Introduction

The Government of Ethiopia (GoE) is in the process of implementing a Growth and Transformation Plan (GTP) in order to achieve a target of 11% GDP growth with an expected growth in demand for electricity of 25% per year. Given the GTP goals and the anticipated increased demand for electricity, the Ethiopian Electric Power (EEP) desires to develop 5,000+ MW of geothermal generation. Such development of the estimated geothermal resource potential to provide substantial amounts of base load power would not only help meet projected demand, but would also increase the reliability of electricity generation by providing for diversity in the generation mix.

The Aluto Project is the first step in accessing the economic potential for geothermal development in Ethiopia and the first real opportunity to develop the capacity of the country relative to geothermal exploration and development. Given this opportunity, which is fully funded by the World Bank through loans and grants, EEP is about to launch an open tender. The full tender would be available between January-February 2018. The tender seeks qualified Firms with the capability to supply 2 drilling rigs and relevant accessories, execute drilling operation and maintenance, in accordance with technical and schedule of requirements. To be more specific, the tender is seeking for both supplying of 2 new drilling rigs and relevant accessories with provision of drilling services and maintenance.

The awarded Firm shall supply all the necessary goods and services as listed below including relevant experienced personnel to carry out all drilling and testing of the wells and provide maintenance of the drilling equipment. The awarded Firm shall execute a comprehensive drilling plan resulting in the safe and timely completion of 8 to 20 geothermal wells comprising the Project requirements, all to be included within a single contract by a single Firm or a consortium/JV of contractors. Wells are anticipated to be either vertical or directionally drilled to a nominal depth of approximately 2,750 meters and fully tested to determine potential for geothermal power production.

The awarded Firm, depending on the results of the first 8 wells, shall be prepared to continue the drilling and program for up to an additional 12 wells; a determination to continue the drilling campaign will of course depend on the results of the drilling. It is anticipated that both production and injection wells would be drilled during project implementation.

Requirements
The awarded Firm shall provide the following but not necessarily limited to:

- Two (2) complete Drilling Rigs with all auxiliary equipment and spare parts.
- Two (2) complete Base Camps of up to 100 persons each, organized as a single Base Camp in Aluto.
- Drilling Rig Crews and other required personnel for carrying out all drilling and testing operations including maintenance and eventual rig refurbishment.
- Fuel for operation of the rigs and camps.
- Base Camp rig-up and management to supply Crews and associated personnel with housing, meals, personnel transportation etc.
- Casing running and cementing services.
- Well logging and testing services during drilling and well testing (production, injection and interference).

The awarded firm shall establish all safety requirements and procedures and ensure compliance by all personnel on site including visitors to the site.

The awarded firm shall conduct all drilling and testing operations in accordance with Drilling programs and well logging and testing programs issued by EEP, and in accordance with “The African Union Code of Practice for Geothermal Drilling”, published in 2016 by the African Unions’ Regional Geothermal Coordination Unit.

**Background/Drilling History**

The Aluto Prospect has been the object of a number or technical and scientific investigation since 1969. During the 1980’s a program of deep exploratory drilling and well testing led to the discovery of a geothermal field of commercial interest and to the installation of a small geothermal electric demonstration power plant.

In recent studies carried out from 2014-16 the sustainable geothermal potential of the Aluto prospect sector has been estimate at 45 MWe and a field development plan for the exploitation 35MWe potential has been outlined.

During previous drilling campaigns, severe circulation loss problems have occurred in the upper portions of each well. However, a new water supply system with adequate quantities available for blind drilling should alleviate the problem as will the enhanced capability of the rigs to be supplied, which includes full equipment for aerated drilling.

Lithologic units encountered include the Recent Aluto Pyroclastic including volcanic sediments and alluvium. Recent Aluto rhyolite; Upper Pleistocene silicic tuff and breccia; Late Pleistocene lake sediment; Early Pleistocene, late Pleistocene silicic tuff and breccias; Upper Pliocene, early Pleistocene basalt; and Upper Miocene, early Pliocene ignimbrite. The Bofa Basalt formation and the Tertiary Ignimbrite formation are hosting the high temperature liquid dominated geothermal reservoir.

