

# Tulu Meye Geothermal Development Project - Phase I: Environmental and Social Impact Assessement

**ESIA Report: Part I of III**

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## Executive summary

Reykjavik Geothermal (RG) is responsible for this Environmental and Social Impact Assessment (ESIA) report on geothermal development in the Tulu Moye area, Ethiopia. The ESIA report includes an overview of the legal and administrative framework, the ESIA methodology, project description, project settings, alternatives, description of baseline conditions for different environmental and social components, impact analysis, mitigation measures and environmental and social management plan (ESMP) for the proposed project development.

This ESIA report is based on baseline survey carried out by GIBB International and baseline surface exploration study by RG geoscientists. The baseline surveys address legal and institutional aspects for the project, the physical environment, the biological environment, socio-economics factors and the geothermal resource of the area.

This report is also based on the public consultation on the draft of the ESIA report and an ERM gap analysis against IFC Performance Standards.

Parallel to the ESIA work, RG has been working on the Stakeholder Engagement plan and Resettlement Policy Framework, which is integral and vital to the company's preparation.

### The Project

Ethiopia has vast potential of geothermal power which is located along the Rift Valley. The development of the geothermal exploration and harvesting in Tulu Moye will be in phases. This ESIA report describes the first phase of the project, which includes e.g. exploration drilling, production drilling, well pads, access roads, water supply, quarries, pipelines, and up to a 100 MW power station.

|                                    |              |  |
|------------------------------------|--------------|--|
| Power generation / Station         | 100 MW       | Base level: < 5,000 m <sup>2</sup>     |
| Production wells [no.]             | 14-16        | Depth: 1,500-3,000 m                   |
| Re-injection wells [no.]           | 3-4          | Depth: 1,000-1,250 m                   |
| Drill pads needed [no.]            | <20          | Base level: 6,000 m <sup>2</sup> each  |
| Separator plants [no.]             | 2-4          | Base level: 750 m <sup>2</sup> each    |
| Cooling towers [no.]               | 1            | Base level: 1,800-2,000 m <sup>2</sup> |
| Fresh water requirements           | 40-60 l /sec | For 100 MW power plant                 |
| Jobs for drilling and construction | 615          | Regional/national/international        |
| Jobs for construction              | 45           | Regional/national/international        |

Indicative results of RG surface explorations suggest that the potential of the Tulu Moye area will possibly and probably support up to 500 MW<sub>e</sub> without adversely affecting the geothermal resource.

Geothermal energy is among the world's lowest cost energy sources, and quality geothermal resources abound in East Africa. While initial investment in the exploration phase can be risky, on a sector basis, it represents one of the most cost effective and impactful ways to invest in Climate Change. The Government of Ethiopia has stated that it is imperative to provide the economy with the necessary energy inputs at the right time and at affordable prices. This will speed economic development and help the country attain the objectives of the Economic Reform Program the government has adopted. With

special emphases on renewable energy the Government has introduced Feed-in-Tariffs to promote installation of renewable power generation facilities.

The geothermal Project in Tulu Moye is a part of this important development.

### The ESIA Process

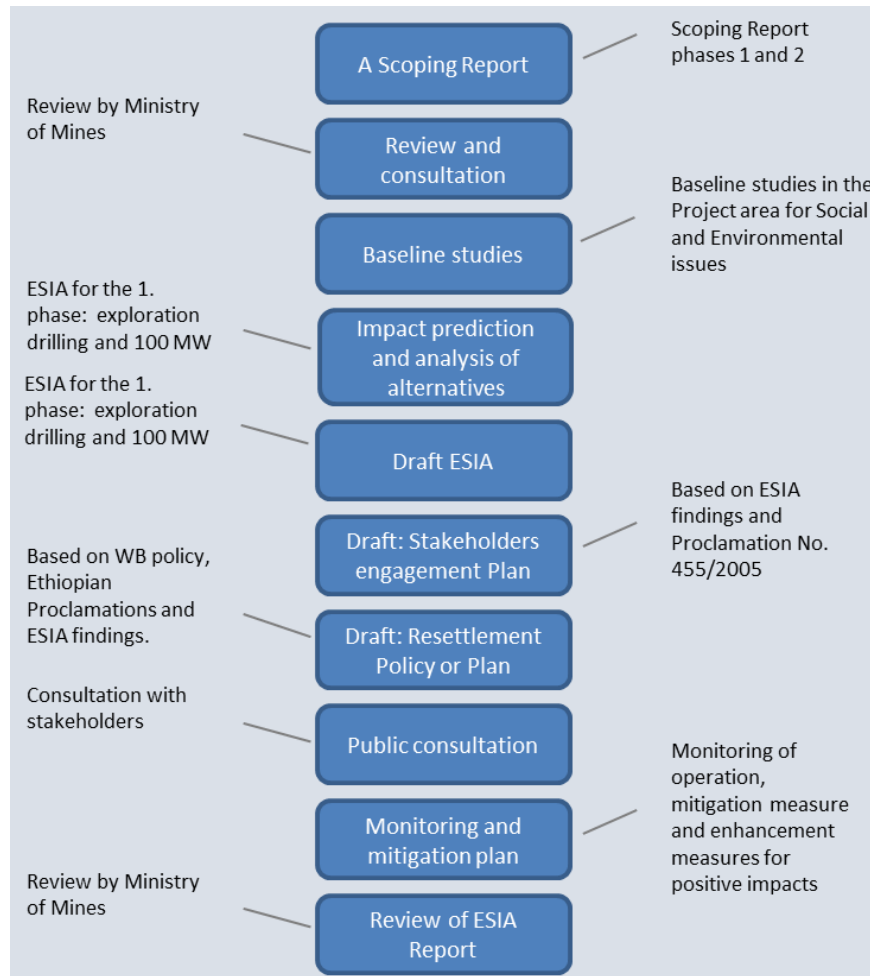
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Due to the dynamic nature of geothermal projects, the ESIA will be phased according to information available and development of the Project. The information gathered in the exploration and resulting 100 MW production phase can have significant effect on the size, location and the overall design of the 500 MW Project.

Due to the fact that the geothermal project is dynamic in nature and therefore it is not possible to locate with precision various project component, the ESIA defines all the issues necessary for finalization of the project. This is done as criteria for choosing among alternatives and to implement the ESMP and its follow up. This approach is to guaranty that the environmental and social issues are always to be part of all decisions on project location, magnitude and characteristics.

The significance of the environmental impacts has been based on:

- Policy and legal framework;
- Social importance;
- Ecological importance;
- Environmental standards;
- Impact analysis and prediction/assessment;
- Conclusion of findings/research; and
- Consultation.



**The ESIA Process**

## Social Impacts

The Project is likely to have minor to moderate positive impacts on the social aspects of the environment. Employment will increase and thus enhance the economy and livelihood of households and lower unemployment rate at least temporarily. Infrastructure will be improved and thus enhance access for tourists which are likely to be interested in the geothermal plant. Increased tourist attraction can have positive impact on the local economy.

The most critical impact is the possible land expropriation which will be met with Livelihood Restoration Plan and Resettlement Action Plan. Impact on farmers and vulnerable groups losing their income and livelihood, will be met with compensation policy and site selection to prevent resettlement. Having taken mitigation measures into account the residual adverse impacts on social aspects is minor to moderate.

In order to minimize risk on health and safety of workers and locals a training program and preventative safety measures will be put in place. Cultural conflicts due to influx of workers of other culture and religion will be met with information and training. Disturbance of cemeteries and other culturally significant sites will be avoided by/when selecting site for the operation.

### Biodiversity and ecology

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During the biodiversity baseline study, some species were observed within the Project area that have protection status. Rapid biodiversity study is planned as part of ESMP to verify presence of wildlife now that precise location of project components is available. Therefore, a thorough assessment on potential impacts on biodiversity and ecology will be available prior to any construction and operation and proper mitigation measures can be implemented.

### Air quality

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Impacts on air quality are minor to moderate, after having taken mitigation measures into consideration. Emphasis will be placed on minimizing dust creation and geothermal gas will be monitored during construction and operation. According to the location of the first two well pads it is possible to predict potential impacts of geothermal gas, i.e. H<sub>2</sub>S on local settlement.

A preliminary study shows that settlement in the Drilling area is distributed over large part of the area. Creating a buffer of 500 m around settlements where H<sub>2</sub>S odour is likely to be detected shows that little area is left where no odour is predicted to be detected.

This means that wells and Power plant will likely be located within impact zone and thus some settlement(s) may be affected. Gas emission will be monitored and a contingency plan regarding high levels of H<sub>2</sub>S will be implemented.

### Archaeology and cultural heritage

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Impacts on archaeological remains and cultural heritage are minor, after having taken mitigation measures into account. If previously unknown archaeological remains are discovered a Chance Find Procedure will be followed. Disburbance of peace at graveyards and historical sites will be limited by site selection, sound barriers and gas emission monitoring.

### Landscape and visual impacts

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Impact on landscape and visual aspects is likely to be moderate, having taken mitigation measures into account. It is evident that the structures and steam plumes that will be placed in the landscape will be visible and some from distance. The most significant impacts are where development is located in relatively pristine lava hills, especially well pad B.

Mitigating the effects can be done by site selection and design of structures. The Project is also likely to have minor beneficial effects as it may attract tourists.

### Noise

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The Project is likely to have ~~minor to~~ moderate impacts on noise having taken mitigation measures into account. The main source of noise is from drilling, well testing and cooling towers. Drilling and well testing is temporary but noise from cooling towers remains through the operation of the power plant. Both people and wildlife can be affected by noise and vibration but mitigation measures in the form of silencers on top of wells, sound barriers and site selection will minimize the impact. Elevated noise levels can cause hearing loss for personnel during construction and operation. Emphasis will be placed on personal protection equipment and health and safety plan for personnel.

A potential impact on wildlife will be assessed when the biodiversity study becomes available.

### Geology and soils

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The Project is likely to have insignificant to moderate effects on geology and soils, having taken mitigation measures into account. The main impact would be the removal of or disturbance of sensitive or valuable geological formations such as surface manifestations/hot springs. Surface clearance can also have adverse impacts on soils and soil erosion. Mitigation methods involve limiting areas of disturbance, to design drains and channels to resist floods. Also to stabilize cuts and slopes with walls and structures and re-vegetate areas to stabilize slopes.

#### Water and hydrology

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Impact on water and hydrology is likely to be insignificant to minor. Care will be taken to adjust design and landscaping as to minimize the disruption of seasonal waterflow. Geothermal fluid will be directed to infiltration ponds during construction and then injected to the bedrock below groundwater during operation phase. Ground water is already geothermal influenced but it is not likely that the Project will add to that influence. Different water sources will be used than that of the locals and thus the Project will not have impact on drinking water availability or quality of the local community.

#### Waste

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If not handled properly waste can have adverse impact on the environment, causing contamination, visual impact and causing hazard to locals and wildlife. A waste management plan will be put in place where emphasis will be placed on reducing, reusing and recycling therefore impact of waste on the environment is likely to be minor.

#### Occupational Health and Safety

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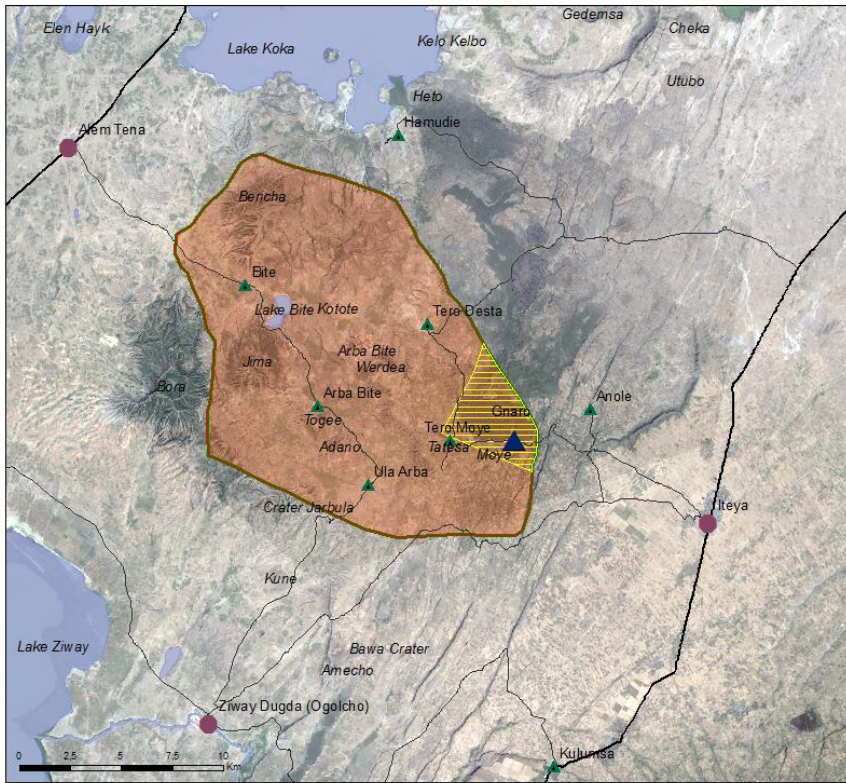
The construction, operation and decommissioning of the project pose some hazards. The hazards will be met with preventative or mitigative measures as to minimize the risk of accidents. A thorough risk assessment will be conducted for the work and from that a set of EHS rules and management plan for the site will be established. RG recognizes the importance for workers' health and safety and will comply with national and international legislation and standards to ensure the safekeeping of the workers.

#### The Environmental and Social Management Plan

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The nature of the Project makes an ESMP a fundamental document since geothermal development is very dynamic in nature. Important components of the Project like site selection for development have been decided and location of more well pads will be based on the outcome from the exploration. Site selection has great influence on the nature and significance of the environmental and social impacts of the Project.

The role of the ESMP is to ensure that implementation of this Project complies with both Ethiopian legislation and regulations and international financial institutions requirements. Reykjavik Geothermal has implemented and conforms to ISO 9001, ISO 26000 (including SA 8000), OHSAS 18001 and ISO 14001 and follow its Policies on Social Responsibility, Occupational Health and Safety, and on the Environment respectively.



**ESIA - Geothermal exploration and harvesting in Tulu Moyo**  
**Map 1: Overview**

- Legend:**
- Project area
  - Drilling area
  - Power plant, potential site
  - Highway
  - Secondary Road
  - Town
  - Village



Base map: VSO Consulting, Reykjavik Geothermal, GIES International

Coordinate System: WGS 1984 UTM Zone 37N

|  |  |                       |
|--|--|-----------------------|
| <b>VSO CONSULTING</b>                    |  | <b>001</b>            |
| BORRARTUNNI 20, 105 REYKJAVIK            |  | Map: GHS/GR           |
| © 2020 VSO, PAC 2020/10                  |  | Date: 11.07.2017      |
| www.vso.is   vso@vso.is                  |  | Scale: 1:200,000 (A4) |
| CLIENT: REYKJAVIK GEOTHERMAL             |  |                       |
| © 2014-143057e1e1b0514305_1MAU_LL_01.mxd |  |                       |

**The Project/Study area, the Drilling area and potential site of Power station**



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## Acronyms and glossary

|                 |   |
|-----------------|---|
| AD              | Anno Domini   |
| AFI             | Acute Febrile Illness   |
| AfDB            | African Development Bank  |
| ADLI            | Agricultural Development Led Industrialization                                  |
| Aol             | Area of Influence   |
| Asl             | Above Sea Level   |
| ARCCH           | Authority for Research and Conservation of Cultural Heritage                    |
| ARDO            | Agriculture and Rural Development Office  |
| BSG             | Bushed Scrubbed Grass Land  |
| CEDAW           | Convention on the Elimination of All forms of Discrimination Against Women      |
| CH <sub>4</sub> | Methane   |
| CIA             | Cumulative Impact Assessment  |
| CITES           | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| CLO             | Community Liaison Officer   |
| CMS             | Conservation of Migratory Species of wild animals                               |
| CO <sub>2</sub> | Carbon dioxide  |
| CRC             | Convention on the Rights of the Child   |
| CSE             | Conservation Strategy of Ethiopia   |
| dB              | Decibel   |
| dBA             | Decibels Acoustic   |
| DEM             | Digital Elevation Model   |
| DHO             | District Health Office  |
| EA              | Environmental Assessment  |
| EAR             | East African Rift   |
| EBI             | Ethiopian Biodiversity Institute  |
| EC              | Electrical Conductivity   |
| EEA             | Ethiopian Energy Authority  |
| EEP             | Ethiopian Electric Power  |
| EEPCo           | Ethiopian Electric Power Corporation  |
| EHS             | Environment, Health and Safety  |
| EIA             | Environmental Impact Assessment   |
| EPA             | Environmental Protection Authority  |
| EPC             | Environmental Protection Council  |
| EPLAUA          | Environmental Protection, Land Administration and Use Authority                 |
| EPSE            | Environmental Policy and Strategy of Ethiopia                                   |
| ERA             | Ethiopian Roads Authority   |
| ERP             | Emergency Response Plan   |

|                  |   |
|------------------|---|
| E&S              | Environmental and Social                                  |
| ESAP             | Environmental and Social Action Plan                      |
| ESIA             | Environmental and Social Impact Assessment                |
| ESMP             | Environmental and Social Management Plan                  |
| ESMS             | Environmental and Social Management System                |
| EWCA             | Ethiopian Wildlife Development and Conservation Authority |
| F                | Fluoride  |
| FAO              | Food and Agricultural Organization                        |
| FDRE             | Federal Democratic Republic of Ethiopia                   |
| FGD              | Focus Group Discussions                                   |
| g                | Gram  |
| GDP              | Gross Domestic Production                                 |
| GIS              | Geographical Information System                           |
| GTP              | Growth and Transformation Plan                            |
| H <sub>2</sub> S | Hydrogen Sulphide   |
| H&S              | Health and Safety   |
| IBA              | Important Bird Areas                                      |
| ICS              | Interconnected System                                     |
| IFC              | International Finance Corporation                         |
| ILO              | International Labour Organisation                         |
| IUCN             | International Union for Conservation of Nature            |
| KPI              | Key Performance Indicator                                 |
| LA               | A-weighted sound level                                    |
| LA <sub>eq</sub> | Equivalent sound level                                    |
| M a.s.l.         | Meter Above Sea Level                                     |
| mcm              | Million Cub. Meter  |
| MDGs             | Millenium Development Goals                               |
| MER              | Main Ethiopian Rift                                       |
| mg/l             | Milligram Per Liter                                       |
| MoEF             | Ministry of Environment and Forestry                      |
| MoWIE            | Ministry of Water, Irrigation and Energy                  |
| MoM              | Ministry of Mines   |
| MWe              | Megawatt Electrical                                       |
| MW               | Megawatt  |
| NCG              | Non-Condensable Gases                                     |
| NGO              | Non-Governmental Organization                             |
| NMSA             | National Meteorological Services Agency                   |
| NMT              | Non-Motorised Transport                                   |
| OFWE             | Oromia Forest and Wildlife Enterprise                     |
| OG               | Open Grass Land   |

|        |   |
|--------|---|
| OMC    | Optimum Moisture Content                              |
| ONRS   | Oromia National Regional State                        |
| ORA    | Oromia Roads Authority                                |
| OW     | Open Wood Land  |
| PAP    | Project Affected People                               |
| PLC    | Private Limited Company                               |
| POPs   | Persistent Organic Pollutants                         |
| PPB    | Parts Per Billion                                     |
| PPM    | Parts Per Million                                     |
| RAP    | Resettlement Action Plan                              |
| RPF    | Resettlement Policy Framework                         |
| RFP    | Request for Proposal                                  |
| SEP    | Stakeholder Engagement Plan                           |
| SNNPR  | Southern Nations, Nationalities & Peoples' Region     |
| TBD    | To be decided   |
| TDS    | Total Dissolved Solid                                 |
| t/hh   | tonnes per household                                  |
| UNFCCC | United Nations Framework Convention on Climate Change |
| URTIs  | Upper Respiratory Tract Infections                    |
| VECs   | Valued Environmental and Social Components            |
| VES    | Vertical Electrical Sounding                          |
| VIP    | Ventilated Improved Pit                               |
| WBG    | World Bank Group                                      |
| WFB    | Wonji Fault Belt                                      |
| WHO    | World Health Organization                             |
| WRMP   | Water Resource Management Policy                      |
| UEPA   | Universal Electricity Access Program                  |
| UNU    | United Nations University                             |
| USC    | Unified Soil Classification                           |



## Terminology

It should be noted that spelling may vary between sources.

### Zone:

Arsi - Arsii

East Shewa /East Showa

### Woreda – Wereda:

Bora

Dodota

Hitosa – Hitossa – Hetosa - Etosa

Ziway Dugda – Zeway /Zuway Dugda

### Kebele:

Amude - Amuddee

Anole - Anole Salen

Arba Chafa – Arba Chefa

Bite - Betti

Bite Daba – Bite Dabaa

Boka

Bora

Burka Lemafo – Burka Lamafo

Denisa - Danisa

Ula Arba - Hula Arba

Hurtu Dembi – Hurtuba Dembi /Bedenbi

Meja Shenen – Meja Shenan

Tero Desta – Terro Desta – Tera /Terra Desita – Tero Dastaa

Tero Moyo– Terro Moyo – Tulu Moyo – Teru Moyo

Wal Argi – Wul Argi - Walaargi

### Town:

Adama City – Nazret

Alem Tena

Asela - Assela

Dera

Hawassa – Awassa

Iteya

## 1 Introduction

The Project proponent Reykjavik Geothermal (RG) is responsible for this Environmental and Social Impact Assessment (ESIA) report on Geothermal Development in Tulu Moye, Ethiopia (the Project). The ESIA report includes an overview of the legal and administrative framework, the ESIA methodology, Project description, Project settings, description of baseline condition for different environmental and social components, impact analysis, information on consultation and Environmental and Social Management Plan (ESMP) for the proposed project development.

### 1.1 Reykjavik Geothermal

Reykjavik Geothermal was established in 2008 by the former CEO of Reykjavik Energy along with a team of project managers and geo-scientists. The RG team has more than 100 years in combined geothermal experience within most if not all aspects of the industry. The team's track record spans over 30 countries, including leading the development of the world's largest geothermal power plant in Iceland both on time and on budget.

RG objective is to work particularly in developing and emerging markets with local partners to harness geothermal resources and develop utility-scale geothermal power plants, providing a competitive, clean and indigenous energy source for the benefit of local economies, while providing returns for investors.

RG is committed to passing geothermal expertise on to local entities, a transition that includes training and education of local experts and cooperation with regional institutions and local contractors and consultants. RG is also dedicated to introducing the UN geothermal program to its partners and to utilizing other educational and training programs to increase the competence of its partners. For decades, the team has performed a leadership role at the UN Geothermal Training Program in Iceland with students from dozens of emerging markets, thus gaining an intimate knowledge of the specific resources in each country, as well as personal contact with key people.

RG comprises a strong financial team in addition to project management and technical and scientific teams. With staffs of about 25 experts in the various disciplines of upstream and downstream geothermal development, RG can comfortably manage the entire value chain of geothermal projects, from the early green field studies up to financing, commissioning and operating large power plants.

RG has an extensive network of political connections and relationships with best in class geoscientists, surveyors, drillers, suppliers, and construction partners. Backed by strong industry, government and investor networks, RG has worked in Africa, Asia, Russia, China, South America, Oceania, and the Caribbean. In addition to pioneering the first geothermal developments in the Arabian Gulf, RG presently focuses on development projects in East Africa; particularly in Ethiopia, but also in other countries. In Ethiopia, RG has finalized the acquisition of the geothermal exploration licenses for the concessions in Abaya, Corbetti and Tulu Moye.

RG actively operates a well-defined policy of Social Responsibility, and strives to work closely with local authorities and communities in all its projects for mutual benefit. RG received ISO 9001 quality certification in 2010, and has implemented the international social accountability standard, SA 8000, and all principles of the ISO 26000 standard on social responsibility. The Company implemented the international standards ISO 14001 and OHSAS 18001 in 2012, on environmental management and occupational health and safety management, respectively. See RG policies in Part III.

RG places great emphasis on developing a constructive and prosperous relationship with the communities in which it operates. RG has dedicated itself to improving people's lives within those markets by choosing local partners, while creating local jobs and increasing educational opportunities. Through its operations, RG supports the improvement of health care and community based resource management.

## 1.2 ESIA external consultants

Although companies can use in-house staff and /or external consultants /experts /competent professionals to carry out risks and impacts identification process, it has been recommended by the International Finance Corporation (IFC) for projects with issues that may pose significant adverse impacts and risks, that companies should retain qualified external experts to assist in the conduct of all or part of the environmental and social assessment. The services of qualified external experts are typically required in certain defined circumstances, such as on issues concerning resettlement, biodiversity, Indigenous Peoples and cultural heritage.

Reykjavik Geothermal placed two additional requirements. Firstly, that the ESIA report be constructed by external consultant with thorough experience in ESIA for geothermal projects. Secondly, that local /national experts or partners should be employed - as per the Social Responsibility Policy of RG and the Ethiopian ESIA process and practise.

Following Inception /Scoping Report for the ESIA work prepared by RG and VSO Consulting, external consultants were selected:

- Two external consultants were requested to prepare ESIA for stakeholder consultation (Version 01): VSO Consulting as the ESIA geothermal expert; and following tender, Gibb International, an African based consultant with an office in Addis Ababa, Ethiopia, and other offices in several countries.
- Two external consultants were requested to prepare ESIA for submission and approval (Version 02): VSO Consulting as the geothermal ESIA expert; and following tender, TS Environment, a leading environmental, social and sustainability consulting service in Ethiopia, certified by the Ethiopian Environmental Protection Authority.

Present ESIA Report is the work of an VSO Consulting and TS Environment Technology Plc. The extensive information on current state of environmental and social factors are based on baseline survey carried out by GIBB International in 2014-2015 and reviewed by TS in 2017. The baseline survey addresses legal and institutional aspects for the Project, water and hydrogeology, soil, geology, land cover and land use, air quality, noise and vibration, climate and meteorology, visual aesthetics, cultural and archaeological issues, the biological environment and socio-economics. The study also focused on finding construction materials e.g. for access roads, both in terms of quality and quantity, yet with as little impact as possible. The baseline study can be found in Annex.

The geology section of ESIA report is furthermore based on surface exploration study by RG geoscientists who surveyed the Tulu Moyo geothermal prospect in terms of geology, geochemistry and resistivity.

This ESIA report was prepared per Ethiopian Proclamations, regulations, standards, rules and commitments. Ethiopian environmental legislation system agrees with The World Bank Operational Manual Policies of Environmental Assessment including Environmental Management Plan with a set of mitigation, monitoring and measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduces them to acceptable levels.

### 1.3 ESIA report phases and versions

This ESIA report describes the first phase of the Project, which includes exploration drilling, production drilling, well pads, access roads, water supply, quarries, pipelines, and up to a 100 MW power station. Indicative results of RG surface explorations suggest that the potential of the Tulu Moye area will probably support up to 500 MW without adversely affecting the geothermal resource.

The nature of geothermal projects is dynamic in the sense that they are continuously evolving during the entire life span of the resource harnessed; surface studies may indicate wide area that gets narrowed down and with more measurements additional areas may be indicated as further potential. The geothermal model may change with each well drilled as more information accumulate and locations and plans will continue to change. Therefore, geothermal projects are generally executed in stages.

It is important that ESIA reporting reflects this nature of the development of the geothermal resource. Ways to deal with this have involved making memos /reports, addendums or annexes /appendices, additional /new ESIA reports and /or by updating the original ESIA report.

It is suggested that this ESIA report be updated and amended with a new version to include updates of studies and additional information to the extent feasible to cover up to 100 MW in Phase I. Phase II will require a new, additional ESIA study report that will be updated accordingly to cover development from 100 MW up to 500 MW.

