

## Monitoring & Evaluation (M&E) Plan and Impact Statement Form

### Objective of the M&E Plan and Impact Statement:

- The M&E Plan and Impact Statement must be designed based on the Technical Assistance Response Plan and must enable the Implementer to complete the Closure Report at the end of the assistance.

### Process for filling in the form:

- The Implementer must identify relevant quantitative and qualitative indicators as specified in the Closure Report. A sub-set of indicators to monitor and assess must be chosen among these.
- The Implementer may also identify other specific, measurable, achievable, relevant, and time-bound indicators suitable to monitor Activities, Outputs and anticipated Outcomes from the technical assistance and add to the M&E Plan and Impact Statement.
- During implementation of the TA or FTA, the Implementer must collect all relevant data as described in the Monitoring & Evaluation Plan. Aggregated data on selected indicators as well as an updated version of the Impact Statement will be presented in the Closure Report at the end of the assistance.

Basic Information	
Title of response plan	Technical Assistance to Identify the Most Suitable Direct Use Applications and Technologies in Low to Medium Temperature Geothermal Systems in Six African Countries
Technical assistance reference number	CTCN request ref: 2019000050
Country/ countries	Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda
NDE organisation and focal point	<b>Djibouti:</b> Mr. Idriss Ismael Nour, distri_play@yahoo.fr <b>Ethiopia:</b> Ms. Yamelakesira Tamene Bekele, yamelakesira516@gmail.com <b>Kenya:</b> Mr. Kelvin Khisa, kelvin.khisa@kirdi.go.ke <b>Rwanda:</b> Mr. Faustin Munyazikwiye, fmunyazikwiye@rema.gov.rw <b>Tanzania:</b> Dr. Gerald Majella Kafuku, kafukugm@gmail.com <b>Uganda:</b> Dr. Maxwell Otim Onapa, m.onapa@uncst.go.ug
Sector(s) addressed	Renewable Energy, Agriculture, Forestry, Industry
Technologies supported	Renewable Energy (geothermal), Agriculture and Forestry (demand efficiency, crop drying, increasing crop resilience and productivity); Industry (conventional power plant efficiency) <sup>1</sup>
Implementation period and total duration	November 15, 2019 – August 11, 2021
Total budget for implementation	\$232,849
Designer of the response plan	Climate Technology Centre and Network (CTCN)
Implementer of response plan	GreenMax Capital Advisors

<sup>1</sup> <https://www.ctc-n.org/resources/ctcn-taxonomy>

A) Outputs and Activities as described in the Response Plan	B) Indicator	C) Expected Results	D) Method and frequency for data collection	E) Comments
<i>Output #:</i> Add title from the Response Plan	<i>Select relevant indicators from the Closure Report (at least one core indicator). You may also define additional relevant indicators to be added.</i>	<i>Add the expected quantitative target/value of the Output or Activity (number of studies, policy recommendations, etc.).</i>	<i>Describe the expected method and frequency for data collection (survey, head count at a training workshop, application of a standard methodology etc.)</i>	<i>Describe any assumptions made or anticipated challenges for collecting quantitative and qualitative data</i>
<b>Output 2:</b> Identification of the most suitable direct use applications in low to medium temperature geothermal systems that will have climate impacts and improve livelihoods of communities in specific geothermal localities	Number of technical documents, feasibility studies etc. improved, revised, or developed	Reports on the applications of geothermal direct use and viable projects in each country <ul style="list-style-type: none"> <li>• One report on the comprehensive review and analysis of existing data and information on low to medium temperature geothermal resources in the identified sites.</li> <li>• One report on stakeholders' identification, engagement and their contribution</li> <li>• One report on local livelihood sources, economic activities with various potential geothermal direct use applications and the climate impacts with estimated local energy demands for the selected sites communities</li> <li>• One report on the application of the geothermal direct use and the viable projects</li> </ul>	Identification of the resources via literature review, local demand identification, matching the demand and the resource <ul style="list-style-type: none"> <li>• A comprehensive report including a record of data and documents analyzed in each country</li> <li>• A report on stakeholder engagement in each country; including a register of stakeholders consulted / meeting minutes/details/ presentations made to during consultations</li> <li>• Record of reports produced and communicated to CTCN and project proponents</li> </ul>	<ul style="list-style-type: none"> <li>• Analysis focused on interrelation between the local demand and the geothermal resources</li> <li>• Potential challenges associated with availability of data/studies on identified sites</li> </ul>

