CTCN Technical Assistance

Request Submission Form

Requesting country or countries:	UGANDA
Request title:	**TECHNICAL ASSISTANCE FOR DIRECT USE ASSESSMENT OF PANYIMUR AND BURANGA GEOTHERMAL AREAS, UGANDA** The Government of Uganda through the Ministry of Energy and Mineral Development has carried out surface geothermal exploration in the four areas namely Katwe, Buranga, Kibiro and Panyimur located in the Western Branch of the East African Rift System in Uganda. Three areas Kibiro, Panyimur and Buranga have reached the stage of drilling and will soon be drilled to discover the resource. The results of the current studies suggest that the geothermal systems of Uganda are medium to low temperature areas unlike the high temperature systems in the Eastern Branch of the African Rift system in Kenya and Ethiopia. The resource, therefore, can be used for both electricity production using binary systems and direct uses of geothermal heat in Industry and Agriculture. There is, therefore, a need to study the possibility of using the resource for direct uses which is a new development in the African Rift countries and Uganda in particular. A number of areas have been identified as potential areas for such a study which include Panyimur, Buranga and Ihimbo in the Western Rift system in Uganda. Direct utilization 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 will also improve the livelihoods of communities living close to the geothermal resources. The proposed project, therefore, is an intervention to promote the use of direct uses of geothermal energy in Uganda. The project will carry out the following activities: resource assessment; assessment of direct use for crop and fish drying, chilling of agricultural produce, fish farming, tourism and other applications.
NDE	Dr. Maxwell Otim Onapa, Deputy Executive Secretary, Uganda National Council of Science and Technology, m.onapa@uncst.go.ug
Request Applicant:	Geothermal Resources Department of the Ministry of Energy and Mineral Development, Godfrey Bahati, Commissioner, gbahati@gmail.com, Plot 21-29, Johnstone Road, P.O Box 9, Entebbe.

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

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

Uganda's economy, livelihoods and social wellbeing are highly vulnerable to climate variability and the challenges imposed by the climate. The impact of climate change includes increased frequency and intensity of droughts, floods, glacial melting, landslides and heat waves, all of which will significantly affect the livelihoods of local communities that largely depend on natural resources. Uganda's energy sector has the potential to contribute adversely to climate change, through the production of Greenhouse Gases (GHG) from thermal power generation, for example. Conversely, the sector can be adversely affected by climate change due to the high dependence on hydropower generation. There is need to integrate climate change considerations into the development and utilization of all energy resources in order to ensure mitigation, adaptation and resilience.

The majority of the Ugandan population, which lives in the rural areas, gets their energy from biomass. This causes massive deforestation and loss of soil fertility, which again results in climate change and the reduction of agricultural productivity. Due to the rapid population and economic growth in the country, the demand for electricity is very high with only 22% of the country with access to electricity and 10% only in the rural areas. There is therefore a need for affordable, accessible and sustainable electricity production. Geothermal energy resource is an indigenous energy resource for the country and has a high load factor; the development cost is competitive and environmentally friendly, and can be used for both electricity production and direct use in industry and agriculture.

Clean energy development such as geothermal energy requires a large amount of capital investment, expertise, and management skills. The Uganda Geothermal Development Programme has met challenges which include inadequate policy, legal and regulatory frameworks to guide public interventions on a strategic basis; high upfront costs of geothermal energy development due to inherent high geological risk; inability to attract significant financial support from International Development Partners; inadequate data and information to guide decision-making; unskilled workforce capable of maintaining a sustainable geothermal

industry; low staffing levels due to vacant positions; low awareness amongst the public; and limited local government and community participation in geothermal exploration and development.

The proposed project, therefore, will support Government of Uganda efforts in addressing the above problems that are currently affecting the development of the geothermal resources.