The present document is:

Tulu Moye Geothermal Development Project – Phase I: ESIA Version 02.

## 2 Project description

### 2.1 Introduction

The objective of the Geothermal Development Project (the Project) in Tulu Moye in Oromia is to provide up to 500 MW of clean electric power from a renewable source to Ethiopia at a stable, cost competitive price. Geothermal drilling proposed by the Proponent is not the first of its nature in Ethiopia; yet the Project will be setting precedents for environmental and health and safety standards. The project will be developed in 2 phases:

**This first phase** of the Project includes 20 +/- wells, the construction of up to 100 MW power station with turbines/generators, collection pipelines from the wells to the station, cooling system (tower), and discharge outlet. A wastewater treatment system may also be required for the power station. This ESIA report is for the first phase, i.e. 100 MW.

**The second phase** is for the extension of the geothermal utilization up to 500 MW. A new ESIA report will be presented for the second phase.

Geothermal power generation involves drilling deep exploration and production wells into the Earth's crust to harness the thermal energy contained in underground reservoirs of geothermal waters or steam. Wells are drilled in clusters/groups; each drill pad/site typically comprises of two to five wells/boreholes. These wells bring a mixture of steam, gas and water (brine) to the surface where the steam can be separated and used to power turbines to produce electricity. Brine and condensate removed by the separators are returned, at the production stage via reinjection wells, to the geothermal reservoir. For the generation of electricity, a power station will be built, with turbines/generators, pipelines from the wells to the station, cooling system and discharge outlet.

### 2.2 Geothermal process

The most common way of capturing the energy from geothermal sources is to tap into naturally occurring "hydrothermal convection" systems, where cooler water seeps into Earth's crust, is heated up, and then rises to the surface. Once this heated water is forced to the surface, it is a relatively simple matter to capture that steam and use it to drive electric generators. Geothermal power plants drill their own holes into the rock to more effectively capture the steam.

The geothermal power plant pulls hot water and steam from the ground, use it, and then return it as warm water to prolong the life of the heat source. In the simplest design, known as dry steam, the steam goes directly through the turbine, then into a condenser where the steam is condensed into water. Another approach, is where very hot water is depressurized or "flashed" into steam which can then be used to drive the turbine. The third approach, called a binary cycle system, the hot water is passed through a heat exchanger, where it heats a second liquid—such as isobutane—in a closed loop. Isobutane boils at a lower temperature than water, so it is more easily converted into steam to run the turbine.

### 2.3 Project settings

The Main Ethiopian Rift constitutes the northernmost part of the East African Rift System, an area characterized by active extensional tectonics and associated volcanic activities. The focus area, Tulu Moye, is situated in the Main Ethiopian Rift, northwest of Asela, close to the eastern margin of the rift. It is a wide Zone where tectonic and volcanic activities are concentrated.

The Tulu Moye geothermal prospect is located about 100 km south east of Addis Ababa, with Lake Koka to the north and Lake Ziway to the south (Figure 2.1). It is close to the Koka hydro power station and the national grid system. The occurrence of fresh obsidian

flows attests to the youth of volcanism in the area. Basalt flows make up the low-lying area at an altitude of about 1,900 m a.s.l. while the central silicic eruptive centres rise to up to 2,300 m a.s.l.

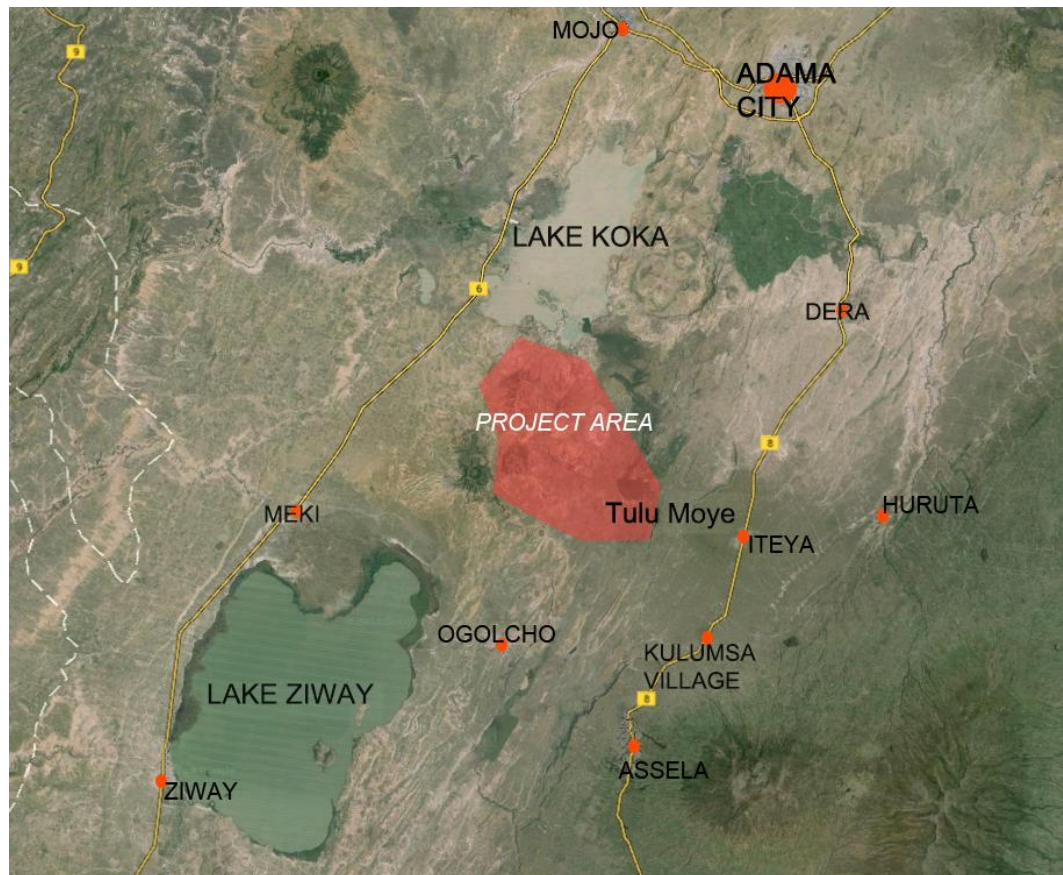


Figure 2.1 The project/study area

## 2.4 Drilling area

Tulu Moye is characterized by volcanism dating from less than 0.8 million years continuing intermittently into historic times (EEPCO, 2005). Due to its relatively high altitude, the prospect area exhibits geothermal activity in the form of weak fumaroles, steaming ground (60-80°C) and geothermal alteration, but no thermal hot springs.

The geothermal target zones within the study area are geophysical areas of interest that has been further assessed. The conclusion of the exploration phase is to locate the Drilling area in the east side of the project/study area. The Drilling area will include: The power plant, drill pads and flowlines linking the locations to the geothermal plant (Figure 2.2). The exact locations of these wells, flowlines and plant will be determined following the exploration drilling and detailed engineering design.

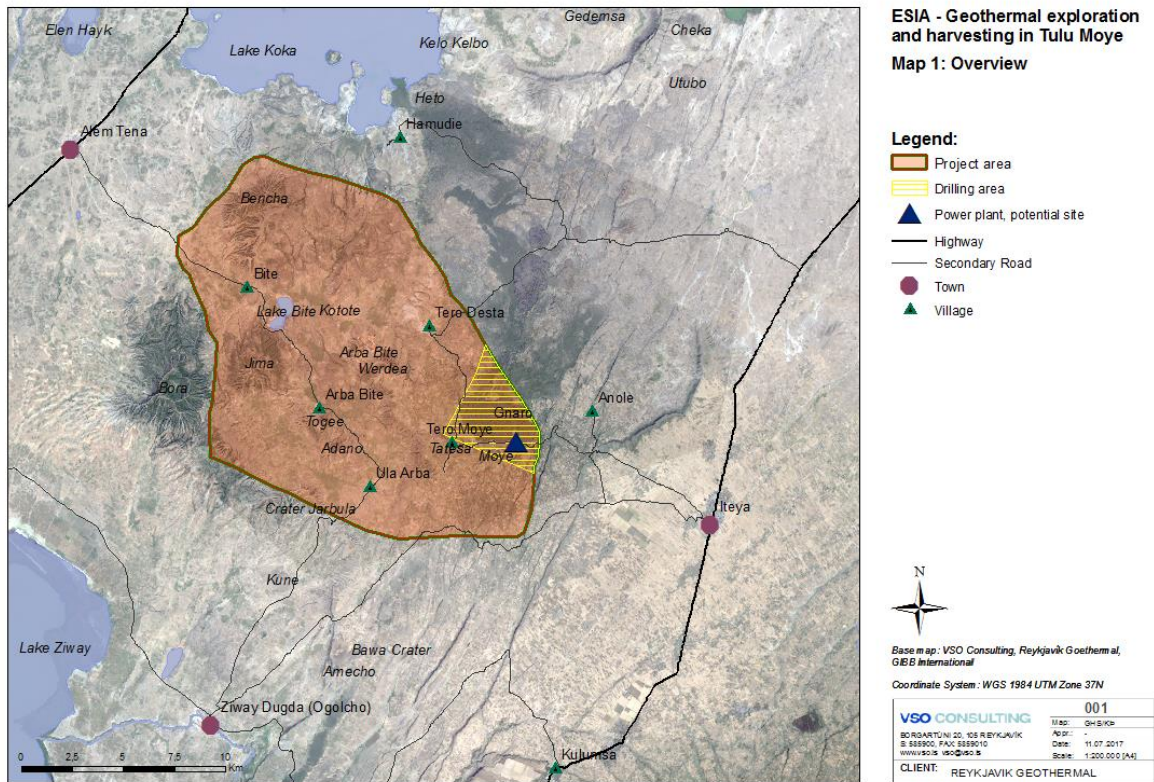


Figure 2.2 The Drilling area within the larger project/study area

## 2.5 Area of Influence

The International Finance Corporation's (IFC) Performance Standard (PS) 1: *Assessment and Management of Environmental and Social Risks and Impacts* (2012) requires that the Project's Area of Influence (AoI) is determined based on the following guidance:

*"Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate:*

- *The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.*
- *Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.*
- *Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.*

*In the event of risks and impacts in the Project's area of influence resulting from a third party's actions, the client will address those risks and impacts in a manner*

*commensurate with the client's control and influence over the third parties, and with due regard to conflict of interest.*

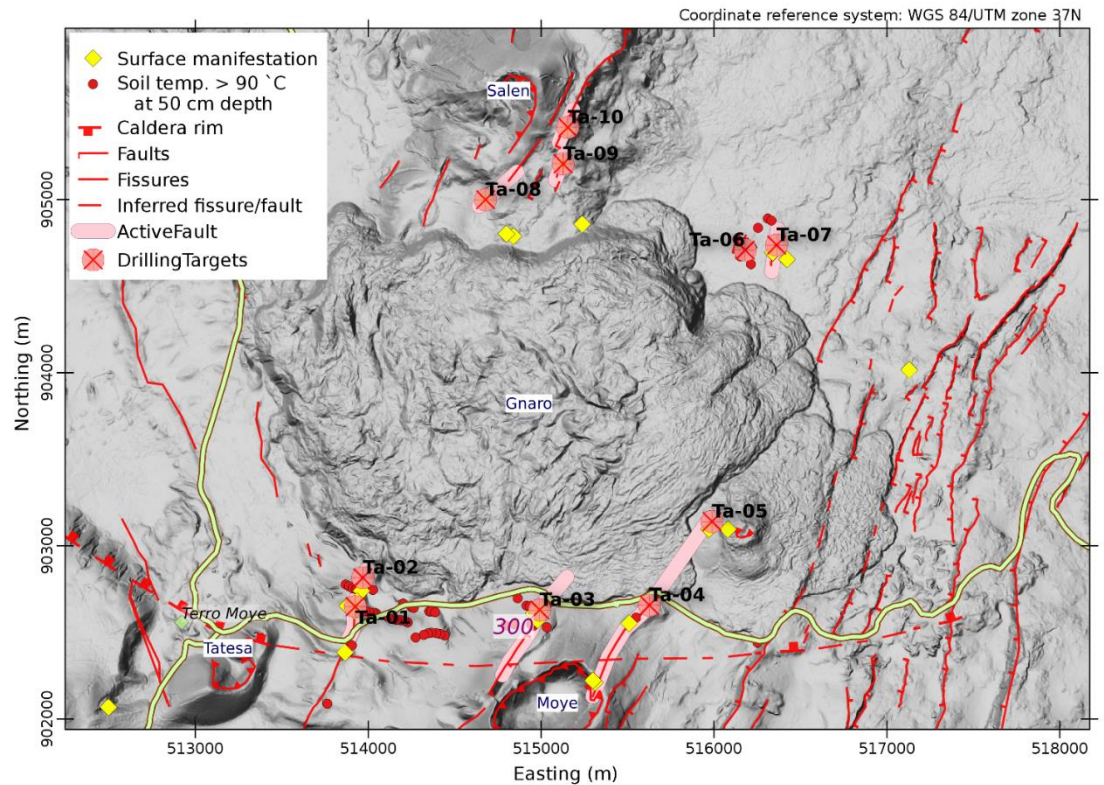
*Where the client can reasonably exercise control, the risks and impacts identification process will also consider those risks and impacts associated with primary supply chains, as defined in Performance Standard 2 (paragraphs 27–29) and Performance Standard 6 (paragraph 30).”*

3-4 drilling platforms have been suggested in an area around the Gnaro lava field. The locations have been selected where two or more identified targets can be reached. The locations are also influenced by logistics, such as possible access roads, an elevation which enables pipeline flow from the drill pad to separation station and other downstream installations, and to minimize interference with current land use.

Based on the preliminary results of the ESIA study and RG geoscience team, the Project's Aol can be determined as follows.

- Areas of immediate Project footprint due to exploration drilling:
  - Area required for construction of access roads to drill pads.
  - Area required for drilling for water and water pipeline. Present plans involve drilling for groundwater south or east of the Gnaro lava, near the town Anole.
  - Area for 3-4 drill pads (about 5,000-7,200 m<sup>2</sup> each) and possible injection site(s).
  - Area about 500m radius around each drill pad because of noise.
  - Lay-down area for materials and an area for a Power Station.
- Agricultural plots located around the Gnaro lava, also along the existing gravel road south of the Gnaro lava (from Highway #9 to the Project site) to be used by the Project for transportation of equipment and materials.
- Settlements around the Gnaro lava such as Tero Moye.
- Settlements located along Highway #9 (between and including Adama and Iteya, possibly Assela) off the main Highway #1.
- Area required for separation station and other installations, to be determined at later stages of the Project development.
- Area required for transmission line(s), to be determined at later stages of the Project development.
- Three Kebeles in and around the Drilling Area (Tero Moye, Anole and Tero Desta), that may feel the impact of the operation but may also benefit from employment and direct and indirect economic opportunities.





**Figure 2.3 Location of Drilling Targets (Ta)**

## 2.6 Project process

Phase I: Power generation up to 100 MW

- 1 Reconnaissance study, overview of the potential resource. Data collection for pre-assessment e.g. through the web and available (open) sources. Desktop study, visual observation. Exploration license in place. Step completed.
- 2 Resource quantification, exploration and confirmation. Field reconnaissance involving geophysical and geochemical surveys and mapping parameters such as depth, resource size and temperature. Step completed.
- 3 Pre-development exploration drilling in target area. Development planned and assessment of the project's feasibility. Civil work on construction of roads and drill pad(s), hiring of contractor(s) for exploration drilling and water provision.
- 4 Geothermal resource production and drilling of production wells. Successful exploration wells may be used for production. Re-injection wells will be considered.
- 5 Power plant construction including turbine/generator and cold end. Electricity production up to 100 MW, plant development.

## 2.7 Project components

### 2.7.1 Resource quantification

Further investment in surface exploration is required to define boundaries of the resource potential and determine if Project development is justifiable and reasonable.

Field reconnaissance required teams of experts and other staff to conduct geophysical and geochemical surveying and mapping. Geophysical work involves Magneto Telluric (MT) and Transient Electro Magnetic (TEM) resistivity measurement technologies; once analysed along with geochemical sampling and analysis, the data yield parameters on the geothermal resource such as depth, size, temperature and other information.

### 2.7.2 **Access roads and traffic**

Roads are required for construction and operational activities immediately at the exploration drilling site. Various possibilities will be considered for alternative access roads. The Proponent will focus on upgrading existing roads where possible and practical (Figure 2.2), but new roads are likely to be required. Consideration will be given to routing in order to minimize visual impacts and effects on landowners and land use. RG has located a potential route to connect the well pad number B according to these criteras (Figure 2.4).

The possible modifications of existing roads and new access roads are essential. The roads need to carry heavy load traffic since heavy equipment will be transferred to each drilling site. It depends on drilling site selection how much modification of existing roads and how many new roads will be needed.

Access road(s) requirements:

- ▶ 6 m wide. Paths to drilling pads can be narrower.
- ▶ Where necessary, gravel will be used to stabilise parts of the track, and erosion.
- ▶ Sediment control measures will be used to prevent erosion of land and siltation of waterways.
- ▶ Vegetation will be cleared using earthmoving equipment and chainsaws as necessary.
- ▶ The necessary tracks will be maintained and used as required for the extent of the Project.

Truck traffic will be considerable during the drilling rig moving phase, up to 40 trucks in addition to large cranes during moving week, but during the drilling operation one can expect around 10 truck transportations per week. This includes transportation of cementing materials, drilling mud materials, disposal of excavated solids and liquids, diesel fuel and drilling equipment.

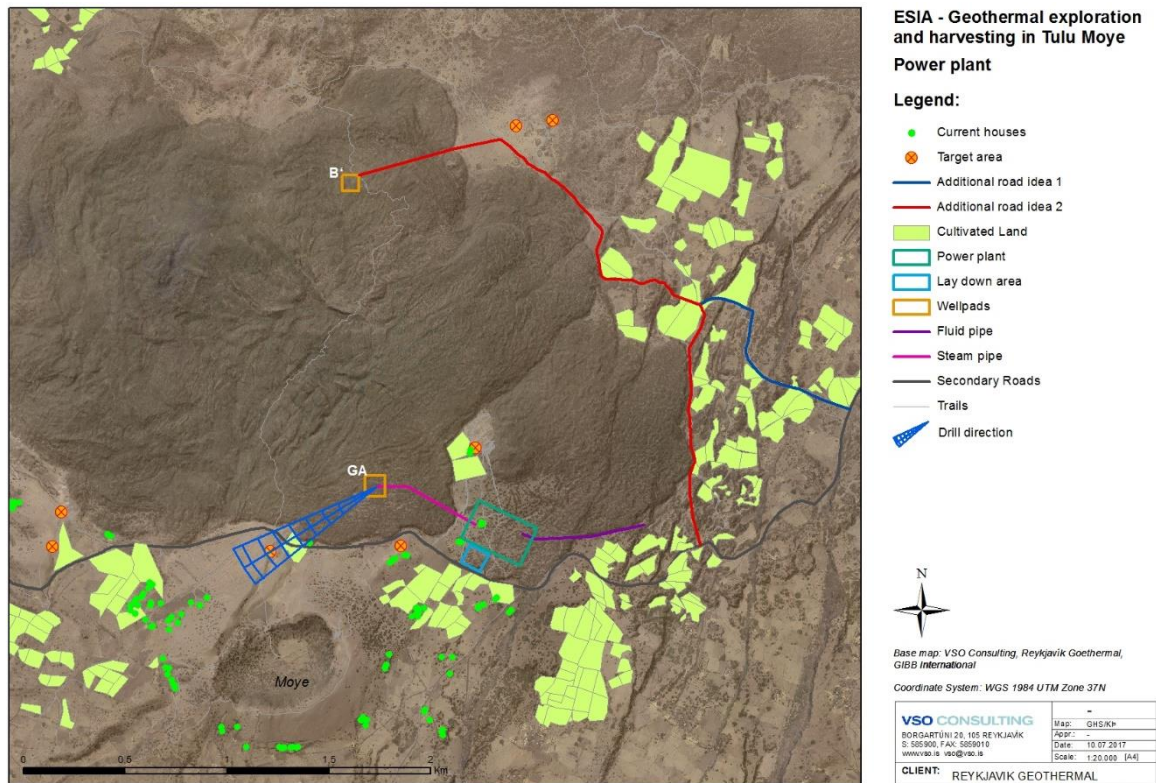
### 2.7.3 **Exploration drilling**

Exploration drilling may involve 1 to 4 exploration wells, which can be 1,500 to 3,500 m deep. Duration for drilling exploration well is 1-2 months. After drilling, a borehole is allowed to blow for 3-4 months; during that time necessary measurements and tests are done on the hole, referred to as blow testing. Blow testing primarily involves reservoir engineering of the geothermal system and the production capacity of the hole. Some noise accompanies the blowing of high-temperature holes, and mufflers/silencers are used to reduce the level of noise.

The preparation, construction and evaluation of the drilling wells include:

- ▶ Well pads location
- ▶ Well design and drilling program
- ▶ Size of well pads will be approximately 7,200 m<sup>2</sup>, when up to 3 wells per well pad
- ▶ Development of an Emergency Response Plan
- ▶ Rig mobilization and material supply
- ▶ Rig-up and inspection
- ▶ Drilling and supervision of exploration well; Well testing and supervision
- ▶ Rig move and supervision
- ▶ Drilling reports and well evaluation reports

The exploration wells will be located within the Drilling area (Figure 2.2), and will possibly call for improvements of existing roads or construction of new track, see chapter 2.7.2.



**Figure 2.4 Overview of the main project components in the first phase**

RG has located the first two well pads for the Project, GA and B (Figure 2.4). From each well pad, there can be drilled up to 5 geothermal wells. From the the first well pad (GA), the target point can be reach by directional drilling which can get in circular path about 800 m from the drill (Figure 2.4). The blue grid from the well pad GA shows the possible direction of the first well which will be about 2,500 – 3,000 m in depth, and reaches target southwest of the well pad. The second of the first two well pads is located in the north part of the Gnaro obsidian lava field, marked B. This area will be reach by building road which will follow the edge of the Gnaro obsidian lava filed. By following this route/path the cultivated area around the lava field can mostly be avoided. The vegetation in the lava field itself is mostly bushes and trees. A more detailed description of enviromental factors will be available when rapid biodiversity study, suggested later in this ESIA report and part of ESMP as an action item,- is completed.

The area at and around the well pad and its access road is covered with vegetation.

Access to water is also necessary, see chapter 2.7.5. Exploration wells will be drilled in the same way as production wells, and therefore can be used for production if applicable.

**Table 2.1 Key data for exploration drilling**

|  |                            |
|--|----------------------------|
| Number of exploration wells                            | 1-4                        |
| Size of well pads                                      | 7,200 m <sup>2</sup>       |
| Depth of exploration well                              | Upto 3,500 m               |
| Drilling water source                                  | At drilling sites          |
| Drilling water take volume/drilling                    | 300 m <sup>3</sup> per day |
| Geothermal fluid produced during exploration well test | 200-400 m <sup>3</sup>     |
| Time of drilling                                       | 30-60 days                 |
| Well testing   | 30-90 days                 |
| Work force   | 60                         |

Exploration wells are typical geothermal wells drilled with directional drilling technique. They are up to 3,500 m long, deviated to about a 30° angle and are cased down to 800 m.

### **Well testing**

Up to 50 litres per second (l/s) of industrial quality water per exploration well may be required for a maximum duration of 45 days. Water will be stored on site in tanks or pond and water pipeline will be required from the water source to the operation area.

Approximately 230 m<sup>3</sup> of drill cuttings may be brought to the surface from each well. In order to collect the drilling fluids and geothermal brine while drilling, lined ponds /basins will be at each rig site and excess water from them led for infiltration in either open fissure(s) or shallow wells drilled close to the drill sites. These ponds and wells may also be used during operation of a power station. The drilling fluid is led through a pond where most of the drill cuttings will settle and the water will cool. The waste drilling fluid is routed and disposed of in shallow well open fissures or disposed at another authorized designated site. The fate of effluent water or brine collected in a pond would be evaporation and infiltration into the soil and bedrock. The pond also acts to delimit the area affected by the discharge. Drill cuttings can be used as land fill at the drilling site or at another appropriate location. Ponds are used for collecting brine from tested wells and partly from the power station (see chapter on 2.7.10 on injection wells).

At the conclusion of drilling and blow testing during the exploration drilling phase, the wells are prepared for connection to the steam utility. If blow testing shows that a well is sufficiently productive to be used for generation, it will be utilized as a production well for the power station.

After drilling, a well head equipment is put on top of the well. A silencer is put in place and connected to the well by pipeline. After thermal recovery of the wells they are blow tested for usually up to 1 to 3 months in order to evaluate the characteristics of the geothermal reservoir. (This testing period can be cut down to a few weeks if need be.) Testing also serves to collect necessary information for the subsequent design work for a geothermal power plant if conditions are found feasible.

The geothermal fluid is separated in the silencer into steam and water at atmospheric pressure. Noise from the well during testing can be in the range of 70-110 dB(A). Noise drops with increased distance from the well and at 100 m distance noise should not exceed 70 dB(A).

#### **2.7.4 Production wells**

The aim of the production drilling program will be to access and collect fluid from the geothermal reservoir through the production wells to supply the geothermal plant. The exact location of the production will be determined after the exploration drilling and analysis has been executed. Drilling each well may take 30-60 days to complete depending on circumstances, and to drill to a depth of at least 1,500 m to 3,500 m. As mentioned in previous chapter, exploration well can be used as production well if sufficiently productive. It is estimated that part of the wells in GA and B will be used as a production well (Figure 2.4).

The three main materials likely to be used in considerable quantities during drilling are polymer liquid drilling fluid, bentonite and a thread lubricant and sealant. It is highly recommended that environmentally friendly versions of these materials be used; biodegradable, bioaccumulation potential-free and non-toxic to all kinds of life forms. Material safety data sheets will be provided with all materials used in the drilling operation.

Table 2.2 Key data for production wells

|  |                      |
|--|----------------------|
| Number of production wells                     | 14-16                |
| Size of well pads (up to 3 wells per well pad) | 7,200 m <sup>2</sup> |
| Depth of production well                       | 1,500-3,500          |
| Drilling water source                          | At drilling sites    |
| Uptake of geothermal fluid                     | 650-750 kg/s         |
| Uptake: liquid / steam                         | 60-70% / 30-40%*     |
| Time of drilling                               | 30-60 days           |
| Work force                                     | 60                   |

\* The uptake 650-750 kg/s is estimated to be 60-70% liquid and 30-40% steam

Although directional drilling may be an option for production wells, the location of well pad(s) and associated facilities are constrained to some extent by the dimensions of the geothermal resource. Site selection of the power station including turbine(s)/generator(s) and cold end will require review of the topography of the area, data on the resource, the available road network and various other issues and variables that will be outlined in the ESIA report.

Site preparation works and mobilisation activities will proceed during daylight hours only, however production drilling activity will be undertaken seven days per week, 24 hours per day.

### Well pads

The size of one drilling pad will be about 7,200 m<sup>2</sup>. All necessary equipments are located within the well pads such as the rod carrier, the mast, mud storage, fuel storage, pipe storage, accommodation and more (see Figure 2.5). To minimize the necessary footprint of area required for each well, multiple wells may be placed within the same drilling pad. Each pad will be built based on gravel. The estimated number of production wells will be 14-16 for Phase I.

