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Project Document

Surface Exploration and Capacity Building for Geothermal Development in Ethiopia

**Ethiopia - Iceland Cooperation in Geothermal Development
Initiated under the Iceland - World Bank Compact on Geothermal Energy**

Sub-Project of the ICEIDA/NDF Geothermal Exploration Project

ICE23066-1301

Implementing Agencies: Geological Survey of Ethiopia and Ethiopian Electric Power Corporation

Funded by the ICEIDA/NDF Geothermal Exploration Project

Estimated budget: 3.318.000 USD



ICELANDIC INTERNATIONAL DEVELOPMENT AGENCY
ISLANDS AMVINNUSTOFNUN ISLANDS



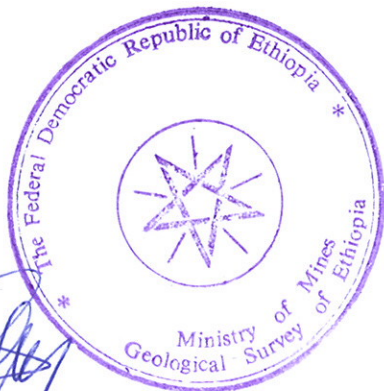
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*This project document was approved by
ICEIDA and NDF in August 2013*



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Agronyms

AFD	Agence Française de Développement
ARGeo	African Rift Geothermal Development Facility Programme
AUC	Africa Union Commission
CRGE	Climate Resilient Green Economy Strategy
EEPCO	Ethiopia Electric Power Corporation
GSDP	Geothermal Sector Development Project
GSE	Geological Survey of Ethiopia
GTP	Growth and Transformation Plan
ICEIDA	Icelandic International Development Agency
IPP	Independant Power Producer
JICA	Japan International Cooperation Agency
KFW	Kreditanstalt fur Wiederaufbau
MT	Magneto Telluric
NDF	Nordic Development Fund
NEP	National Economic Policy
SREP	Scaling Up Renewable Energy Program
TEM	Transient Electro Magnetic
UNEP	United Nations Environment Programme
UNU-GTP	United Nations University Geothermal Training Programme
WB	World Bank



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1. Introduction

The Icelandic International Development Agency (ICEIDA) and the Nordic Development Fund (NDF) are implementing a project to support geothermal exploration and capacity building in East Africa. ICEIDA is the Lead Agency in the Geothermal Exploration Project with joint co-financing of NDF. The project is the initial phase of the Geothermal Compact partnership, initiated jointly by Iceland and the World Bank.

The main objective of the Geothermal Exploration Project is to assist countries in East Africa to enhance geothermal knowledge and capacity in order to enable further actions on geothermal utilization in the respective countries. This includes support to the exploratory phase of geothermal development and capacity building in the field of geothermal research and utilization. Support for geothermal development is outlined as a priority area in the Strategy for Iceland's Development Cooperation.

Ethiopia is considered to have vast potential for geothermal energy development, estimated to be up to 5.000 MW. A geothermal power plant with a capacity of 7MW is already operational in Aluto Langano, and initial geothermal exploration has been carried out in sites considered to have geothermal potential. The Geological Survey of Ethiopia (GSE) has considerable capacity in geothermal research and exploration while the Ethiopia Electric Power Corporation (EEPCO) is responsible for the energy production and power plants. To further coordinate development of the geothermal resource the Government of Ethiopia plans to initiate a joint Geothermal Development Unit.

In 2012 the Government of Ethiopia, through the Ministry of Mines, expressed interest for cooperation with ICEIDA under the World Bank - Iceland compact on geothermal energy and the Geothermal Exploration Project. Subsequently, a request was submitted to ICEIDA by the Geological Survey of Ethiopia. Following these requests a process was initiated with the authorities in Ethiopia to define the scope and extent of the cooperation. This involved meetings, field visits, and collaboration in preparing this project document, including both GSE and EEPCO. The outcome of these discussions was that further efforts were required to continue with detailed surface explorations in priority areas for geothermal energy production, as well as strengthen capacity of relevant Ethiopian agencies covering geothermal development, from research to utilization and operations of geothermal power plants.

The overall objective of this project is to assist the Government of Ethiopia to increase their renewable energy access through low emissions geothermal energy development for the social and economic benefit of the country. The immediate objective of this project is to identify potential sites for exploration drilling in the target areas and develop capacity in Ethiopia to advance geothermal energy production in the country.

The focus of this project will thus both address the needs for Geological Survey of Ethiopia (GSE) and EEPCO to build capacity to handle further growth and development in geothermal energy production, as well as assist with finalizing geothermal surface explorations and associated geophysical and geochemical studies in order to identify locations for drilling of exploration and production wells in target sites.

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The collaboration between ICEIDA and Ethiopia further links together under the compact between Iceland and the World Bank. The World Bank is currently planning support through a Geothermal Sector Development Project (GSDP) in Ethiopia. Various aspects of the outputs under this project have direct and indirect linkages with other consequent geothermal activities Ethiopia is initiating under the GSDP and under other funding mechanisms, including the ARGeo/UNEP programme and the AUC-KfW GRMF programme.

The implementation of this Project Document is subject to the Partnership Agreement between The Government of Ethiopia and ICEIDA for the Geothermal Exploration Project.

1.1. The Energy Sector in Ethiopia

Access to energy is among the key elements for the economic and social developments of Ethiopia. The energy sector in Ethiopia can be generally categorized in to two major components: (i) traditional (biomass), and (ii) modern (such as electricity and petroleum). As more than 80% of the country's population is engaged in the small-scale agricultural sector and live in rural areas, traditional energy sources represent the principal sources of energy in Ethiopia.

Domestic energy requirements in rural and urban areas are mostly met from wood, animal dung and agricultural residues. At the national level, it is estimated that biomass fuels meet 88 % of total energy consumed in the country. In urban areas access to petroleum fuels and electricity has enabled a significant proportion of the population there to employ these for cooking and other domestic energy requirements.

The annual per-capita consumption of electricity stands at 100 kWh. The same figure for the Sub-Saharan Africa is 510 kWh. This reveals that most of the energy usage is still from traditional energy sources such as wood and animal waste. Moreover it also informs the fact that with the country's economic development and improvement of the per-capita income, there will be huge potential for consumption of electricity within the country.

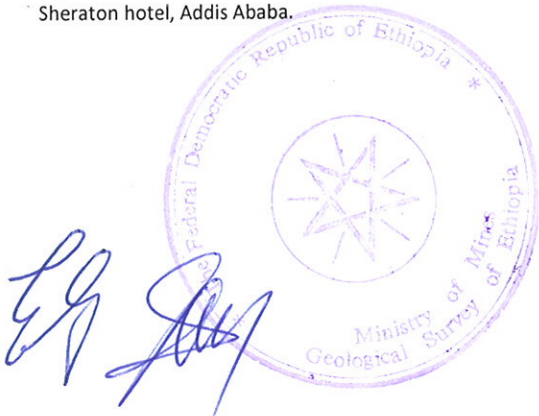
The total installed electrical capacity in Ethiopia commissioned by the end of 2011 is about 2041 MW and from this a total of about 5000 GWH were generated in 2011 (Lemma 2012)¹.

