

Terms of Reference

Consultancy Services for Data review and Surface Exploration, supervision of Drilling operations and, well testing

1. Introduction

The World Bank will finance drilling and resource establishment at multiple locations in Ethiopia for de-risking resource availability, under the framework of PRIME project. The areas selected for this purpose are: Alalobad in Tendaho, Bobessa and Other relocated promising site at Aluto.

The Alalobad geothermal site is located in Dubti Woreda, Afar Regional State in the northeastern part of Ethiopia, and is about 600 km from Addis Ababa. Both Bobessa and Other relocated promising site geothermal sites are located in Adami Tulu Jido Kombolcha Woreda, Oromia Regional state, about 180 km south-east of the Capital, Addis Ababa.

A surface exploration study has been carried out at Alalobad, Dubti (Tendaho) and Finkilo, Bobesa, and Other relocated promising site (Aluto) geothermal prospects by ELC Electro consult in 2014/15. This study was funded by ICEIDA and NDF under their joint Geothermal Exploration Project in cooperation with GSE and EEP. The final report of the study was presented in November 2016. The immediate objective of the study was to define potential drilling targets at Alalobad and prioritize the three prospects at Aluto for drilling and development. Accordingly nine deep wells have been drilled at Finkilo and one deep well at Bobesa in 2022/2023 using two deep drilling rigs owned by EEP and a full service drilling contractor. However, at the third target at Aluto, Other relocated promising site sufficient surface exploration was not conducted to enable well siting. At Alalobad a conceptual model has been developed and drilling sites have been selected.

Under the forthcoming PRIME Project, for the drilling and other technical advisory services a consultant will be hired after evaluating technical and financial proposals to be provided by bidding companies. This terms of reference (TOR) defines the scope of the consultancy services which will form part of the Contract.

2. Project Description

In total of up to 8 deep exploration wells are to be drilled in three prospective areas.

In Alalobad, Afar, three deep wells will be drilled, logged and tested at sites selected by previous surveys, using one of the deep drilling rigs owned by EEP.

At Bobesa of Aluto two deep wells will be drilled on sites to be selected on the bases recommendation to be given by previously hired consultant (ELC Electroconsult S.p.A) after evaluating the first well result drilled in 2023.

At other relocated promising site , surface exploration will be conducted aimed at conceptual modelling of the prospect and well siting. Following the completion of a conceptual model and well siting, three deep wells will be drilled to test the existence of the deep reservoir.

The drilling activity will be conducted by a full service drilling contractor to be hired with one of the rigs to be placed at Alalobad and the other at Aluto, operating in parallel.

3. General Scope of the Services

The Consultant needs to provide a range of services to EEP to support exploration drilling, in addition to the reservoir assessment program in Alalobad, Bobessa, Other relocated promising site, tender document preparation, bid evaluation, and contract technical discussion under the PRIME Project. These services will be needed throughout the term of the project, i.e. until the project closing date August 30, 2030 in the following areas:

- A. Preparation of all drilling permit documents based on Ethiopia's geothermal drilling regulatory body requirement.
- B. Technical assistance for the Drilling, Logging and Testing Program in support of the EEP Project Implementation Unit (PIU). This will include the design and preparation of the drilling program, and supervision of the drilling and testing operation for the drilling project.
- C. Provide drilling and other technical advisory supports (geology, geophysics, geochemistry, and reservoir engineer) as specified under item 7 below for Alalobad, Aluto Bobessa, and Other relocated promising site during drilling and testing of the wells.
- D. Full supervisory drilling services prior to the onset of drilling and throughout the completion of drilling and testing of the wells (drilling program, well casing program, mud logging, cementing and well testing).

- E. Planning surface exploration (including geology, geochemistry, and geophysics, or 3G) and conceptual modeling at Other relocated promising site and updating the existing conceptual model for the Alalobad and Bobesa for targeting drilling exploration wells.
- F. Technical assistance on Environmental Social Health and Safety (ESHS) matters within the project implementation and RAP audits (for Other relocated promising site, Bobesa and Alalobad),
- G. Training services for rig crew, drilling supervision and design to strengthen new institutional capacity.
- H. Preparation, update and monitoring of project Implementation Master schedule for all activities including disbursement forecast.
- I. Preparation of payment certificate based on the day rate time sheet and disbursement-related documents.