The elevation of the equivalent water level of deep aquifers ranges between 1800 and 1700 m a.s.l, (the elevation of Aluto project site ranges from 1900 to 2075 m a.s.l.) indicating at depth pressures are lower than hydrostatic for local elevation and temperature distribution.
Temperatures at 1600 m a.s.l. may be expected in the 120-200°C range, while at 900 m a.s.l. it can be expected to be in the 190-290 °C range. Maximum recorded temperatures did not exceed 330 °C. Expected maximum wellhead pressure will not exceed 120 bar under shut-in conditions, but wellhead pressure in existing wells does not exceed 30 bar.

**Site Location and Access**

The Aluto geothermal prospect area is located at the Aluto site, in the central region of Ethiopia approximately 180 km Southwest from Addis Ababa and consists of two adjacent fields, Aluto and Bobessa, both subject of the proposed drilling program.

The site is some 920 km from the closest port (Djibouti). Transport from Djibouti is presently provided by the highway system, but a newly completed rail system should considerably improve transportation access.

**Plan of Activities**

The project plan is to drill the first eight (8) production/injection wells and depending upon the results of drilling and testing during this initial phase, there is a possibility to extend the number of wells up to 20. Wells may be either vertical or deviated and such determination will be made by EEP’s drilling supervisor. Well depths can be anticipated to be from 2,200 to 2,800 meters.

The implementation of the initial drilling program will require the preparation of 5 drilling sites, since four (4) wells will be drilled from the same drilling pad. *All infrastructure elements will be provided by EEP through a separate contract with a Civil Engineering and Construction Company.*

*EEP has already purchased consumables for ten wells. If the results of the first 8 wells justify drilling of additional wells, the contractor shall supply consumables for the additional wells (i.e. beyond the 10th well).*

**Project Infrastructure**

A Civil Engineering and Construction Company will be retained by EEP to establish the infrastructure for the project including: the water supply system, all access roads, drilling pads and sumps, camp location etc. The Civil Engineering and Construction Company will also be responsible for the maintenance of all infrastructures throughout the drilling campaign to ensure that delays are not due to infrastructure deficiencies.

- **Water supply.** The water supply will consist of a dual pipeline system bringing water from Lake Ziway to three water reservoirs at the project site; supply lines from the reservoirs will provide water to each drill pad and to the labor camp(s). Total flow available will be 500 m³/h.
- **Roads.** The road system will be established and maintained by the Civil Engineering and Construction Company throughout the whole drilling and testing operation campaign.
  Road specifications are as follows:
  - All weather roads with 22 cm top gravel fill
  - Minimum width 6 m (one lane)
  - Minimum radius of curves 20m
  - Maximum grade: 10%
• Well pads and sump 100 m x 70 m.

• Warehousing and storage. EEP has constructed 6 new warehouse units (30 m x 15 m) for storage of drilling consumables. In addition 2 older warehouses are also available.
   An additional warehouse unit will be constructed near the casing lay down area. The casing lay down/storage area is being completed and will provide excellent access to materials.

• Labor camps and equipment storage areas. EEP will provide leveled areas for the labor camp and an additional area for the contractor’s materials. Water will be supplied to the site and other requirements such as sewage/septic/garbage disposal will be contracted for through EEP’s Civil Engineering contractor.

**Transport and Supply**

The Firm shall undertake custom clearance to import the drilling rigs and related accessories in Ethiopia and the transportation of such items from Djibouti port to the Aluto Project Site (distance around 920 km). EEP will use its tax exemption privilege to import the Rigs and accessories (permanent importation). The Firm shall not be liable taxes and duties for permanent importation.

Contractor shall undertake the handling, including custom clearance or any other duties or levies to import or re-export Contractor’s equipment (temporary importation, such as directional drilling equipment) in or out of Ethiopia, and transportation of all Contractor's equipment to and from the Aluto Project Site.

Vehicles and lifting machinery (including trucks, trailors, pick-ups, land cruisers, buses, cranes, forklifts as well as water trucks, diesel oil trucks and ambulances) necessary for loading/unloading, transport, rig-up and rig-down as well as personnel transport and safety at the project site are to be supplied within the same tendering process and will be made available to the Contractor during the site project activities.

The Firm shall submit to EEP a rig move plan for each rig move prior to commencing such move. The selected route shall be subject to Owner approval.

It is expected that this will give a brief description of the coming up bid which will assist bidders to prepare themselves; and any query can be addressed to Mr. Fikru W/Mariam, Project Manager at wmariamfirk@gmail.com and Mr. Riccardo Balsotti, Engineer’s Project Manager at riccardo.balsotti@elc-electroconsult.com.