Although Ethiopia is endowed with a variety of energy resources, many of these resources have not yet been exploited. Currently about 95% of the electricity generation is from hydro and the remaining 4.4 % and 0.4% are from thermal and geothermal respectively (Table 1).

	Thermal	Hydro	Geothermal	Wind	Total
MW	89.2	1950	7.2	50	2096.4
%	4.2	93	0.4	2.4	100

Table 1: Current modes of generation and their contribution

¹ Lemma, M. 2012: Along the development of renewable power in Ethiopia, Workshop on the findings of surface explorations at Corbetti Geothermal Prospect, organized by Reykjavik Geothermal Company, Power point presentation, Sheraton hotel, Addis Ababa.



Development of alternative energies from renewable sources such as hydro, wind, geothermal and biomass will be a key part of Ethiopia's energy mix during the existing 5-year Growth and Transformation Plan period (GTP) and integrated with the country's new Climate Resilient Green Economy (CRGE) Strategy², which has the ambitious objective of a transforming Ethiopia into climate resilient green economy by 2025 (EPA 2011)³.

The medium and long term electrical generation development plan consists mainly of hydro projects. Generation from wind and geothermal power plants are foreseen to compliment the hydro. The GTP aims to increase the power generation capacity of the country from the present level of about 2041 MW to over 10,000 MW by the end of 2015. The CRGE foresees to develop up to about 25,000 MW of Ethiopia's generation potential by 2030. Of this hydro holds 22,000 MW, geothermal 1,000 MW and wind 2,000MW.

1.2. The Geothermal Sector

The geothermal potential within Ethiopia has long been recognized. Under a program that began in 1969, geo-scientific studies have been conducted in a number of Ethiopian areas within the ERS and over sixteen prospect have been identified to have geothermal resources suitable for electricity generation The Total Potential of the Country in Geothermal Power has been estimated to be 5,000MW.

Over the years, a number of prospects in the ERS have been subjected to surface investigation: geology, geochemistry and geophysics. From these prospects, six prospects have been studied further in-depth than others through surface exploration methods. The results show the probable existence of economically exploitable deep geothermal reservoirs with temperature in the range of 200 to 300° C. From the explored prospects, deep exploratory drilling has been conducted at Aluto and Tendaho fields.

Although the country has a long history of geothermal exploration, the only power plant so far installed is at Aluto Langano geothermal field. A 7.2 MWe capacity geothermal pilot plant was installed in 1998 at Aluto Langano. The main reasons for the slow progress of geothermal development in the country are seen to be; (i) Limitations in local capacity in terms of human resources and instrumentation for geothermal development which requires advanced technology and; (ii) A focus in previous policies which brought about a strategy of emphasis on a single energy resource (hydro).

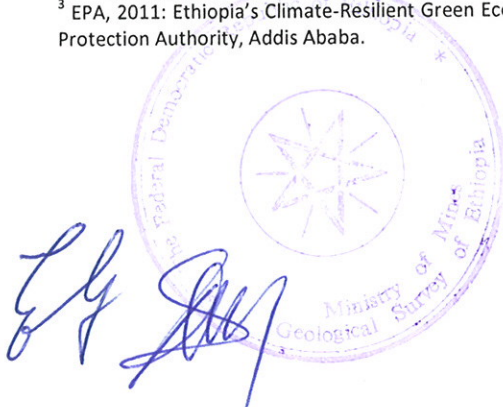
1.2.1. Private Sector Participation in Geothermal

The sector policy and regulatory framework supports private sector development. Subsequent to the National Economic Policy (NEP) of 1991 that encouraged private sector participation in the economic development of the country, a number of proclamations and reforms have been made, aimed at enabling private participation within the electricity sector.

An independent power producer (IPP) may engage in power development for selling the generated electricity to the public utility, known as the single buyer model. The single buyer model does not

² See: http://www.uncsd2012.org/content/documents/287CRGE%20Ethiopia%20Green%20Economy_Brochure.pdf

³ EPA, 2011: Ethiopia's Climate-Resilient Green Economy Strategy, Federal Democratic Republic of Ethiopia, Environmental Protection Authority, Addis Ababa.



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exclude captive geothermal power generation, i.e. generation for own use in primary economic production or service industries owned by the developer. EPC turn-key contracts could be negotiated and signed between a private companies and the public utility, in which the private sector would have the role of not just as a project developer but also as a critical stakeholder that can bring financing to the table under the right circumstances.

To IPP's, the Government of Ethiopia is at present in the process of finalizing a Feed-in-Tariff proclamation, which is expected to pass into law shortly, aimed at facilitating the large scale deployment of geothermal and other renewable technologies, providing investment security and market stability for private investors in electricity generation from these resources (MoW&E 2011)⁴. Incentives such as, corporate income tax holidays, waiver of import duties, grant of tax holidays on dividend and interest incomes are on the table for negotiations. In addition to encouraging investment, such measures should contribute to lowering the cost of electricity supply, and allow affordable tariffs.


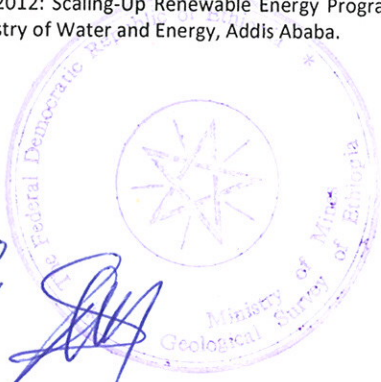
Initiated by the existing conducive environments for private sector participation, currently concessions are issued for private companies in few geothermal prospect areas in the country. The Icelandic company Reykjavik Geothermal had concessions in 3 prospects and are currently negotiating with the government on how to go about for development. One of the challenges for the private sector participations are the risks associated in geothermal development, in particular at the earlier phases of geothermal exploration, which increases the tariffs for ultimate power sale. In order to avert these challenges the government wishes to take over the early exploration activities until the existence of the resource has been proven. To this end, the project outlined here, and initiated under the Ethiopia - Iceland-World Bank partnership will have its own contribution.



1.3. Other donors in the sector

1.3.1. The World Bank

To support Ethiopia in its geothermal exploration and development program the World Bank has established partnership with Iceland and is further initiating a Geothermal Sector Development Program for Ethiopia. Under the WB/Iceland partnership the ICEIDA/NDF Geothermal Exploration Project will fund surface explorations in selected geothermal prospects of Ethiopia in collaboration with the local implementing institutions (Geological Survey of Ethiopia (GSE) and Ethiopian Electric Power Corporation (EPCO) and conduct capacity building activities, including consultancy in predrilling preparations. The aim of the surface exploration is to bring the selected areas to a position where they have viable drilling programs installed to test and evaluate the resource. The exploration part will be financed through ICEIDA/NDF and in parallel the World Bank working through its energy sector management assistance program will collaborate with other partners and funding agencies to finance test drilling activities that can share the costs and risks of specific drilling programs in selected areas. After the test drilling program at Tendaho (Allalobeda) proves positive the World Bank plans to finance the initial power plant of 25MW to be installed as part of its Geothermal Sector Development Programme for Ethiopia (GSDP).