4. Detailed Scope of Works

The detailed scope of work comprises various tasks:

Task 1: Tendering for Civil Engineering Design, Construction and Maintenance Services

Prepare all tender documents (including preparation of detailed employer's requirement and preliminary design) for hiring the services of a Civil Engineering and Construction Company to design, construct, and maintain all infrastructure elements including the construction of access road, building the water supply system including provision of pumps, piping, and reservoir, construct all drill pads and sumps and maintain all facilities throughout the drilling and well testing program. In addition, the Civil Engineering and construction company will design and construct a labor camp for EEP staff and consultants including housing, canteen, and office; the facility will be provided with sanitary water, electricity, and sewerage/garbage disposal in accordance with World Bank E&S policy guideline. The contractor will also prepare a site for the drilling contractor's labor camp including the above-mentioned utilities. The tender documents will need to specify the design parameters of the civil works to be constructed. The consultant assists EEP in evaluating all bids, prepare evaluation reports as per World Bank Procurement Guidelines and during contract negotiation with winning bidder including compilation of contract document.

Task 2: Supervision of civil works including Preparation Activities

Provide on-site - design review, supervision construction and maintenance of all infrastructures needed for the Alalobad, Bobessa and Other relocated promising site.

Task 3: Tendering for the Services of a Full-Service Drilling Contractor

Prepare all tender documents for hiring a Full-Service Drilling Contractor-(FSDC) whose main responsibility is to drill up to 8 deep exploration wells using EEP rigs, mobilize and demobilize rigs/camps, conduct well logging and testing, and supply of all required consumables as identified by the consultant. Assist EEP to evaluate all bids, prepare evaluation report as per World Bank Procurement Guidelines and during contract negotiation with the winning bidder including compilation of contract document.

Task 4: Surface Exploration and Well Siting at Other relocated promising site

Planning of surface exploration (including 3G) and conceptual modeling at Other relocated promising site. Initially, the consultant has to review existing data, re-calibrate on the bases of the findings from the recently drilled wells at Aluto, identify the gaps and propose the exploration strategy. Generally the surface exploration work to be conducted includes geology, geochemistry and geophysics. The total area of interest to be covered is about 20 Sq km. The geophysical exploration may include gravity and MT/AMT aimed at filling data gaps. The consultant shall temporarily import a gravimeter and 3 units of MT and 1 unit of AMT for the proposed geophysical data collection. The field survey shall be conducted with the involvement of the consultant's; one geology expert, one geochemical expert and one MT/TEM and gravity surveys expert. EEP local staff will assist the field data collection process. Finally, interpretation, integration, conceptual modelling of collected data and siting of three exploratory wells and drilling program shall be done by the consultant.

Task 5: Supervision of the Full-Service Drilling Contractor

The consultant shall Prepare all drilling permit documents based on Ethiopia's geothermal drilling regulatory body requirement.

The consultant shall supervise the FSDC during drilling, logging, and testing activities at the three target areas on a 24/7 drilling supervision basis. Also, the consultant shall prepare a drilling plan and program, and a work plan for the drilling activities ensure that drilling is carried out under the African Union Code of Practice for Geothermal Drilling.

Task 6: Provision of Technical and Scientific Assistance

The consultant will provide a Technical Advisory Team (TAT) covering expertise in geology, basis geochemistry, geophysics, and reservoir engineering. This team will provide technical and scientific assistance relative to the Modeling, siting, and targeting of all wells, drilling program, well design, designing and overseeing all well testing including logging of the wells, and maintaining the reservoir model of the field. The consultant's TAT will review reports from the FSDC (daily reports, well-testing reports, well-completion reports, and final reports) and ensure that they are technically sound and of high quality. The consultant's TAT will prepare a prefeasibility study and final resource assessment report, summarizing the results of the exploration drilling project, presenting a revised and updated conceptual model, and assessing the long-term power production potential of the reservoir as well as preparing and presenting periodical weekly, monthly, and yearly progress reports about overall the projects.