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

The following are the past and on-going efforts to address the problem:

- A Geothermal Resources Department was created through restructuring of the Ministry of Energy and Mineral Development in 2014 to focus on geothermal exploration and development.
- Geothermal Policy and Legislation is being developed. The first draft was produced with support from CTCN in 2016. The draft has since been reviewed two times to produce the final draft which has been validated and awaiting a Regulatory Impact Assessment (RIA) report before it is submitted to Cabinet for approval. Once approved, the Parliament of Uganda will proceed to draft the Geothermal Act. There is a need for a specific policy designed to promote geothermal exploration, development and utilization. The policy will guide the exploration and development of the geothermal industry in Uganda.
- Since 1993, Government has carried out systematic geothermal energy exploration on the geothermal areas of Uganda. Subsurface temperatures of 150-250°C, 110-140°C, 120-150°C, and 140-200°C are predicted by geothermometry for Kibiro, Panyimur, Buranga, and Katwe respectively. These temperatures, if confirmed, are good for electricity production and for direct use in industry and agriculture. Three areas Kibiro, Panyimur and Buranga have reached advanced stages of surface exploration. Subsurface conceptual models have been developed to guide the location of drill sites. While Katwe still lags behind at intermediate stage of surface exploration. Drilling of 16 Temperature Gradient Wells (TGW) at Kibiro and Panyimur geothermal prospects has been budgeted for in the FY 2018/19. Once drilled, it will mark the end of surface exploration at Kibiro and Panyimur. In other areas, the current results suggest geothermal potentials with subsurface temperatures of 100-160˚C also good for electricity production and direct heat for use in industry and agriculture. These areas should be studied in detail and developed in a cascaded manner.
- The project has procured a number of surface exploration and laboratory equipment, and data processing softwares. This equipment includes geophysical, geological, geochemical and environmental. The geophysical equipment forms the bulk and include Magneto-tellurics (MT) (6 units), Transient Electromagnetics (TEM) (1 unit), Gravity Meter (1 unit), Magnetometers (2 units), Global Navigation Satellite system (1 unit) among others.
- Since 1990, the Ministry has trained 16 members of staff in specialized courses for six (6) months at the United Nations University Geothermal Training Programme in

Reykjavik, Iceland; three (3) have attended a nine (9) month course at the University of Auckland in New Zealand; and more than 25 members of staff have attended short courses ranging between one week and three months in various institutions in Kenya, Italy and Japan.

- The Geothermal Resources Department has developed a database and website to house all geoscience data and information related to geothermal industry. The department is also participating in the development and maintenance of a regional database, the Africa Geothermal Inventory Database (AGID). AGID houses and disseminates data from all African Countries with geothermal activities. AGID can be accessed through http://argeo.geothermal.is

Currently, there is no active direct use project in Uganda besides spas at Kibenge, Rwagimba, Ihimbo, Kitagata and Karungu geothermal areas. Recent studies collected data on potential direct uses around Kibiro, Panyimur, Buranga and Katwe. Direct use applications identified included heating greenhouses, crop and grain drying, spas and resorts, mineral extraction, timber drying, milk processing, geothermal tourism, balneological and therapeutic use, fish farming, fruit and vegetable drying, microbreweries, bathing. The proposed project, therefore, should look into this data as a basis for further investigations.

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

The surface geothermal studies on the Uganda geothermal systems have used geological, geochemical, hydrological and geophysical methods with the aim of elucidating subsurface temperatures and the spatial extent of geothermal systems, and in turn come up with a conceptual model that would be a basis for drilling exploration wells. The results indicate that the geothermal activity in the Western Branch of the East Africa Rift System appears to be fault-controlled deep circulation systems rather than magmatically heated systems associated with volcanoes in the Eastern Branch in Kenya and Ethiopia.

The results from various studies indicate that the Ugandan geothermal portfolio is likely to be made up of relatively small, low to medium temperature resources. Given the nature of the resource and the requirements of the electricity market, direct use of the heat in combination with power production would likely improve project economics and directly benefit the communities near the resource.

The following are the identified technological barriers affecting geothermal energy development:

- Resource location and definition: There is need to identify resource, define and characterize it. Inadequate geoscience data relevant to direct use is a challenge and barrier. Therefore, data acquisition, management and dissemination are important

[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)*

issues for the industry.