⁴ MoW&E, 2012: Scaling-Up Renewable Energy Program, Investment Plan for Ethiopia, submitted to Climate Investment Funds, Ministry of Water and Energy, Addis Ababa.

In addition the World Bank under its energy sector development programme will finance the cost of production drillings in Aluto and subsequent installment of two 35 MW units together with other co-financers including the Japanese government soft loan.

The World Bank has also assigned a budget for the procurement of a drilling rig and its accessories for the upcoming drilling works as part of energy sector development programme. The program outlined in this document will provide technical assistance to prepare technical specifications for the drill rig and accessories.

1.3.2. SREP

The Scaling up Renewable Energy Program (SREP) of the World Bank and other multilateral development banks has already granted 26 million USD for Aluto Langano production drillings. This funding will be utilized under the GSDP.

1.3.3. ARGeo/UNEP

The UNEP ARGeo programme has allocated a 500,000 US\$ grant for surface exploration at Tendaho (Doubti-Ayrobera) in order to locate promising sites for deep exploration drilling. This support also includes a component for purchase of equipment. Potential gaps in this project to complete the proposed exploration work may be considered by ICEIDA, in order to close the gaps by way of providing access to expert advice and capacity building.

1.3.4. KFW-AUC and AFD

After the completion of surface exploration at Tendaho (Doubti-Ayrobera) by ARGeo an application is in process with KFW- AUC to support partial expenses of exploratory drillings as part of Geothermal Risk Mitigation Fund for East Africa (GRMF). Agence Française de Développement (AFD) will finance the remaining costs of exploratory drillings, production drillings and initial power plant installation in collaboration with other co-financers.

1.3.5. JICA

GSE and MOFED have recently signed an agreement with JICA for a 18 months project for a Geothermal Master Plan study in which the total potential of geothermal resources in all the 18 areas in Ethiopia will be re-assessed and recalculated.

2. Background and Rationale

As outlined above the development of alternative energies from renewable sources will be a key part of Ethiopia's energy mix during the existing 5-year Growth and Transformation Plan period (GTP). In order to avert possible shortfalls and also due to their added advantage in complementing the hydro generation during fluctuations in rainfall and unfavorable periods of severe droughts, geothermal development in Ethiopia has been given increasing attention in recent years. Increased utilization of geothermal energy has the potential to improve energy security as well as enhance climate resilience and development of a green economy in Ethiopia. Accordingly, significant geothermal development goals have been set by the government in the medium term as stated above.



In recent years the Ethiopian government has changed its policy of relying on a single energy source and is implementing a strategy to develop all its renewable energy resources including geothermal side by side with hydro, in order to bring energy security in the country and ensure sustainable supply of power. To this end, geothermal, the only base load renewable energy resource in the country has been given significant attention.

A total of 470 to 675 MW geothermal power is planned to be developed from six selected prospects by 2020 (Table 2).

Prospect	Initial output (MW)	Commissioning
Aluto Langano	75	2016
Tendaho	100	2018
Corbetti	75-300	2018
Abaya	100	2020
Tulu Moye/Gedemsa	60	2018
Dofan Fantale	60	2018
Total	470-675	

Table 2: Medium term geothermal development plan





To achieve these goals, the Ethiopian government has been looking for development partners. The partnership between Iceland and Ethiopia will be an important component in the establishment of partnerships to advance the country's geothermal program. Ethiopia and Iceland have a long history of cooperation in geothermal. As a result more than 30 geothermal professionals from Ethiopia have been trained in Iceland at the UNU-GTP during the last 20 years. The implementation of this project will further strengthen the geothermal relationship between the countries involved and may open up opportunities for investors to participate more in geothermal development in the country.

The collaboration between ICEIDA and Ethiopia further links together under a compact with the World Bank, which is also supporting a Geothermal Sector Development Project (GSDP) in Ethiopia. Various aspects of the outputs under this project have direct and indirect linkages in with other consequent activities Ethiopia is initiating under the GSDP and other funding mechanisms, including exploration drilling.

2.1. Process for project preparations

The Geothermal Exploration Project is demand-driven and activities funded by the project are based on specific needs and requests from governments in the countries of the region. In October 2012 The Government of Ethiopia expressed an interest in participating in the project with subsequent initial mission to Ethiopia where the initial scope and potential for cooperation was discussed. This was followed up at a meeting in Nairobi in November 2012, with the Ethiopian Minister of Mines, H.E. Sinknesh Ejigu and the Geological Survey of Ethiopia, where it was determined that an ICEIDA mission would visit Ethiopia for further planning.

ICEIDA mission then visited Ethiopia from April 15 – April 22 2013, to continue discussions on the scope of cooperation in the field of geothermal development with Ethiopian authorities. Meetings were held in Addis Ababa with the Geological Survey of Ethiopia (GSE), Ethiopian Electric Power Corporation (EEPCO), Aluto Langano Project Office, Ministry of Mines, Ministry of Water and Energy

and the World Bank. Field visits were made to geothermal sites in Aluto Langano and Tendaho Alalobeda, accompanied by experts and project managers from GSE and EEPKO. Technical discussions were further carried out on the details of exploration studies, existing and required data as well as requirements for capacity building.

These discussions resulted in the outline for project components as outlined in this project document. Wrap up meeting was held on Monday 22 April, with GSE and EEPKO, where the proposed components were discussed and revised. This document has been jointly prepared by ICEIDA, Ethiopian authorities and technical consultants from Iceland Geosurvey (ISOR).

2.2. Challenges to be addressed

This project aims to contribute to the efforts of the Government of Ethiopia to further the development of geothermal energy in the country, by addressing two main challenges which are considered of key importance to move forward:

1. Lack of detailed surface exploration studies in key geothermal sites, and identification of potential exploration drill sites within those areas.
2. Need for increased capacity and human resources in Ethiopia to take on the growing work in scientific and managerial aspects of geothermal development

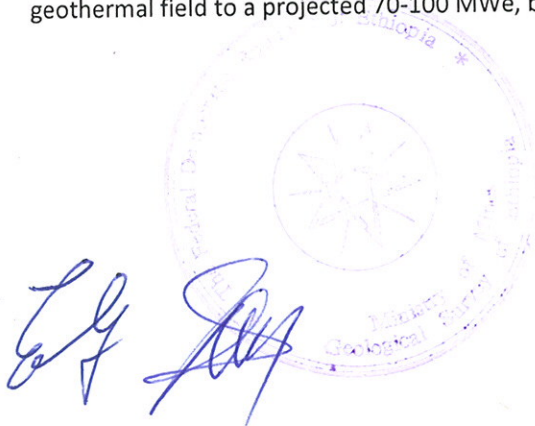
Due to the uncertainty associated with geothermal energy development, in particular in the early stages, public resources are required for resource identification, including research on geochemistry, geophysics through surface exploration studies and subsequent test drilling. In light of the vast potential for the development of geothermal energy in the country, investment in local capacity building and knowledge transfer to advance geothermal development is further considered of great importance.