Task 7: Well Testing Protocols

The consultant will define the well logging and testing protocols and supervision as follows: provide plans/protocols for short and long-term testing of the exploration wells drilled, including designs for testing apparatus and measurement instruments. Provide technical support to EEP for the procurement of contractors to construct the well testing apparatus as designed by the Technical Advisory Team. The testing protocol needs to clearly specify how each test is to be performed, the scope also includes monitoring and reviewing all the well testing reports from the FSDC and the consultant is responsible for giving feedback.

Task 8. Technical Assistance on Environmental Social Health and Safety (ESHS)

The Consultant shall be carried out the technical assistance on Environmental Social Health and Safety (ESHS) matters within the projects and resettlement action plan (RAP) monitoring and audit for (Other relocated promising site, Bobesa and Alalobad) projects. The tasks to be carried out but not limited to;

- Support for Environmental Social Management Plan (ESMP) implementation and monitoring activities
- Support for health and safety implementation and monitoring activities
- Support for RAP/LRP follow up and monitoring
- RAP audit in accordance with WB guidelines

The technical assistance on ESHS, ESMP, RAP, and LRP shall be carried out according to Ethiopian and the World Bank environmental and social policy documents and guidelines.

The RAP audits will be carried out based on review of relevant documents, the World Bank Safeguards Policy on Involuntary Resettlement, and relevant national laws and regulations.

Task 9: Capacity building

EEP intends to build complete drilling operation capacity through its drilling crew to take over drilling activities in the long term using the available two deep drilling rigs. The consultant is required to give EEP staff theoretical training on basic and advanced drill rig operations, maintenance, and programming for a minimum of 50 EEP employees on site. The consultant shall provide training services for rig crew, data management implementation, and office software and hardware to strengthen new institutional capacity. The consultant is also required to provide training on environmental and social safeguards policy and principles, preparation of environmental and social management instruments (ESIA, RAP, ESMP, LRP), detailed land measurement surveys (GIS), assessing impact on Indigenous Peoples (IPs) and planning, environmental and social compliance monitoring, labor and working conditions, resource efficiency and pollution prevention, community health and safety, health and safety monitoring and supervision, land acquisition, restrictions on land use, and involuntary resettlement.

Respective counterpart training for PIU teams such as Geoscience, Engineering, and Safeguard Supporting staff shall be given accordingly. The consultant shall also arrange the examination and certification of the crew by a third party to be trained after sufficient training is given.

EEP requires the creation of a centralized data repository for use by itself and other stakeholders. For this, it is essential to implement a GIS enterprise system with the following capabilities: data acquisition, data storage and management, data processing and analysis, reporting and visualization, and collaboration and sharing. Towards this goal, the consultant is required to train selected EEP staff to be able to run the data and management system processes, workflows, and overall data.

The consultant shall also procure and avail the DMS and conduct system development, deployment, testing, data migration, and capacity building.

5. The Ethiopian Electric Power (EEP) will provide:

- The resource assessment and conceptual reservoir model report prepared by ELC Electro Consult in 2016 and related previous works.
- Access to other federal agencies responsible for environmental protection, regulation of drilling and testing activities, transmission services, etc.
- Counterpart staff (Geophysicist, Geologist, Reservoir Engineer, Geochemist, Sociologist, Health and safety officer, environmentalist and Engineering staff)
- Direct access to FSDC staff responsible for all drilling, logging, well testing, and geochemical analysis. Reports prepared by the FSDC (daily reports, well completion and testing reports, and final drilling reports) will be shared directly with the Consultant by the FSDC.
- Office space at project sites.
- Dedicate the Environmental experts, Social experts, and health and safety experts to facilitate the works of the consultant.
- Carry out periodic quality and performance reviews of the consultancy outputs.
- Liaise with the World Bank for approval of the RAP and clearance of ESMP.