- The geological risk is high which makes it difficult to attract significant financial support from International Development Partners. The fault-controlled systems with Low to Intermediate temperatures make the areas less attractive to potential investors in electricity production, and therefore suitable for direct use options.
- Lack of technical expertise in geothermal direct use application. Technical expertise is crucial for developing geothermal resources. A critical mass of engineers, geologists, technicians, soil scientists, food scientists, agriculturalists, fisheries specialists, is required. However, there is a continuing shortage of qualified personnel in Uganda. There is lack of institutional capacity and capability in direct use applications.
- Information and awareness barrier: There is generally lack of public understanding of geothermal energy, its utilization and social-economic benefits and environmental effects. There is need to undertake information and awareness visits to direct-use projects in USA, Iceland and Turkey. There is much valuable knowledge available worldwide about direct utilization of geothermal energy which we need to tap through networking with established direct use projects and Technical Interest Groups.
- Markets for direct use products: Marketing for direct use products need to be identified and established as part of the proposed project outputs.
- Environmental Issues: Geothermal energy development is not without environmental impacts. Although geothermal projects generally present much lower overall environmental impacts than conventional fossil fuel power plants, they nonetheless may pose some environmental impacts and raise community concerns for direct use projects. Potential environmental impacts should be identified and mitigated.

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):

- **Overall objective**

  To develop geothermal resources for binary electricity production and direct heat for use in industry and agriculture.

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

  In the next five (5) years, the Government of Uganda is planning to carry out Feasibility studies at Kibiro, Panyimur, Buranga and Katwe geothermal prospects; and additional studies covering costs, funding options, power sales, direct use and local economic development, and environmental benefits of geothermal energy. Other studies shall include Infrastructure assessment for installation of appropriately sized power plants, and Capacity building in both Equipment and Human Resource.

  We are proposing that the study with support from CTCN being limited to one year should concentrate on direct use applications of geothermal energy. The following are the anticipated activities/studies:

  - Analysis of potential direct use or combined heat and power opportunities given economic development plans in the locality;
  - Review of the existing direct uses for geothermal energy;
  - Support in consultations with the local community regarding the possible opportunities for direct utilisation of the geothermal energy;
  - Evaluation of the potential for geothermal energy production, and the likely market for electricity and direct heat both locally and nationally;
  - Development of business and financial models for the prospects.
  - Infrastructural assessment for direct use facilities for crop and fish drying and

other uses to be determined by the study.

- Environmental and Social Impact Assessment (ESIA) for utilizing surface or subsurface water.
- Capacity building to the staff of the Ministry and local communities.
- Bankable feasibility studies both engineering, potential markets (marketability) and economic (value, income).
- Conduct information awareness workshops to promote the geothermal industry.

- **Anticipated products to be delivered by the technical assistance.**
  - Report on the existing direct uses.
  - Report on potential direct use opportunities.
  - Business and financial models for the prospects.
  - Infrastructural assessment report.
  - Environmental and Social Impact Assessment (ESIA) Report.
  - Capacity building report.
  - Bankable project proposals.
  - Stakeholder awareness of the geothermal industry.

Expected timeframe:

Project period is 12 months.

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

A gender sensitive approach is important for energy security and agriculture and industry because of the importance that women play in these sectors. It is estimated that 10-50% of those engaged in agriculture sector are women. A gender sensitive approach is needed to create a supportive environment for increasing women's involvement and empowering their position within the geothermal sector. Particular actions would include;

- Awareness programs highlighting the differing roles and positions held by men and women targeted at government officials working with geothermal sector.
- Exchange of experience between women of different communities.
- Education
- Training
- Small business and cooperative developments and,
- Credit schemes available to women's cooperatives to ensure their continued empowerment in the geothermal sector.

Direct use of geothermal energy in homes and commercial operations is much less expensive than using traditional fuels (firewood); savings can be as much as 80%. Furthermore, direct-

use applications such as fish farms, greenhouses, microbreweries, fruit and vegetable drying, spas, pulp and paper processing, and lumber drying offer attractive and innovative opportunities for local businesses and entrepreneurs including women and youth.

Improved Indoor Air Quality & Safety. Culturally, it is mostly women and children involved in cooking and are subjected daily to gaseous emissions from fossil fuels. There is no combustion in a geothermal direct use, therefore there is no chance of carbon-monoxide poisoning like in firewood and charcoal burning by ladies (cleaner environment). Use of geothermal heat for drying and extraction of salt will go a long way to improving indoor pollution.

Jobs Boost: Direct-use geothermal energy projects leverage existing women workforces within Uganda. Their simple design and construction from off-the-shelf parts can utilize local engineering firms, geologists, drilling operators, construction trades, pipefitters, technicians, and welders.