The focus of this project will thus both address the needs for GSE and EEPKO to build capacity to handle further growth and development in geothermal energy production, as well as assist with finalizing geothermal surface explorations and associated geophysical and geochemical studies in order to identify locations for drilling of exploration and production wells in target sites.

2.3. Target areas for surface explorations

2.3.1. Aluto Langano

Aluto Volcano is located in the NNE-SSW trending Main Ethiopian Rift between Lake Langano and Lake Ziway and covers an area of approximately 100 km². Aluto Volcano is an active, peralkaline rhyolitic complex of Quaternary age, which is characterized by numerous rhyolitic domes forming a 6x9 km large caldera ring structure. The surface exploration of the geothermal system at Aluto Volcano commenced in 1969 and by 1985 had eight wells been completed. A combined steam and binary pilot plant with a capacity of 8.5 MWe was installed and commenced power generation in 1998, but due to problems with plant, gathering system and production wells (scaling) production was stopped in the years 2002-2007. Currently are underway preparations to drill 4 appraisal wells (3 production wells, 1 reinjection well) as part of the plan to raise a 35 MWe power plant, but drilling is expected to be completed in 2014. The long term plan is further development of the Aluto geothermal field to a projected 70-100 MWe, but in order to reach this goal it is assessed that further



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surface exploration is required in order to expand or identify new areas within the Aluto Volcano with sufficiently high temperatures for geothermal power production.

Feasibility study to expand the field to 75 MW by drilling of appraisal and production wells has been conducted in 2010 with the assistance of the Japanese government. The study indicated that the expansion plan is feasible. Accordingly, preparations to drill four appraisal wells are on progress with the assistance of the Japanese government and soft loan from the World Bank. After this phase is completed the next phase of development would be the drilling of production wells and the installation of a power plant for the first unit of 35MW.

In order to expand the field to additional 35 MW, additional surface exploration for well siting and well designing, additional production drillings and installation of additional 35MW unit shall be conducted. To carry out these tasks, Ethiopia, ICEIDA and the World Bank have established a partnership, in which the role of the project outlined in this document will be to assist in carrying out the surface exploration, well siting and technical assistances for specifying the purchase of an electric drill rig and drilling consumables.

2.3.2. Tendaho Alalobeda

Tendaho is a 50 km wide NNW trending graben of Quaternary age located about 600 km N of Addis Ababa. The Tendaho graben hosts the Afar Triple Junction where the Gulf of Aden, Red Sea and the main Ethiopian Rift come together. Three geothermal fields are identified near the town Tendaho in the Tendaho graben. These are Dubti (sometimes referred to as Tendaho proper), Ayrobera and Alalobeda (sometimes referred to as Alalobad). These three fields are collectively referred to as the Tendaho fields although they are separated by about 20 km from each other. The locations of the Tendaho fields are shown on figure 8. The Tendaho geothermal fields are located where NNE trending faults of the Ethiopian rift system intersect the dominant NNW trend of the Tendaho graben. At Tendaho, a project proposal has been prepared by Ethiopia to develop the geothermal resource to 100 MW, divided in different phases.

As noted above the Tendaho geothermal field consists of three main areas; (1) Doubti, (2) Ayrobera and (3) Alalobeda. In order to develop these fields in parallel, (i); The Government of Ethiopia has got technical assistance from ARGeo Project for well siting in Tendaho (Doubti-Ayrobera) and after well siting exploration and appraisal wells will be drilled from AFD soft loans and Risk Mitigation Funds from AUC-KfW GRMF. Subsequent development of the field would be conducted with AFD and others financing.

In Tendaho - Alalobeda the surface exploration, well siting and drilling and initial power development will be conducted under the framework of Ethiopia, Iceland and World Bank partnership in which the support from ICEIDA/NDF will have the role of surface exploration and well siting for exploration drilling.

2.3.3. Gedemsa

Gedemsa is considered to be one of the most promising geothermal prospects in Ethiopia and it is selected for inclusion in this project on the bases of previous explorations and prefeasibility studies. Gedemsa is a peralkaline rhyolitic volcanic complex, which is located in the northern sector of the Main Ethiopian Rift 25 km SW of Nazareth and about 100 km SE of Addis Ababa (Ayele et al., 2002).



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Gedemsa volcano is characterized by an 8 km in diameter large caldera, while NNE-SSW trending faults of the MER also are prominent in the area. Gedemsa volcanic complex has an estimated age of 0.5-0.8 Ma, but most recent volcanic activity occurred within 0.2-0.1 Ma. Hydrothermal manifestations are scarce and are limited to localized areas with weakly steaming ground inside the caldera and warm alkali-bicarbonate springs far outside the caldera. Gedemsa geothermal area was studied in 1985-1987 as part of a large reconnaissance study conducted in collaboration between Ethiopia and Italy, which included geological, geochemical (fluid and soil surveys) and geophysical surveys (electrical resistivity profiling, VES, gravity and magnetic surveys). Two shallow wells were drilled in the Gedemsa caldera, however, they encountered cold aquifers. Since then geothermal development in Ethiopia concentrated on Aluto Langano and Tendaho geothermal areas.

With the renewed interest in developing geothermal energy in Ethiopia, Gedemsa has now been given high priority for further exploration. In this prospect the ICEIDA/NDF Geothermal Exploration Project will assist to complete the remaining surface explorations for well siting and in so doing train, local experts required for the future geothermal development endeavors of the country. Completion of surface explorations in this field, would pave the way for implementation of subsequent activities required to develop the field and realize the geothermal potential of the area.

2.4. Beneficiaries

In the short term the implementing agencies, EEPKO and GSE will benefit from the project through increased capacity to develop and utilize the geothermal resource. In the long run it is expected that the population of Ethiopia will benefit from activities implemented within the project, through increased availability of clean renewable energy in the country.

3. Project description

3.1. Strategy

- The ICEIDA/NDF Geothermal Exploration Project will, through material, technical and financial support contribute to the efforts of the Government of Ethiopia to develop geothermal energy in accordance with the plans and priorities of the Government of Ethiopia.
- The project will be closely aligned with other initiatives and donor support undertaken for the development of geothermal energy in Ethiopia, including The World Bank Geothermal Sector Development Project (GSDP) and projects initiated under the ARGeo programme. This will ensure relevance of the project interventions and provide linkages of project activities to further stages of geothermal energy development for instance under the World Bank GSDP.
- For the purpose of conducting exploration studies the project will ensure that highly qualified geothermal consultants will be available to assist Ethiopian authorities to carry out surface exploration field surveys, research and modeling to identify potential sites for exploration drilling. It is expected that in all cases where explorations are conducted with input from external experts, knowledge and technology transfer will take place with the implementing agencies to ensure that capacity is strengthened as a part of the process.
- To further build capacity in Ethiopia in surface exploration the project will implement a practical course carried out in relation to the Gedemsa area. The training will be carried out by the UNU-



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GTP, and will cover all aspects of surface exploration with local staff under the supervision of experienced experts who will validate the results.