6. Outputs/deliverables of the Consultant

The Consultant will provide:

- All Tender documents needed for the project execution.
- Evaluation Report for all tenders to be submitted within Four (4) weeks from submission of Proposals from the bidders.
- Weekly, Monthly and Quarterly progress reports.
- Review of all reports by FSDC and endorse/comment within two weeks after receipt of same from FSDC.
- The prefeasibility and final resource assessment report consisting of a summary of all drilling and testing information collected during the implementation of the project at each geothermal prospect. The final report should contain revised conceptual model for the Alalobad, Bobessa and Other relocated promising site geothermal system and a revised assessment of power generation capacity. The final report shall be completed within 1 month after the completion of the drilling and well testing by the FSDC.

- Final and progress report on implementation and monitoring/follow up of ESHS, ESMP, RAP, and LRP by incorporating comments from the client, stakeholders and World Bank in both hard copies and electronic copies.
- Monitoring and supervision of the occupational health and safety activities of the project
- Finally, project completion report (implementation completion report) (from project initiation to project closing in all aspect) shall be provided by the consultant within 3 months.

7 The Consultant Personnel Tasks

7.1 The Drilling Manager/Team Leader is to:

- Serve as a Team Leader for the Consultant's team working on the Alalobad, Bobessa, and Other relocated promising site geothermal exploration drilling project.
- Coordinate the surface exploration, conceptual model updating as well as targeting, and planning for all drilling, well logging, and testing operations and related drilling services.
- Prepare the bidding documents for retaining the services of an FSDC for drilling 8 wells, including provision of consumables and well logging and testing. The bidding documents must be consistent with the World Bank Procurement Guidelines.
- Coordinate the evaluation of the bids received related to the above tender documents and preparation of the evaluation reports as per World Bank procurement guidelines.
- Assist in the negotiation of contracts with winning bidders.
- Serve as the liaison between EEP, other consultant staff assigned to the project, and contractors.
- Coordinate the technical review of all reports from the FSDC and oversee the preparation of the final drilling reports from the FSDC.
- Organize and chair quarterly technical/scientific review meetings beginning 3 months before the onset of drilling operations for Alalobad, Bobessa, and Other relocated promising site and throughout the drilling of the wells.
- Coordinate the preparation of the Final Resource Assessment Report for the Alalobad, Bobessa, and Other relocated promising site exploration drilling activities following the completion of drilling and testing activities.
- Preparation of implementation and completion report at the project closing time.

7.2 The Drilling Superintendent/Drilling Expert/ will be expected to:

- Design and develop a detailed drilling program (including proper investigation and production tests of the encountered geothermal reservoir). As a whole, propose the most appropriate sequence of drilling and testing; and develop plans for drilling, logging, and testing.
- Make recommendations to EEP and the FSDC relative to proposed changes in well sites and/or in the drilling and testing program (e.g. over pressure versus under pressure drilling; deviated vs. vertical drilling etc.).
- Oversee onsite that drilling, logging, and well testing are conducted in compliance with drilling, logging, and testing program.
- Ensure that all safety requirements and procedures as defined by the African Union Code of Practice for Geothermal Drilling are followed by the FSDC.
- Ensure that all BOP tests are correctly conducted and certified by the FSDC.
- Assist and advise EEP and the FSDC with remedial action(s) in case of such events as a blowout.
- Ensure that wells are properly plugged and abandoned by the FSDC if plugging and abandonment are requested by EEP.
- Review daily as well as weekly drilling and/or testing reports submitted to EEP by the FSDC.
- Review well logging and testing reports to be submitted to EEP by the FSDC.
- Provide on job-training training for EEP's counterpart staff.

7.3 The Reservoir Engineer will be expected to:

- Act as assistant Team Leader and conduct all tasks vested up on the Team Leader in the absence of the Team Leader.
- Provide reservoir engineering services.
- Maintain the conceptual model and update it as appropriate.
- Serve as a member of the Technical Advisory Team.
- Prepare the reservoir engineering report describing the revised conceptual model.
- Preparation of reservoir 3D modeling report using leapfrog/equivalent software for each drilled wells.