Economy Boost. Geothermal heated facilities have the potential to stimulate local economies through increased tax revenues, the creation of new businesses and local jobs, tourism, agriculture, and enhanced community and women involvement. This will economically empower women in communities. Direct use application can save money and energy for the women, youth and the nation in general. Directly using geothermal energy in homes and commercial operations is much less expensive than using traditional fuels.

Locally Produced Energy. Directly using geothermal energy in homes and commercial operations on site, such as food production, can offset imported energy, keeping jobs, dollars, and other benefits in local communities. Savings can be as much as 80 percent over fossil fuels.

Carbon Emission Reduction. Geothermal direct-use projects produce near-zero emissions hence will lead to increased safety of women involved in cooking. Depending on the existing heating fuels being offset, this may result in annual emissions reductions and cleaner and safer environment. The country will pursue dramatic environmental benefits for women and the nation in general.

Flexible Heating Systems (Cascaded applications). Applications of geothermal direct use may include district heating, spas and pools, agriculture, food processing, and other uses where women are involved. Within a single system these diverse applications can be “cascaded” and work together in the most efficient way possible to ensure the maximum benefit and lowest costs possible from direct-use systems.

Reliable and Sustainable Heat Source: Geothermal heating projects last for decades—typically 25 years or more—providing reliable energy at a low, stable price. This can provide price certainty and insulate consumers (and the economy) from often unpredictable fluctuations in fossil fuel prices.

Low to moderate temperature fluids can be used for direct heat applications like resorts and spa, aquaculture (fish farming), water distillation, greenhouses, space heating and cooling, agriculture drying, cooking, bathing, swimming, pasteurization of milk, health care and industrial applications (laundry facilities, brewery, biodiesel, mineral extraction and

processing). Food and grain dehydration is critical especially in tropical areas where spoilage is common. The use of geothermal heat can aid in electricity saving, reduction in greenhouse gas emissions and enhance food security. Cascaded use enables maximum utilisation of the resource both for power and heat (Combined Heat and Power). Geothermal direct use applications exist in 82 countries and it is a proven technology. It can bring significant economic benefits to a Country.

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	Monitoring and evaluation.
Request Applicant	Implementation, monitoring and evaluation.
Ministry of Energy and Mineral Development (MEMD)	The Lead Agency for geothermal resources development spearheading the following: (a) Surface and sub surface exploration of geothermal prospects up to the point of licensing the site to a private sector developer or developers. (b) Undertaking pre-feasibility and feasibility studies as necessary in order to provide an economic basis for licensing. (c) Preparation of agreements (implementation agreements, power purchase agreements, connection agreements, direct use contracts) to underpin licences and enable private sector participation. (d) Liaison with Government Ministries and development partners with regard to the financing of geothermal projects. (e) Management of tender processes for the award of licences, and recommending such award for the Minister to approve. (f) Research on breakthrough technologies and deployment of technology & construction of pilot plants.

Ministry Responsible for Local Governments	Specific roles shall be: (a) Guiding local governments to undertake plans and capacity building that take cognisance of geothermal activities, in particular opportunities for local economic empowerment and the direct use of geothermal heat to promote local industry; (b) Integrating geothermal resource development opportunities in local governments' plans and programmes; (c) Mobilizing local governments to support geothermal resource development activities including provision where possible of the necessary infrastructure.
Ministry Responsible for Water and Environment	Specific roles shall be: (a) Ensuring that geothermal activities conform to the requirements of the policies regarding the protection and utilization of water bodies and aquifers; (b) Identifying opportunities to utilise climate and carbon finance to support geothermal energy development; (c) Regulating water use and pollution load into water bodies through issuance of water permits; (d) Ensuring compliance with conditions provided for in the water permits; (e) Ensuring protection of water catchment and drainage areas; (f) Participating in monitoring and management of geothermal waste or effluent emergencies.
National Environment Management Authority (NEMA)	Specific roles shall be: (a) Coordinating the processes of environmental impact assessments. (b) Carrying out, alongside other stakeholders, environmental monitoring and audits. (c) Ensuring and monitoring compliance of geothermal activities with environmental guidelines; (d) Issuing guidelines for strategic environmental assessment.
Ministry of Agriculture, Animal Industry and Fisheries	(a) Source of data on Aquaculture, milk pasteurisation, greenhouses, fruit and vegetable, drying onions, garlic, coconut, meat, fruits, food and grain drying, Mushroom growing. (b) Source of data, input and opinions on aquaculture and fish farming, fish breeding. (c) Source of data, opinions and input in agribusiness. (d) Source of data, input and opinion on fruit and vegetable, drying onions, garlic, coconut, meat, fruits, food and grain drying lumber, potatoes, spices, sugar, concrete blocks.
Ministry Responsible for Labour	Specific roles shall be: (a) Carrying out regular statutory inspections to ensure health and safety in the geothermal industry;