- To support the proposed exploration drilling at Aluto Langano the project will provide consultancy for drill rig specifications and preparation of a list of consumables for the drilling.
- To further strengthen the capacity of GSE and EEPCO to develop and manage the development of geothermal resources for energy production, relevant areas for capacity building training and technical assistance will be implemented.
- As stated in the Project Document for the Geothermal Exploration Project, the United Nations University – Geothermal Training Programme (UNU-GTP) is a key partner in the project relating to geothermal training and capacity building.
- Support for equipment and logistics to carry out geothermal exploration will be implemented as a part of the project. Purchase of equipment could be carried out as part of other capacity building activities but may also entail more specific requirements which need to be defined through needs assessments.
- Additional technical assistance may be provided in relation to this project, to address imminent needs and gap-filling related to project activities and geothermal development in the target areas.
- For outputs and activities, as applicable, defined under this project document, a detailed Terms of Reference will be prepared and agreed upon by ICEIDA and the implementing agencies prior to implementation.

3.2. Objectives

The **overall objective** of this project is to assist the Government of Ethiopia to increase their renewable energy access through low emissions geothermal energy development for the social and economic benefit of the country.

The **immediate objective** of this project is to identify potential sites for exploration drilling in the target areas and develop capacity in Ethiopia to advance geothermal energy production in the country.

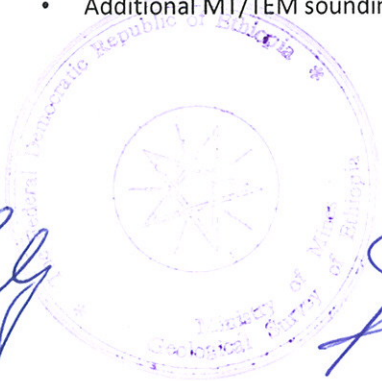




At the end of the project it is expected that Ethiopia will have defined drill sites in 3 potential geothermal areas, which could potentially yield 100-150 MW of energy, as well as enhanced capacity in exploration, drilling, and geothermal project management to advance projects to further stages of development as laid out in future energy development plans of the country. Environmental and Social Impact Assessments will be in place for areas where potential exploration drill sites have been identified.

3.3. Expected results (Outputs)

1. Up to 10-12 new wells sited and designed for additional energy production of 35MW in Aluto Langano.

1.1. Geothermal surface exploration conducted in Aluto Langano. Expert consultants hired to supervise and guide up to 10 GSE scientists in the field data collection and to lead data interpretation and modeling. The exploration will include the following:

- Additional MT/TEM soundings covering the caldera (ca. 75)

- Microseismic study
- Soil gas study
- Revised conceptual model integrating new and existing data, volumetric assessment of resource and proposal of new drilling targets in Aluto II for the next phase of additional 35 MW
- Elaboration of well design and drilling program
- Transfer of knowledge and techniques for geothermal surveys and modeling to the implementing agencies.

1.2. Review of exploration report by an external panel of reviewers.

2. Four exploration wells sited and designed in Tendaho Alalobeda.

2.1. Geothermal surface exploration conducted in Alalobeda by external geothermal consultants, including the following:

- Additional MT/TEM survey (100)
- Additional soil gas study (*to be conducted by GSE*)
- Magnetics and gravity study
- Microseismic study
- Geological and geochemical (incl. isotopic) studies
- Structural analysis of the Tendaho Graben (Ayrobera, Doubti and Alalobeda) using high resolution remote sensing data
- Develop conceptual model integrating new and existing data, volumetric assessment of resource and propose drilling targets
- Transfer of knowledge and techniques for geothermal surveys and modeling for the implementing agencies.

2.2. Supervision/monitoring of the exploration with strong emphasis on capacity building for GSE.

2.3. Review of exploration report by an external panel of reviewers.

2.4. Environmental and social impact assessment for the proposed exploration drilling

3. Exploration wells sited and designed in Gedemsa through training activities where at least 10 GSE scientists will enhance their capacity to carry out exploration field surveys, develop conceptual models and site wells.

3.1. Training course for at least 10 local scientists in surface exploration carried out with UNU-GTP for geothermal exploration in the Gedemsa area, including the following

- On-site training based on human resource needs assessment, including:
 - MT/TEM survey
 - Microseismic survey
 - Magnetics and gravity study
 - Soil gas study
 - Geological, structural and geochemical studies
 - Conceptual model development



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- Well siting and design
- Evaluation of all participants in the training course

3.2. Review of exploration report by an external panel of reviewers.

3.3. Environmental and social impact assessment for the proposed exploration drilling

4. Implementing agencies in Ethiopia have the required equipment to conduct field surveys and geothermal modeling.

4.1. Needs assessment for equipment conducted prior to planned exploration studies and training courses.

4.2. Procurement, tender and purchase of equipment

5. Drill rig specifications for the purchase of a new drill rig/s defined and training strategy developed for geothermal drilling

5.1. Drill rig specifications and required technical input for bid documents prepared, including:

- Define the specification of a rig (using both electricity and diesel generators options); capable of drilling directional wells to about 3500m.
- Define specifications of required accessories
- Preparation of technical input for international bid document according to World Bank regulation for the purchase of the rig, including definition of required user training

5.2. Assessment of training needs for Geothermal drilling in General, including drilling engineers, drillers and borehole geologists.

6. Enhanced capacity for at least 30 staff of implementing agencies to monitor and administer relevant scientific and practical aspects related to geothermal drilling

6.1. On-site drill training in accordance with needs assessment carried out in conjunction with on-going drilling in Ethiopia

6.2. Staff of implementing agencies attends relevant courses for drill training, in accordance with drill training needs assessment.

7. List of consumables and estimated cost for about 20 wells in Aluto Langanu established

7.1. Preparation of a list of consumables for next drilling phase (20 wells)

8. Enhanced capacity in power plant operation, maintaining geothermal power plants and reservoir monitoring, for plant engineers, reservoir engineers and geochemists.

8.1. Training course carried out following a needs assessment for at least 12 participants, involving:

- Plant operation
- General maintenance
- Scaling and corrosion
- Pressure and temperature
- Well head pressure, discharge and enthalpy



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- Reservoir chemistry

8.2. Three (3) staff members from implementing agencies attend the 6 months UNU-GTP with a focus on the relevant areas of expertise (Operation and maintenance, reservoir monitoring, reservoir chemistry.)

9. Enhanced local capacity in preparation of bankable geothermal project documents for external finance institutions (donors and lenders).