	<ul style="list-style-type: none"> <li>Number of communication/outreach activities conducted by proponents to showcase CTCN assistance</li> </ul>	<ul style="list-style-type: none"> <li>Six consultation events (one in each country).</li> </ul>	<ul style="list-style-type: none"> <li>Documented report for the consultation meetings ( one consolidated report for the 6 meetings)</li> </ul>	
<b>Output 3:</b> Identification of direct use geothermal energy harnessing technologies	<p>Total number of tools, technical documents and information material supported by the assistance (excluding mission, progress and internal reports)</p> <ul style="list-style-type: none"> <li>Number of technical documents strengthened, revised or created</li> </ul>	<ul style="list-style-type: none"> <li>One report on technology options identified, assessed and considered appropriate for the identified direct use geothermal application inclusive of a preliminary analysis of the various available technology options for direct use application.</li> </ul>	<ul style="list-style-type: none"> <li>A report on the selected and prioritized most appropriate technologies for identified geothermal direct use projects including preliminary analysis of various technology options for direct use application.</li> </ul>	
	<ul style="list-style-type: none"> <li>Anticipated number of technologies (identified) transferred or deployed as a result of CTCN support.</li> </ul>	<ul style="list-style-type: none"> <li>5-10 technologies identified for direct use geothermal energy harnessing based on the report on technology options identified, assessed and considered appropriate for the identified direct use geothermal application.</li> </ul>	<ul style="list-style-type: none"> <li>A documentation report of the technologies identified for direct use geothermal energy harnessing as per the report on technology options identified, assessed and considered appropriate for the identified direct use geothermal application.</li> </ul>	
<b>Output 4:</b> Market and economic assessment on commercial viability of identified technologies	<ul style="list-style-type: none"> <li>Commercial viability (economic and market feasibility) of identified technologies</li> </ul>	<ul style="list-style-type: none"> <li>One report on the commercial viability of the selected geothermal direct use projects</li> </ul>	<ul style="list-style-type: none"> <li>A documented report on the commercial viability of the selected geothermal direct use projects</li> </ul>	
<b>Output 5:</b> Capacity developed on the procedures for identification of technologies and development of conceptual models of low-to-medium geothermal systems for direct use application	<p>Total number of tools, technical documents and information material supported by the assistance (excluding mission, progress and internal reports)</p> <ul style="list-style-type: none"> <li>Number of tools/technical documents strengthened, revised or developed</li> </ul>	<ul style="list-style-type: none"> <li>One set of guideline documents and training materials on tools and methods for geothermal resources assessments for direct use application (whole value chain- from resources assessment to technology identification to project designs)</li> </ul>	<ul style="list-style-type: none"> <li>Documented guidelines and training materials on tools and methods for geothermal resources assessments for direct use application (whole value chain- from resources assessment to technology identification to project designs)</li> </ul>	