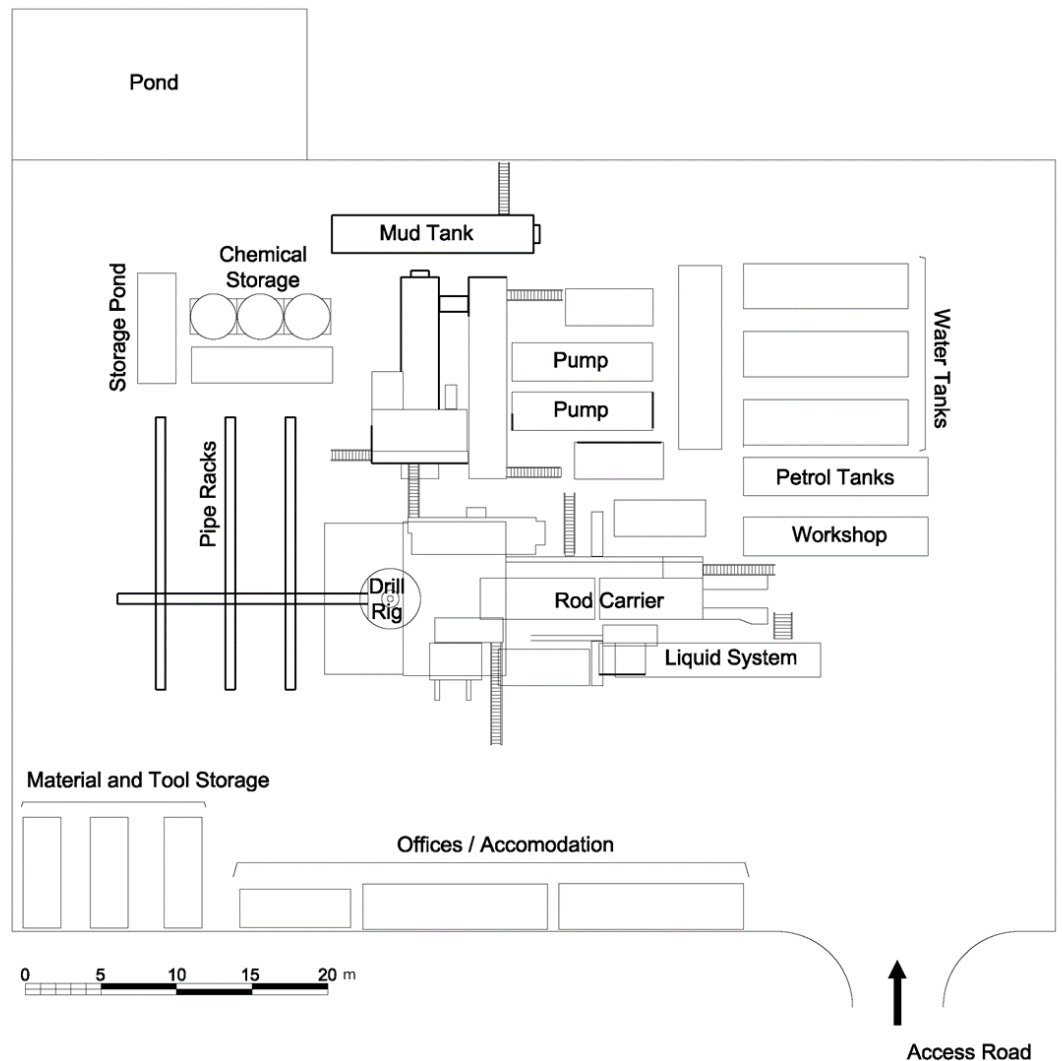


Figure 2.5 Example of a well pad layout area

The distance between well pads will be about 1,000 m, but will depend on landscape and various environmental components as described later. The planned time for drilling each production well is 1-2 months. This depends on exact well design, drilling formations and the experience of the drilling supervisors and contractors working in the geothermal area.

In each production well pad, one wellhead silencer or one rock muffler will be attached as peripheral equipment which is used during discharge tests after drilling or other purposes. Collecting ponds adjacent to the well pads will be used to temporarily accumulate the brine drained from the silencer during the production tests.

During the drilling operations up to 30 personnel can be working at any given time.

All drilling equipment will fulfill strictest standards regarding noise levels. The motor generator will create the highest noise level, 92 dB(A) at a 2 m distance. In a case should results from the drilling prove negative, the drill pad is removed and reshaped to blend in with the landscape. The borehole is sealed and closed permanently with concrete. The size of the construction area will be minimal, within 5 m<sup>2</sup>.

### 2.7.5 **Water supply**

Generally, drilling requires 25-30 l/s of water for cooling and to wash the drill cuttings from the hole. A reservoir of 5,000-10,000 m<sup>3</sup> will be built and used for drilling purposes. Water is also necessary for the operation of the power station, estimated 40-60 l/s.

Therefore, a deep water well will be drilled for the project to secure the drilling and power station with water.

Wells will be drilled for water extraction. Present plans involve drilling for groundwater south or east of of the Drilling Area, near the town of Anole. Currently RG is studying the efficiency of several potential water drilling sites. Special report(s) will be published on the water issue and information and data shared with the appropriate Woreda admins.

Water from source is piped in temporary plastic pipelines that will be removed after drilling. Water source for the power station will be supplied by deep wells, but alternatively water from nearest lake if possible. Water wells will be within the Drilling area, possible south of it. It may be necessary to drill 3-5 water wells for the drilling purpose, and another 3-5 for the operation of the power station. It is estimated that the capacity for each water well is 5 l/s (Table 2.4).

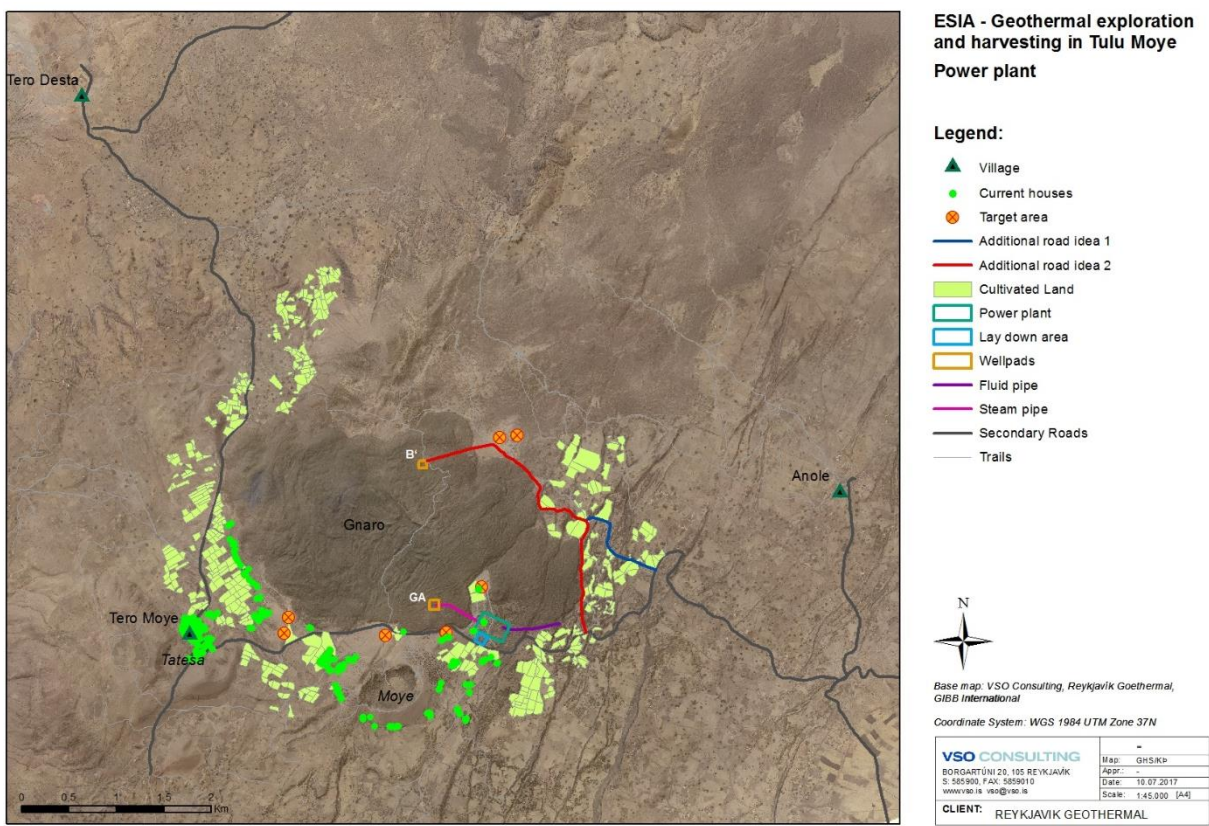
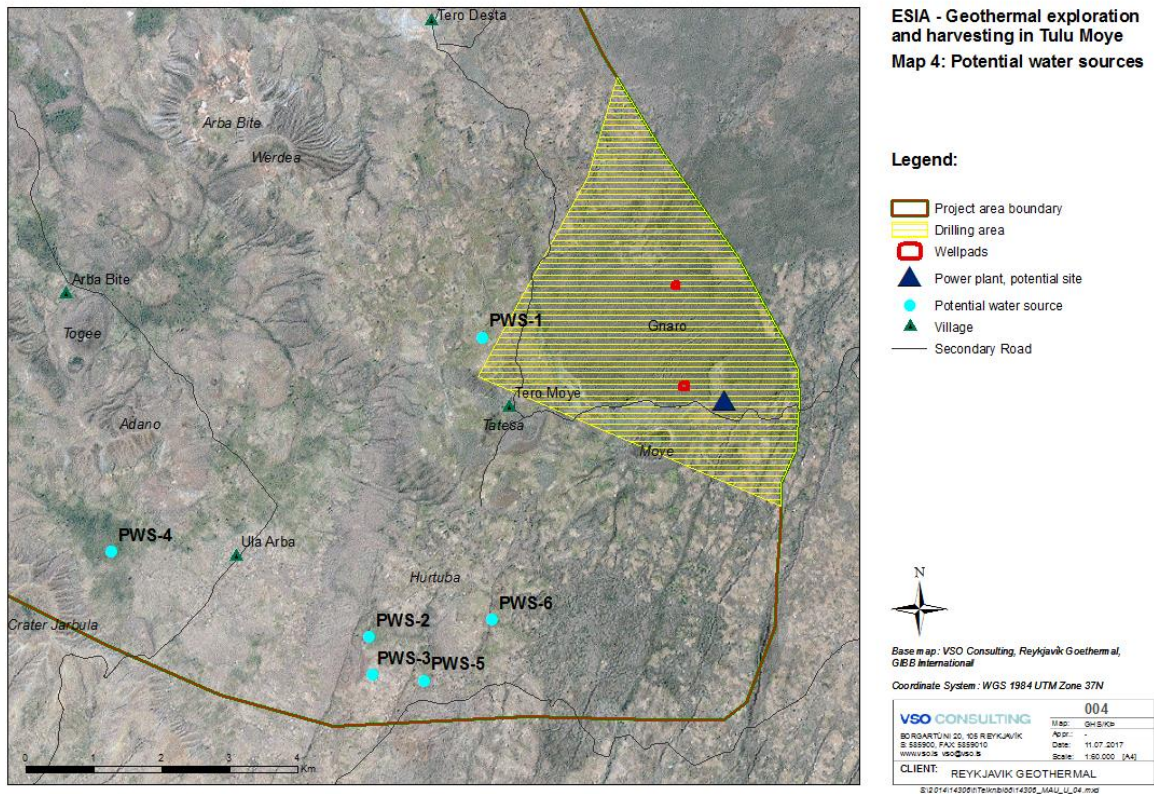


Figure 2.6 The main project components and nearby villages



**Figure 2.7 Initial proposed location of possible water wells within the Project area**

**Table 2.3 Potential water sites considered**

| No.   | Locality   |
|-------|--|
| PWS-1 | Side, Tero Moye, Hitosa (GIBB, 2015)   |
| PWS-2 | Adam Dule Kure, Arba Chafa (GIBB, 2015)  |
| PWS-3 | Adam Dule Kure, Arba Chafa (GIBB, 2015)  |
| PWS-4 | Arba Chafa (GIBB, 2015)  |
| PWS-5 | Shekeka, Hurtu Denbi (GIBB, 2015)  |
| PWS-6 | Hadano, Hurtu Dedenbi (GIBB, 2015)   |
| Anole | Potential sites south or east of the Drilling Area, possibly in vicinity of Anole. Specific location TBD. (RG) |

Possible alternatives to consider regarding water supply include drilling deep wells for water or get water from nearest lake (Lake Koka). Should the lake option be taken, potential impact on the lake should be evaluated, including its ecology and other water users should be considered and a hydrological assessment carried out. In addition, any water pipelines and flowlines must be considered in the ESIA, especially in terms of their routing, to avoid /minimise environmental and social impacts. This will involve expanding the Area of Influence to cover water intake in Lake Koka and water pipeline.



Issues concerning water supply include:

- ▶ Distance to water source must be considered.
- ▶ Drilling for water depends on how deep the groundwater level is within the Project area.
- ▶ The quality of the groundwater may not fulfill the limits set for drinking water.
- ▶ A temporary pipeline system is used for the drill wells but a permanent water works system is needed to pipe water to the power stations.
- ▶ Rights-of-way issues should be resolved if water needs to be supplied from lake.

Table 2.4 Key data for water supply

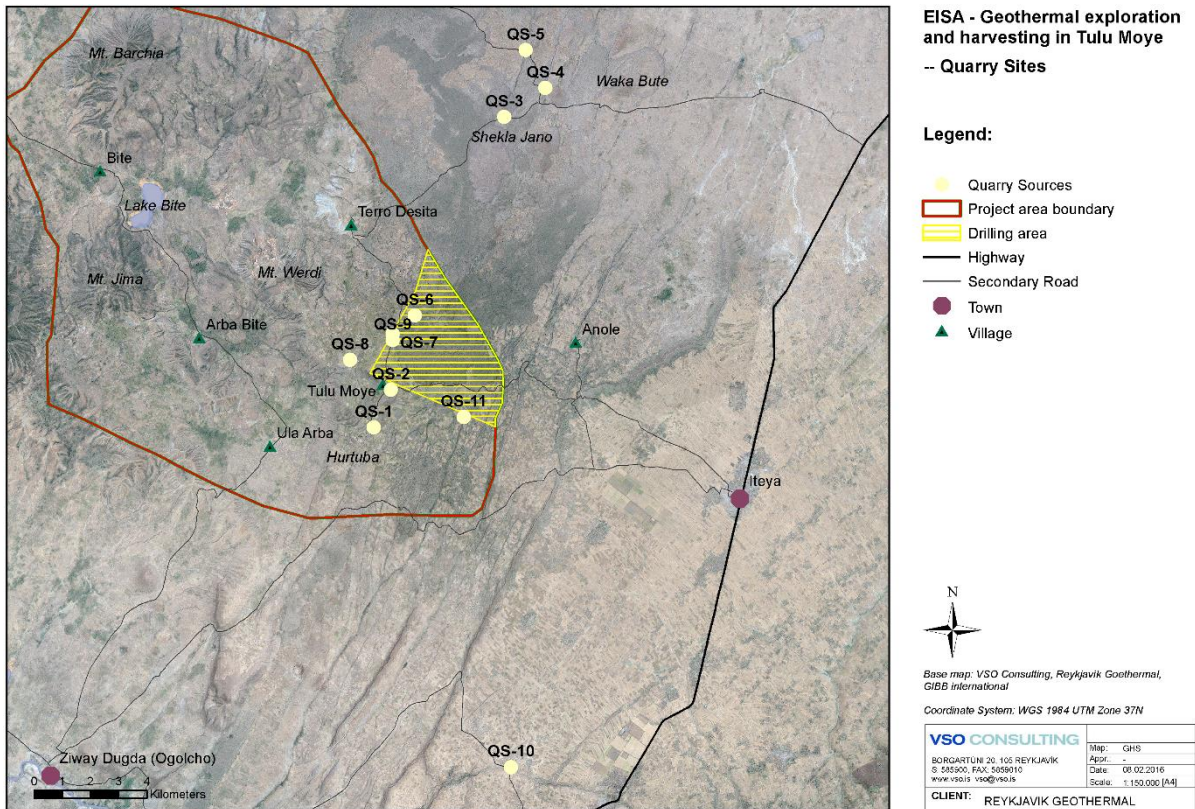
|  |                    |
|--|--------------------|
| Number of water wells for drilling       | 3-5                |
| Number of water wells for power station  | 3-5                |
| Size of well pads                        | 500 m <sup>2</sup> |
| Drilling water take volume/drilling      | 25-30 l/sec        |
| Drilling water take volume/power station | 40-60 l/sec        |
| Work force                               | 15                 |

### 2.7.6

#### **Quarries**

At this stage it is possible to estimate the the amount (m<sup>3</sup>) of construction materials for drilling pads, however the amount for roads is uncertain. Survey was conducted to find suitable construction materials for well pads and road construction. As can be seen in Figure 2.8 (GIBB, 2015) suitable construction material is accessible at a reasonable hauling distance.

The Baseline Report concludes on the basis of observations, that the materials sampled and tested are promising for use as good sources for the anticipated purposes, see Table 2.5.



**Figure 2.8 Proposed quarry sites**

**Table 2.5 Potential quarries (GIBB International, 2015)**

| No.   | Locality                     | Status   | Description                        | Accessibility                      |
|-------|------------------------------|----------|------------------------------------|------------------------------------|
| QS-1  | Mt. Tulu Jebi, Tulu Moye     | Existing | Fresh Scoria Cone                  | Very good                          |
| QS-2  | Mt. Tatesa, Tulu Moye        | Proposed | Fresh Scoria Cone                  | Close to Drilling area. Very good  |
| QS-3  | Shekla Jano                  | Proposed | Fresh to slightly weathered Basalt | Very good                          |
| QS-4  | Miesa Shokosaye              | Proposed | Fresh to slightly weathered Basalt | Very good                          |
| QS-5  | Waka Bute                    | Existing | Fresh Scoria Cone                  | Very good                          |
| QS-6  | Mt. Salen, Tero Desta        | Existing | Fresh Scoria Cone                  | Inside of Drilling area. Very good |
| QS-7  | Mt. Gnaro, Weafo, Tero Desta | Proposed | Fresh Basalt                       | Inside of Drilling area. Very good |
| QS-8  | Gaya, Tero Moye              | Proposed | Slightly weathered Ignimbrite      | Very good                          |
| QS-9  | Mt. Gnaro, Weafo, Tero Desta | Proposed | Fresh Ignimbrite                   | Inside of Drilling area. Very good |
| QS-10 | Jango Kilisa, Hitosa         | Proposed | Fresh Ignimbrite                   | Very good                          |
| QS-11 | Hurtu Dembi                  | Proposed | Fresh Basalt                       | Close to Drilling area. Very good  |

Whereas the exact quality of gravels required for surfacing of well pads could vary, the material for this purpose should not only be strong enough but also of good permeability to allow the free flow of surface water to its bottom, where it would be collected on an impervious inclusion like geo-membrane, so that the collected water would be easily guided to an appropriately designed drainage system. Such gravels may thus not have as much fine content as the surface gravels to be used in the access roads in order that water percolation is not impeded (GIBB International, 2015).

Table 2.6 Key data for estimation of construction material

|  |                                 |
|--|---------------------------------|
| Construction material for 20 well pads           | 70,000 to 85,000 m <sup>3</sup> |
| Construction material for roads                  | Uncertain m <sup>3</sup>        |
| Construction material for Power station and more | 12,000 to 18,000 m <sup>3</sup> |

### 2.7.7 **Pipelines and separation plants**

The geothermal liquid from production wells is collected into a separator plant, where the steam is separated out and led into the power station via intake pipes (Figure 2.10). The steam is subsequently used to run the turbine to generate electricity.

Pipelines from the well to the separator for two-phase flow, as well as steam pipes and pipes for brine water are all carbon steel pipes. Pipe wall thickness is determined from steam pressure and corrosion, depending on the fluid condition. Pipelines are covered with thermal insulation to prevent temperature drop and for safety.

Diameter of pipelines is determined from the pressure drop between production wells and the power station. They are designed to maintain appropriate flow speed depending on the form of fluid. The pipelines will be raised above the ground on stays, with expansion joints at regular intervals.

### 2.7.8 **Electricity supply**

During the exploration drilling the rig will provide electricity for the pumping of cooling water from water wells. Electricity is needed to pump the water for the power station, as well as for other operational needs. This electricity will come either from local transmission grid, or through diesel powered engine at site.

### 2.7.9 **Power station**

The preparation, construction and operation of the power station will include:

- ▶ Earthworks and foundation construction
- ▶ Location of Power station
- ▶ Power station construction
- ▶ Pipeline construction for steam and water
- ▶ Geothermal steam turbine installation
- ▶ Cooling system installation
- ▶ Chemical analysis laboratory and hydrogen sulphide (H<sub>2</sub>S) detection and protection system installation
- ▶ Service water supply, water storage tank, filters, pump, pipes from inlet installation (service water is to be used for initial fill of cooling water system and for fire-fighting system)
- ▶ Electrical works and connection to power grid
- ▶ Discharge systems (water, drilling mud, gas, etc.) installation

### Location of Power Station

RG has studied various locations for the Power Stations, e.g. location south and north of Gnaro lava. The result was to recommend a power plant area, south of Gnaro lava, where it is possible to minimize adverse impacts on settlement, landuse and landowners (Figure 2.4). Few huts (3-4) are within the proposed site, observed during a field trip dated June 2017 (Figure 2.9).



Figure 2.9 The potential Power Station site, lay-down area

Two types of power stations fit the conditions in Tulu Moyo for power production, a backpressure unit or a condensing turbine.

#### Backpressure unit

The most common portable T/G units are backpressure units. All equipment is mounted on one common base. The fluid from the well head goes to a separator where the steam and brine are separated. The brine water goes directly to reinjection wells (or at the surface disappearing into the ground). The inlet steam pressure to the turbine is controlled by governing valve that comes with the unit. The steam flows into the turbine, rotating the turbine and generator, the steam pressure drops, exiting at atmospheric pressure. The geothermal gases, such as CO<sub>2</sub> and H<sub>2</sub>S, flow with the steam through the turbine and then is exposed to the atmosphere. The oil cooler is either air cooled or water cooled if water is at disposal.

#### Condensing turbine

A small condensing turbine unit is also possible for the Corbetti project. The T/G unit is mounted on common base similar to the backpressure unit. In addition, a condenser, cooling tower, ejectors and pumps are needed. These units are not as easily transported, and the civil work in installing the units is more extensive. In condensing units, the steam is utilized at much lower pressure than in backpressure units so the efficiency is much better. In the condenser the steam is condensed to water creating pressure much lower than in backpressure unit. Steam ejectors create this low pressure during start up of the

unit and they remove the non-condensable gases (NCG) during operation. The condensed steam can be blended with the brine water for disposal. The gases are exposed to the atmosphere at the end of the process.

Table 2.7 Key data for Power Station

|                           |                              |
|---------------------------|------------------------------|
| Power Station: Base level | < 5,000 m <sup>2</sup>       |
| Seperation Station        | 700 - 1,400 m <sup>2</sup>   |
| Cooling tower             | 1,800 – 2,000 m <sup>2</sup> |

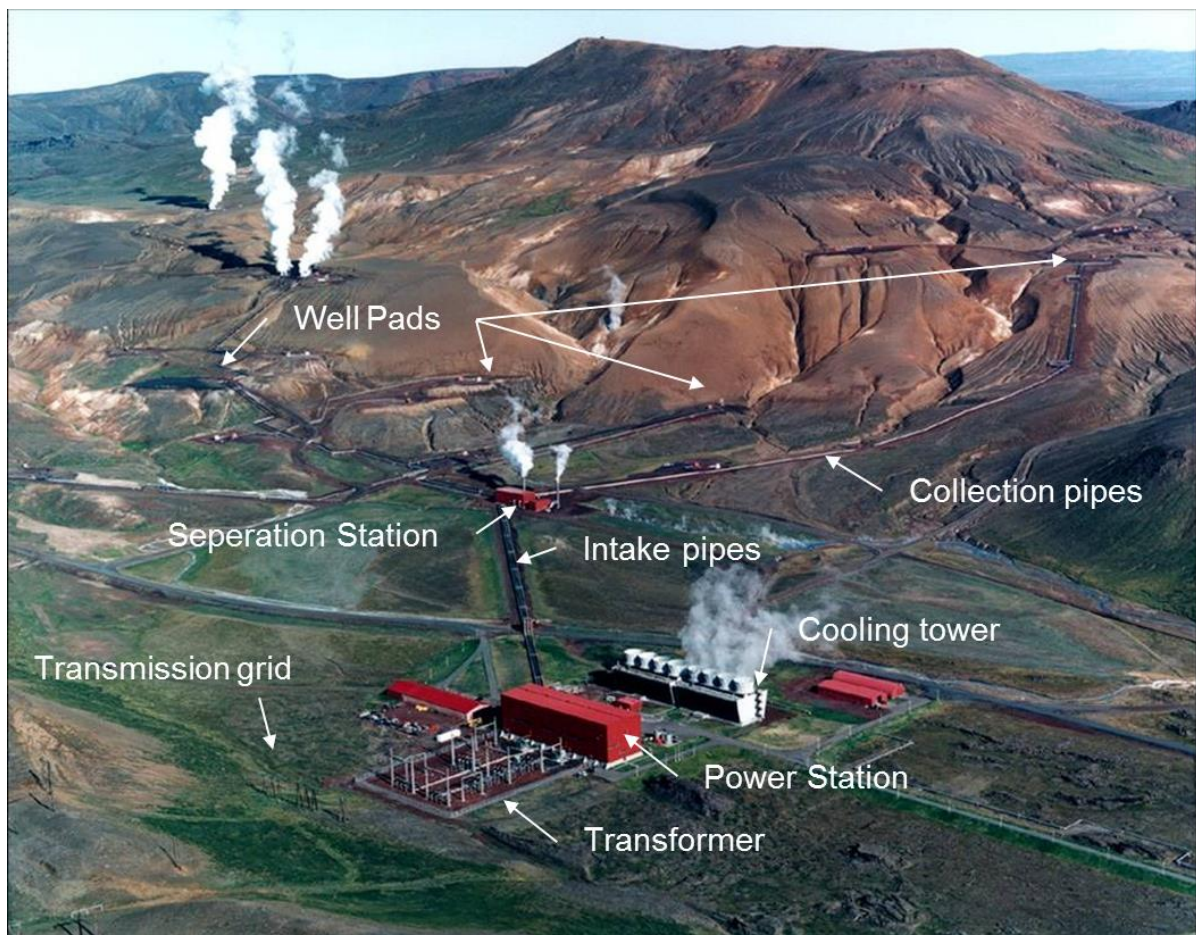


Figure 2.10 Example of main components of a geothermal utilization (Krafla 60 MW Power Plant in Iceland)

Construction of the power plant site will require vegetation and site clearance works as well as earthworks to construct a platform and foundations for the power plant. During the site construction phase the site work-force will reach its maximum of 400 people.

Site preparation work involves bulk earthworks including associated storm-water and sediment control work and road building. Establishing temporary construction facilities, security fencing, drainage controls and access control is also required. Any excavated material will be used for landscape bunds to minimise the requirement to remove material from the site. As the power plant installation nears completion, commissioning will commence; testing initially without, and then with, geothermal fluid. This involves cleaning of steam piping by steam blowing. Once the entire plant has been brought into operation a range of performance tests will be undertaken. Having successfully completed performance tests, the plant will be handed over for commercial operation.

### 2.7.10 Injection wells

By monitoring and using reinjection along with extraction from the geothermal resource, a certain degree of sustainability will be reached:

- ▶ Fluid extracted from the resource is reinjected back.
- ▶ Heat energy left in the fluid is also returned to the reservoir.