9.1. A two weeks training program to be designed at UNU-GTP in Iceland, with input from leading experts, targeting at least 14 top and middle managers, project coordinators and senior technical staff. The course will address the following:

- Planning geothermal projects (from surface exploration to power plant),
- Cost estimation
- Situation analysis,
- Technical and economic feasibility including financial modeling
- Environmental issues

3.3. Cross cutting issues – Gender and Environment

An Environmental and Social Impact Assessment will be carried out in cases where potential sites have been identified for exploration drilling. This will ensure that environmental and social aspects are addressed as required in relation to exploration drilling. As part of the social impact analysis of these studies, gender aspects will be addressed.

Gender ratio of trainees will be observed and participation of both genders encouraged, applications from female trainees for the UNU-GTP 6 months program will be encouraged.

4. Implementation and Management

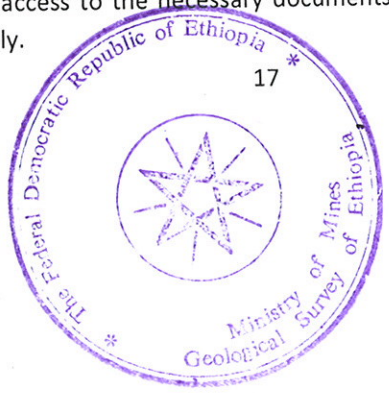
GSE and EEPCO are the implementing agencies. A joint project unit comprised of staff from EEPCO and GSE has been implementing the geothermal project at Aluto Langano and the Government of Ethiopia has plans to establish a Geothermal Development Unit which would in the long run be responsible to cover the various aspects of geothermal development. When these plans come into implementation the project will take into account the changes in the institutional set-up for geothermal development as applicable.

Detailed Terms of Reference will be prepared for outputs and activities outlined in this project document, which will define the objective, scope and timeframe for the activities to be undertaken in relation to the respective outputs. Such documents shall be agreed to in writing by both parties prior to implementation of respective activities.

The Government of Ethiopia and implementing agencies will make the required logistical arrangements and make available the required permits for contractors to carry out the work according to plans.

GSE and EEPCO will ensure that:

- Contractors have access to the necessary documents and data in order to conduct project activities effectively.



- It has qualified staff available to undertake the training and field survey activities.
- Transportation and required logistics are provided and managed effectively in relation to project activities as required.

GSE and EEPKO will undertake procurement of equipment, as applicable, in line with International Competitive Bidding (ICB) procedures. Tender documents shall be reviewed and no objection given by ICEIDA before bids are called for. Agreements for provision of equipment shall similarly be reviewed and no objection given by ICEIDA prior to signing. ICEIDA will undertake procurement of other services in accordance with the Partnership agreement.

ICEIDA is responsible for funding project activities and will disburse all funds directly to suppliers of goods and services in accordance with the respective agreements.

The responsibilities of the parties are further stipulated in the Partnership Agreement.

4.1. Points of Contact for the Project Management:

For GSE

Mr. Solomon Kebede
Director, Geothermal Resources Development
Tel: +251-911-935028
Email: solo450354@yahoo.com

For EEPKO

Mr. Mulugeta Asaye Adale
Geothermal Projects Manager
Tel: +251-115512564
Email: eppcogeothermal@yahoo.com

For ICEIDA

Dr. David Bjarnason
Programme Manager
Tel: +354 5457974
Email: david@iceida.is

4.2. Reporting, meetings and coordination

GSE, EEPKO and ICEIDA shall establish regular communication through the points of contact regarding the progress and implementation of project activities. Bi-annual progress meetings shall be held to discuss the progress of implementation. This may also involve ICEIDA/NDF visit to the project sites.

ICEIDA shall be provided with bi-annual progress reports from the implementing agencies for the activities undertaken in this project. In addition, ICEIDA shall receive such other information from the implementing agencies regarding the implementation and administration of the Project as ICEIDA shall reasonably request.

GSE, EEPKO and ICEIDA will collectively work together to coordinate the activities of this project with those of other donors and stakeholders working in geothermal development. This includes the World Bank, the ARGeo/UNEP programme as well as the AUC-KfW GRMF programme. Such coordination

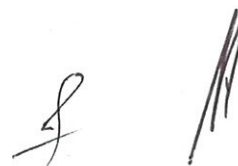


shall ensure that activities are complementary and not overlapping and enhance synergies between the activities of the different programs.

The implementing agencies shall produce and submit to ICEIDA a completion report within 6 months of the completion of the Project.

5. Risk and Assumptions

- There is considerable uncertainty and risk associated with geothermal exploration, thus the results from surface exploration may be such that further exploration and drilling is not deemed feasible in the particular target areas.
- There is considerable uncertainty regarding the progress and implementation of geothermal exploration and drilling. This needs to be taken into account with the timeline and implementation of planned training activities.
- It is assumed that qualified staff are employed at the implementing agencies to undertake the training, and that mechanisms are in place at the respective agencies to retain qualified and trained staff.
- Candidates for the UNU-GTP fellowships in Iceland need to fulfill similar conditions as other candidates for training at UNU-GTP in Iceland.



6. Indicative Budget

The project will be carried out in accordance with the estimated budget (USD) provided below:

Expected Results (Outputs)	2013	2014	2015	Total
1. Up to 10-12 new wells sited and designed for additional energy production of 35MW in Aluto Langano.				
1.1. Geothermal surface exploration conducted in Aluto Langano.		296.000		296.000
1.2. Review of exploration report by external reviewers.		7.400		7.400
2. Four exploration wells sited and designed in Tendaho Alalobeda.				
2.1. Geothermal surface exploration conducted.	494.000	494.000		988.000
2.2. Supervision/monitoring of the exploration	20.000	20.000		40.000
2.3. Review of exploration report by external reviewers.		7.400		7.400
2.4. Environmental and social impact assessment		102.000		102.000
3. Exploration wells sited and designed in Gedemsa through training activities where GSE scientists will enhance their capacity.				
3.1. Training course for surface exploration carried out by the UNU-GTP for exploration in the Gedemsa area.		410.000		410.000
3.2. Review of exploration report by external reviewers.			7.400	7.400
3.3. Environmental and social impact assessment			102.000	102.000
4. Implementing agencies in Ethiopia have the required equipment to conduct field surveys and geothermal modeling.				
4.1. Needs assessment for equipment conducted				
4.2. Procurement, tender and purchase of equipment	631.000			631.000
5. Drill rig specifications defined and training strategy developed for geothermal drilling				
5.1. Drill rig specifications and required technical input for bid documents.	50.000			50.000
5.2. Assessment of training needs for Geothermal drilling in general, including drilling engineers, drillers and borehole geologists.	11.000			11.000
6. Enhanced capacity for implementing agencies to monitor and administer relevant scientific and practical aspects of geothermal drilling				
6.1. On-site training in geothermal drilling in accordance with needs assessment carried out in conjunction with on-going drilling in Ethiopia		100.000	100.000	200.000
6.2. Staff of implementing agencies attends relevant courses for drill training, in accordance with drill training needs assessment.		60.000	60.000	120.000
7. List of consumables and estimated cost for about 20 wells in Aluto Langano established				
7.1. Preparation/review of a list of consumables for next drilling phase (20 wells)		26.000		26.000
8. Enhanced capacity in power plant operation, maintaining geothermal power plants and reservoir monitoring.				
8.1. 2 weeks training course carried out following a needs assessment.		70.000		70.000
8.2. 3 staff members from implementing agencies attend the 6 months UNU-GTP with a focus on the relevant areas of expertise.		40.000	80.000	120.000
9. Enhanced local capacity in preparation of bankable geothermal project documents for external finance institutions (donors and lenders).				
9.1. A two weeks training program to be designed at UNU-GTP in Iceland, with input from leading experts.	70.000			70.000
Evaluation of capacity building and final project evaluation	10.000	20.000	30.000	60.000
Total (USD)	1.286.000	1.652.800	379.400	3.318.200



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7. Timeframe and workplan

The timeframe of the activities outlined in this project document is expected to be 2 years, from July 2013 – July 2015. The progress of project implementation is planned as outlined in the table below.