	<p>Number of people who received the training:</p> <ul style="list-style-type: none"> <li>• Number of men</li> <li>• Number of women</li> </ul>	<ul style="list-style-type: none"> <li>• 18 participants (3 from each country) in one regional training workshop for target national technical staff in Nairobi, Kenya</li> </ul>	<ul style="list-style-type: none"> <li>• Documented list of 18 participants (men and women) in attendance of the one regional training workshop for target national technical staff in Nairobi, Kenya</li> </ul>	
	<p>Number of communication and outreach activities conducted by proponents and implementing partners to showcase CTCN support</p>	<p>Organized regional training workshop for target national technical staff</p> <ul style="list-style-type: none"> <li>• One organized regional training workshop for target national technical staff in Nairobi, Kenya</li> </ul>	<p>Documented report of the organized regional training workshop for national technical staff in Nairobi, Kenya</p> <ul style="list-style-type: none"> <li>• A report on the organized regional training workshop for target national technical staff</li> </ul>	
	<ul style="list-style-type: none"> <li>• Number of other information materials strengthened, revised or created (e.g., training / workshop reports)</li> </ul>	<ul style="list-style-type: none"> <li>• One report on the training of geothermal technology direct uses</li> </ul>	<ul style="list-style-type: none"> <li>• Documented report on the training of geothermal technology direct uses</li> </ul>	
<p><b>Output 6:</b> Validation of the results of the Technical Assistance</p>	<p>Total number of tools, technical documents and information material supported by the assistance (excluding mission, progress and internal reports)</p> <ul style="list-style-type: none"> <li>• Number of other information materials strengthened, revised or created (e.g., training and workshop reports, Power Points, exercise docs etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• One Validation workshop final report of the technical assistance</li> </ul>	<ul style="list-style-type: none"> <li>• Documented validation workshop final report of the technical assistance</li> </ul>	

*Note: The Response Plan may contain information useful for the section below. The information in the table below will be used by the CTCN for public communication of the achieved and expected results of the Technical Assistance through the CTCN website [www.ctc-n.org](http://www.ctc-n.org) and other communication channels. See for example: [https://www.ctc-n.org/sites/www.ctc-n.org/files/benin\\_a\\_ag\\_forestry.final\\_.pdf](https://www.ctc-n.org/sites/www.ctc-n.org/files/benin_a_ag_forestry.final_.pdf)*

<b>Impact Statement</b>	
Challenge	<ul style="list-style-type: none"> <li>• The availability of geothermal energy resources in East Africa is promising for power generation and development of direct use projects. This region plans to utilize geothermal power to improve energy security, reduce dependence on imported fuels, and address the energy demand gap in order to increase electrification rates and support long-term economic development.</li> <li>• Geothermal energy also plays a significant role in helping countries advance their climate commitments given the impact of geothermal development on energy sector decarbonization.</li> <li>• There is significant untapped potential for direct use applications of geothermal energy in East Africa, particularly in the agricultural sector, which is a key driver of economic activity across the region. This is broadly attributed to limitations in access to finance as well as local capacity. It is therefore important to develop wider understanding regarding opportunities for direct use projects from technical, financial, market viability perspectives.</li> </ul>
CTCN assistance	<ul style="list-style-type: none"> <li>• The objective of the TA was to conduct a review of low-to-medium temperature geothermal systems for direct use applications in six East African countries (Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda) to promote sustainable development, particularly for rural beneficiary communities.</li> <li>• In each country, the TA identified potential direct use geothermal applications as well as the corresponding sectors and technologies that are best suited to benefit from direct use geothermal projects.</li> </ul>
Anticipated impact	<ul style="list-style-type: none"> <li>• In the short term, as the TA is expected to test the economic viability of direct use projects in specific sites within the region; availability of such information is expected to accelerate efforts to coordinate action that will spur investment to develop the geothermal potential of this region.</li> <li>• In concrete terms, implementing into practice the data, knowledge and skills acquired in the context of the TA provided should allow, in the long-term:               <ul style="list-style-type: none"> <li>- The implementation of geothermal energy direct use technologies appropriate to the identified sites in the six countries;</li> <li>- The continuous updating of the regional and national databases;</li> <li>- Strengthening the resilience capacity of people living in the project localities as a result of availability of energy that is instrumental in supporting and diversifying their livelihood. This can be envisioned in reduced loss of livelihood (e.g., through prevention of post-harvest losses that are mainly attributed to improper drying of agricultural produce) and/or through establishment of local industries such as agro-processing facilities that would result in production of agricultural value-added products, hence increased income and employment opportunities</li> </ul> </li> <li>• Greenhouse gases abatement: geothermal technologies for power generation or direct use operate with little or no emissions. Geothermal energy development has thus great CO<sub>2</sub> emission reduction potential when substituting fossil sources of energy.</li> </ul>
Gender aspects of the TA and co-benefits	<ul style="list-style-type: none"> <li>• While the TA did not include a specific gender analysis component, in order to ensure that the outputs of the TA accounted for the priorities and perspectives of women, gender-disaggregated data was a focus of the data collection activities, including the surveys and focus group meetings administered in the identified communities</li> </ul>