	(b) Ensuring that the equipment and technologies brought into the country are environmentally friendly and comply with the desired safety and health standards.
Ministry Responsible for Industry	Specific roles shall be: (a) Ensuring that geothermal policies are in harmony with the country's industrial policy; (b) Promoting opportunities for direct use of geothermal resources to support industrial development; (c) Promoting the use of mineral co-production to support industrial development in the country.
Ministry Responsible for Tourism and Wildlife	Specific roles shall be: (a) Ensuring that geothermal policies are in harmony with wildlife conservation and tourism development policies; (b) Identifying opportunities for the geothermal sector to contribute towards tourism development; (c) Ensuring that geothermal activities are in harmony with wildlife conservation and development of infrastructure and services for tourism; (d) In collaboration with relevant stakeholders, monitor the impact of geothermal activities on wildlife conservation, development of tourist infrastructure and services together with the harmonious coexistence between ecotourism and geothermal operations; (e) Monitoring the impact of geothermal activities on antiquities.
Ministry Responsible for Works and Transport	Specific roles shall be: (a) Planning and regulating transport services such as road, rail, pipelines, air and waterways; (b) Providing technical guidance on mechanical engineering aspects of machinery used in geothermal resource development activities imported into the country; (c) Participating in verification of the structural integrity of drill rigs and other production facilities.
Private sector	Specific role shall be: (a) Create industry wide frameworks for interaction with local communities; (b) Encourage consultations with inhabitants before initial activities and conducting baselines; (c) Promote local development projects related to direct uses of geothermal resources e.g green houses, food and wood drying systems, aqua culture, and therapeutic uses, etc.
Universities, development partners and research institutions	Specific role shall be: (a) Participate in outreach activities to promote and educate societies about geothermal energy; (b) Promote and create study programmes that provide students with the technical capacity to work in the

	geothermal subsector; (c) Engage government and private sector/ industry to expand sharing and partnerships in geothermal resource development.
Civil Society and Cultural Institutions	Specific role shall be: (a) Advocacy, mobilization and dialogue with communities; (b) Contribute to holding the different players accountable with regard to geothermal development issues and participate in getting the voices of the poor into designing, monitoring and implementation and participation in geothermal industry.

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.).
Nationally Determined Contribution (NDC)	Direct alignment and contribution to NDC implementation is required for all CTCN technical assistances. Please include a direct reference to the INDC/NDC document (chapter, page number, etc.). On 26th June 2018, Uganda became the first country in Africa to sign the Partnership Plan for Nationally Determined Contributions (NDC) to achieve national climate goals as part of its obligations to the Paris Agreement. Under Chapter 3: Mitigation of climate change, Uganda commits to undertaking a number of policies and measures to support low-carbon development in key priority sectors. These include (i) construction of enabling infrastructure for electricity sector development, including power lines, substations and transmission facilities which has a potential to offset wood and charcoal burning, and the consequential deforestation, and to achieve a total of at least 3,200 MW renewable energy electricity generation capacity by 2030, up from 729 MW in 2013. In Annex I: Potential impact of the mitigation contribution, the Nationally Determined Contribution energy sector measures will increase the amount of renewable energy capacity by at least 1,100 MW compared to business- as- usual by 2030, generating an estimated 4.6 - 5.2 Tera watts (TWh) (million watts) more than in