7.4 The Technical Advisory Team (geologist, geophysicist and Geochemist) will be expected to:

- Become familiar with the project based on the information available as per above and remain familiar with the on-going drilling, logging and testing activities throughout the life of the project.
- Review daily reports, well testing report, well completion reports, the final report and other reports from the FSDC and provide written recommendations as to its adequacy or lack thereof.
- Be available for telephonic and electronic communications with the Drilling Manager/Team Leader and EEP staff to discuss the project.
- Attend quarterly Technical Advisory Team meetings in Addis Ababa, Ethiopia.

7.5 The Civil Engineer will be expected to:

- Prepare the tender documents for retaining the services of a Civil Engineering and Construction Company to design and construct all infrastructure elements required to support the drilling of the wells at Alalobad, Bobesa and Other relocated promising site (access roads; wells pads and sumps; water supply system including the provision of all pumps, pump stations and water lines and labor camp for use by EEP staff and consultants as well as preparing site for drilling contractor labor camp. The tender documents will need to include the design parameters for the infrastructure to be constructed.
- Conduct a thorough evaluation of the bids received in relation to the above tender and prepare a documented evaluation report for EEP management.
- Assist the EEP in contract negotiations and contract documentation with the winning bidders.
- Provide the civil contractor(s) with the requirements for well pads, sumps, lay down yards, camps, access roads, water supply system, etc.
- Provide necessary oversight relative to the design, subsequent construction, and ongoing maintenance of all infrastructure elements.

7.6 The Environmentalist will be expected to:

- Support/supervision for Environmental Social Management Plan (ESMP) implementation and monitoring activities.
- Addressing all the government and World Bank environmental policies triggered by the project.

7.7 The Health and Safety officer will be expected to:

- Conduct regular audits on Workplace (Occupational) Safety, Health and Welfare Conditions.
- Undertake audits and supervisions or inspections of any site where the contractor is undertaking activities related to the works, to verify the contractor's compliance with ESHS requirements including its GBV/SEA obligations, with and without contractor and relevant client-relevant representatives.
- Ensure the client is immediately informed of any notification related to ESHS aspects
- Provide immediate notification to the client should any incident occur while carrying out any activities in the work area.
- Provide technical assistance for client and contractors in the preparation of Health and Safety reports, training and audit formats.

7.8 The Sociologist will be expected to:

- Follow up and monitoring the environmental and social management system of projects; RAP LRP, GBV, CoC and SA required by national governments and international lending agencies.
- Addressing all the government and World Bank safeguards policies triggered by the project.
- Carry out RAP audits in accordance with the WB guidelines.

8. Consultant's qualification requirement, team composition and competence requirements for Key Personnel

The consultant's team should include a drilling project manager/team leader, senior geothermal drilling supervisor, highly experienced geologist, geophysicist, geochemist, reservoir engineer, environmentalist, health and safety officer and sociologist. Experience and expertise of the team involved in the drilling activities of the project should be specifically related to carrying out the duties as summarized above and detailed below.

8.1 Drilling Manager (Team leader) shall be familiar with the preparations necessary for and the management of drilling and testing operations as they pertain to the drilling of deep geothermal wells. The Team Leader shall have a degree in one of the Geosciences or in Engineering (i.e Geology, Geophysics, and Geochemistry or Drilling Engineering, Petroleum Engineering, Mechanical Engineering) and have minimum of 15 (fifteen) years' experience in drilling; of these a minimum of 5 years in the geothermal industry. He/She shall have completed or delivered minimum of three similar assignments. He/she shall also have extensive experience in drilling supervision and testing operations as well as the construction and maintenance of required infrastructure and preferably have experience working in East Africa. The Team Leader shall also have experience working on projects using the World Bank procurement procedures including preparation of tender documents and bid evaluations. The holder of this position is expected to be available until the end of the project (estimated input may be 36 expert man months).