Injection/Reinjection requires equipment, pipelines and reinjection wells. (Re)injection must be at some distance from the production wells. This calls for long (2,000 m +/- 1,000 m) pipelines. Geothermal fluid may be injected below ground water but not necessarily reinjected into the geothermal reservoir.

Injection can stimulate seismicity but there is some uncertainty regarding this impact in the Tulu Moye area. Data or knowledge regarding seismicity will only be available as the project continues.

Table 2.8 Key data for injection wells

|                           |                      |
|---------------------------|----------------------|
| Number of injection wells | 3-4                  |
| Size of well pads         | 5,000 m <sup>2</sup> |
| Depth of injection wells  | 1,000-1,250 m        |

### 2.8 Transmission line

Initial plan for the geothermal power plant involves transmission line from the Ethiopian Electric Power (EEP) to transmit electricity to the national grid. The Project's transmission line design (e.g., its height and pole type) and alignment have not been established at this time. Cross-country /inland route will have potential impact on important bird species and possibly other species habitat. It should be encouraged that EEP starts a feasibility study for the transmission line that will consider route alternatives and begin to collect field data that would support a robust evaluation of Project alternatives.

For further discussion, see Cumulative Impacts Assessment (Section 5.5),

### 2.9 Decommissioning

The life of the geothermal power plant is dependent on the life of the geothermal resource. If the resource conditions are still favourable, equipment can be refurbished or replaced at the end of their design life to upgrade and repair equipment to enable operation and generation to continue. The power plant and steam field will be designed to allow for full decommissioning should that be required at the end of the plants design life, or before if unforeseen conditions make the development uneconomic. Following decommissioning, the site will be restored to approximate its original condition or to a standard that results in stable environmental conditions.

Decommissioning activities would include:

- ▶ Closure of all facilities
- ▶ Plug and abandon wells
- ▶ Access roads will be de-compacted and re-vegetated (if not maintained for other uses)
- ▶ Rehabilitation and restoration of sites, including re-contouring the surface and re-vegetation.
- ▶ Decommissioning activities will follow the good international industry practice methods which are established at the time. It is likely that for plant decommissioning on this scale, a specialist contractor would be engaged to oversee the entire plant and steam field decommissioning.

## 2.10 Project benefits

RG commits itself to respect, meet and exceed national and international laws /proclamations, regulations and standards, prior to, during and following project operations, and to fulfill other standards that may apply, especially standards and requirements regarding social responsibility, health and safety, and the environment.

The long-term strategy of RG is to support the federal government of Ethiopia in promoting social and economic progress in the country. To meet this strategic goal, RG project objectives are as follows (but not limited to):

- ▶ Creation of jobs, local workers will be hired and national partners chosen whenever possible (Table 2.9).
- ▶ Technical training will be provided to local staff and expertise passed on to local entities.
- ▶ This transition will include training and education of local experts and cooperation with regional institutions and local contractors and consultants.
- ▶ UNU geothermal programs will be introduced and utilized to increase the competence of employees and partners.
- ▶ Improvements of existing roads, and making of new roads leading to and around project sites.
- ▶ Provision of more and cheaper energy.
- ▶ Production of clean, renewable energy. Geothermal energy is classified as renewable energy and plays a role in reducing the overall emission of greenhouse gases.
- ▶ The use of geothermal source will be monitored to secure sustainable development, and the needs of the present will be met without compromising the ability of future generations to meet their own needs.
- ▶ Reliance on imported energy will be reduced, and thereby energy sovereignty increased.
- ▶ The project will help make a stronger and more stable economy for the communities and regions.
- ▶ Eventually this may enable the country to export energy to neighboring countries.
- ▶ The supply of electricity will enable the rural economies to modernize and use irrigation pumps and thereby producing higher output and increase their income.
- ▶ It also creates investment opportunity in different economic sectors such as food, chemical, and metallic and non-metallic industries.
- ▶ Philanthropic activities may be undertaken to support health care, education, environmental awareness, and increase wellbeing and living standards in local communities /regions.

Table 2.9 Estimation for new jobs created during the construction and operation

| Project                            | Regional jobs | National and international | Total jobs |
|------------------------------------|---------------|----------------------------|------------|
| Survey (on-going)                  | 20            | 5                          | 25         |
| Civil works                        | 20            | 50                         | 70         |
| Exploration drilling               | 30            | 30                         | 60         |
| Production drilling                | 30            | 30                         | 60         |
| Construction 100 MWe power station | 200           | 20                         | 400        |
| Operation                          | 40            | 5                          | 45         |
| <b>Total</b>                       | <b>340</b>    | <b>140</b>                 | <b>660</b> |

Access to electricity is an input to the growth of the modern sector as well as an ingredient to the overall social and economic transformation of any nation. Access to electricity plays a role in breaking the circle of energy poverty. In the near future it is the aim of RG Geothermal to expand the power station to 500 MWe geothermal steam power plants in Tulu Moye as the investigation of the production areas continues, which will increase the benefits listed above considerable.

## 2.11 Summary of key figures for the Project

|                                    |              |  |
|------------------------------------|--------------|--|
| Power generation / Station         | 100 MW       | Base level: < 5,000 m <sup>2</sup>     |
| Production wells [no.]             | 14-16        | Depth: 1,500-3,000 m                   |
| Re-injection wells [no.]           | 3-4          | Depth: 1,000-1,250 m                   |
| Drill pads needed [no.]            | <20          | Base level: 6,000 m <sup>2</sup> each  |
| Separator plants [no.]             | 2-4          | Base level: 750 m <sup>2</sup> each    |
| Cooling towers [no.]               | 1            | Base level: 1,800-2,000 m <sup>2</sup> |
| Fresh water requirements           | 40-60 l/sec. | For 100 MW power plant                 |
| Jobs for drilling and construction | 615          | Regional/national/international        |
| Jobs for construction              | 45           | Regional/national/international        |

## 2.12 Project schedule

The first phase of the Project may take at least 4 years to complete from commencement.

Table 2.10 Time schedule for the project

| Tasks of project                 | 2017 |   |   | 2018 |   |   |   | 2019 |   |   |   | 2020 |   |   |   | 2021 |   |   |   |  |  |  |
|----------------------------------|------|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|--|--|--|
|                                  | 2    | 3 | 4 | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 |  |  |  |
| Exploration drilling and testing |      |   |   | ■    |   |   |   |      |   |   |   |      |   |   |   |      |   |   |   |  |  |  |
| Drilling for production wells    |      |   |   |      |   |   |   | ■    |   |   |   |      |   |   |   |      |   |   |   |  |  |  |
| Construction of power station    |      |   |   |      |   |   |   | ■    |   |   |   |      |   |   |   |      |   |   |   |  |  |  |
| Start of Operation               |      |   |   |      |   |   |   |      |   |   |   |      |   |   |   |      |   | ■ |   |  |  |  |



### 3 Project feasibility and analysis of alternatives

#### 3.1 Project feasibility

Hydropower accounts for the bulk of Ethiopia's electric power generating capacity and the country has immense potential for hydroelectric power and geothermal energy generation. The potential total capacity for hydroelectric power generation is between 15,000 and 30,000 MW. Ethiopia's heavy reliance upon hydropower to supply its electric power has also made the country vulnerable to lengthy droughts. Similarly, the possible geothermal energy generation is also immense.

Despite these huge resources, however, the country only managed to utilize 790 MW of its power generation potential prior to 2005. This meant no more than 17% of the population had access to electricity. To fulfill the growing demands for power, following steadily increasing economic growth, power plants have been built in different parts of the country.

Under the Universal Electricity Access Program (UEAP), which was designed to push access to electric power to 50% in five years, the EEPCo has plans to electrify 1,700 towns per annum in the coming years. UEAP aims at enabling all parts of the country to enjoy access to electric power in 10 years period.

Though Ethiopia is endowed with vast energy resources 30,000 MW hydropower resources, 1,387 million TOE biomass resources, 17.5 million TOE agricultural residue, over 100 billion cubic meter of natural gas, 4,000 MW geothermal energy, 40.3 million tons of coal and oil shale and vast resources of solar and wind energy, it has not been able to develop, transform and utilize these resources for optimal economic development (GoE, The National Energy Policy).

The most important issue in the energy sector in Ethiopia is the supply of household fuels, which is associated with massive deforestation and contributing factor in land degradation along with farming. The increasing scarcity of fuel wood is compounded by Ethiopia's high population growth rate (GoE, The National Energy Policy).

Therefore, the Transitional Government of Ethiopia believes it is imperative to provide the economy with the necessary energy inputs at the right time and at affordable prices. This will speed economic development and help the country attain the objectives of the Economic Reform Program (GoE, The National Energy Policy) the government has adopted. With special emphases on renewable energy the Government has introduced Feed-in-Tariffs to promote installation of renewable power generation facilities.

Geothermal energy is a clean energy source that combines low emission with economics that are superior to most other sources of energy. Despite this, growth in geothermal energy has not kept up with that of wind and solar energy, largely due to the fact that most of the resources are located in the developing world. A successful private-sector led geothermal power project has the potential to start a snowball effect of growth in utility-scale investment in geothermal power across the developing and emerging markets.

In light of the problems encountered with overreliance on hydroelectric power generation, the Ethiopian authorities are currently aiming to increase diversification of the nation's energy mix. A mix of geothermal and hydroelectric power generation can contribute to a more balanced and stable power infrastructure that is well equipped to deal with seasonal fluctuations in demand and supply. Looking forward, Ethiopia has ambitions of becoming a large-scale exporter of clean, inexpensive energy to neighboring countries. Developing a strong geothermal sector in Ethiopia could thus have developmental impacts on various levels within the country.

In order to build on its economic success, the government recently launched a new five-year plan to further transform the economy. To achieve the goals of the Growth and Transformation Plan energy has a central role to play. The supply of power is essential to register developments in the manufacturing industrial sector for example. Without abundant power and systems of large scale centralized generation, it isn't possible to start industrial decentralization. Taking this into consideration the government envisages a significant increase in electricity generation capacity, completing the power projects currently under construction and building new ones in order to increase the distribution of power to rural towns and kebeles on a large scale (Walta Information Center, 2011).

Geothermal energy is among the world's lowest cost energy sources, and quality geothermal resources abound in East Africa. While initial investment in the exploration phase can be risky, on a sector basis, it represents one of the most cost effective and impactful ways to invest in Climate Change.

Large investments are already being made, and during the next five years the government plans to quadruple power production capacity to 8,000, even 10,000 MW. The geothermal project in Tulu Moyo is a part of this important development.

### 3.2 Alternatives

Alternatives will be examined regarding the project:

1. Location of well pads.
2. Location of access roads and water pipeline.
3. Location of power station.
4. Handling of discharge water.

#### 3.2.1 Location of well pads

Location for two well pads with up to 10 wells combined have been selected for drilling. If successful, they should be sufficient/capable to produce geothermal energy up to 100 MW. Based on the results of that experimental drilling new pads will be located to expand the geothermal project in cooperation with authorities. The geology, geochemistry and resistivity baseline study by the Proponent indicates an area covering the priority drilling targets (Figure 2.2). The following table is an overview of some of the main factors that will be considered when choosing well pads location (Table 3.1).

Table 3.1 The relevance of the location of drill pads for environmental impact and preferable site selection.

| Environmental component | Impact characteristic   | Preferable site criteria   | Standard             |
|-------------------------|---|--|----------------------|
| Noise                   | Disturbance to residents  | >1,200 m buffer Zone from residential areas<br>500 m with mitigation | 45 dB(A)<br>IFC PS4  |
|                         | Disturbance at culturally important sites (cemeteries, mosques) | >1,200 m buffer Zone from residential areas<br>500 m with mitigation | Uncertain<br>IFC PS8 |
|                         | Disturbance to livestock  | >1,000 m buffer<br>Or 500 m with mitigation                          | IFC PS3 & 4          |
| Gas emission            | Odour   | >500 m buffer Zone from residential areas                            | 0.005-0.3 ppm        |
| Land use                | Loss of agriculture and grazing land                            | Avoid land cover class agriculture land                              | IFC PS5              |

|                          |   |   |         |
|--------------------------|---|---|---------|
| <b>Hazard and risk</b>   | Risk of flooding and erosion in critical slopes | Out of flooding areas                           | IFC PS4 |
| <b>Water</b>             | Discharge                                       | Avoid pollution                                 | IFC PS3 |
| <b>Vegetation</b>        | Disruption of forest                            | Avoid land cover class forest                   | IFC PS6 |
| <b>Wildlife</b>          | Disturbance due to noise and traffic.           | >1,200 m buffer Zone from any critical habitats | IFC PS6 |
| <b>Geology</b>           | Direct disruption of geological features        | Avoid fumaroles, craters, „younger“ lava flows  | IFC PS3 |
| <b>Landscape</b>         | Visual aesthetics affected                      | Concealed site, not “eye-catching”              |         |
| <b>Cultural heritage</b> | Disturbance of archaeology findings             | Chance Find Procedure                           | IFC PS8 |

Prerequisites for a drilling site must be considered. These include:

- ▶ A drilling target must be within a reachable drilling depth, preferably less than 1,500 m and not more than 3,000 m.
- ▶ Temperature should be in excess of 240°C, and the higher temperature the better.
- ▶ It is also a location where near-vertical fault systems and volcanic structures are most likely to maintain high permeability.
- ▶ Water supply must be feasible and doable with regard to water quality, cost and transport route. A temporary water supply system must be available.

Environmental components that must be taken into consideration when selecting drilling sites, and consequently for drill pads, have been analysed in Part II for socio-economic, physical and biological environment.

- ▶ National and international standards for noise and gas concentration in atmosphere are used to define buffer Zones around settlements and culturally important sites. This narrows down sites that are more feasible for drilling pads with regard to environmental impacts.
- ▶ By using the criteria for preferable drilling sites the environmental impact can be minimized.
- ▶ Preferences and criteria for drilling pad locations must be applied in detail on site (see ESMP in Part III).

### 3.2.2 **Location of access roads and water pipelines**

Currently there is a proposal for the access road for well pad B. RG will locate access roads and water pipelines with care and according to the same criteras as for well pads (Table 3.1). Site selection depends on:

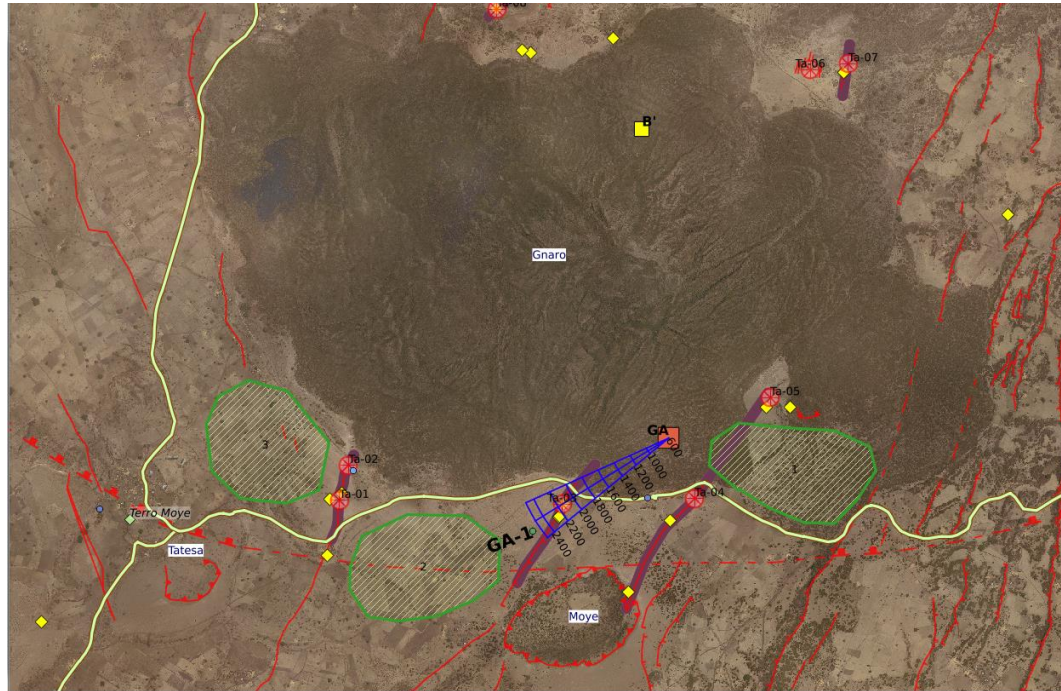
- ▶ Location of feasible water supply, water quality, costs and transport route. This is valid for both temporary and long term water supply.
- ▶ Location of current roads, distances, costs and slope of land.

Environmental components that must be taken into consideration have been analysed in Part II for socio-economics, physical and biological environment and other variables.

### 3.2.3 Location of power station

RG has selected a potential site for the Power Station. Site selection depends on vicinity of targets, landuse, settlement and vegetation. RG located the power station according to the criteras in Table 3.1.

There where 3 main alternatives, 1, 2 and 3 (Figure 3.1).



**Figure 3.1 Alternatives for Power Station Site (marked green 1, 2 and 3)**

Of these three sites, it is concluded that site 1 would be the best location based on following arguments:

- ▶ Site 1 is not settled to the degree as the other areas so there are less displacement issues to be resolved.
- ▶ Possible injection areas for the injection of geothermal fluid into the ground has been identified as the area east of the Gnaro lava. Site 1 is closest to that area.
- ▶ Infrastructure in form of roads and pipes are estimated to be less costly for site 1 compared to the alternatives.
- ▶ Site 3 is very close to Tero Moya village, and is in a populated area, so it is not acceptable to place a power station at that site.

Prerequisites for a power station site must be considered. These include:

- ▶ Sufficiently productive wells for the production up to 100 MW.
- ▶ Water supply must be feasible and doable regarding water quality, costs and transport route. A temporary water supply system must be available.

Environmental components that must be taken into consideration when selecting power station site have been analysed in Part II for socio-economics, physical and biological environment and other variables.

- ▶ National and international standards for noise and gas concentration in atmosphere are used to define buffer Zones around settlements and culturally important sites. This narrows down sites more feasible for power station with regard to environmental impacts.

- ▶ By using the criteria for preferable power station sites the environmental impact can be minimized.
- ▶ Preferences and criteria for power station locations must be applied in detail on site (see ESMP in Part III).

### 3.2.4 **The handling of discharge water**

Alternatives considered for the handling of discharge water and mud are:

- ▶ Reinjection
- ▶ Discharge to brine collection ponds and infiltration.

Criteria for the comparison of alternatives are in Table 3.1.

#### **Reinjection**

By monitoring and using reinjection along with extraction from the geothermal resource, a certain degree of sustainability will be reached:

- ▶ Fluid extracted from the resource is reinjected back.
- ▶ Heat energy left in the fluid is also returned to the reservoir.
- ▶ Reinjection can damp down subsidence by reducing pressure drop which can accompany extraction from the reservoir.

Reinjection however requires equipment, pipelines and reinjection wells, which for a small power station is not cost efficient. Reinjection must be at some distance from the production wells. This calls for long (2,000 m +/- 1,000 m) pipelines, which increases the overall impact area.

Reinjection can stimulate minor seismicity but there is some uncertainty regarding this impact in the Tulu Moyo area. Data or knowledge regarding seismicity will only be available as the project continues.

#### **Brine collection ponds**

Ponds are used for collecting brine from tested wells and from the power station. The fate of effluent water or brine collected in a pond would be evaporation and infiltration into the soil and bedrock. The pond also acts to delimit the area affected by the discharge.

The size of a brine collection pond would depend on the steam/water ratio from each well.

In general, there is risk of groundwater pollution from the infiltration of discharge water into the soil. The circumstances in Corbetti are that the groundwater table is deep down and the amount of discharge water is limited due to the size of each power station. The risk of groundwater pollution is remote.

It is therefore recommended that in Phase I, brine collection ponds are to be used for the handling of discharge water.

#### **Conclusion**

It is therefore recommended that in Phase I, reinjection and brine collection ponds should be used as a means of handling of discharge water.

### 3.3 **No project alternative**

The alternative of no go will not benefit the local or national society and economy in the form of:

- ▶ Economic development.

- ▶ Employment, locally and nationally.
- ▶ Increased national energy production and less dependence on imported fossil fuels.
- ▶ Increased knowledge of the capacity and nature of the geothermal resources.

### 3.4 Alternative technology

Table 3.2 Summary of Technology Alternatives

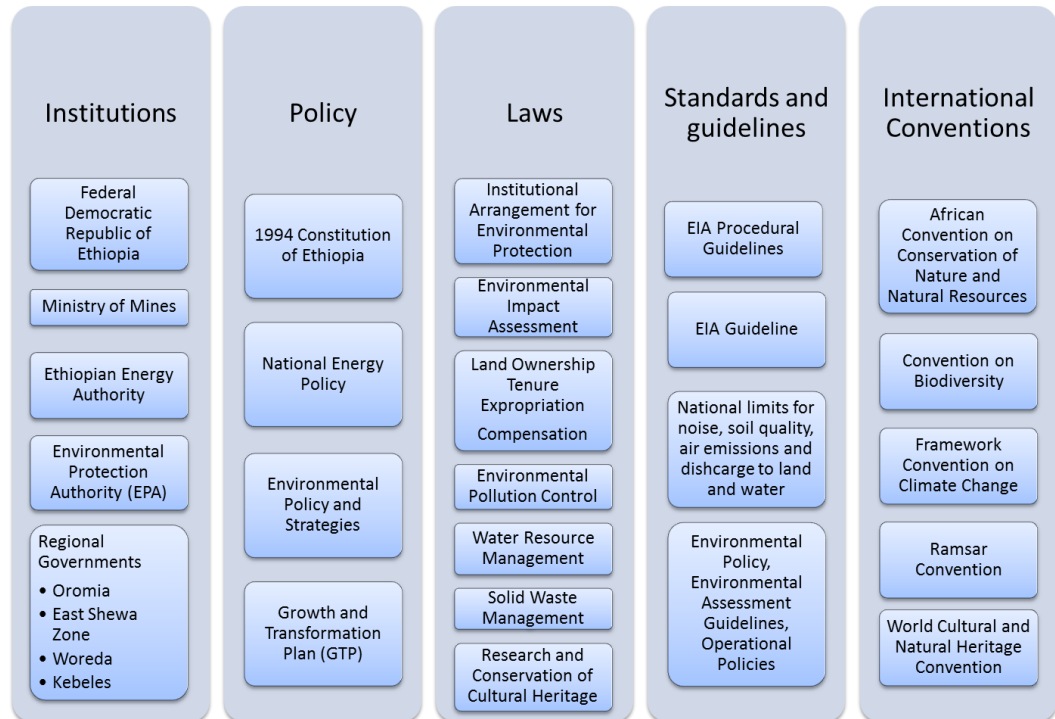
| Technology                 | Advantage  | Disadvantage   |
|----------------------------|--|--|
| <b>Geothermal Power</b>    | Renewable energy source<br>Need relatively small area of land<br>Utilizing resources of the area | Possible ecological impacts<br>Emissions: air and water  |
| <b>Diesel Engine Plant</b> | Relatively high level of plant efficiency  | Small scale, and not contributing to the aim of Government of Ethiopia<br>Heavy fuel use<br>Emissions                                    |
| <b>Wind Power</b>          | Renewable energy source  | Only suitable for areas with high wind intensity/regularity<br>Comparable energy production needs large area of land<br>Visual amenities |
| <b>Solar Power</b>         | Renewable energy source  | Large areas required<br>Energy production only during sunlight hours / not a base load power   |
| <b>Hydro Power</b>         | Renewable energy source<br>Energy storage possible   | Not possible within this area<br>Possible ecological impacts   |

\* Based on RG comparisons and (Mott MacDonald & Green and Clean solutions, 2013).

## 4 Policy and legal framework

### 4.1 Introduction

An overview of policies and legal framework regarding the proposed project was made by GIBB International (GIBB International, 2015). This chapter lists international requirements from guidelines, standards and conventions on one hand and national requirements on the other hand from law, regulations, standards and policies.



### 4.2 Administrative framework

#### 4.2.1 General organization

The Federal Democratic Republic of Ethiopia (FDRE) constitutionally comprises the Federal State and nine Regional States. Each region is divided into Zones, and Zones into Woredas. The basic administration unit is the Woreda (district) and each Woreda is further sub divided into Kebeles (Sub districts). Each administrative unit has its own local government elected by the people. The power and duties of the Federal, Regional and Local governments are defined by Proclamations 33 of 1992, 41 of 1993, and 4 of 1995. Under these Proclamations, duties and responsibilities of Regional States include: planning, directing and developing social and economic development programs, as well as the protection of natural resources of their respective regions.

The key environmental institutions are established by the Environmental Protection Organs Establishment Proclamation No. 295/2002, which became effective on 31st October, 2002 (FDRE, 2002). This Proclamation establishes the institutional arms of the Federal Government to ensure the realization of the objectives of the Constitution and of the Environmental Policy of Ethiopia with respect to environmentally sustainable management of economic and social development of the country, both at Federal and Regional levels. Environmental Protection Authority (EPA) is the federal government agency responsible for environmental matters. The Proclamation in part three also requires every relevant sectoral agency of the Federal Government to set up an environment unit as part of its organizational structure and also for each Regional State to establish a Regional autonomous environmental agency.

Apart from assigning specifically defined responsibilities to EPA the Proclamation links the efforts of Regional States with that of the EPA by instructing the Regional States to prepare and submit reports on the respective state of the environment and sustainable development and submit them to the EPA.

Additionally, the other legal and regulatory provisions reviewed in the foregoing Sections have assigned some responsibilities to institutions created by other existing laws to ensure that the requirements of sustainable environmental management, general public and occupational health and safety are met. The key institutions identified at both federal and regional levels and their roles relevant in the ESIA management of the Tulu Moyo project are discussed in the following Sections.

#### **4.2.2 Ministry of Environment and Forestry**

According to Definition of Powers and Duties of Executive Organs of the FDRE (Amendment) Proclamation No. 803/2013, the Ministry of Environment and Forestry (MoEF) has powers and duties to, among others:

- ▶ Coordinate measures to ensure that the environmental objectives provided under the Constitution of the FDRE and the basic principles set out in the Environmental Policy of Ethiopia are realized.
- ▶ Establish a system for environmental impact assessment of public and private projects, as well as social and economic development policies, strategies, laws and programmes.
- ▶ Establish a system for the evaluation of the environmental impact assessment for investment projects submitted by their respective proponents. Evaluation will be undertaken by the concerned sectoral licensing organ prior to granting permission for their implementation. Permission for implementation will be in accordance with the Environmental Impact Assessment Proclamation.

While the MoEF is mandated to steer environmental impact assessment processes in Ethiopia, the Ministry of Mines (MoM) has within its directorate MoEF representatives. Since the proposed Project is mining related, the MoEF has delegated review and decision making Authority to the MoM.

#### **4.2.3 Environmental Protection Authority (EPA)**

The National Environmental Protection Authority (EPA) was initially established under Proclamation No. 9/1995 as an autonomous government body entrusted with the protection and conservation of natural resources in Ethiopia. EPA is an autonomous federal institution reporting directly to the Prime Minister. It has a broad mandate covering environmental matters at federal level. The Proclamation sets out the main responsibilities and broad organizational structure of EPA which may be summarized as follows:

- ▶ Preparation of environmental protection policies and laws and to ensure that these are implemented.
- ▶ Preparation of directives and implementation of systems necessary for the evaluation of the impact of projects on the environment.
- ▶ Preparation of environmental protection standards and implementation of directives concerning soil, water and air.
- ▶ Conduct of studies on desertification and the co-ordination of efforts to combat it.
- ▶ Establish a system for EIA of public and private projects, as well as social and economic development policies, strategies, laws, and programs.