	the business-as-usual scenario case. Technologies include hydro, solar, biomass and geothermal. The mitigation impact is 18 forecasts to be between 2.7 Million tons Carbon dioxide equivalent per year (MtCO2e/a) and 3.7 MtCO2e/a. The mid-point is taken as 3.2 MtCO2e/a.
National Development Plan (NDP)	**Uganda Vision 2040** Geothermal resources in Uganda are still undeveloped to produce electricity and if developed could support government's strategic direction as set in the Second National Development Plan (NPD II) and Uganda Vision 2040 which projects per capita electricity consumption to rise from the current 75 kWh to 3,668 kWh by 2040. To achieve this target, it is estimated that the national grid access rate should increase to 80% with total installed generation capacity reaching 41,738 MW by 2040 compared to the current 951 MW. Peak demand in 2030 is estimated to reach between 1,873-2,722 MW (PSIP, 2011). Among the key energy sources available to meet this demand include hydropower which is expect to contribute 4,500 MW and geothermal 1,500 MW. **Second National Development Plan (NDP-II) 2015/16 – 2019/20 dated June 2015.** Sectors identified for development intervention include; ➢ Agriculture ➢ Tourism ➢ Minerals, oil and gas ➢ Environment and natural resources ➢ Infrastructure development ➢ Trade Industry and Cooperatives ➢ Human Capital Development ➢ Social Development **UN Sustainable Development Goals (SDGs) which include**; Access to modern and clean energy services is a necessary precondition for achieving development goals that extend far beyond the energy sector, such as poverty eradication, access to clean water, improved public health and education, women's empowerment and increased food production ➢ Zero hunger, no poverty, good health and wellbeing, gender equality, affordable and clean energy, industry, innovation and infrastructure, climate action,

	Government's Policy Vision for Renewable Energy is: To make modern renewable energy a substantial part of the national energy consumption. **SE4ALL Action Agenda,2014:** Support Uganda aim in achieving the SDG with its 3 objectives (i) providing universal access to modern energy, (ii) Doubling the global rate of improvement in energy efficiency, and (iii) doubling the share of renewable energy in the global energy mix by 2030 Renewable Energy is key to addressing some of the challenges in the sector and country at large • Diversifying the energy mix • Mitigating climate vulnerabilities • Meet the country's energy needs • Improve energy access • Reduce environmental pressures • Create "green" jobs Energy is listed among climate relevant sectors (Whitley and Tumushabe, 2014).
National Adaptation Plans	The livelihood of the people of Uganda is highly dependent on the exploitation of her natural resources, including climate (Uganda INDC, 2015). Uganda's priority is adaptation in the above Intended National Determined Contribution (INDC). The country will continue to work on reducing vulnerability and addressing adaptation in agriculture and livestock, forestry, infrastructure (with emphasis on human settlements, social infrastructure and transport), water, energy, health and disaster risk management. Sustainable Land Management (SLM) and Climate Smart Agriculture (CSA) will be scaled up to increase resilience at the grass root level. Uganda's priority energy sector actions for adaptation include: • Increasing the efficiency in the use of biomass in the traditional energy sector. • Promoting renewable energy and other energy sources • Increasing the efficiency in the modern energy sector, mainly of electricity. • Ensuring the best use of hydropower by careful management of the water resources. • Climate proofing investments in electricity power sector.
Nationally Appropriate	For mitigation, Uganda is to focus on implementation of a series of policies and measures in the energy supply, forestry and wetland

Mitigation Actions	sectors. In the business-as-usual (BAU) scenario the estimated emission in 2030 will be 77.3 Million tons of carbon dioxide equivalent per year (MtCO2eq/Yr). The estimated potential cumulative impact of the policies and measures could result in approximately 22% reduction of national greenhouse gas emissions in 2030 compared to BAU. Uganda proposes to implement the identified policies and measures, and their impact may be higher or lower than these estimations illustrate. Policies and measures of Uganda's mitigation contribution include: • Construction of enabling infrastructure for electricity sector development, including power lines, substation and transmission facilities (development of the electricity sector holds great mitigation potential for Uganda due to the potential offsetting of wood and charcoal burning, and the consequential deforestation). • Achieve a total of at least 3,200 Mega Watts renewable electricity generation capacity by 2030, up from 729 MW in 2013.
Add others here as relevant	Severe weather events, such as droughts and floods, have historically imposed heavy costs in Uganda. The projected impacts of climate change are likely to add to the toll, potentially undermining further advancements in critical development areas such as food security, water resources management, health, and economic growth. In recognition of this, the Government of Uganda and donor community have initiated activities to determine vulnerability and adaptation priorities, and integrate adaptation considerations into development and sectoral planning. However, adaptation challenges remain, including mainstreaming adaptation into the country's medium-term development framework. Accomplishing these will require addressing challenges regarding data availability and accessibility, as well as a need for strengthened capacity to predict future climate change and measure sector impacts.