	<ul style="list-style-type: none"> <li>Gender considerations are critical to the overall TA given the clear linkages between energy and gender, namely different rates of access and use as well as the impacts of energy sources and appliances in the home, community and wider society</li> </ul>
Anticipated contribution to NDC	<p>Geothermal energy offers a clean, reliable and affordable source of power/heat that can support sustainable development as countries aim to reduce emissions to meet their National Determined Contributions (NDCs):</p> <ul style="list-style-type: none"> <li><b>Djibouti</b> has prioritized geothermal development in order to meet its 2015 NDC, which aims to reduce emissions by up to 60% compared to the business-as-usual (BAU) scenario by 2030.</li> <li><b>Ethiopia</b> plans to reduce emissions by 64% from the BAU scenario by 2030 through the development of renewable energy, including geothermal</li> <li><b>Kenya</b> seeks to abate its GHG emissions by 30% by 2030 relative to BAU. The country is the leader in the region in geothermal development.</li> <li><b>Rwanda</b> has prioritized low-carbon energy development with a vision to establish new grid connection from renewable energy.</li> <li><b>Tanzania</b> has made a commitment to reduce greenhouse gas emissions economy wide between 10-20% by 2030 and has made geothermal development a priority.</li> <li><b>Uganda</b> intends to increase the amount of renewable energy capacity by at least 1,100 MW compared to BAU by 2030, with priority technologies including hydro, solar, biomass and geothermal.</li> </ul>
The narrative story	<p>To date, the main focus of utilizing geothermal resources in East Africa has been for power generation, as the technology offers a clean source of baseload power that reduces emissions and improves energy security. However, there is also significant untapped potential for direct use applications of geothermal energy, particularly in the agricultural sector, which is a key driver of economic activity across the region. In this context, this assignment provided specialized TA in order to identify potential geothermal direct use applications in six East African countries – Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda. The services included capacity building to inform policymakers in each country to improve their understanding of opportunities for direct use geothermal projects from technical, financial and market viability perspectives.</p> <p>In each country, the TA identified potential direct use geothermal applications as well as the corresponding sectors and technologies that may benefit from the utilization of direct use geothermal projects. The TA also established the economic and market viability of the identified direct use technologies and projects. In addition to supporting rural livelihoods and economic development, this project supported each country’s efforts to advance their climate commitments given the impact of geothermal development on energy sector decarbonization.</p>
Contribution to SDGs	<ul style="list-style-type: none"> <li><b>SDG-1</b> (End poverty): Among the envisioned long-term impact of the technical assistance is the enhanced community resilience and improved livelihood.</li> <li><b>SDG-2</b> (End hunger, achieve food security and improved nutrition and promote sustainable agriculture): Many of the identified geothermal direct use applications involved sustainable practices in the agricultural sector (e.g., geothermal drying and heating)</li> <li><b>SDG-7</b> (Ensure access to affordable, reliable, sustainable, and modern energy for all): geothermal energy is sustainable and is a key driver of low-carbon growth</li> <li><b>SDG-13</b> (Take urgent action to combat climate change and its impacts): The envisioned long-term impact of the TA is enhanced community resilience and improved livelihood. In addition, practical training for national and regional experts will strengthen their technical capacity in geothermal direct use technologies for their exploitation</li> </ul>
Reference to knowledge products	<p>Extensive reference documentation (obtained through desk research and/or provided by the Project Proponents) was analyzed to identify appropriate geothermal sites. A sample reference document from each country is included below:</p>