8.2 Senior Drilling Supervisor (Drilling superintendent) shall have the necessary qualifications in the relevant field of studies in one of the Geosciences or in Engineering (i.e Geology, Geophysics, Geochemistry or Drilling Engineering, Petroleum Engineering, Mechanical Engineering) and a minimum of 15 years of experience in supervision of drilling geothermal wells in volcanic environments; of these a minimum of 5 years' experience providing similar services in comparable geologic settings and has completed or delivered a minimum of two similar assignments. The holder of this position is expected to be available until the end of the project full-time of the assignment and support during defect liability period (estimated input may be 96 expert man months).

8.3. Reservoir Engineer (assistant team leader) must have a minimum of Master's degree in reservoir engineering or related fields and a minimum of 15 years of experience in providing reservoir engineering services to the geothermal industry; of these a minimum of 5 years' experience in providing reservoir engineering services working with projects in comparable geologic settings and has completed at least two similar assignments. Estimated input may be 28 expert man months (the exact staff deployment schedule depends on the specific methodology and approach of the consulting firm);

8.4. Senior Geologist, Senior Geophysicist and Senior Geochemist each must have at least a Master's degree qualification in relevant areas of studies (i.e MSc. in Geology, Geophysics and

Geochemistry or related fields) and a minimum of 10 years of experience; of these a minimum of 5 years experience in the geothermal industry. He/She shall have completed or delivered a minimum of two similar assignments. These positions are to work as Technical Advisory Team members. The Technical Advisory Team members will be paid in two parts: a quarterly or yearly retainer fee plus a time-based payment for the time the members spend on providing various advice/support from their home offices and attending quarterly meetings in Ethiopia. Reimbursable items covering their travels, hotels per diem, etc., will be covered separately by EEP. The three Technical Advisory Team members' total input during the entire assignment period is estimated to be 18 expert man-months (6 man-months for each expert), but the actual input depends on the approach and methodology of the Consultant.

8.5. The Civil Engineer must have at least a master's degree qualification in relevant areas of studies (i.e MSc. in Civil Engineering or related fields of study) and a minimum of 10 years of experience in a Civil Engineering Construction Company; of these a minimum of experience in the design of infrastructure for Geothermal drilling, i.e. access roads, well pads and cellars, sump pits and a water supply system as well as labor camps. He/She shall have completed or delivered a minimum of one similar assignment. The civil engineer is expected to be available for the design and overseeing of the construction works amounting to 12 man-months.

8.6 The Environmentalist must have at least a master's degree qualification in relevant areas of studies (i.e MSc. in Environmental Science or related fields of study) and minimum of 10 years of experience in Environmental Engineer/environmental sciences or related areas of studies. The environmentalist shall have experience in implementation and monitoring ESIA/RAP/ESMP for drilling operation. He/She shall have completed or delivered minimum of one similar assignments. The environmentalist is expected to be available for the monitoring and supervision tasks until the end of the project (amounting to 3 man months).

8.7 The Health and Safety officer shall have at least a master's degree qualification in relevant areas of studies HSE and minimum of 10 years of experience; of these a minimum of 5 years of experience in Geothermal operations. The Health and Safety officer should provide certificate. The Health and safety officer shall have experience in monitoring and supervision in drilling operation. The Health and safety officer is expected to be available for the monitoring and supervision tasks until the end of the project (amounting to 12 man months).

8.8 The Sociologist shall have at least a master's degree qualification in relevant areas of studies (i.e MSc. in Sociology or related fields of study) and a minimum of 10 years of experience working with WB operational policies and standards for Construction Company. He/She shall have completed or delivered a minimum of one similar assignment. The sociologist shall have experience in follow up and monitoring RAP/LRP, RAP audits for drilling operations. The sociologist is expected to be available for the amount to 3 man months

9. Duration of the Service

The duration of the service will be 36 months: 6 months for tendering, 6 months for surface exploration and well siting, 18 months for drilling supervision and 4 months for final resource assessment and 2 months for Implementation Completion Report and other related reports preparation.

During the execution of the intended consultancy services, expert-months reallocation can be made if so required upon approval by EEP as long as it is within the budget.