is looking at providing technical assistance projects that will use climate-related technology for non-conventional direct use applications. Specifically, CTCN is keen to provide technical

assistance on resource assessment, financing appropriate technology and assessment of markets for crop drying, chilling of agricultural produce and fish farming, among a host of other applications.

To qualify, CTCN has urged all countries to submit a request using the CTCN template.

Background documents and other information relevant for the request:

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

Chevron (2006). Preliminary Assessment of Rwanda's Geothermal Energy Development Potential.

De Dieu Uwisengeyimana, J., Teke, A. and Ibrikc, T., 2017. Current overview of renewable energy resources in Rwanda. *Journal of Energy and Natural Resources*, *5*(6), pp.92-97.

GDC-Geo2D, 2017. Study in support of developing geothermal resources at Rubavu-Kalisimbi.

Gestur, G., 2016. Conceptual model report: Regional Project for Geothermal Exploration in Rwanda, Burundi and DRC. Report No.: 13006-08

Gestur, G., Hjálmar, E., Snorri, G., Sigurbjörn, J., and Jón Ö. J., 2014. Surface Exploration Report: Regional Project for Geothermal Exploration in Rwanda, Burundi and DRC. Report No.: 13006

Geothermal Development Plan Final Report (JICA, 2015).

Gissurarson, M. and Georgsson, F.2015. Use of geothermal resources for drying of agricultural commodities in East Africa-Rwanda report

Harðarson, S.B., Kristinsson, S.G., and Óladóttir, A. (2017). Temperature gradient wells and gas fluxes presentation in Sustainable Development Goals (SDGs) Short Course II on Exploration and Development of Geothermal Resources, Kenya.

Jolie, E., Gloaguen, R., Wameyo, P., Ármannsson, H., A. Hernández Pérez, P., 2009. *Geothermal Potential Assessment in the Virunga Geothermal Prospect, Northern Rwanda*. Report Geotherm I, Federal Institute for Geoscience and Natural Resources (BGR).

KenGen, 2010. Geothermal potential appraissal of Karisimbi prospect, Rwanda.

Rutagarama, U., 2009. *Assessing generating capacity of Rwanda geothermal fields from green field data only*. Report 25, UNU-GTP, Iceland.

Shalev, E., Browne, P., Wameyo, P., Palmer, J., Hochstein, M., Fenton R., 2012: *Geoscientific surveys of the Rwandan Kalisimbi, Gisenyi, and Kinigi Geothermal Prospects*. Institute of Earth Science and Engineering (IESE) report for Rwanda.

Tadesse, M., Gestur, G., and Snorri, G., 2016. Temperature gradient drilling report: Regional project for geothermal exploration in Rwanda, Burundi and DRC. Report No.: 13006-07.

Web links :

Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development (October 2011): http://www.greengrowthknowledge.org/national-documents/rwanda-green-growth-and-climate-resilience-national-strategy-climate-change-and

Intended Nationally Determined Contribution (INDC) for the Republic of Rwanda: https://www.rema.gov.rw/fileadmin/templates/Documents/rema_doc/publications/Intended%20Nationally%20Determined%20Contributions%20(INDCs)%20of%20Rwanda.pdf

Law n°48/2018 of 13/08/2018 on Environment: https://waterportal.rwfa.rw/sites/default/files/2018-10/Water%20law%20gazetted%2C2018.pdf

Technology Needs Assessment and Technology Action Plans for Climate Change Mitigation and Adaptation (November 2012): http://www.tech-action.org/-/media/Sites/TNA_project/TNA-Reports-Phase-1/Africa-and-Middle-East/Rwanda/TechnologyNeedsAssessmentReport_Rwanda.ashx?la=da&hash=8F745464A51189EC341AE5B964D60F296E2636DD

Vision 2020 : www.minecofin.gov.rw/fileadmin/templates/documents/NDPR/Vision_2020_.pdf

OPTIONAL: Linkages to Green Climate Fund Readiness and Preparatory Support

The CTCN is collaborating with the GCF in order to facilitate access to environmentally sound technologies that address climate change and its effects, including through the provision of readiness and preparatory support delivered directly to countries through their GCF NDA. These actions are in line with the guidance of the GCF Board (Decision B.14/02) and the UNFCCC, particularly paragraphs 4 and 7 of 14/CP.22 that addresses Linkages between the Technology and the Financial Mechanisms[2].

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

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

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

[2] Please see: https://unfccc.int/files/meetings/marrakech_nov_2016/application/pdf/auv_cop22_i8b_tm_fm.pdf

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

NDA name:

Date:

Signature:

Monitoring and impact of the assistance:

By signing this request, I affirm that processes are in place in the country to monitor and evaluate the technical assistance provided by the CTCN. I understand that these processes will be explicitly identified in the CTCN Response Plan and that they will be used in the country to monitor the implementation of the technical assistance following standard CTCN procedures.
I understand that, after the completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short, medium and long-term impacts in the country.

Signature:

NDE name: **Faustin MUNYAZIKWIYE**
Deputy Director General of Rwanda Environment Management Authority (REMA)

Date: 31/01/2019

Signature:

MUNYAZIKWIYE Faustin
DDG - REMA

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

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