	<ul style="list-style-type: none"> <li> <p>• <b>Djibouti</b>            Moussa, O. and Souleiman, H., 2015. “Country Report, Geothermal Development in Djibouti Republic,” Ministry of Energy and Natural Resources, (World Geothermal Congress, 2015): <a href="http://agid.theargo.org/reports/Djibouti/Country%20Report-%20Geothermal%20Development%20in%20Djibouti.pdf">http://agid.theargo.org/reports/Djibouti/Country%20Report-%20Geothermal%20Development%20in%20Djibouti.pdf</a></p> </li> <li> <p>• <b>Ethiopia</b>            Kebede, S., 2016. “Country Update on Geothermal Exploration and Development in Ethiopia. Proceedings, 6th African Rift Geothermal Conference,” Addis Ababa, Ethiopia, (2 – 4 November 2016):  <a href="https://theargo.org/fullpapers/COUNTRY%20UPDATE%20ON%20GEOHERMAL%20EXPLORATION%20AND%20DEVELOPMENT%20IN%20ETHIOPIA.pdf">https://theargo.org/fullpapers/COUNTRY%20UPDATE%20ON%20GEOHERMAL%20EXPLORATION%20AND%20DEVELOPMENT%20IN%20ETHIOPIA.pdf</a></p> </li> <li> <p>• <b>Kenya</b>            Omenda, P. and Mangi, P., 2016. “Country update report for Kenya: 2016. Proceedings, 6th African Rift Geothermal Conference Addis Ababa, Ethiopia, (2nd – 4th November 2016):  <a href="http://theargo.org/fullpapers/COUNTRY%20UPDATE%20REPORT%20FOR%20KENYA%202016.pdf">http://theargo.org/fullpapers/COUNTRY%20UPDATE%20REPORT%20FOR%20KENYA%202016.pdf</a></p> </li> <li> <p>• <b>Rwanda</b>            Rutagarama, U. 2018. “Geothermal Resource Exploration in Rwanda: A Country Update,” Proceedings, 7th African Rift Geothermal Conference, Kigali, Rwanda, (31<sup>st</sup> October – 2<sup>nd</sup> November 2018):  <a href="http://theargo.org/fullpapers/C7/Geothermal%20Resource%20Exploration%20in%20Rwanda-converted.pdf">http://theargo.org/fullpapers/C7/Geothermal%20Resource%20Exploration%20in%20Rwanda-converted.pdf</a></p> </li> <li> <p>• <b>Tanzania</b>            Kajugus, S.I., Kabaka, K.T. and Mnjokava, T. 2018. Geothermal Development in Tanzania - a Country Update. Proceedings, 7th African Rift Geothermal Conference, Kigali, Rwanda, (31<sup>st</sup> October – 2<sup>nd</sup> November 2018):  <a href="http://theargo.org/fullpapers/C7/Geothermal%20Development%20in%20Tanzania%20-%20a%20Country%20Update-converted.pdf">http://theargo.org/fullpapers/C7/Geothermal%20Development%20in%20Tanzania%20-%20a%20Country%20Update-converted.pdf</a></p> </li> <li> <p>• <b>Uganda</b>            Alexander, K., Cumming, W.B., and Marini, L., 2016. “Geothermal Resource Assessment Report, Kibiro geothermal prospect, Uganda,” (2016):  <a href="https://www.researchgate.net/publication/339137489_Exploration_of_fault-related_deep-circulation_geothermal_resources_in_the_western_branch_of_the_East_African_Rift_System_examples_from_Uganda_and_Tanzania">https://www.researchgate.net/publication/339137489_Exploration_of_fault-related_deep-circulation_geothermal_resources_in_the_western_branch_of_the_East_African_Rift_System_examples_from_Uganda_and_Tanzania</a></p> </li> </ul>
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