- ▶ Enforce implementation of this EIA process (i.e. review EIA reports) and the recommendations which result from it for projects that are subject to Federal licensing, execution or supervision.
- ▶ Enter any land, premises or any other places that falls under the Federal jurisdiction, inspect anything and take samples as deemed necessary with a view to ascertaining compliance with environmental protection requirements.
- ▶ Ensure implementation of environmental protection laws.
- ▶ Preparation of recommendations regarding measures needed to protect the environment.
- ▶ Prepare and avail to the government as well as the public a periodic report on the state of the environment of the country.
- ▶ Enhancement of environmental awareness programs.
- ▶ Implementation of international treaties concerning the environment to which Ethiopia is a signatory.
- ▶ Provision of advice and technical support to the regions on environmental matters.

**(a) Environmental Protection Council**

In view of the multi-sectoral nature of the EPA and the number of government agencies involved in various aspects of environmental management, overall coordination and policy review and direction is the responsibility of an Environmental Protection Council (EPC) within EPA.

The responsibilities of the Council shall include:

- ▶ To review proposed environmental policies, strategies and laws, and issue recommendations to the Government.
- ▶ Based on report submitted to it by the Authority, evaluate and provide appropriate advice on the implementation of the environmental policy of Ethiopia.
- ▶ Review and approve directives, guidelines and environmental standards prepared by the Authority.

The significance attached to the EPA is reflected in its composition as per Article 8 of the Proclamation. Members of the Council shall comprise the following:

- ▶ The Prime Minister or his designate (Chairperson).
- ▶ Ministers to be designated by the Federal Government.
- ▶ A representative designated by each National Regional State.
- ▶ A representative of the Ethiopian Chamber of Commerce.
- ▶ A representative of local environmental non-governmental organizations (NGOs).
- ▶ A representative of the Confederation of Ethiopian Trade Unions.
- ▶ The Director General of the EPA.

The council is legally required to hold its regular meetings once every six months; but it may also, at any time, hold extraordinary meetings whenever deemed necessary.

**4.2.4 Ministry of Mines**

The Ministry of Mines (MoM) is one of the Federal Ministries. MoM is the regulatory body of mining activities including geothermal drilling. The role of the Ministry is mainly to generate the basic geoscience data of the country, to promote the mineral and petroleum potentials of the country, to negotiate and issue licenses to the private investors and ensure that they conduct mineral and petroleum operations in accordance with their concession agreements. The ministry has various directorates responsible for specific roles. The following directorates within the ministry are relevant to the project's environmental and social management

**(a) License and Administration Directorate**

The License and Administration Directorate is the Licensing Authority that controls and administers mineral resources and grants, refuses and manages licenses. It is responsible for approving of mining concessions, and providing and renewing licenses, such as exploration licenses and mining licenses. RG has already been licensed by the MoM vide license No.MOM/EL/4358/2009.

**(b) Environment and Community Development Directorate** In line with Article 14 of Proclamation 295/2002, every competent agency is required to establish or designate an environmental unit that shall be responsible for coordination and follow-up so that the activities of the competent agency are in harmony with this Proclamation and with other environmental protection requirements.

The Environment and Community Development Directorate in the ministry of mines is responsible for screening projects, if they require full ESIA, preliminary assessment, or no ESIA. Following screening, scoping is required for the review, followed by draft of ESIA including baseline survey. The Directorate provides review feedback, comments and recommendations. Public participation, and in particular by the communities likely to be affected, is required through the Authority or relevant regional environmental agency. It also conducts monitoring both in the construction and operation phases as well as community development and occupational health and safety progress on projects, giving technical support where necessary. As the proposed Project is mining related, the MoM has been delegated responsibility of reviewing and making decision on the project ESIA.

**4.2.5 Ministry of Water, Irrigation and Energy (MoWIE)**

The Ministry of Water, Irrigation and Energy is the federal institution mandated and responsible for ensuring sustainable development in the energy sector through development, planning, and management of energy resources as well as for creation of policies, strategies, and programs. The MoWIE develops and implements laws and regulations for the energy sector, provides technical support to regional energy bureaus and offices, and signs international agreements. Furthermore, the ministry is responsible for exploration, allocation and utilization of water resources in Ethiopia and ensuring that measures are put in place so as to prevent and control pollution to the country's water resources.

**4.2.6 Ethiopian Energy Authority**

Established in line with energy Proclamation No 810/2013 and through The Ministry of Councils Regulation No 308/2014, the Ethiopian Energy Authority is a regulatory body in the energy sector with the powers to issue licenses for energy generation, transfer, distribution and selling, as well as the import and export of electricity in Ethiopia.

- ▶ The electric power purchase and network service agreements between RG and EEPCo can only be approved by EEA.
- ▶ Promote energy efficiency and conservation at national and sectoral levels.
- ▶ Determines relevant environmental protection laws, and safety, quality and performance standards for the energy sector.

RG will require the relevant electricity generation and sale licences from Ethiopian Energy Authority once viable resources for energy generation are established in the Tulu Moye geothermal fields.

**4.2.7 Ethiopian Electric Power**

Ethiopian Electric Power is established through the Council of Ministers Regulation No. 302/2013 which amended the structure of the former Ethiopian Electric Power Corporation (EEPCo) as a public enterprise established by Council of Ministers

regulation No. 18/1997. EEPCo had mandates to engage in the generation, transmission, distribution, and sale of electricity in Ethiopia. In the new set up, EEP retains all the other functions except the distribution roles. Through the Council of Ministers regulation 303/2013 a new entity, Ethiopian Electric Utility was established with the functions of constructing and maintaining electricity distribution networks effective 9 December 2013 (FDRE, 2013). RG signed PPA with EEP 27 July 2015.

#### **4.2.8 Ethiopian Roads Authority**

The Ethiopian Roads Authority (ERA) was established in 1951 through Proclamation No.63/1963 as “Imperial Highway Authority” with responsibilities for the construction, improvement and maintenance of the Country’s major road network. However, the Organization has undergone through different areas of jurisdiction and the current entity was re-established with Proclamation No. 80/1997 with major responsibilities of initiating policies, determining design standards, road classification, short- and long-term plan preparation, preparation of feasibility studies and other studies as found appropriate, maintaining highways through appropriate body, contract management, enforce vehicle size and weight, training of manpower, determine the extent of land requirement for roads, uses free of charge material production sites, etc.

The highest body in the management hierarchy is the Board. Ethiopian Roads Authority (ERA) is responsible for the overall planning, development and maintenance of national road networks as well as construction of major link roads. The Project area is bounded by two major national roads, Modjo-Ziway to the west and Adama-Assela road to the east. The responsibility of rural roads construction and maintenance has been decentralized and given to the Regional States which have their own Regional Organizations responsible for Rural Roads construction and routine maintenance. Oromia Roads Authority (ORA) is such an organization established to execute the development and maintenance of rural roads in the region while the Environmental Protection, Land Administration and Use Authority (EPLAUA) of the region is responsible for the protection and development of all natural and man-made resources within the Region.

Transportation activities during exploration work and power plant construction will require transport of heavy drilling rigs among other supplies. Transportation of these along the major national roads will have to be in line with ERA guidelines. On the other hand, new access roads may be required in the Project area. These will require closer liaison with the ORA.

#### **4.2.9 Ministry of Labour and Social Affairs**

Established by Proclamation No. 127 the Ministry is responsible for coordinating the nation’s labour and Social Affairs and implementing Programmes thereof. Through its department of occupational Safety, Health and Working Environment, the Ministry follows-up the proper implementation of directives, polices and international labour conventions; Conducts study and research and generates policy ideas; follow-up the implementation of occupational safety, health and working environment laws, rules & regulations in establishments; and undertakes capacity building activities in the areas of occupational safety, health and working environment for regional bureaus.

#### **4.2.10 Ministry of Health**

The ministry of health has powers and duties to among others: devise and follow up the implementation of strategies for the prevention of epidemic and communicable diseases; and take preventive measures in the events of emergency situations that threaten public health, and coordinate measures to be taken by other bodies. The Ministry should be incorporated in the Project’s ESMP implementation strategy especially as matters concerning public health are concerned.

#### 4.2.11 ***Ethiopian Wildlife Development and Conservation Authority***

The major responsibility for wildlife conservation in Ethiopia is vested in Ethiopian Wildlife Development and Conservation Authority (EWCA). This is a newly established government institution under Ministry of Culture and Tourism. In its responsibility for the husbandry of the wildlife resource of the country, EWCA carries major responsibility within the present system of Wildlife Conservation partly with the Regional Governments. The main task is to ensure the continuity of all wildlife species not only those in Wildlife Conservation Areas, but also within the entire terrestrial, aquatic and aerial ecosystem of the nation, with special emphasis on the endemic or threatened wild fauna and their habitat.

#### 4.2.12 ***Authority for Research and Conservation of Cultural Heritage***

Protection and conservation of cultural heritage from man-made and natural hazards is one of the duties of the ARCCH. Prior approval of ARCCH is required to remove an immovable cultural heritage from its original site, (Art. 21/1). Whenever a registered movable cultural heritage is encountered during the execution of the project it is possible to remove such property by notifying the Authority in advance (Art. 21/2). However, it is also stated that the removal of any cultural ruins is to be carried out under strict supervision of the responsible Authority, ARCCH.

Article 42 of the same Proclamation states under 'Reserved Area' that the Authority has the power of issuing building permission for any work to be carried out in an area declared reserved by the Council of Ministers.

#### 4.2.13 ***Regional Agencies***

Article 15 of Proclamation No. 295/2002 empowers each Regional state to establish its own independent environmental agency with the responsibilities to coordinate and follow-up the Regional effort to ensure public participation in the decision making process, to play an active role in coordinating the formulation, implementation, review and revision of Regional conservation strategies as well as to foster environmental monitoring, protection and regulation. Many of the responsibilities related to environment within the Regional Governments Bureaus have been formulated and a bureau has been organized to handle or manage environmental activities.

The Regional Government's office for environmental protection activities shall:

- ▶ Based on the Conservation Strategy of Ethiopia, coordinate the formulation, implementation, review or revision of regional conservation strategies.
- ▶ Facilitate the establishment of lower level environmental coordinating bodies at the Zone, Woreda and community levels.
- ▶ Ensure the implementation of Federal environmental standards or, as appropriate, issue and implement their own no less stringent standards.
- ▶ Prepare reports on the state of the environment and sustainable development of their respective states and submit them to the EPA.
  - > Administer, oversee and pass major decisions regarding impacts assessments of projects subject to licensing by regional agency.
  - > Projects subject to execution by a regional agency.
  - > Projects likely to have regional impacts.

The Tulu Moyo Project area lies in Oromia National Regional State (ONRS) and covers for Phase I part of the Arsi Zone. Based on the powers and responsibilities vested in the regional governments during establishment, the Regional Government has established Sectoral Bureaus, Commissions and Authorities for various administrative functions. In

ONRS, there has been established the Oromia Bureau of Land and Environmental Protection as discussed below.

**(a) Oromia Environmental Protection Agency**

Responsible for the ESIA process in Oromia Region, incl. review and approval of Environmental and Social Impact Assessment for projects in Oromia.

**(b) Oromia Bureau of Land and Environmental Protection**

Responsible for the protection and development of all natural and man-made resources within the Region and facilities in coordination with the Federal EPA and the Regional EPA for Oromia region/Oromia Bureau of Land and Environmental Protection.

**(c) Oromia Forest and Wildlife Enterprise (OFWE)**

Oromia Forest and Wildlife Enterprise (OFWE) is an autonomous public enterprise established by the government of Oromia. It is mandated to administer and sustainably manage regional forests, woodlands and wildlife conservation areas in Oromia within its concessions. OFWE does not have any concession area within the Project area.

**(d) Oromia Regional Health Bureau**

The Project will require a lot of staffs and synchronizing may be necessary in terms of health issues.

**(e) Oromia Regional Bureau of Water and Energy**

The Project will require water works system for drilling and operational purposes. According to Water Resources Management Proclamation No. 197/2000, water use permit for geothermal drilling will be required from the Oromia Regional Bureau of Water and Energy (FDRE, 2000).

**(f) Regional /Zonal and Urban Administration**

The Project will require construction of power plant(s) and other structures. Considerable (solid) waste will result from the Project development. Regional and/or Zonal and Urban Administrations will be consulted regarding permits, if needed.

**(g) Woreda and Kebele Administration**

Some committees will need to be considered with Woreda Administrator as the Chair Person. Examples include:

- ▶ Complaints against environmental pollution and community disturbances/nuisance.
- ▶ RAP Grievance Redress Committee.
- ▶ Property Evaluation Committee

**4.3 International requirements**

**4.3.1 International Finance Corporation (IFC) Guidelines**

The International Finance Corporation (IFC) is a division of the World Bank Group that lends to private investors. IFC has released a Sustainability Policy and a set of Performance Standards on Social and Environmental Sustainability (January 2012). These Standards replace the previous July 2006 safeguard policies and are used to evaluate any project seeking funding through the IFC. For Projects that do not anticipate seeking financing from the IFC; the IFC Performance Standards are normally applied as a benchmark of international best practice.

**(a) IFC Performance Standards on Environmental and Social Sustainability**

The Performance Standards are relevant to the project, providing guidance on how to identify risks and impacts, and help avoid, mitigate, and manage risks and impacts as a way of ensuring project sustainability, including stakeholder engagement and disclosure

obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires project proponents to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced. Eight (8) Performance Standards establish standards that the project proponent is to meet throughout the life of an investment funded by IFC:

- ▶ Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.
- ▶ Performance Standard 2: Labour and Working Conditions.
- ▶ Performance Standard 3: Resource Efficiency and Pollution Prevention.
- ▶ Performance Standard 4: Community Health, Safety, and Security.
- ▶ Performance Standard 5: Land Acquisition and Involuntary Resettlement.
- ▶ Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- ▶ Performance Standard 7: Indigenous Peoples Cultural Heritage. This standard is not applicable for this Project.
- ▶ Performance Standard 8: Cultural Heritage.

The Performance standards relevant to the project which should be incorporated further in the ESIA studies and ESMP formulation are summarised in the following table.

**Table 4.1 Relevant IFC performance standards.**

| Performance Standard   | Objectives applicable in Tulu Moye EISA and ESMP  |
|--|---|
| PS1: Assessment and Management of Environmental and Social Risks and Impacts | <ul style="list-style-type: none"> <li>▶ To identify and assess environmental and social risks and impacts of the Project.</li> <li>▶ To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.</li> <li>▶ To promote improved environmental and social performance of clients through the effective use of management systems.</li> <li>▶ To ensure that grievances from Affected Communities (both directly and indirectly affected) and external communications from other stakeholders are responded to and managed appropriately.</li> <li>▶ To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated. A stakeholders' engagement plan has been formulated to ensure this is carried out.</li> </ul> |
| PS2: Labour and Working Conditions   | <ul style="list-style-type: none"> <li>▶ To promote the fair treatment, non-discrimination and equal opportunity of workers.</li> <li>▶ To establish, maintain and improve the worker management relationship.</li> <li>▶ To promote compliance with national labour and employment laws.</li> <li>▶ To protect workers, including vulnerable categories of workers such as migrant workers, workers engaged by third parties, and workers in the clients supply chain.</li> </ul>  |

|  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>▶ To promote safe and healthy working conditions, and health of workers.</li> <li>▶ To avoid the use of forced labour.</li> </ul>   |
| PS 3: Resource Efficiency and Pollution Prevention                                     | <ul style="list-style-type: none"> <li>▶ To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.</li> <li>▶ To promote more sustainable use of resources, including energy and water.</li> <li>▶ To reduce project-related greenhouse gas emissions. Even though geothermal power production is regarded as green energy, this objective is especially applicable in exploration phase where a lot of fossil-based fuel is bound to be used.</li> </ul>  |
| PS 4: Community Health, Safety and Security  | <ul style="list-style-type: none"> <li>▶ To anticipate and avoid adverse impacts on health and safety of the affected community during the project life from both routine and non-routine circumstances.</li> <li>▶ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities.</li> </ul>  |
| PS 5: Land Acquisition and Involuntary Resettlement                                    | <ul style="list-style-type: none"> <li>▶ To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.</li> <li>▶ To avoid forced eviction.</li> <li>▶ To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.</li> <li>▶ To improve, or restore, the livelihoods and standards of living of displaced persons.</li> <li>▶ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.</li> </ul> |
| PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources | <ul style="list-style-type: none"> <li>▶ To protect and conserve biodiversity.</li> <li>▶ To maintain the benefits from ecosystem services.</li> <li>▶ To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.</li> </ul>   |
| PS 7: Indigenous Peoples   | <ul style="list-style-type: none"> <li>▶ Ensure full respect for human rights, dignity, aspirations, culture of Indigenous Peoples.</li> <li>▶ Avoid adverse impacts on communities of Indigenous Peoples.</li> <li>▶ Promote benefits and opportunities in culturally appropriate manners.</li> <li>▶ Establish relationship based on Informed Consultation and Participation with the Indigenous Peoples.</li> <li>▶ Ensure Free, Prior, and Informed Consent of Affected Communities.</li> <li>▶ Respect and preserve the culture, knowledge, and practices of Indigenous Peoples.</li> </ul>   |

|   |  |
|---|--|
| <p>PS 8: Cultural Heritage</p> <p>PS 8: Cultural Heritage, contd.</p> | <ul style="list-style-type: none"> <li>▶ Protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented. Where relevant this includes the retention of a competent professional to assist in the identification and protection of cultural heritage.</li> <li>▶ Develop provisions for managing chance finds, requiring any chance find to be undisturbed until an assessment by competent professional is complete and management actions are identified.</li> <li>▶ Consult with affected communities to identify cultural heritage of importance and to incorporate their views into the decision making process. This should involve national and local regulatory agencies.</li> <li>▶ Allow continued access to cultural heritage sites for communities that have used the sites within living memory for long-standing cultural purposes.</li> <li>▶ Avoid or minimize impacts to, or restore in situ, the functionality of replicable cultural heritage.</li> <li>▶ Not remove any non-replicable cultural heritage unless the following criteria are met: there are no technically or financially feasible alternatives, the overall benefit of the Project outweigh the anticipated cultural heritage loss from removal and the removal of cultural heritage is conducted using the best available techniques.</li> <li>▶ Should not remove, significantly alter, or damage critical cultural heritage. In exceptional circumstances where impacts are unavoidable, the project will use a process of informed consultation and participation (ICP).</li> </ul> |
|---|--|

**(b) IFC Environmental, Health and Safety General Guidelines**

The EHS general guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice. The guidelines provide issues and recommendation in the following areas:

- ▶ Environmental
- ▶ Occupational health and safety
- ▶ Community health and safety
- ▶ Construction and decommissioning.

The guidelines should be consulted as a technical reference source to support the implementation of the IFC Performance Standards within the Tulu Moye project.

**(c) IFC Environmental, Health, and Safety Guidelines for Geothermal Power Generation**

The EHS Guidelines for Geothermal Power Generation are applicable to geothermal power generation activities such as exploration and reservoir evaluation, production field development, and power plant construction. The guidelines provide environmental, health and safety issues that may occur during geothermal exploration, construction and generation.

Environmental, health and safety performance and monitoring indicators for effluent and emissions are also provided in the guidelines to be used to measure performance and



make correction where performance is not satisfactory. These are discussed in consequent chapters.

#### **(d) IFC Cumulative Impact Assessment and Management Guidance for the Private Sector in Emerging Markets**

The Guidelines are based on IFC's experience in applying its Performance Standards and are to be used in conjunction with the Performance Standards, their Guidance Notes, and the World Bank Group Environmental, Health, and Safety Guidelines, which contain basic requirements and good international practices to be followed when designing, developing, and/or implementing projects. It provides a practical guidance to companies investing in emerging markets to improve their understanding, assessment, and management of cumulative environmental and social impacts associated with their developments.

Cumulative Impact Assessment (CIA) should focus the assessment and management strategies on Valued Environmental and Social Components (VECs) such as:

- ▶ Physical features, habitats, wildlife populations (e.g., biodiversity).
- ▶ Ecosystem services.
- ▶ Natural processes (e.g., water and nutrient cycles, microclimate).
- ▶ Social conditions (e.g., health, economics).
- ▶ Cultural aspects (e.g., traditional spiritual ceremonies).

#### **4.3.2 World Bank Policies**

The following World Bank operational policies are triggered by the proposed Tulu Moye geothermal project:

##### **(a) Operational Policy (OP) 4.01: Environmental Assessment**

The objective of OP 4.01 is to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. This policy is triggered if a project is likely to have potentially adverse environmental risks and impacts in its area of influence. The Bank classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. The proposed Tulu Moye geothermal project falls under Category A thus requires a full environmental and social impact assessment study.

**Category A:** A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA).

OP 4.01 covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources, social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources) and transboundary and global environment concerns.

The Tulu Moye Geothermal Development Project will fall into Category A as it will have diverse and most likely severe impacts that may affect an area broader than the size or facilities subject to the physical works.

**(b) Operational Policy (OP) 4.04: Natural Habitats**

This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. The Bank therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and most native species. Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either:

- ▶ Legally protected,
- ▶ Officially proposed for protection, or
- ▶ Unprotected but of known high conservation value.

The proposed geothermal station has the potential to cause conversion (loss) or degradation of natural habitats within the Tulu Moye area, directly (through construction) as well as indirectly (through human activities induced by the project).

**(c) Operational Policy (OP) 4.10 Indigenous peoples**

The objective of this policy is to:

- (i) ensure that the development process fosters full respect for the dignity, human rights, and cultural uniqueness of indigenous peoples.
- (ii) ensure that adverse effects during the development process are avoided, or if not feasible, ensure that these are minimized, mitigated or compensated.
- (iii) ensure that indigenous peoples receive culturally appropriate and gender and inter-generationally inclusive social and economic benefits.

**(d) Operational Policy (OP) 4.11 Physical Cultural Resources**

Through OP 4.11, the World Bank aims at assisting countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements.

OP 4.11 on Physical Cultural Resources, considers the recommendations in *Investment Lending Reform: Modernizing and Consolidating Operational Policies and Procedures*. Given that some cultural resources may not be known or be visible, it is important that a project's potential impacts on cultural resources are considered at the earliest possible stages of project processing. The assessment of impacts to cultural heritage has been based on identified aboveground features and known sites of archaeological interest, this is because, there is no archaeological cultural and settlement inventory covering the Project area throughout the history of human occupation. However, as the policy requires, precaution is necessary in case of a chance find. RG will follow chance find

Procedures and engage a specialist approved by ARCCH should any archaeological site or artefact encountered during construction.

**(e) Operational Policy (OP) 4.12 Involuntary Resettlement**

The World Bank's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled, people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater, community institutions and social networks are weakened, kin groups are dispersed; and cultural identity, traditional Authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks. This policy contributes to the World Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of affected people. For all projects that are proposed for Bank financing and affect people, the Bank requires the borrower to engage in a process of free, prior, and informed consultation. The World Bank provides project financing only where free, prior, and informed consultation results in broad community support to the Project Affected People (PAP). Such Bank financed projects include measures to (a) avoid potentially adverse effects on the communities; or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank-financed projects are also designed to ensure that the Affected People receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

Resettlement Policy Framework (RPF) is suggested when displacement is anticipated although extent and locations are not known. Once defined, Resettlement Action Plan (RAP) is required in line with this OP, IFC PS 5 and other standards as applicable, to ensure the process avoids involuntary displacement as possible. Livelihood Restoration Plan is required in instances of economic displacement (e.g. for losses in earnings).

**(f) Operational Policy (OP) 17.50: Public Disclosure**

This OP Supports decision making by the Borrower and Bank by allowing the public access to information on environmental and social aspects of projects. It is further mandated by other safeguard policies that have specific requirements should be disclosed and consulted with stakeholders. Consultation is regarded as a two-way process in which beneficiaries provide advice and input on the design of proposed projects that affect their lives and environment and promotes dialogue between governments, communities, NGOs and implementing agencies to discuss all aspects of the proposed project.

**4.3.3 Relevant International References**

The Project ESIA has considered relevant and latest updates of following documents among others:

- EIB Environmental and Social Handbook
- IFC Environmental, Health and Safety General Guidelines
- IFC Environmental, Health, and Safety Guidelines for Geothermal Power Generation
- IFC Guidance Notes: Performance Standards on Environmental and Social Sustainability
- IFC Handbook for Preparing a Resettlement Action Plan
- IFC Environmental and Social Management System – Implementation Handbook
- IFC Environmental and Social Management System Toolkit – General

- IFC Cumulative Impact Assessment and Management Guidance for the Private Sector in Emerging Markets
- IFC Stakeholder Engagement: A Good Practice Handbook for Companies doing Business in Emerging Markets
- IFC Community Development Resource Guide for Companies
- WHO, Guidelines for Drinking-water Quality
- WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide
- World Bank's Pollution Prevention and Abatement Handbook
- World Bank Group Environmental, Health, and Safety Guidelines, General (known as the "EHS Guidelines")

#### 4.4 International conventions and treaties

The Federal Democratic Republic of Ethiopia has ratified numerous international conventions and protocols that need to be considered in the project ESIA studies. These are discussed in the following sub-sections.

##### 4.4.1 *Vienna Convention for the Protection of the Ozone Layer*

Intergovernmental negotiations for an international agreement to phase out Ozone depleting substances concluded in March 1985 with the adoption of the Vienna Convention for the Protection of the Ozone Layer. This Convention encourages intergovernmental cooperation on research, systematic observation of the Ozone layer, monitoring of CFC production, and the exchange of information.

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in September 1987, and was intended to allow the revision of phase out schedules on the basis of periodic scientific and technological assessments. The Protocol was adjusted to accelerate the phase out schedules. It has since been amended to introduce other kinds of control measures and to add new controlled substances to the list. Ethiopia ratified this convention in 1994.

Nitrous oxide (NO<sub>x</sub>) which is released with geothermal harnessing is an Ozone depleting substance (Jackson & Jackson, 2000).

##### 4.4.2 *Convention on Biological Diversity*

The purpose of this convention is to ensure the conservation and sustainable use of biodiversity. Ethiopia ratified the convention in July 1994 and Ethiopia Biodiversity Institute (EBI) is the national focal point to this Convention on Biological Diversity. The provisions of this Convention have been integrated in many laws of Ethiopia.

##### 4.4.3 *The Paris Agreement to the UNFCCC*

The agreement requires all nations shall react to systematically reduce greenhouse gas emission and react to impacts due to global warming. The agreement aims to ensure that the global warming will within 2°C and efforts will be made to keep the increase within 1.5°C. The actions to reduce the emissions of greenhouse gases and to adapt to the impacts of the global warming will take effect after 2020 when the Kyoto Protocol ends. The nations can start signing the agreement in April 2016 (Ministry for the Environment and Natural Resources, 2015).

##### 4.4.4 *Kyoto Protocol to the UNFCCC*

The Kyoto Protocol requires signatories to the United Nations Framework Convention on Climate Change to reduce their greenhouse emissions levels to 5% below 1990 levels by the year 2012. The Protocol came into force on 13 July 2005, after it received the pre-

requisite signatures. Ministry of Environment and Forestry is the national focal point for this Protocol.

#### **4.4.5 The 1992 UNFCCC**

The UNFCCC is a “Rio Convention”, one of three adopted at the “Rio Earth Summit” in 1992. The primary purpose of the convention is to establish methods to minimize global warming and in particular the emission of the greenhouse gases. The UNFCCC was adopted on 9<sup>th</sup> May 1992 and came into force on 21<sup>st</sup> March 1994. The Convention has been ratified by 189 states including Ethiopia. Ministry of Environment and Forest is the national focal point for this Protocol.