Expected Results (Outputs)	2013		2014				2015	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1. Up to 10-12 new wells sited and designed for additional energy production of 35MW in Aluto Langano.								
1.1. Geothermal surface exploration conducted in Aluto Langano								
1.2. Review of exploration report by an external panel								
2. Four exploration wells sited and designed in Tendaho Alalobeda.								
2.1. Geothermal surface exploration conducted in Alalobeda								
2.2. Supervision/monitoring of the exploration								
2.3. Review of exploration report by an external panel								
2.4. Environmental and social impact assessment								
3. Exploration wells sited and designed in Gedemsa through training activities where GSE scientists will enhance their capacity to carry out exploration field surveys, develop conceptual models and site wells.								
3.1. Training course for surface exploration carried out by the UNU-GTP for exploration in the Gedemsa area								
3.2. Review of exploration report by an external panel								
3.3. Environmental and social impact assesement								
4. Implementing agencies in Ethiopia have the required equipment to conduct field surveys and geothermal modeling.								
4.1. Needs assessment for equipment conducted in relation to planned exploration studies and training courses.								
4.2. Procurement, tender and purchase of equipment								
5. Drill rig specifications defined and training strategy developed for geothermal drilling								
5.1. Drill rig specifications and required technical input for bid documents prepared.								
5.2. Assessment of training needs for Geothermal drilling								
6. Enhanced capacity for implementing agencies to monitor and administer relevant scientific and practical aspects related to geothermal drilling								
6.1. On-site training in geothermal drilling in accordance with needs assessment carried out in conjunction with on-going drilling in Ethiopia								
6.2. Staff of implementing agencies attends relevant courses								
7. List of consumables and estimated cost for about 20 wells in Aluto Langano established								
7.1. Preparation/review of a list of consumables for next drilling phase (20 wells)								
8. Enhanced capacity in power plant operation, maintaining geothermal power plants and reservoir monitoring, for plant engineers, reservoir engineers and geochemists								
8.1. Training course carried out following a needs assessment.								
8.2. 3 staff members from implementing agencies attend the 6 months UNU-GTP with a focus on the relevant areas of expertise.								
9. Enhanced local capacity in preparation of bankable geothermal project documents for external finance institutions (donors and lenders).								
9.1. A two weeks training program to be designed at UNU-GTP in Iceland, with input from leading experts, targeting top and middle managers, project coordinators and senior technical staff.								

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Any delays in project implementation foreseen or experienced by the implementing agencies should be communicated to ICEIDA as soon as possible.

8. Monitoring and Evaluation

Monitoring of project activities will be carried out through bi-annual progress reports from the implementing agencies, progress and final reports from contractors as will be defined in the respective ToRs, and with site visits from ICEIDA.

In training programs which will be carried out by the UNU-GTP all participants will be independently evaluated and all such evaluations will be assessed by the ICEIDA monitoring and evaluation unit in relation to a framework for evaluations of capacity building activities.

Monitoring and quality assurance related to geothermal exploration studies and modeling, will be managed by Iceland GeoSurvey. As a part of this monitoring, capacity building will be carried out in Ethiopia related to the supervision and monitoring of surface exploration activities.

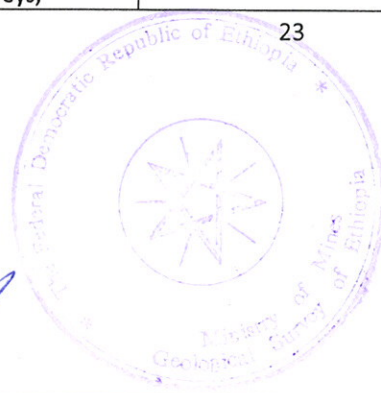
All geothermal exploration reports will be reviewed by external experts.

An external evaluation of the geothermal support to Ethiopia will be carried out, supervised by ICEIDA Head of Monitoring and Evaluation, 6 months after the completion of the project.



Annex 1 – Logical Framework Matrix

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Assumptions/Risks
Overall Objective (Impact)			
Assist the Government of Ethiopia to increase access to renewable energy through low emissions geothermal energy development.	<ul style="list-style-type: none"> MWs of geothermal energy produced in Ethiopia (10-15 years). 	<ul style="list-style-type: none"> Installed capacity of geothermal power plants. 	
Immediate Objective (Outcome)			
Potential sites for exploration drilling have been identified in the target areas and capacity developed in Ethiopia to advance geothermal energy production in the country.	<ul style="list-style-type: none"> # of sites identified for exploration drilling and expected MW production Increased capacity of GSE and EEPKO staff to undertake relevant aspects of geothermal development, from exploration to utilization. 	<ul style="list-style-type: none"> Exploration reports External reviews Training reports and assessment of performance 	<ul style="list-style-type: none"> Uncertainty associated with geothermal resources Qualified staff available for training Drilling operations according to plans
Expected Results (Outputs)			
1. Up to 10-12 new wells sited and designed for additional energy production of 35MW in Aluto Langanu.	<ul style="list-style-type: none"> 10-12 sites for geothermal drilling identified 		
1.1. Geothermal surface exploration conducted in Aluto Langanu. Expert consultants hired to supervise and guide up to 10 GSE scientists in the field data collection and to lead data interpretation and modeling.	<ul style="list-style-type: none"> Identification of sites 	<ul style="list-style-type: none"> Exploration reports 	<ul style="list-style-type: none"> Geothermal potential existing
1.2. Review of exploration report by an external panel of reviewers.	<ul style="list-style-type: none"> Results of review 	<ul style="list-style-type: none"> Review report 	
2. Four exploration wells sited and designed in Tendaho Alalobeda.	<ul style="list-style-type: none"> 4 exploration wells sites and designed 		
2.1. Geothermal surface exploration conducted in Alalobeda by external geothermal consultants.	<ul style="list-style-type: none"> Identification of sites for geothermal drilling 	<ul style="list-style-type: none"> Exploration reports 	<ul style="list-style-type: none"> Geothermal potential existing
2.2. Supervision/monitoring of the exploration with strong emphasis on capacity building for GSE.	<ul style="list-style-type: none"> Quality of analysis Capacity of GSE to supervise 	<ul style="list-style-type: none"> Report Assessment of GSE staff 	
2.3. Review of exploration report by an external panel of reviewers.	<ul style="list-style-type: none"> Results of review 	<ul style="list-style-type: none"> Review report 	
2.4. Environmental and social impact assessment for the proposed exploration drilling	<ul style="list-style-type: none"> Environmental and social impact assessed 	<ul style="list-style-type: none"> EIA report 	<ul style="list-style-type: none"> Sites have been identified for drilling
3. Exploration wells sited and designed in Gedemsa through training activities where at least 10 GSE scientists will enhance their capacity to carry out exploration field surveys,	<ul style="list-style-type: none"> # exploration wells sited and designed 		