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

Direct use of geothermal resources in Africa Rift countries was first recommended by the ***"Technical Workshop on the Geologic Development and Geophysics of the Western Branch of the Greater East African Rift System with Emphasis on Factors that Control the Development of their Geothermal Systems"*** held in Kigali, Rwanda from 9th to 12th March 2016. The aim of

the workshop was to discuss the geologic setup and conditions that would support the development of geothermal systems in the countries of the western branch of East African Rift System (EARS) which include Burundi, Rwanda, Uganda, Zambia, Tanzania, Malawi and Mozambique.

The workshop observed the sluggishness of geothermal development in the Western Branch compared to the more advanced Eastern Branch of the EARS, which was attributed to (a) lack of sufficient data and information, (b) some systems in the Western Branch not associated with magmatic geologic conditions, (c) the nature and characteristics of the systems not fully understood, (d) experiences and research methods for geothermal exploration used in the Eastern Branch inappropriately applied to systems in the Western Branch.

The main outcome of the workshop was the knowledge gained by the region's geoscientists concerning the heterogeneous geologic conditions in the Western Branch of EARS that determine the possible generation and storage of the region's geothermal resources. It was concluded that the geothermal activity in the Western Branch of the EARS was dominated by a fault-controlled deep circulation system rather than magmatically heated systems associated with volcanoes as is the case with the Eastern Branch in Kenya and Ethiopia. Fault-controlled systems are characterized by low to intermediate subsurface temperatures that are good for binary power plants and direct use of the resources in industry and agriculture. Since then a number of meetings and workshops have been held in a number of countries in the African Rift system all emphasizing the need to promote direct uses of geothermal energy.

Recent studies on the Ugandan geothermal systems with support from the East African Geothermal Energy facility (EAGER) sponsored by the United Kingdom Department for international Development (DFID) focused on four areas namely Katwe, Buranga, Kibiro and Panyimur all in the Western Branch of the EARS. The areas have been extensively explored on surface and are ready for exploration drilling and feasibility studies. The recommendation was that going forward, the geothermal resources should be developed for electricity and direct uses taking a high priority. This was also supported by an unequivocal resolve by countries in the Africa Rift System to mainstream direct use in geothermal power development at the 7th African Rift Geothermal Conference (ARGeo_C7) held in Kigali, Rwanda from 29th October to 4th November 2018. Direct uses of geothermal resources have the potential to contribute to the socio-economic development of the African continent.

The problem now is inadequate data on direct uses, inadequate skilled personnel, inability to attract foreign support, limited government support, and lack of awareness among the public and private sector players. With the above background, the Ministry has developed a proposal to study, quantify the power from direct uses in at least two geothermal prospects, and advise decision-makers on the need to promote geothermal energy.

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.

Background documents and other information relevant for the request:

- Republic of Uganda, NDC, 2018. Uganda's Nationally Determined Contribution (NDC).
- UN Sustainable Development Goals (SDGs): http://www.ug.undp.org/content/uganda/en/home/sustainable-development-goals.html
- SE4ALL Action Agenda,2014: https://www.seforall.org/sites/default/files/Uganda_AA_EN_Released.pdf
- PSIP, 2011. https://www.minstryofenergyandmineraldevelopment
- Republic of Uganda, 2007; THE RENEWABLE ENERGY POLICY FOR UGANDA
- Republic of Uganda, 2015; SECOND NATIONAL DEVELOPMENT PLAN 2015/16 –2019/20 (NDPII)
- Republic of Uganda, National Vision 2040.
- Shelagh Whitley and Godber Tumushabe, 2014. Mapping current incentives and investment in Uganda's energy sector Lessons for private climate finance.
- GoU-EAGER, 2018; Pre-feasibility for combined power plant and direct use facilities selected direct use applications.
- Uganda National Climate Change Policy, 2015.

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

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

design of this request and the NDA will be involved in the further process leading to an official agreement for accessing GCF readiness support.

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

NDA name: Ministry of Finance Planning and Economic Development.

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:	Dr. Maxwell Otim Onapa,
Date:	11 February 2018
Signature:	

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

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