#### **4.4.6 African Convention on the Conservation of Nature and Natural Resources**

This convention reaffirms the importance of natural resources both renewable and non-renewable, particularly the soil, water, flora and fauna. The main objective is to facilitate sustainable use of the above resources. The convention was adopted in Algiers on 15<sup>th</sup> September, 1968 by the Heads of state Government of independent African states including Ethiopia. The convention came into force on 16<sup>th</sup> June 1969.

The Contracting States recognize that it is important and urgent to accord a special protection to those animal and plant species that are threatened with extinction, or which may become so, and to the habitat necessary to their survival. The convention lists protected species in two classes, A and B whose conservation by the signatories is particularly emphasized but with varying limitations.

The established baseline biodiversity of the Project area has been assessed against these lists of protected species and is used in valuation of the likely impacts and significance of the Project during the ESIA study.

#### **4.4.7 Convention on International Trade in Endangered Species**

This Convention was adopted in 1973 and came into force in 1975. The purpose of the Convention is to regulate the international trade in wild plants and animals that are at risk of extinction as a result of trade. The Convention seeks to control trade not only in live species but also in dead specimen and their derivatives. The Ethiopian Wildlife Conservation Agency is a member of IUCN. The ESIA phase of the Project has consulted the IUCN red data list in evaluating the likely project impacts on any IUCN listed species.

#### **4.4.8 Convention on the Conservation of Migratory Species of Wild Animals**

As an environmental treaty under the aegis of the United Nations Environment Programme, Convention on the Conservation of Migratory Species of wild animals (CMS) provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.

Migratory species threatened with extinction are listed in Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species. Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention. For this reason, the Convention encourages the Range States to conclude global or regional agreements. Ethiopia has been a party to CMS since 2010.

#### 4.4.9 **United Nations Convention to Combat Desertification (UNCCD)**

Established in 1994, UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the dry lands, where some of the most vulnerable ecosystems and peoples can be found. In the 10-Year Strategy of the UNCCD (2008-2018) that was adopted in 2007, Parties to the Convention (including all African nations) further specified their goals: *"to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability"*.

#### 4.4.10 **World Heritage Convention, 1972**

Ethiopia is party to the World Heritage Convention (1972) having ratified on 6 July 1997. The convention is concerned with cultural and natural heritage and deals with monuments and areas that are deemed to be of "outstanding universal value" in terms of beauty, science and/or conservation. Ethiopia has several sites that have been declared World Heritage Sites including nine cultural sites and 1 natural site, the Simien National Park. There are also five sites in the Ethiopian tentative list for inscription into the list. Any deterioration or disappearance of such heritage is a loss to all the nations of the world. However, none of these sites is located within close proximity of the Project area.

#### 4.4.11 **The Ramsar Convention on Wetlands of International Importance**

The Ramsar Convention which came into force in 1971 is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources including water birds of international importance. From the latest consultation of the Ramsar website, Ethiopia is yet to adopt this convention. There are however potential Ramsar sites within the Ethiopian Rift Valley system including lake Ziway, the only perennial natural lake in proximity to the Tulu Moye project site.

#### 4.4.12 **Millennium Development Goals**

Whilst there is no mention of energy in each of the eight Millennium Development Goals (MDGs), energy services is inevitably an essential input to achieving all the eight goals. This is due to the fact that in order to implement the goal accepted by the international community, to halve the proportion of people living below the poverty line, by 2015, access to affordable energy services is a prerequisite (United Nations, 2016).

#### 4.4.13 **Convention on the Rights of the Child**

The Convention on the Rights of the Child (CRC), 1989 is the most comprehensive compilation of international legal standards for the protection of the human rights of children. The CRC is also the most widely ratified international human rights treaty, ratified by all countries in the world, with the exception of two. The Convention acknowledges children as individuals with rights and responsibilities according to their age and development (rather than the property of their parents or as victims), as well as members of a family and community. Underlying the Convention are the following main principles: Non-discrimination, the best interests of the child, the right to life, survival and development and the right to participation (United Nations, 1989).

#### 4.4.14 **Convention on the Elimination of All Forms of Discrimination Against Women**

The Convention on the Elimination of all forms of Discrimination against Women (CEDAW) places explicit obligations on states to protect women and girls from sexual exploitation and abuse. Universal Declaration of Human Rights (Article 7), the UN Charter (Articles 1, 13, 55, and 76) and the International Covenant on Civil and Political

Rights (Article 24) reaffirm the freedoms and rights of all children, including internally displaced children (United Nations, 1979).

#### **4.4.15 *International Labour Organisation***

Since 1919, the International Labour Organization (ILO) has developed and maintained a system of international labour standards aimed at promoting opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security and dignity. International labour standards are legal instruments drawn up by the ILO's constituents (governments, employers and workers) and set out basic principles and rights at work. They are either conventions, which are legally binding international treaties that may be ratified by member states, or recommendations, which serve as non-binding guidelines. Some of the key provisions that must be observed under the standards include:

- ▶ Freedom of association of workers
- ▶ Occupational health and safety of workers
- ▶ Prevention of Forced labour
- ▶ Prevention of Child labour
- ▶ Prevention of Discrimination

Ethiopia has ratified various ILO conventions on the above aspects since 1963 and all labour conditions in the country are expected to abide by the ILO standards and international best practices.

#### **4.4.16 *The Stockholm Convention***

In the year 2002, Ethiopia fully accepted and ratified the Stockholm Convention designed to ban the use of POPs. The Environmental Protection Authority has the full mandate to implement the Convention at the national level. A project to develop an appropriate system for the realization of the objectives of the Convention in Ethiopia is in progress.

#### **4.4.17 *The Bamako Convention***

The Bamako Convention on the ban on the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa is a treaty of African nations prohibiting the import of any hazardous (including radioactive) waste. The Convention was negotiated by twelve nations of the Organization of African Unity at Bamako, Mali in January 1991, and came into force in 1998. Impetus for the Bamako Convention arose from the failure of the Basel Convention to prohibit trade of hazardous waste to less developed countries (LDCs), and from the realization that many developed nations were exporting toxic wastes to Africa.

#### **4.4.18 *The Basel Convention***

The objective of the Basel Convention is to control and regulate the trans-boundary movement of hazardous waste. The Bamako Convention of 1991 plays a similar role at the level of the African continent. Ethiopia has ratified the Convention by Proclamation No. 192/2000. At present measures designed to amend the Basel Protocol is in progress. In addition, activities related to prior informed consent are being carried out. In order to implement the Convention within the country, draft policies and legislation have been prepared and submitted to the government.

#### **4.4.19 *The Rotterdam Convention***

This convention relates to prior informed consent in the context of international trade in specific hazardous chemicals and pesticides. The Environmental Authority is the organ responsible for the domestic implementation of this convention, which has been ratified

by Ethiopia in 2003. The Environmental Protection Authority is preparing a framework for its implementation.

#### 4.5 National legal and regulatory framework

##### 4.5.1 *The Constitution of the Federal Democratic Republic of Ethiopia*

The Constitution is the supreme law of the land of the Federal Democratic Republic of Ethiopia (FDRE). The 1994 Constitution of FDRE has several provisions with direct policy, legal and institutional relevance for the general management of environment in Ethiopia and implementation of ESIA for the Tulu Moye geothermal project. The constitutional provisions in Articles 40-44, 91 and 92 are of relevance to the project as far as sustainable management of environment, land; social and cultural issues are concerned.

Environmental Rights are specifically anchored in Article 44. It states that:

- ▶ All persons have the right to a clean and healthy environment
- ▶ All persons who have been displaced or whose livelihoods have been adversely affected as a result of State programs have the right to commensurate monetary or alternative means of compensation including relocation with adequate State assistance.

Under the Right to Property, Article 40(3) of the constitution vests the right to ownership of rural and urban land as well as all natural resources exclusively upon the state and the people of Ethiopia. It further indicates that land is a common property of the Nations, Nationalities and the people of Ethiopia and shall not be subjected to sale or to other means of transfer.

However, according to Article 40(6), without prejudice to the right of nations, nationalities, and peoples to own land, government may grant use of land to private investors on the basis of payment arrangements established by law. Article 40(8) gives the government powers to expropriate private property in the public interest. In doing so, government shall pay compensation in advance commensurate to the value of the expropriated property.

Article 41 deals with Economic, Social and cultural Rights and in its Section 9, the State has undertaken the responsibility to protect and preserve historical and cultural legacies, and to contribute to the promotion of the arts and sports. Article 42 deals with Rights of Labour.

Section 2 of this Article states that labour has the right to reasonable limitation of working hours, to rest, to leisure, to periodic holiday with pay, to remuneration for public holiday as well as to a healthy and safe work environment. This therefore requires that safety at work places is ensured.

Article 43 deals with The Right to Development and states as follows:

- ▶ The peoples of Ethiopia as a whole, and each nation, nationality, and people have the right to improved living standard and to sustainable development.
- ▶ All persons have the right to participate in national development and, in particular, to be consulted in respect to projects affecting their community.
- ▶ All international agreements to which Ethiopia is a party or relations that Ethiopia establishes and conducts with foreign countries shall ensure the country's right to sustainable development.
- ▶ The aim of development policies and programs shall be to enhance the capacity of citizens for development and to meet their basic need.



Article 44(2) the constitution stipulates that: “Everyone who is uprooted from the place of his residence by virtue of programmes undertaken by the Government, or one whose livelihood has been affected shall have the right to receive adequate monetary or other alternative compensation, including transfer, with assistance, to another locality.”

Finally, Articles 91 and 92 respectively state the cultural and environmental objectives, rights and duties of the government and people with respect to management of environment, natural endowments, historical sites and objects. The environmental objectives of the constitution include:

- ▶ Government shall have the duty to ensure that all Ethiopians live in a clean and healthy environment.
- ▶ The design and implementation of the programs and projects of development shall not damage or destroy the environment.
- ▶ People have the right to full consultation and to the expression of views in the planning and implementation of environmental policies and projects that affect them directly. Government and citizens shall have the duty to protect the environment.

Various Proclamations and associated council of ministers’ regulations that elaborate the constitutional provisions for the protection and management of the environment have been discussed in the following Sections to ensure that the Tulu Moye Project environmental studies are in line with these principles.

#### **4.5.2 Environmental Impact Assessment Proclamation No. 299 /2002**

The Environmental Impact Assessment Proclamation No. 299 /2002 aims primarily at making Environmental Impact Assessment (EIA) mandatory for categories of projects specified under a directive issued by the Environment Protection Agency (EPA) whether such projects belong to public or private bodies. The Proclamation describes a policy, strategy, program, law or an international agreement as “public instrument” and directs the EPA to issue guidelines distinctively classifying certain categories of public instruments as likely to entail significant environmental impact. The Proclamation requires, among others:

- ▶ Specified categories of projects to be subjected to EIA and receive an authorization from EPA or the relevant regional environmental agency prior to commencement of implementation.
- ▶ Licensing agencies to ensure that the requisite authorization has been duly received prior to issuing an investment permit, a trade or operating license or a work permit to a business organization.
- ▶ The EPA or the relevant Regional environmental agencies may exempt from environmental impact assessment projects with insignificant environmental impact.
- ▶ A licensing agency may suspend or cancel a license that has already been issued where the EPA or the relevant regional environmental agency suspends or cancels environmental authorization.

The Proclamation outlines the procedures that need to be followed in the process of environmental impact assessment. Thus a project initiator (Proponent):

- ▶ Must undertake a timely environmental impact assessment, identifying the likely adverse impacts, incorporate the means of their prevention, and submit the environmental impact study report accompanied by the necessary documents to the Authority or the relevant regional environmental agency.
- ▶ Must ensure that an environmental impact assessment is conducted and an environmental impact study report prepared by an expert who meets the requirements set forth by the directive issued by EPA.

- ▶ Must submit an environmental impact study report to the Authority or the relevant Regional environmental agency for review.

Article 8 requires that an environmental impact study report to contain sufficient information to enable EPA or the relevant regional environmental agency to determine if and under what conditions the project shall proceed.

Public participation in the EIA process is a requirement by Article 15. This Article requires that comments made by the public and in particular by the communities likely to be affected by the implementation of a project are incorporated into the environmental impact study report as well as in its evaluation. It also requires EPA or the relevant regional environmental agency to make any environmental impact study report accessible to the public and solicit comments on it. Further, in Article 17, the Proclamation allows persons dissatisfied with the authorization or monitoring or any decision of EPA or the relevant regional environmental agency regarding a project to submit a grievance notice to the head of EPA or the relevant regional environmental agency, as may be appropriate for redress.

#### **4.5.3 Environmental Pollution Control Proclamation No. 300/2002**

The Proclamation on Environmental Pollution Control (No. 300/2002) is mainly based on the right of each citizen to a healthy environment, as well as on the obligation to protect the environment of the Country (FDRE, 2002). The primary objective of the Proclamation on Environmental Pollution Control is to provide the basis from which the relevant environmental standards applicable to Ethiopia can be developed and to make the violation of these standards a punishable act. In Article 3(1), the Proclamation prohibits any person from polluting or causing any other person to pollute the environment by violating the relevant environmental standards. The Proclamation states in Article 3(4) that the “polluter pays” principle will be applied to all persons. Article 4 covers Management of Hazardous Waste, Chemical and Radioactive Substances. It prohibits generation, keeping, storage, transportation, treatment or disposal of any hazardous waste without a permit from EPA or the relevant regional environmental agency. Under part four of this Proclamation, EPA is given the mandate for the creation of the function of Environmental Inspectors. In order to ensure implementation of environmental standards and related requirements, inspectors of the Authority or of the relevant Regional environmental agency are empowered by the Proclamation (Article 7(1)) to enter, without prior notice or court order, any land or premises at any time, which seems to them appropriate. It is also notable that EPA is allowed by Article 6 (5) to, for a fixed period of time, authorize the waiver of the duty to comply with some requirements of specified environmental standards in order to promote public benefit.

EPA has developed some environmental standards based on this Proclamation within which diverse industrial activities should operate as reviewed in Section 3.5 of this report. These standards adopted by EPA should be considered towards ensuring the project's compliance to this Proclamation.

#### **4.5.4 Investment Proclamation No. 280/2002**

The Investment Proclamation no. 280/2002 encourages and promotes investment necessary so as to accelerate the economic development of the country and to improve the living standards of its peoples. It also describes, that in addition to that of domestic investors, it is deemed essential to widen the scope of participation of foreign investors and to facilitate conditions thereof with view to enhancing the country's activities (FDRE, 2002).

#### 4.5.5 **Solid Waste Management Proclamation No. 513/2007**

The objective of the Solid Waste Management Proclamation No. 513 /2007 is to enhance, at all levels, capacities to prevent possible adverse impacts while creating economically and socially beneficial assets out of solid waste. Some of the important provisions include: obligations of urban administrations, i.e. the relevant body must obtain a permit from urban administration prior to the engagement in the collection, transportation, use or disposal of solid waste – solid waste management planning and inter-regional movements of solid waste.

Article 3 of the Proclamation allows transportation of solid waste from one regional state or urban administration to another only if the recipient regional state or urban administration has notified the sender in writing that it has the capacity to recycle or dispose of it in an environmentally sound manner. This is a provision which could be exploited if solid waste generated by the project cannot be adequately handled within Oromia National Regional State (ONRS).

Articles 11 and 12 respectively make specific provisions for management of household solid wastes, and construction debris and demolitions wastes. The latter will be very important during both (exploratory/production) drilling phases and construction phases of the Project. In fact Article 12(2) stipulates that construction permit shall be issued only when the contractor deposits a legally valid bond or any other instrument to ensure environmentally sound disposal of construction debris or excavated earth (FDRE, 2007).

#### 4.5.6 **Mining Operations Proclamation No.678/2010**

This Proclamation vests all mineral resources on the government of FDRE and provide for security of tenure for all investors in respect of exploration and mining operations. One of its objectives clearly stated in Article 4(5) is to ensure that the country's mineral resources are developed in an orderly and sustainable manner. According to Article 7, no person may be allowed to undertake mining operations without a valid license. Different licence types are required for different stages in the mineral development processes. These include: reconnaissance licence, retention license, exploration licence and mining (small/large scale) licence. To ensure sustainable development of mineral resources, one of the requirements for granting an exclusive large scale mining license as per Article 26 of this Proclamation is the approval of Environmental Impact Assessment (EIA) of the mining operations. Secondly, Section 60 in Part seven of the Proclamation requires any applicant for a license (except for reconnaissance license, retention license or artisan mining license) to submit an EIA and obtain all the necessary approvals from the competent Authority required by the relevant environmental laws of the country. Further, Article 44 (2) (e) allows the licensing Authority to revoke a mining licence if the licensee is in breach of the approved EIA and safety and health standards.

Article 34 of the Proclamation obligates mining licensees to among others:

- ▶ Conduct mining operations in such a manner as to ensure the health and safety of his agents, employees and other persons, and comply with the applicable laws pertaining to environmental protection.
- ▶ Ensure that employees get the training and education necessary for mining Operations.
- ▶ Take proper precautions not to interfere with other legitimate occupants of the license area, the land covered by a lease and adjacent land.
- ▶ Give preference to the employment of Ethiopian nationals, provided that such persons have the required qualifications.
- ▶ Give preference to domestic goods and services, where they are readily available at a competitive price and are of a comparable quality.

To ensure mining areas are properly decommissioned, a holder of a mining license is required by Article 61 to apply to the Licensing Authority for a mine closure certificate upon either: a) revocation of the license; b) termination of the mining operations; c) relinquishment of the whole or any portion of the license area; or d) abandonment of the mine. No such closure certificate can be issued until the provisions pertaining to health, safety and the environment have been addressed.

Part six of this Proclamation covers compensation matters related to mining sites' operations. The principles of compensation under this part are stipulated in Article 57 and include:

- ▶ Where it is necessary for the achievement of the objectives of the mining Proclamation, the Licensing Authority may expropriate any immovable property on any land and shall cause the payment of fair compensation by the Licensee in accordance with the relevant laws.
- ▶ Any license holder shall be liable for any damage caused to property in connection with its mining operations.

The modes of compensation agreements and of determining compensation by the licensing Authority are stipulated in Sections 58 and 59 respectively (FDRE, 2010).

In line with this Proclamation, RG has been issued with exploration licence covering the study area by the Ministry Of Mines as attached in Appendix IX. Once exploration confirms viability of geothermal resources, RG will need to apply for a mining licence. An EIA licence of the proposed geothermal works is required in this application as this will contribute to ensuring the Project sustainability in line with these regulations.

#### **4.5.7 Mining Operations Council Of Ministers Regulations No. 182/1994**

These regulations were issued under the old Mining Proclamation No. 52/1993 but are still valid under the new Proclamation No.678/2010 reviewed above as far as they are consistent with it. The regulations serve to elucidate further on the provisions of the mining Proclamation on licensing and obligations of licensees. Regulation 11 iterates areas excluded for mining licensing unless the licensing Authority decides otherwise (FDRE, 1994). Such areas include:

- ▶ Any area which is within 100 meters of a site of archaeological, cultural or religious importance or a public building, railway, highway, airport, dam reservoir, pipeline, factory or other Government installation.
- ▶ Prospecting on land which is within 100 meters of a municipal area, village community or burial ground or which is on land actually under cultivation.
- ▶ Mining operations in areas excluded by any other law.

Regulation 29 is very specific on health safety and environmental protection and obligates a mineral operation license for any scale of mining operations to ensure provision for:

- ▶ Appropriate Personal Protective Equipment (PPE).
- ▶ Commensurate health and medical facilities.
- ▶ Notify the licensing Authority of any injury/death at the licensed site.
- ▶ Proper and safe site decommission.

Tulu Moye Project ESIA should ensure that the ESMP addresses these requirements given the proximity of the area to Lake Koka and presence of burial sites within the wider Project area.

#### 4.5.8 ***Ethiopian Water Resources Management Proclamation No. 197/2000***

The Ethiopian Water Resources Management Proclamation No. 197/2000 in Article 5 vests ownership of all water resources to the Ethiopian people and the state. It requires in Article 3 that the water resources have to be managed properly in that the quality and quantity should not be adversely changed and the environment be not negatively affected as a result of natural resources development. Permit for water use for various activities is required from Regional Bureau of Water and Energy. In accordance with Article 11 of the Proclamation, a water permit is required for the following activities:

- ▶ Construction of water works.
- ▶ Supply of water, whether for own use or for others.
- ▶ Transfer of water abstracted from a water resource or received from another supplier.
- ▶ Release or discharge of waste into water resources.

The Tulu Moye Project will require substantial water supplies especially during exploration drilling phase. RG will review and ensure that appropriate water permit is obtained for the chosen mode of water supply and any discharge of treated effluents from its operations into a water body where applicable.

#### 4.5.9 ***Ethiopian Water Resources Management Council of Ministers Regulations No. 115/2005***

These regulations elaborate on the requirements of water permit and the conditions under which such a permit may be suspended, terminated, varied or transferred. Regulation 5 indicates that a water use permit may authorize discharge of treated waste water into water resources. Regulation 12 obligates any persons discharging treated waste water to:

- ▶ Install and use waste treatment method.
- ▶ Discharge only the type and volume of treated waste permitted.
- ▶ Allow the supervising body to take the treated waste discharge sample at any time.

Under these regulations, a treaty for waste water discharge permit must be renewed every two years. Regulations 15 to 16 govern the sitting of wells for water supplies and requires testing for ground water quality as well as care for the supply wells in order to prevent the seepage of surface runoff and sewage into water supply wells. Further, only professionals/contractors with certificates issued by the supervision Authority (Ministry responsible for water) are allowed to undertake water works. In its part nine, the regulations stipulate procedures that shall be applicable in hearing and deciding cases between permit holders, as well as between a permit holder and a third party concerning rights or obligations arising from water permits. The Tulu Moye Project will require water supply for its operations and also discharge waste water. Necessary supply and waste discharge permits will have to be obtained in line with these regulations (FDRE, 2005).

#### 4.5.10 ***Research and Conservation of Cultural Heritage Proclamation No. 209 /2000***

Research and conservation of Ethiopian cultural heritage is regulated by Proclamation No.209/2000 of Ethiopia. It defines cultural heritage as “anything tangible or intangible which is the product of creativity and labour of man in the pre-history and history times, that describes and witnesses to the evolution of nature and which has a major value in its scientific, historical, cultural, artistic and handcraft content” (FDRE, 2000).

The Proclamation establishes an Authority for Research and Conservation of Culture (ARCCCH) which is accountable to the Minister of information and Culture.

According to Article 11(1), cultural heritage may be owned by the state or by any person. Section 20 requires any person to ensure the preservation of cultural heritage situated on

land which is given to him in usufruct. The purchase and sale of cultural heritage for commercial purposes by any person is prohibited in Section 24(1). In Section 19(1) any conservation and restoration work on Cultural Heritage requires prior approval of the Authority. The Authority may confiscate any cultural heritage which is not properly protected, repaired and restored; or, which is exposed to decay. Article 30 prohibits conduct of exploration discovery and study of cultural heritage without obtaining a prior written permit from the Authority.

Article 36 deals with chance finds and require that any person who discovers any Cultural Heritage in the course of an excavation connected with mining explorations, building works, road construction or other similar activities or in the course of any other fortuitous event, shall forthwith report the same to the Authority, and shall protect and keep same intact, until the Authority takes delivery thereof. However, if the Authority fails to do this within six months, the person may be released from his responsibility by submitting a written notification, with a full description of the situation, to the Regional government official. The Article prohibits any person, without a permit issued by the Authority, from carrying out building or road construction, excavations of any type or any operation that may cause ground disturbance in an area declared reserved by the council of ministers. Further, any person who holds permit to conduct construction works in reserved area and who discovers cultural heritage in the course of construction activities shall stop construction and shall forthwith report same in writing to the Authority. Any person who destroys or damages cultural heritage intentionally shall be punished with gregarious imprisonment not less than 10 years and not exceeding 20 years in line with Article 45 (2).

No reserved area exists in the Project area. However, the chance find provisions in Article 36 will apply to the Project.

#### **4.5.11 Public Ownership of Rural Lands Proclamation No. 31/1975**

According to Article 3 of the Public Ownership of Rural Lands Proclamation No. 31/1975 all rural lands are the collective property of the Ethiopian people, abolishing private ownership of rural land (FDRE). No compensation shall be paid in respect to rural lands and any forests and tree crops thereon; provided that fair compensations shall be paid to moveable properties and permanent works on the land. Article 5 of the Proclamation prohibits any transfer of land by any person by sale, exchange, succession or mortgage, antichresis, lease or otherwise to another person. These provisions were retained in the new constitution, approved in December 1994, retains land under the control of the people and Government of Ethiopia. Farmers have the right to obtain land without payment, and are protected against eviction from land in their possession.

In Article 8, the Proclamation provides for the establishments of peasant associations in rural areas and gives them some responsibility in the management of environment at local levels.

Each peasant association is formed in manner suitable for an area development and taking *Chika* area as a basis, with a minimum area of 800 hectares (20 *gashas*). Among other functions, the peasant associations are:

- ▶ Responsible for distribution of land amongst the members with assistance from the government where necessary.
- ▶ Administer and conserve any public property within their area especially soil, water and forest.
- ▶ Establish judicial tribunals to hear land disputes arising within the area.
- ▶ To excluded from distribution mining and forest lands and places with historical and antiquarian significance.

Minister of land reform and administration is required in Article 12 to assign to every Woreda, at least one land reform officer whose duty is to advise the peasant associations and assist them in any other manner.

According to Article 17, the government has powers to expropriate land from peasant associations for public purposes including schools. Hospitals, roads, offices, military bases and agricultural projects. However, the government has to make good any damage to the peasant association by the expropriation.

**4.5.12 Oromia Bureau of Land and Environmental Protection Establishment Proclamation No. 147/2009.**

This proclamation in Article 3 establishes the Oromia Bureau of Land and Environmental Protection to regulate implementation of any development activities to be accomplished with knowledge of land use planning and environmental protection. Duties and powers of the bureau are defined in article 5 of the proclamation and include:

- ▶ Formulate policies and strategies pertinent to land and environmental protection.
- ▶ In collaboration with concerned organs determines compensation to a person whose land holding has been expropriated for development works, regulate and follow up the person to be rehabilitated.
- ▶ In collaboration with concerned organs resolve or cause to be resolved any conflicts or disputes arising on land and Environmental protection.
- ▶ Promote and develop public awareness on land use and environmental protection at all levels.
- ▶ Undertake environmental auditing on the manner of liquid and toxic wastes disposal management by factories and industries so that it may not damage the environment.
- ▶ Regulate and follow up that any development body shall conduct environmental impact assessment prior to project implementation
- ▶ Prepare environmental standards and make them available for use and regulate its implementation.

**4.5.13 Expropriation of Landholdings for Public Purposes and Payment of Compensation Proclamation No. 455/2005**

Proclamation No. 455/2005 describes in several Articles, issues on determination of compensation, displacement compensation, valuation procedures, property valuation committees, and complaints and appeals in relation to compensation. Regarding the determination of compensation, the basis and amount is explained in part three, Article 7. Article 7(1) states that a landholder whose holding has been expropriated shall be entitled to payment of compensation for his property situated on the land and for permanent improvements made. Article 7(2) states that the amount of compensation shall be determined on the basis of replacement cost of the property. In Article 8(1) of the same Proclamation, a landholder whose land has been expropriated shall, in addition to the compensation payable under Article 7, be paid displacement compensation, which shall be equivalent to ten times the average annual income he secured to bring the five years preceding the expropriations of the land.