develop conceptual models and site wells.			
3.1. Training course for at least 10 local scientists in surface exploration carried out with UNU-GTP for geothermal exploration in the Gedemsa area.	<ul style="list-style-type: none"> Capacity of staff to carry out field survey and modeling 	<ul style="list-style-type: none"> Training and capacity assessment report 	
3.2. Review of exploration report by an external panel of reviewers.	<ul style="list-style-type: none"> Results of review 	<ul style="list-style-type: none"> Review report 	
3.3. Environmental and social impact assessment for the proposed exploration drilling	<ul style="list-style-type: none"> Environmental and social impact assessed 	<ul style="list-style-type: none"> EIA report 	
4. Implementing agencies in Ethiopia have the required equipment to conduct field surveys and geothermal modeling.	<ul style="list-style-type: none"> Equipment in place and staff capable of operating equipment 	<ul style="list-style-type: none"> Progress reports 	
4.1. Needs assessment for equipment conducted prior to planned exploration studies and training.	<ul style="list-style-type: none"> Needs assessed 	<ul style="list-style-type: none"> Needs assessment report 	
4.2. Procurement, tender and purchase of equipment	<ul style="list-style-type: none"> Tender for equipment 	<ul style="list-style-type: none"> Tender documents 	
5. Drill rig specifications for the purchase of a new drill rig/s defined and training strategy developed for geothermal drilling	<ul style="list-style-type: none"> Procurements documents and training strategy in place 	<ul style="list-style-type: none"> Bid documents Training strategy 	
5.1. Drill rig specifications and required technical input for bid documents prepared.	<ul style="list-style-type: none"> Specifications prepared 	<ul style="list-style-type: none"> Bid documents 	
5.2. Assessment of training needs for Geothermal drilling in General, including drilling engineers, drillers and borehole geologists.	<ul style="list-style-type: none"> Training strategy in place 	<ul style="list-style-type: none"> Training strategy 	
6. Enhanced capacity for at least 30 staff of implementing agencies to monitor and administer relevant scientific and practical aspects related to geothermal drilling	<ul style="list-style-type: none"> Increased capacity in place for scientific and practical aspects of geothermal drillings. 	<ul style="list-style-type: none"> Capacity assesment 	<ul style="list-style-type: none"> Geothermal drilling conducted in Ethiopia according to plan
6.1. On-site drill training in accordance with needs assessment carried out in conjunction with on-going drilling in Ethiopia.	<ul style="list-style-type: none"> Capacity in place for scientific and practical aspects of geothermal drillings. 	<ul style="list-style-type: none"> Training reports Capacity assessment 	
6.2. Staff of implementing agencies attends relevant courses for drill training, in accordance with drill training needs assessment.	<ul style="list-style-type: none"> Capacity of staff 	<ul style="list-style-type: none"> Training reports Capacity assessment 	
7. List of consumables and estimated cost for about 20 wells in Aluto Langanu established.	<ul style="list-style-type: none"> List of consumables 	<ul style="list-style-type: none"> Bid documents 	
7.1. Preparation of a list of consumables for next drilling phase in Aluto Langanu (20 wells)	<ul style="list-style-type: none"> List of consumables 	<ul style="list-style-type: none"> Bid documents 	
8. Enhanced capacity in power plant operation, maintaining geothermal power plants and	<ul style="list-style-type: none"> Enhanced capacity 	<ul style="list-style-type: none"> 	



<p>reservoir monitoring, for plant engineers, reservoir engineers and geochemists.</p>			
<p>8.1. Training course carried out following a needs assessment for at least 12 participants.</p>	<ul style="list-style-type: none"> • Increased knowledge on power plant operations and maintainance. 	<ul style="list-style-type: none"> • Training and capacity assessment reports 	
<p>8.2. Three (3) staff members from implementing agencies attend the 6 months UNU-GTP with a focus on the relevant areas of expertise (Operation and maintenance, reservoir monitoring, reservoir chemistry.)</p>	<ul style="list-style-type: none"> • Increased capacity of staff 	<ul style="list-style-type: none"> • UNU-GTP Evaluation 	
<p>9. Enhanced local capacity in preparation of bankable geothermal project documents for external finance institutions (donors and lenders).</p>	<ul style="list-style-type: none"> • Bankable geothermal documents produced 	<ul style="list-style-type: none"> • Project documents for geothermal development 	
<p>9.1. A two weeks training program to be designed at UNU-GTP in Iceland, with input from leading experts, targeting at least 14 top and middle managers, project coordinators and senior technical staff.</p>	<ul style="list-style-type: none"> • Increased capacity of staff • Project documents prepared/drafted for a specific project 	<ul style="list-style-type: none"> • Training and assessment reports • Project Document 	

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Annex 2 – Request from GSE



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The Federal Democratic Republic of Ethiopia
Ministry of Mines
Geological Survey of Ethiopia



25 OCT 2012
Date
ETMD/1/19
Ref. No

To: Icelandic Development Agency (Iceida)
Iceland

Dear Sir/Madam

Subject: Ethio-Iceland Collaboration in Geothermal Energy

It is to be recalled that the World Bank and Iceland have established a partnership aimed at supporting East African Countries including Ethiopia to develop their Geothermal Resources. Ethiopia being one of the countries with extraordinary potential in geothermal power has officially expressed its interest to the World Bank to be one of the beneficiaries of this endeavor.

As you know, the Icelandic component of this partnership is to support countries like Ethiopia in advancing surface exploration works in selected prospects, bringing them to a position where they have viable drilling program installed, intended to measure and test the resource. In parallel the World Bank and Iceland will collaborate with other partners and funding agencies to develop flexible financing facilities for test drillings and subsequent development.

In this context, preliminary discussions in October, 2012, between iceida members and the Geological Survey of Ethiopia has reached a consensus on the benefits of the would be Ethio-Iceland collaboration in Geothermal and have agreed that the survey shall officially express its interest to iceida to begin the process.

Accordingly, we kindly express our interest to be a beneficiary of this program and suggest iceida fact finding mission to Ethiopia to asses and identify with us specific projects for potential collaboration, leading to protocols to be signed through the right government channels.

With Best Regards,

Messcha G/Selassie
Messcha G/Selassie
Director General



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E-mail:survey@ethionet.et Website:http://www.geology.gov.et

2302 አዲስ አበባ
Addis Ababa



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