**4.5.14 Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes Council of Ministers Regulations No. 135 /2007**

Regulations No. 135/2007 are issued in line with Article 14(1) of Proclamation 455/2005 and give the details on the payment of compensation for property situated on land holdings expropriated for public purpose. This regulation was issued for the purpose of not only paying compensation but also to assist displaced persons to restore their livelihood. Part two of these regulations stipulates the assessment criteria for

compensation for various assets/properties as well as the formula for calculating the amount of compensation payable. However, with regard to compensation payable when a mining site is expropriated, regulation 11 indicates that compensation due should be determined by the relevant mining law (FDRE, 2007).

**4.5.15 Oromia Rural Land Use and Administration Proclamation No. 130/2007**

This Proclamation is only applicable to rural land in Oromia National Regional State and is administered by Oromia Agricultural Rural and Development Bureau. Article 5 of the Proclamation accords any resident of the region, aged eighteen years and above, whose livelihood depends on agriculture and/or wants to live on, the right to get rural land free of charge. Similarly, Government and non-governmental organizations, private investors and social organizations have the right to get rural land (ONRS, 2007).

Article 12 allows any private investor to have access to rural land and is obliged to conserve accordingly. Private investors are obliged to plant indigenous trees on at least 2% of the given land and such investment land is determined in a way that protects the natural resources of the surrounding. The Proclamation also has several provisions for restrictions of rural land use planning and conservation. For instance, it requires that rural lands that have gullies and are located on hilly areas be rehabilitated and developed communally and that the biodiversity in rural wetland shall be conserved and utilized in accordance with a suitable land use strategy as necessary. Rural land users are obliged to refrain from performing activities that cause damage to the wetlands and springs and rural land use in the vicinity of lakes, streams and springs that can cause devastation of natural resources and biodiversity are prohibited.

**4.5.16 Energy Proclamation No. 810/2013**

This Proclamation came into force on 27 January 2014 and underscores the importance of expansion of electricity services as essential to enhance Ethiopia's economic and social development and the need to regulate electricity and energy efficiency and conservation. In Article 3, it establishes the Ethiopian Energy Authority to promote the development of efficient, reliable, high quality and economical electricity services.

Article 10 of the Proclamation obligates any licensee to carry out his activities in compliance with among other, the relevant environmental protection laws, and safety, quality and performance standards determined by the Ethiopian Energy Authority.

In Articles 16-17, the Proclamation allows a licensee to expropriate land under private holding for any generation, transmission, distribution and sale of energy. In undertaking the expropriation, the relevant laws must be followed and the licensee is responsible for compensation of any damages caused to properties of a landholder.

**4.5.17 Electricity Proclamation No. 86/1997**

Ethiopia also has Electricity Proclamation No. 86/1997 that RG will have to follow in due course and acquire licence for generating electricity.

**4.5.18 Public Health Proclamation No. 200/2000**

This Proclamation has provisions for safeguarding general public health as well as occupational safety which shall be applicable to the Project. In Article 10, the following are prohibited:

- ▶ Giving water supply service from springs, wells or through pipes unless its quality is verified by the Health Authority.
- ▶ Discharging untreated liquid waste generated from septic tanks, seepage pits, and industries into water bodies, or water convergences.



Article 11 requires employers to have occupational health control and use of machinery. An employer is required to ensure the availability of occupational health services to his employees and use of any machinery or instrument that generates excessive noise is prohibited and where used, installation of noise abating apparatus is required. However, the threshold noise level has not been defined by the Proclamation.

Regarding waste handling and disposal, Article 12 of the Proclamation requires that any generator collects waste in a designated place and in a manner that does not affect the health of a society. Further, disposal of solid, liquid or any other waste in a manner which contaminates the environment or affects the health of the society is prohibited.

Article 18 obligates any person constructing buildings for public services to get health permit and registration by an appropriate health Authority from the planning to completion of construction (FDRE, 2000).

#### **4.5.19 *Prevention of Industrial Pollution Council of Ministries Regulation No.159/2008***

This regulation is directed to industry and in particular “factories”. Though the regulation does not provide a clear definition of “factories”; Articles 8 and 9 of the regulation are deemed applicable to the proposed Tulu Moye geothermal Project. These Articles include the need for emergency response systems and the need for monitoring of environmental safety. Further, any person is allowed to raise pollution complaints to an environmental Authority without having to show any vested interests (FDRE, 2009).

The ESIA process will ensure that the Project has necessary Emergency Response Plan (ERP) and environmental safety monitoring for exploration, plant construction and operation phases both for environment and public/workers safety.

#### **4.5.20 *Labour Proclamation No. 377/2003***

This Proclamation in Article 12(4) requires that the employer takes the necessary measures to adequately safeguard the health and safety of their workers. In this Proclamation, the worker-employer relations are governed by the basic principles of rights and obligations with the goal to enable workers and employers to maintain industrial peace and work in the spirit of harmony and cooperation towards the all-round development of the country. The Proclamation in part four also provides requirements around normal working hours and overtime work (FDRE, 2003).

#### **4.5.21 *The 1960 Civil Code of Ethiopia***

The 1960 Civil Code of Ethiopia contains relevant provisions regarding expropriation of property for public purposes (see Articles 1444 - 1488). Some of these include provisions for:

- ▶ Determining land subject to expropriation for projects that serve public interest.
- ▶ Serving of expropriation orders.
- ▶ Handling partial expropriation.
- ▶ Fixing amount of compensation including elements to be considered in determination of compensation amount.

These should be reviewed further whenever need for expropriation of land for the Project is established in the subsequent phases.

### **4.6 National Guidelines and Standards**

The Ethiopian Environmental Protection Authority has issued a number of guidelines for environmental and social impact assessment of projects in different sectors as well as for preparation of environmental management plans. These guidelines will be consulted during the conduct of ESIA. These include:

- ▶ Environmental Study Procedural Guidelines require all projects to be subject to an IEE to decide whether the project is to be submitted to full EIA, EPA, 2000.
- ▶ Sectoral Guidelines for specific types of projects, e.g. water supply, dams and reservoirs, irrigation, hydropower, rangeland management, soil conservation.
- ▶ Guidelines to prepare environmental and social management plans, EPA, 2004
- ▶ Guideline on ambient water quality of domestic, agricultural and industrial wastes
- ▶ Environmental Impact Assessment Guideline For Mineral and Petroleum Operation Projects, EPA 2003

#### **4.6.1 *Environmental Impact Assessment Procedural Guidelines Series 1, EPA, 2003***

The Environmental Impact Assessment Procedural Guidelines Series1 of November 2003 details the EIA Process as applicable to development projects (EPA, 2003). Schedule 1 of the guidelines lists projects which require full EIA. Production and distribution of electricity, gas, steam and hot water are listed in item 7 as energy industry projects which require full EIA. Resettlement of people is also included in this schedule as requiring full EIA.

The procedural guidelines further elaborate the roles and responsibilities of various stakeholders in the ESIA process including the federal environment agency (EPA).

#### **4.6.2 *Environmental Impact Assessment Guideline for Mineral and Petroleum Operation Projects, EPA 2003***

The Environmental Impact Assessment Guideline for Mineral and Petroleum Operation Projects, EPA 2003 is organized in such a way that the impact of exploration is considered first, then development phase and mining phases separately with transfer of environmental information from the preceding phase of operation (activities) to the next phase.

#### **4.6.3 *Environmental Standards for Industrial Pollution Control***

The Ethiopian Federal EPA has developed a list of environmental standards for the purposes of preventing significant industrial pollution. These standards present pollution limits for discharge to water and emissions to the air for 12 specific classes of industrial activities. None of the standards is applicable to geothermal power plant operations. However, the EPA draft guidelines for EIA for Mineral and petroleum operation projects of 2003 in its appendix 1 gives air, water and soil quality standards for the mining sector, which in the absence of suitable guidelines could be adapted to the geothermal projects. These are shown in chapters on air, water and soil.

### **4.7 National policies and plans**

#### **4.7.1 *Environmental Policy and Strategies***

To further amplifying the Constitutional provisions on environmental protection, the Environmental Policy of Ethiopia was approved in 1997 (EPA 1997a). The policy goal is to improve the health and quality of life of the people of Ethiopia and to promote sustainable social and economic development through sound management and use of natural, humanmade and cultural resources and the environment as a whole. The policy seeks to:

Ensure that essential ecological processes and life support systems are sustained, biological diversity is preserved and renewable natural resources are used in such a way that their regenerative and productive capabilities are maintained and where possible enhanced so that the satisfaction of the needs of future generations is not compromised;

where this capability is already impaired to seek through appropriate interventions a restoration of that capability.

#### 4.7.2 **The National Energy Policy**

The National Energy Policy (FDRE, 2013) is an integral part of an overall development policy of the State /Government of Ethiopia. The policy aims to facilitate the sustainable development of energy resources for economical supply to consumers. It seeks to achieve the accelerated development of indigenous and modern energy resources as well as to provide the support and incentives for the participation of the private sector and community, particularly women in the development of energy. The National Energy Policy is intended to enhance and foster Agricultural Development Led Industrialization (ADLI), envisaging the structural transformation of the economy through export-led growth that feeds into an interdependent agricultural and industrial development. One of the general key objectives of the policy is to ensure that the development and utilization of energy is benign to the environment. In the policy, the government of Ethiopia undertakes among others to:

- ▶ Greatly expand and strengthen agro-forestry programs.
- ▶ Introduce energy conservation and energy saving measures in all sectors.
- ▶ Ensure the compatibility of energy resources development and utilization with ecologically and environmentally sound practices.
- ▶ Ensure community participation, especially the participation of women, in all aspects of energy resources development and encourage the participation of the private sector in the development of the energy sector.

Among the policy priorities are: to provide the private sector like in this case of Tulu Moye, with necessary support and incentives to participate in the development of the country's energy resources; and to pay due and close attention to ecological and environmental issues during the development of energy projects. As part of modern energy resources development, Ethiopia's geothermal and coal resources will be developed on the basis of their economic profitability.

#### 4.7.3 **Growth and Transformation Plan**

The Growth and Transformation Plan (GTP) is a medium term strategic framework for five year period (2010 /2011 – 2014 /2015) directed towards achieving Ethiopia's long term vision and sustaining the rapid and broad based economic growth (Ministry of Finance and Economic Development, 2010). Its vision in the economic sector is ...to build an economy which has a modern and productive agricultural sector with enhanced technology and an industrial sector that plays a leading role in the economy; to sustain economic development and secure social justice; and, increase per capita income of citizens so that it reaches at the level of those in middle-income countries. One of the four major objectives of the plan is to maintain at least an average real GDP growth rate of 11% and meet the Millennium Development goals. Enhancing expansion and quality of infrastructure development is one of the pillar strategies on which maintenance of this growth is hinged on. Under this pillar, telecommunication, railway, road, energy and irrigation development are to receive sustained support during the plan period. The Tulu Moye Project is in line with the GTP energy sector target which is to increase the country's generating capacity from 2000 MW (2010/2011) to 8,000 up to 10,000MW by the end of the plan period (2014/15). The implementing strategies for the electric generation construction program are to:

- ▶ Promote energy mix by developing wind and geothermal renewable energy sources;
- ▶ Prevent power loss and promote proper utilization of energy; and
- ▶ Reduce power generation investment /cost and provide electricity at affordable price.

#### 4.7.4 ***Ethiopia's Climate-Resilient Green Economy Strategy***

This strategy was developed through a joint initiative led by the Prime Minister's Office, the Environmental Protection Authority, and the Ethiopian Development Research Institute. The objective of the strategy is to identify green economy opportunities that could help Ethiopia reach its ambitious growth targets (which are stipulated in the Growth and Transformation Plan) while keeping greenhouse gas emissions low. The strategy (The Green Economy Strategy) is currently being implemented and will require a boost in Ethiopia's Agricultural productivity, strengthening the industrial base and fostering export growth. Electric power generation has been identified as one of the most critical components to capture growth and economic development and a condition for building a green economy in other sectors. Under the electric power sector, geothermal has been identified as one of the potential generation means that can significantly de-carbonise the regional energy profile as well as contribute to Ethiopia's capital stock formation, a critical enabler of industrial and urban growth and a key priority for the growth and transformation programme through rural electrification. The Tulu Moye Project will hence contribute towards this national strategy (FDRE, 2011).

#### 4.7.5 ***Conservation Strategy of Ethiopia (CSE)***

Since the early 1990s, the Federal Government has undertaken a number of initiatives to develop regional, national and sectoral strategies for environmental conservation and protection. Paramount amongst these was CSE, approved by the Council of Ministers, which provided a strategic framework for integrating environmental planning into new and existing policies, programs and projects. The CSE provides a comprehensive and rational approach to environmental management in a very broad sense, covering national and regional strategies, sectoral and cross sectoral strategy, action plans and programs, as well as providing the basis for development of appropriate institutional and legal frameworks for implementation. Based on CSE, the Oromia National Regional State have already developed Conservation Strategy document for its respective Zones. The document gives details about environmental issues prevalent in the territory and outlining how the environmental issues are to be addressed.

#### 4.7.6 ***Ethiopian Water Resources Management Policy***

The Ministry of Water Resources has formulated the Federal Water Resource Management Policy (WRMP) for a comprehensive and integrated water resource management. The overall goal of the policy is to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of the country for significant socio-economic development on sustainable basis. The specific objectives of the policy include:

- ▶ Promote the development of the water resources of the country for economic and social benefits of the people, on equitable and sustainable basis.
- ▶ Allocate and apportion the water, based on comprehensive and integrated plans and optimum allocation principles that incorporate efficiency of use, equity of access and sustainability of resources.
- ▶ Manage and combat drought as well as other drought associated impacts and disasters through efficient allocation, redistribution, transfer, storage and efficient use of water resources.
- ▶ Conserve, protect and enhance water resources and the overall aquatic environment on sustainable basis.

With regard to Water Supply and sanitation for Industries and Other Users, the policy seeks to:

- ▶ Promote the "User Pays" principle in the supply of water for industrial and other users.
- ▶ Ensure that when industries develop their own water supply systems, they will be accountable for the water supply services costs only.
- ▶ Control and ensure that water bodies are protected from pollution by waste water and other wastes indiscriminately discharged by industries and other institutions.

The policy requires water resources schemes and projects to have "Environmental Impact Assessment and Evaluation".

#### 4.7.7 **Wildlife Policy**

Ethiopia has in the past made some efforts to protect its wildlife resources without a clear, appropriate and approved policy but only with some outdated legislations, though the success was not satisfactory. Recently, Wildlife Development, Conservation and Utilization Policy and Strategy, which was for a long time in a draft form, has been updated and approved. The Policy has the following key objectives:

- ▶ To conserve, manage, develop and sustainably utilize the wildlife resource so that the country can derive the socio-economic and ecological benefit from the resource.
- ▶ To enable the country to discharge its obligations assumed under the international treaties regarding the conservation and utilization of wildlife and pass the resource and benefits to the coming generation.

The policy identifies the main threats to the country's wildlife as resulting from improper land use, which include habitat destruction due to illegal agricultural encroachment, rapid population growth, illegal settlement and poaching. It has five major Sections dealing with wildlife development and protection, utilization of wildlife resources, participation of the community and investors in the sector, conservation education and information network. The policy recognizes wildlife both within and outside protected areas. The policy pays special attention to conserving endemic and threatened wildlife. One of the strategies adopted which may be relevant to the Project is facilitating favourable conditions for translocation of threatened wildlife to protected areas or to facilities where ex-situ conservation may take place. The policy is championed by the Ministry of Agriculture and Rural Development. However, regional states can also prepare their own policies. No similar policy has been developed by the ONRS.

## 5 ESIA Team and methodology

### 5.1 E&S policy of the ESIA

The IFC Performance Standards on Environmental and Social Sustainability are the benchmark of international best practice, involving commitment to transparency and good governance in operations and disclosure obligations. The IFC PSs provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations in relation to project-level activities.

The IFC Performance Standards are the overarching policy defining the environmental and social objectives and principles that guide the Project to achieve sound environmental and social performance provided in this ESIA. The IFC PSs 1 through 8 articulate Reykjavik Geothermal strategic commitment to sustainable development and approach to E&S risk management.

### 5.2 Impact assessment team

The environmental consulting firms undertaking the ESIA work are VSO Consulting, TS Environment Technology Plc. and GIBB International, in cooperation with the Reykjavik Geothermal geoscientists.

VSO Consulting is an Icelandic engineering consulting firm. The environmental division of the firm is specialized in environmental impact assessment, planning, environmental and quality systems for geothermal projects. The firm has over 19 years of experience of ESIA work for geothermal projects.

TS Environment Technology Plc. Is an environmental, social, and sustainability consulting and service providing company in Ethiopia since 2006. It is approved by the Ethiopian Ministry of Environment, Forest and Climate Change with a certificate of competence on Environmental Impact Assessment studies as a Consulting Firm in Level 1.

**Table 5.1 ESIA team**

| Name                      | Qualif. | Specialization                 | Assignment in the Project                                  |
|---------------------------|---------|--------------------------------|--|
| <b>Project Management</b> |         |                                |  |
| Gudjon Jonsson            | M.Sc.   | Chemical Engineering at VSO    | Project Management   |
| Loftur R. Gissurarson     | Ph.D.   | Head of QHSE at RG             | Project Management   |
| Samuel Hailu              | CEO     | Environmental expert at TS     | Team Leader  |
| Stefan G. Thors           | M.Sc.   | Environmental economist at VSO | Project Management and ESIA report                         |
| <b>RG Scientists</b>      |         |                                |  |
| Gestur Gislason           |         | Geology/geochemistry           | Flow testing, fluid chemistry, field development           |
| Hjalmar Eysteinnsson      | Ph.D.   | Geophysics                     | Resistivity surveying. Interpretation of geothermal fields |
| Snorri Gudbrandsson       | Ph.D.   | Geochemistry                   |  |
| <b>VSO Experts</b>        |         |                                |  |
| Andrea Kristinsdottir     | M.Sc.   | Environmental Planning         | ESIA report  |
| Audur Magnúsdóttir        | M.Sc.   | Environmental Science at VSO   | ESIA report  |
| Greta H. Sveinsdóttir     | B.Sc.   | Environmental Planning         | ESIA report, GIS.  |

|                                      |       |                                      |                              |
|--------------------------------------|-------|--------------------------------------|------------------------------|
| <b>TS Experts</b>                    |       |                                      |                              |
| Abebe Ameha Mengistu                 | Ph.D. | Herpetologist, biodiversity assessor | Baseline and ESIA review     |
| Befekadu Refera Soreta               | M.Sc. | Animal ecology                       | Baseline and ESIA review     |
| Brook Lemma                          | Ph.D. | Baseline ecological research         | Baseline and ESIA review     |
| Kumelachew Yeshitela                 | Ph.D. | Flora                                | Baseline and ESIA review     |
| Mehret                               |       | Maps /GIS expert                     |                              |
| <b>GIBB International Scientists</b> |       |                                      |                              |
| Eng. Maurice Namiinda                |       | Water Supply Enginner                | Project Director             |
| George G. Owuor                      | M.Sc. | Environmental Geology and Management | Team Leader/Environmentalist |
| Temesgen Yimer                       | B.A.  | Sociology                            | Sociologist                  |
| Dr Ronald K. Mulwa                   | Ph.D. | Natural Sciences                     | Ecologist                    |
| Yonas M. Worgassa                    | M.Sc. | Hydrology                            | Hydro-geologist              |
| Sekou T. Kenyanito                   | M.Sc. | Geographic Information Systems       | GIS Expert                   |
| Aggrey O. Kwadha                     | M.A.  | Physical Planning                    | Environmental Planner        |
| Philip Abuor                         |       | Chemist                              | Environmental Chemist        |
| Anastasia Ngatti                     | M.A.  | Sociology                            | Sociologist                  |
| Caleb Ouma                           |       | Statistician                         | Socio-economist              |

### 5.3 Ethiopian Expert Certification

Present ESIA Report V.02, is the work of an VSO Consulting and TS Environment Technology Plc. While VSO Consulting is the geothermal ESIA expert, TS Environment is a leading environmental, social and sustainability consulting service in Ethiopia with a certificate of competence from the Ministry of Environment, Forestry and Climate Change. TS Environment has at least eight (8) ESIA staff specialists /experts.



### 5.4 Methodology and approach

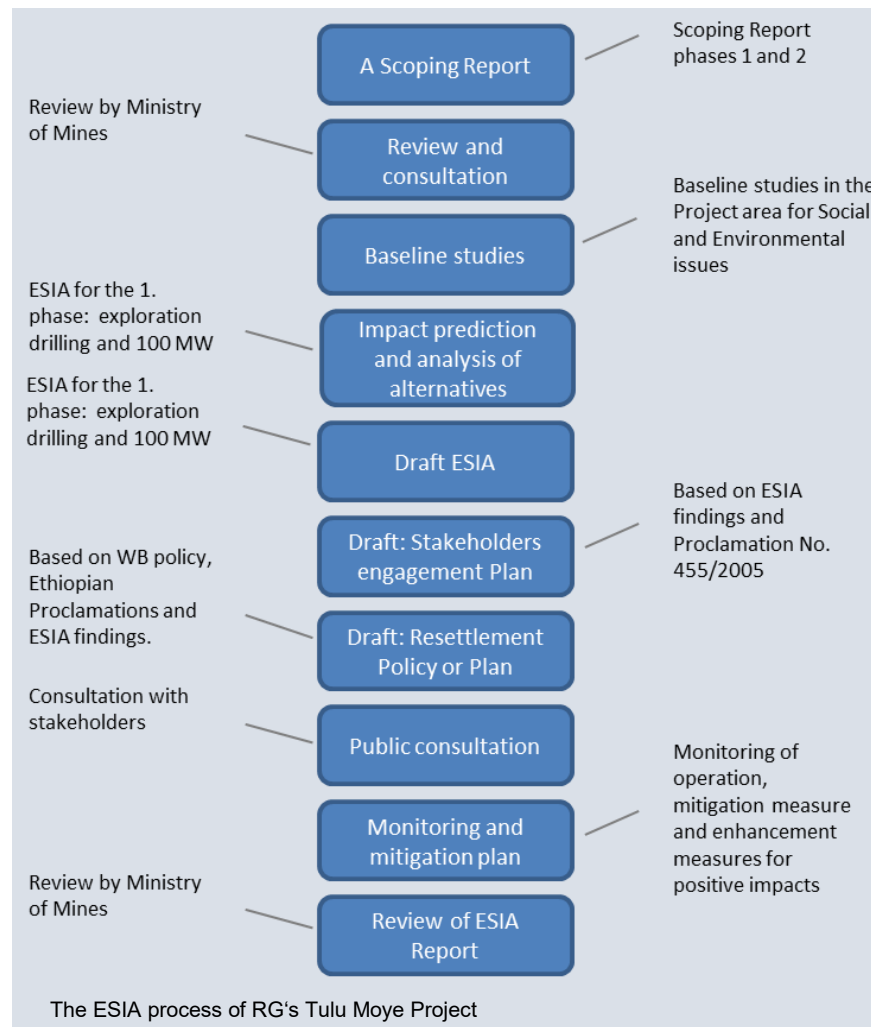
Geothermal projects are generally executed in a staged approach. The overall experience gained from the operation of a preceding step forms the basis for the design

of the succeeding step. The geothermal reservoir and its technology are developed over time. A succeeding step to one or several steps in operation can for example, involve increased steam production with associated increased reinjection for power generation or other industrial usage which in turn calls for more wells to be drilled and more facilities to be built.

The very nature of geothermal projects is therefore dynamic in the sense that they are continuously evolving during the entire life span of the resource harnessed (Albertsson et al. 2010). When results are obtained from exploration drilling and initial reservoir model, the Proponent will know more about where further drilling and power station will /can be located. The geothermal model may /will change with each well drilled as more information is accumulate. Locations and plans may / will continue to chance.

Due to this dynamic nature of geothermal projects, the ESIA will be phased according to information available and development of the Project. The information gathered in the exploration and resulting 100 MW production phase can have significant effect on the size, location and the overall design of the 500 MW Project and therefore it may not be feasible to assess the whole Project all-in-one from beginning to end.

During the assessment work, RG has decided upon the first two well pads, the site for the Power Station, access roads to well pads, as well as some of the major pipelines. This has been done in accordance to the RG ESIA methodology, i.e. to make decisions as further information becomes available. RG will continue with this approach, and use the ESMP and necessary criterias, for all decision making.





Since the geothermal project is dynamic in nature and therefore it is not possible to locate with precision various project component, the ESIA defines all the issues necessary for finalization of the project. This is done as criteria for choosing among alternatives and to implement the ESMP and its follow up. This approach is to guaranty that the environmental and social issues are always to be part af all decisions on project location, magnitude and characteristics.

## 5.5 Impact identification and significance

The assessment of possible impact was based on the considerations in the EPA Guideline (2003). Impact significance is invariably subjective despite the presence of clear cut criteria, government policy, standards and international conventions. A potential impact will be evaluated and analysed based on its nature/characteristics, location and extent, magnitude, timing, duration, reversibility, probability, significance and whether it is direct, indirect and/or cumulative.

The significance of the impacts will be based on:

- Policy and legal framework;
- Social importance;
- Ecological importance;
- Environmental standards;
- Impact analysis and prediction/assessment;
- Conclusion of findings/research; and
- Consultation.

Table 5.2 Criteria for determining impact magnitude

| Magnitude (positive or negative) | Description   |
|----------------------------------|---|
| High                             | Significant changes to the environmental aspect resulting in long term or permanent change, over significant area. Disagreement with national legislation, standards, limits and international conventions. |
| Medium                           | Detectable but not significant change to the environmental aspect resulting in temporary or permanent change.   |
| Low                              | Noticeable but minor change to the environmental aspect. The change is temporary. In agreement with national legislation, standards, limits and international conventions.                                  |
| Negligible                       | No predicted changes or negligible changes to the environmental aspect.   |

Table 5.3 Criteria for determining sensitivity of environmental aspect

| Sensitivity (positive or negative) | Description  |
|------------------------------------|--|
| High                               | Vulnerable receptor with little or no capacity to accommodate proposed changes or minimal opportunities for mitigation. Key characteristics of the environmental aspect in question. High conservation values. |
| Medium                             | Some tolerance to accommodate the proposed change or limited opportunities for mitigation. Other characteristics (not key) of the environmental aspect in question. Some conservation values.                  |
| Low                                | Receptor generally tolerant of the proposed changes or moderate opportunities for mitigation. Low conservation value.  |
| Negligible                         | Receptor has good capacity to accommodate proposed changes or/and good opportunities for mitigation. No conservation value.  |

Table 5.4 Impact significance matrix, adverse impacts

|             | Magnitude     |               |               |               |
|-------------|---------------|---------------|---------------|---------------|
| Sensitivity | Substantial   | Moderate      | Slight        | Negligible    |
| High        | Major         | Major         | Moderate      | Insignificant |
| Medium      | Major         | Moderate      | Minor         | Insignificant |
| Low         | Moderate      | Minor         | Minor         | Insignificant |
| Negligible  | Insignificant | Insignificant | Insignificant | Insignificant |

Table 5.5 Impact significance matrix, positive impacts

|             | Magnitude     |               |               |               |
|-------------|---------------|---------------|---------------|---------------|
| Sensitivity | Substantial   | Moderate      | Slight        | Negligible    |
| High        | Major         | Major         | Moderate      | Insignificant |
| Medium      | Major         | Moderate      | Minor         | Insignificant |
| Low         | Moderate      | Minor         | Minor         | Insignificant |
| Negligible  | Insignificant | Insignificant | Insignificant | Insignificant |

## 5.6 Cumulative Impacts Assessment

This section describes Cumulative Impacts Assessment and Management (CIA) from the Project.

### 5.6.1 Cumulative impacts

Cumulative impacts are defined as successive, incremental, and /or combined effects of a project or activity, accumulated with other projects or activities. As present Project is complying with IFC PSs, potential cumulative impacts are evaluated pursuant to IFC's cumulative impacts guidance, *Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets* (IFC 2013).

CIA focuses on E&S impacts and risks evaluated as significant or critical by the affected communities and other stakeholders (Valued Environmental and Social Components or VECs), and are cumulatively impacted by the Project, other projects, and sources of external stressors. Development of CIA requires identification of VECs based on the Aol of the Project; other existing, planned, and future projects; sources of external social and environmental pressure; and results of consultation with stakeholders.

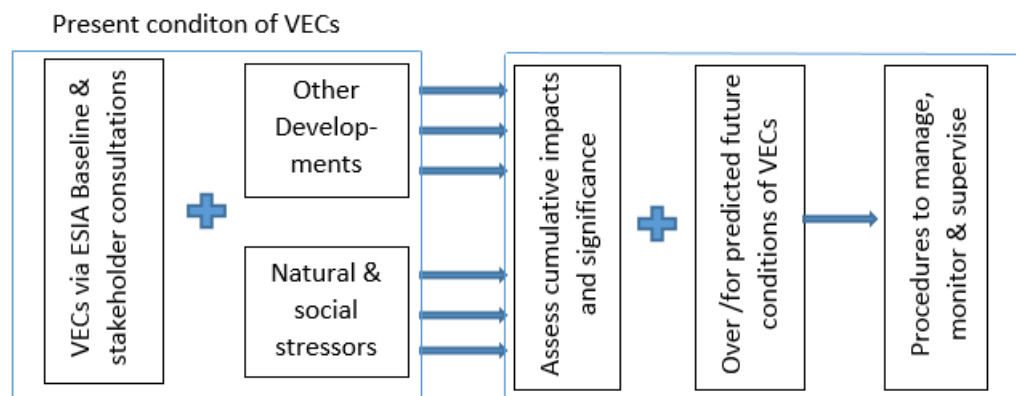


Figure 5.1 Rapid Cumulative Impact Analysis Process

### 5.6.2 VECs

The identification of VECs is based on information obtained during the Baseline survey, other known activities in the Project area, the stakeholder disclosure and consultation process of this ESIA, and E&S receptors identified in the ESIA assessment of impacts.

Taking into consideration the impacts of the Project and the location and nature of other projects and external pressures, the identified VECs for this RCIA are probably:

- Project affected people
- Terrestrial biodiversity

At this point, the only other project identified within the AoI is the expansion of the Tulu Moyo Geothermal Development Project beyond planned drill pads with water works system and access roads. This project would be continuation of the current Project, assuming that exploration drilling will be successful. Phase II would involve more space for drill pads, injection pads, construction of a power plant at a selected site and electric transmission line system to bring electricity generated by the Project to the national grid.

The primary external stressor affecting VECs in the AoI is to complete Project milestones in time and on budget, to most if not all stakeholders' satisfaction.

The potential cumulative impacts created by Phase I and Phase II activities are:

- Ongoing displacement of human receptors (i.e., farmers) at and in the immediate vicinity of the Phase II facilities, including but not limited to the transmission line
- Ongoing and new habitat loss and degradation (from human activity, noise, and air emissions) at and in the immediate vicinity of the Phase II facilities, including but not limited to the transmission line

As part of the Phase II ESIA, a full CIA should be carried out to fully assess the magnitude and significance of these and potentially other cumulative impacts related to the Phase II Project.

#### (a) Displacement of farming activities

Occupation of land for the Phase II activities would result in the displacement of farmers from the Project site and immediate surrounding area. Additionally, new physical and economic displacement may be required as a result of the transmission line. The extent of displacement cannot be appraised until a route is determined.

#### (b) Degradation and loss of habitat

The Phase I activities will result in some habitat degradation and possibly direct habitat loss at and in the immediate vicinity of the well pad sites. This impact can be evaluated as a long-term impact for the area around the selected sites if the Project is successful and continues to Phase II. Noise and human activity during Phase II would continue to displace wildlife species that are sensitive to noise and human disturbance, although some species would be expected to habituate to the noise and human activity.

The primary air emission of concern for biological receptors is H<sub>2</sub>S and this pollutant would be emitted during Phase I drilling and blow testing and during Phase II from the same activities. Emissions of H<sub>2</sub>S during Phase I and II activities are expected to be low and limited to a small area around the well pad and injection pad sites and the power plant, impacting particularly plants and sessile species that are stationary or move only short distances.

#### (c) Impact of transmission line

The Project involves eventually the construction and operation of a transmission line, which would result in cumulative impacts related to habitat loss and fragmentation, wildlife disturbance and displacement, and wildlife injury or mortality.

Habitat loss will be inevitable within the transmission line right-of-way and will fragment intact habitats and degrade wildlife habitat conditions within and adjacent to the right-of-way. The degree of fragmentation and habitat degradation would depend on the alignment of the right-of-way and whether it traverses intact or modified habitats. The transmission line could result in bird collisions and electrocutions, leading to injury or mortality of birds that fly into the transmission lines or their supporting structures, or they attempt to nest on or near grounded or electrified parts.

The Project's transmission line design (e.g., its height and pole type) and alignment have not been established at this time. A transmission line that would parallel existing roads would pose lower risk of collision and electrocution because the line would not traverse new key habitats for the species.

### 5.6.3 **Conclusion of CIA**

The assessment considered the possible impacts of other activities in and around the Project area for the planned drill pads and associated infrastructure. To RG's knowledge there are no other projects on-going or being planned within or close to the area.

The conclusion is that it is not applicable for time being to assess cumulative impacts in full. CIA analysis will become relevant, however, probably when a power plant will be considered, and definitely in next phase, i.e. when assessing the extension to 500 MW.

## 5.7 **Physical and economic displacement**

Part of the ESIA methodology is to make, engage and carry out Resettlement Action Plan (RAP) to compensate impacts of economic and physical displacement in compliance with IFC Performance Standard 5.

If there is any physical or economical displacement, then PS5 is triggered. If drilling targets are not known Resettlement Policy Framework (RPF) is created, spelling out the process of Resettlement issues. When the targets have been defined, and located, Resettlement Action Plan is made and disclosed to Stakeholders for consultation. If there are no resettlement issues or physical displacement, only economic displacement, Livelihood Restoration Plan is prepared (or Land Acquisition Plan depending on terminology). Livelihood Restoration Plan can be published as part of RAP.

Although RG aims to choose locations and routings to avoid physical and economical displacement – there will most likely be resettlement issues to resolve at some stage.

### 5.7.1 **Resettlement Policy Framework**

At present stage in the Project development the Area of Influence has been defined, the Drilling area has been located and potential Drilling Targets suggested. However, site specifics have not been established and finalized, such as road design, water source and pipeline route, and what Drilling Target to start with.

Therefore, Resettlement Policy Framework (RPF) has been constructed along with this ESIA report and is published as an Annex.

### 5.7.2 **In due course: Resettlement Action Plan**

All acquisition of land or resettlement will be resolved with voluntary process undertaken through participation, communication and consent of the affected communities. Physical and economic displacement, cemeteries, forests and significant wildlife areas will be avoided.

A Resettlement Action Plan in line IFC PS5 will be developed in due course as the Project advances. The principle of leaving people better off than they were before

(displacement) - will be the aim of RAP. All displacement issues will be resolved prior to any disruption of land.

For further information on present resettlement status, refer to Resettlement Policy Framework that has been prepared for this Project and is published as an Annex to /with this ESIA report.

### 5.7.3 **Gap analysis of Ethiopian legal framework**

Ethiopia environmental and social legal environment is well advanced. It includes essential laws and regulations required for environmental and social protection and by and large - fair treatment. Furthermore, the country has ratified several international treaties on the protection of the environment and sustainability.

Ethiopian laws promote the principle of full replacement cost for loss of livelihoods and assets. In addition, the law promotes in-kind compensation which is strongly recommended by IFC. The law also promotes some livelihood restoration strategies, including compensation and entitlements. However, additional assistance may have to be provided to vulnerable groups as part of the livelihood restoration strategies.

Comparison of Ethiopian laws and IFC policies shows some issues that can be improved. Additionally, for RG as project proponent, it will need to consider adequate stakeholder engagement, monitoring and evaluation program, Grievance Redress Mechanism and a reporting system.

## 5.8 **Environmental and Social Management System**

The central tool to address and manage the specific risks and impacts of geothermal projects is an appropriate Environmental and Social Management System (ESMS) in line with relevant legislation of the host country and compliant with the applicable standards.

It is usual practise in geothermal development for the Project proponent /owner to spell out environmental, social, health and safety requirements in RFP to drilling contractors, and request ISO compliance and certificates, work procedures and details on their Environmental, Health & Safety (EHS /HSE) system. This includes requirement for Emergency Response Plan (Emergency Preparedness and Response) or ERP.

In present Project, only drilling contractors will be considered who have implemented the ISO 9001, ISO 14001 and OHSAS 18001 international standards on quality, environment and occupational health & safety. Furthermore, they must provide detailed information on their system of Environmental, Health & Safety (EHS) system to be considered, evaluated and scored.

The Reykjavik Geothermal QHSE policies (see Part III) are requirements that will be made to the EHS /ESMS system of the drilling contractor (see Section 21).

Today, most internationally operating drilling contractors have implemented the ISO 9001, ISO 14001 and OHSAS 18001 standards with most if not all the elements of an Environmental and Social Management System (ESMS) and the interrelated parts of the Plan-Do-Check-Act cycle.

RG will conduct Gap Analysis on the EHS /ESMS system of the drilling contractor and compare with requirements defined in the: *Environmental and Social Management System – Implementation Handbook (General)*, published by the IFC. Additional elements will be added to the system if /as necessary.

## 5.9 The scope of the Baseline studies

As described, geothermal development is continuously evolving and geothermal projects are typically executed in stages. Although several not-known items have been eliminated in present version of ESIA such issues will continue and will be dealt with in due course.

To best prepare, it was decided to focus the Baseline studies on the wide Project area determined by surface geological and geochemical surveys including the first potentially successful targets in the Drilling area following geophysical surveys. The rationale:

- The Baseline studies cover the Project area, as all that wide area is a potential target zone for further drilling, infrastructure and a power plant. This was preferred instead of executing several small-scale studies for every new, emerging target direction.
- The Baseline studies are specific and valid for the whole Project area and describe communities, wildlife, and other variables that can be affected by the Project. In case of gap(s) or further verification, additional specific /rapid study may be required.
- Should the Project develop outside the present Project area, although still within the license area, additional Baselines studies will be required and ESIA, ESMPs, SEP and RAP updated accordingly.

## 6 Consultation and participation

### 6.1 Requirements for consultation and disclosure

The IFC Performance Standards trigger several disclosure and consultation issues to be considered.

This chapter briefly describes stakeholder plan and engagements undertaken. It provides first perceptions of potentially impacted communities and their views on the proposed project as expressed by the respondents interviewed.

### 6.2 Stakeholder Engagement Plan

The IFC Performance Standard 1 requires ESIA study for all Category A projects. It also requires thorough stakeholder engagement with disclosure and consultations.

- ▶ Immediately at the Scoping or Baseline stage, this may involve thorough introduction of the project to stakeholders including disclosure of information to the communities and the PAP; elders, females, vulnerable groups, and so forth.
- ▶ Once the impacts have been identified and mitigation measures for ESMP, another round of disclosure is suggested; to discuss this information with the impacted communities and affected people for feedback and incorporate and amend impacts and mitigation measures accordingly as feasible.
- ▶ Finally, during the ESIA process, further disclosure consultations are indicated for review of the final draft of the ESIA report.

This IFC standard recommends that Stakeholder Engagement Plan (SEP) be prepared, reviewed and published as early as possible. Draft of this document needs to be disclosed to stakeholders for consultation and discussion prior to publication. The SEP should include Grievance Redress Mechanism that is a process of how to handle, investigate and resolve concerns, complaints and problems.

For further information refer to the Stakeholder Engagement Plan that has been prepared for this Project and is published as an Annex to /with this ESIA report.

### 6.3 Summary of stakeholder engagement activities

#### 6.3.1 *Project preparation*

Several stakeholder engagements have taken place with national and local government officials by Reykjavik Geothermal since 2008. These have involved administrative and elected officials on various issues at different levels from Federal, Regional, Elected, Woreda to Kebele. Many meetings have been held with the off-taker, Ethiopian Electric Power Office. Furthermore, a number of high-level stakeholder engagements have taken place with potential development partners (e.g. EIB), NGOs (USAID /Power Africa, Clinton Foundation, SOS Children's Villages), and also with local administrative officials and farmers when preparing and during geoscience field work. Several Ethiopian media events have taken place since signing and defining the Project with the Government and pledging to harvest 1.000 MW of geothermal energy in Ethiopia.

A number of these meetings are documented in minutes but not all by far. Others have resulted in agreements of various sorts.

#### 6.3.2 *Household survey*

As part of RG ESIA baseline preparation, Gibb International administered a household survey in the Project /Study area in Tulu Moye in 2015. It was carried out with a team of supervisors and enumerators who were trained to administer a questionnaire to an adult member of the household (usually the household head and women) except for a child headed household, where they were to administer the questionnaire to the eldest

responsible person. A total of 41 enumerators including some females (6 in number) participated in this survey. Lists of supervisors, enumerators and respondents is presented as appendices in the Baseline report. The interviews were conducted on a one-on-one and face-to-face basis. Enumerators were encouraged to record the telephone numbers of the respondents for future verification. The supervisors were government officials who were allocated to the team by the Woreda administration. Sample of 742 households were interviewed for the household sample data.

Data was analysed and reported in the Environmental and Social Baseline Study Report for Tulu Moya Geothermal Project by Gibb International.

### 6.3.3 **Information disclosure consultations**

Initial stakeholder consultations were carried out 10 May to 6 June 2015 with the potentially affected communities. Consulted were during this period; Regional, Zonal, Woreda, Kebele administrations as well as project affected community members including women and elders.

The objectives of the above disclosure activities were to:

- Publicize the development of the Project both at local, regional and national levels
- Engage key stakeholders by introducing the pre-feasibility study, on-going feasibility exercise and ESIA process
- Identify additional potential and key stakeholders
- Identify concerns and opportunities to be addressed by the ESIA process
- Provide stakeholders with points of contact to address further concerns and liaise with over project development

These initial meetings revealed stakeholders overall interest and support of the proposed Project. Main concerns raised during these meetings were related to impacts on land loss, effect on private properties and the need to maintain consultation during the entire private cycle. Of key interest and importance among those consulted, was the potential for the proposed project to create employment for the locals and accessibility of electricity power for their homes.

Total of 39 consultations meetings were held: - 12 public meetings; 14 meetings with Kebele leadership and elders, 4 with women groups and 9 with officials at the Zones and Woreda levels. The public meetings were attended by a total of 467 potential PAPs. A total of 151 with local officials were also interviewed. See summary below

### 6.3.4 **Public disclosure consultations of ESIA impacts and mitigation measures**

This public disclosure and consultation meeting series was held first weeks in June to meet the requirements of the Government of Ethiopia and the International Finance Corporation (IFC) Performance Standards. The primary purpose of these public disclosure meeting was to disclose to stakeholders the results of the (Draft) ESIA V.01 on possible impacts and the recommended mitigation measures to minimize environmental and social impacts of the Project, in an inclusive and effective manner. The E&S team documented specific actions and measures required to be incorporated into the ESIA as a result of the input of those who participated in the consultation.

These stakeholder disclosure and consultation engagements involved:

- Federal and Ministry officials, also NGOs and interest groups in Addis
- Oromia Regional Buraus and Oromia EPA officials in Addis Ababa
- Arsi Zone administration offices /bureaus and technical representatives in Asela, including NGOs and interest groups in and around the project area



- Hitosa and Dodota administration offices in Iteya and Dodota, respectively, including kebele administrators from Tero Moye, Anole and Tero Desta
- Tero Moye, Anole and Tero Desta kebele meetings in community centers in the kebeles with the communities, including leaders, men, youth, women and elders

The conferences were visual display workshop meetings (with overhead projector on portable power) in English, Amharic and /or Oromiffa, with focus on:

- Project status - Update and overview on the RG Project by presenting background information on (i) Project concept for developing the geothermal resource, (ii) specific location of the Project, (iii) techniques of geothermal energy production, (iv) and facilities and infrastructures needed during the lifecycle of the Project
- ESIA impacts and mitigation measures - Provide information to the stakeholders on the ESIA results, potential positive and negative impacts, present proposed mitigation measures, and information on the grievance redress mechanism.
- Gather views, comments and recommendations on ESIA results.

Prior to each meeting, and in accordance with IFC guidelines, the Draft ESIA and SEP in English, and a non-technical summary, overheads and comment forms in English, Amharic and Oromiffa, were distributed (all received the material on CDs, also printouts of the non-technical summary and overheads). This was to make sure of availability of information to all stakeholders in the locations within the Project Area of Influence.

This disclosure allowed the public access to all available information and facilitated informed dialogue about the Project's potential positive and negative impacts. The methods utilized to advertise the meetings included: E-mails, messengers, and phone-calls by the E&S team and administrators. Allowance was provided for transportation expenses. Newspaper advertisement were published in the Reporter Newspaper and Capital Newspaper (see Figure below).

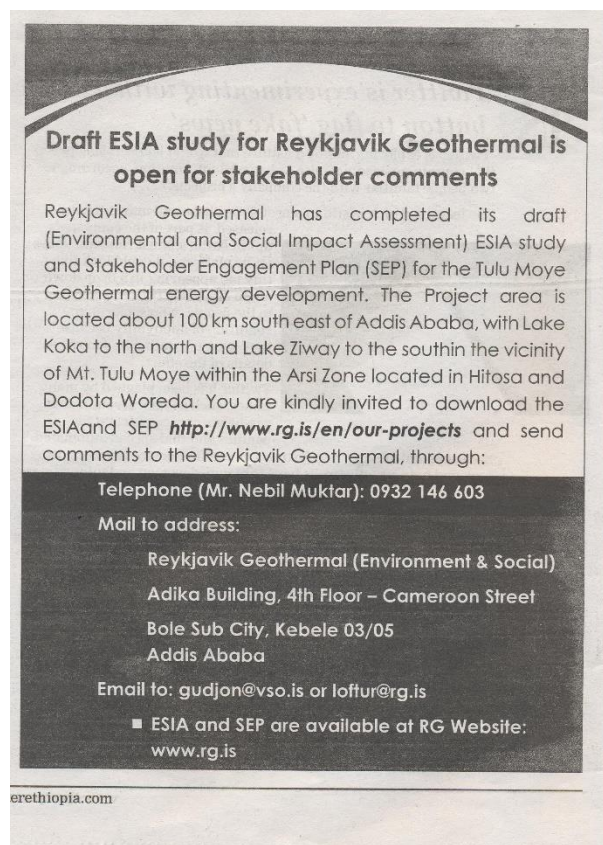


Figure 6.2 Public announcement

The number of people attending ranged from 15 +/- at the regional administrations to 250 +/- in the kebeles. There were both male and female presenters on the E&S team. The Comment forms were used to gather feedback and concerns from those who did not provide comments verbally. Concerns of potentially vulnerable populations e.g., women, youths and the elderly were obtained both verbally and on comment forms at the meetings and immediately afterwards.

A Grievance Mechanism has been developed and drafted as part of the SEP and was introduced at these disclosure and consultation engagements, and made available on CDs and USB chips. Full details of these consultations, as well as specific questions asked, can be found in the SEP. No other questions or comments on the Draft ESIA have been received from the public outside of these community meetings, either through RG home web-page, RG telephone number or mail address, e-mail addresses or through other interested parties. All outstanding comments have been addressed, and all applicable recommendations have since been incorporated into this ESIA V.02.

#### **6.4 Household survey and information disclosure consultations**

Following information was gathered by GIBB International (GIBB International, 2015) during the first Project disclosure consultations with stakeholders that also involved surveying of various demographic variables and views.

##### **6.4.1 Project awareness and willingness to support**

A trifling (38%) of the respondents are aware about the proposed project, with a relatively lower proportion in Dodota (29%). This shows that stakeholder sensitization program needs to be enhanced. This process will not encounter any challenge since most (88%) of the respondents welcome the proposed Project.

##### **6.4.2 Expectations from those supporting the proposed Project**

The following reasons were given by those supporting the project. They expect that the project shall provide/create:

- ▶ Job opportunities (99%)
- ▶ Development of business activities (95%)
- ▶ Various benefits as the result of the Project (93%)
- ▶ Access to electric light to the communities (98%)
- ▶ Improved social services (93%).

##### **6.4.3 Reasons for not supporting the proposed Project**

Those against the project raised the following as their reasons for not supporting it:

- ▶ Loss of farm land (98%)
- ▶ Loss of houses (96%)
- ▶ Loss of trees and fruit trees (83%)
- ▶ Decrease of income from livestock (84%)
- ▶ Loss of grazing land (81%)
- ▶ Decrease of income from farm activities (72%)
- ▶ Disruption of social interaction (62%)
- ▶ Loss of social service buildings/ institutions (60%)
- ▶ Unfair compensation for the lost properties (60%)
- ▶ Fear of relocation (65%).

#### **6.4.4 Major problems of the Project area**

The following are some of the problems and challenges faced by the people in the proposed Project area as outlined in the household surveys:

- ▶ Shortage of water (97%)
- ▶ Perennial drought (89%)
- ▶ Lack of infrastructure such as roads, telephone network, markets etc (86%)
- ▶ Livestock diseases (75%)
- ▶ Inadequate grazing land (72%)

Kebele officials were also asked to identify problems in their areas. The following problems were mentioned:

- ▶ Shortage of potable water
- ▶ Poor road network
- ▶ Lack of improved health facilities for both human and animals
- ▶ Lack of improved education facilities
- ▶ Lack of electric power
- ▶ Food insufficient problem
- ▶ Human and animal health problem
- ▶ Shortage of farmland and grazing
- ▶ Crop pests and wild animals attack crops
- ▶ Unemployment
- ▶ Deforestation
- ▶ Access to market
- ▶ Grinding mills

#### **6.5 Comments and concerns re. impacts and mitigation measures**

Following information was gathered by the E&S team (June 2017) during the first Project disclosure consultations with stakeholders that also involved Project status, ESIA impact and mitigation measures and the proposed Grievance Redress Mechanism.

##### **6.5.1 Comments and concerns from high-level stakeholders**

Following main comments and concerns were received from the Ministries of Mines and Environment, Climate Change and Forestry, Oromia Regional Office and Oromia EPA:

- ▶ The resettlement impact and the biodiversity impacts should be extensively addressed in the final ESIA.
- ▶ The draft ESIA should include comments from the various consultations that have been conducted. The offices would like to receive meeting minutes from the consultation process as annex to the revised ESIA
- ▶ It was inquired how the impact of the noise will be felt in the community and up to what radius.
- ▶ It was asked if the Project will be restricting farmers from using unused land for grazing purposes.
- ▶ It was recommended that the Project should boost economic activity to local suppliers by employing locally as much as possible.
- ▶ The participants asked how the project will affect the surface and ground water resources; moreover, how the project will affect ground water should be clearly examined

### 6.5.2 **Comments and concerns from federal administrations and NGOs**

Following main questions, comments and concerns were received from federal administrations and NGO's during the disclosure consultations by the E&S team (2017):

- ▶ One of the first questions was on how the Project will benefit the communities.
- ▶ Participants asked how the Project will use water, what water resources could be impacted and if this will affect the water in the communities.
- ▶ Stakeholders asked for an assessment on the impact of the Project on vegetation and biodiversity and how RG is going to mitigate this impact.
- ▶ The community demands local employment opportunities; how will RG make sure that job opportunity will be provided to the community.
- ▶ It was recommended that the opportunity to develop the area into a tourist attraction site should be explored.
- ▶ It was recommended that RG should look out to install small power stations to provide electricity to the community.

### 6.5.3 **Comments and concerns from regional administrations**

Following main questions, comments and concerns were received from regional administrations during the disclosure consultations by the E&S team (2017):

- ▶ The Project should clearly identify the impact of resettlement on the people, how many people will be resettled and how they will be compensated.
- ▶ The participants stressed that the Project should clearly identify the impact of resettlement on the people. As the Ethiopian compensation value is too low the Project should use better compensation value during resettlement.
- ▶ The stakeholders asked if the local employment opportunity that will be created required skilled people or unskilled people. Moreover, job opportunities should be given to the local people as much as possible.
- ▶ The stakeholders asked if the 300 local employment opportunities are for the local youth from the Woreda. The further stressed that job opportunities should be given to the local people as much as possible.
- ▶ The participants asked for more explanation regarding the environmental pollution related to geothermal energy production.
- ▶ The participants asked how the project will implement community development initiatives and how it will benefit the community.
- ▶ The participants asked what will happen, if during drilling, the Project discovers valuable minerals, what procedures will RG follow.
- ▶ The stakeholders inquired if the steam related to geothermal energy production will have an impact on indigenous trees. Furthermore, as the proposed area is covered with trees the Project should reduce the loss of trees and mitigate its impact on trees.
- ▶ The participants asked about the total area of land the Project will need and how much energy resource are found in Tulu Moye
- ▶ Water is a major challenge in the area; can the water from the cooling unit be supplied to the community for farming.
- ▶ How will the Project mitigate the impact of noise on wildlife. The participants also stressed that proper mitigation should be designed for the loss of vegetation
- ▶ The participants stressed that the Project should implement community development initiatives and benefit the community.

#### 6.5.4 **Comments and concerns from kebele communities**

Following main questions, comments and concerns were received from regional administrations during the disclosure consultations by the E&S team (2017):

- ▶ The community asked how the Project will compensate for the loss of farm and grazing land due to expansion of access road.
- ▶ The community indicated that water, health care, access road, and electricity are very crucial missing items for them.
- ▶ The community indicated that it is very keen to support the project in anyway. Some of the youth have attended school; however, due to lack of employment opportunity in the area they have not been able to get employment. The community stressed that employment opportunity for the eligible youth should be a focus.
- ▶ The community indicated that there is a growing belief that RG when conducting different assessments (geophysics and geochemistry) in their farmland was extracting precious minerals and taking them away. They asked for a clear explanation if this growing belief was true.
- ▶ The community asked how far the noise will be felt and what will happen to the people residing closely to the noise source.
- ▶ The community stressed that the electric power that will be produced should be able to give power supply to the community.
- ▶ Community members asked that RG should continue to engage with the community and train representatives for continuous transparency and engagement.
- ▶ The community asked how if the Project will affect public school land, private owned land and how compensation will be paid to the affected people.
- ▶ The community inquired what the benefits of the project to the community are; will the electric power that is produced be shared with the community or will it be transmitted to somewhere else.
- ▶ Will the noise impact affect the community domestic animals? Will it make them flee the area? Will big drilling machine damage houses on the sides of the access road?
- ▶ The improvement of the access road is highly appreciated by the community; due to bad road conditions transporting pregnant and sick people to the nearest clinics has been a difficult task especially in rainy seasons. The community hopes due to the road improvement their livelihood will be improved.
- ▶ Lack of water is a major problem to the community; the community asked for support by addressing the water challenge and by upgrading healthcare facilities in the area.

#### 6.6 **Labour consultation**

Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. It applies to workers directly engaged by the Company (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged through primary suppliers (supply chain workers).

The RG Stakeholder Engagement Plan includes all workers of the Project and will be introduced. Staff can file complaints and concerns through the same grievance redress mechanism as other stakeholders. Strict rules govern health and safety of all workers on the Project, working conditions and social accountability is required by contractors. These requirements are described in the EHS Management Plan with this ESIA Report.

**6.7 Conclusion**

The data shows that some information on the Project to the residents is lacking but most of the respondents favour the Project when asked. By disclosing the ESIA and ESMP to the public as required by the PS1 an opportunity arises to introduce the project further to the community.