

E4392 V1

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

OF

GEOHERMAL SECTOR DEVELOPMENT PROJECT

FOR

ALUTO EXPANSION GEOHERMAL PROJECT SITE

By

ETHIOPIA ELECTRIC POWER CORPORATION (EEPCo)

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ACRONYMS

ADLI	Agricultural Development Led Industrialization
ADB	Asian Development Bank
AfDB	African Development Bank
ARCCH	Authority for Research and Conservation of Cultural Heritage
Birr	Ethiopian Local Currency
CSE	Conservation Strategy of Ethiopia
EEPCo	Ethiopian Electric Power Corporation
ESMP	Environmental and Social Management Plan
FEPA	Federal Environmental Protection Authority
EPE	Environmental Policy of Ethiopia
ESIA	Environmental and Social Impact Assessment
FDRE	Federal Democratic Republic of Ethiopia
FHH	Female Headed Household
GSE	Geological Survey of Ethiopia
GRC	Grievance Redress Committee
Ha	Hectare
HIV/AIDS	Human Immunodeficiency Virus /Acquired Immune Deficiency Syndrome
IC	Implementation Committee
Km	Kilometer
kV	Kilovolt
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forest
MW	Mega-watt
MoWIE	Ministry of Water, Irrigation and Energy

1 EXECUTIVE SUMMARY

Introduction

This executive summary gives a synopsis of the project and the project area, project justification, lists the relevant policies, legal and administrative framework, describes the project environment, provides potential impacts and mitigation /enhancement measures, stipulates public consultations and disclosure processes and outlines the monitoring with its cost estimates.

Project Description, Area and Justification

Project Description

The Aluto Geothermal Power Plant Expansion Project Phase III has the following components: Drilling of 20 deep geothermal wells, heat gathering system, 70 MW power plant and switchyard construction, 132 kV 13 km transmission line, substation construction at Adami Tulu and access road construction.

Project Area

The proposed drilling of twenty deep geothermal project site is located in Central Southern part of the main Ethiopian Rift Valley about 200 km south east of Addis Ababa in the lowland plain.

Project Justification

The Aluto Langanu geothermal field is part of “FY 2009 Studies for Economic Partnership Projects in Developing Countries” promoted by the “Ministry of Economy, Trade and Industry of Japan (METI)” and that was entrusted to West Japan Engineering Consultants Inc. (West JEC) through Ernst and Young ShinNihon LLC and the Japan External Trade Organization (JETRO) March 2010.

Policy, Legal and Administrative Framework

There is sufficient legal and administrative ground in Ethiopia for environmental and social management in the process of implementation of development projects. The ESIA study considers both the Ethiopian and the World Bank environmental and social policy documents and guidelines.

Description of the Project Environment

Physical Environment

The drilling of the twenty deep geothermal wells will be carried out near the existing Aluto Langanu Geothermal pilot power plant, within the central-southern part of the main Ethiopian Rift Valley about 200 km south of Addis Ababa in the low plain of Ethiopia, between Lakes Ziway and Langanu in Oromiya Regional State, Adami Tulu – Jido-Kombolcha Woreda. The total area of Adami Tulu – Jido – Kombolcha Woreda is 141,990 km².

Topography

The landscape in the Woreda is mostly plain land except some dotted hilly morphologies around the peripheries, composed of mainly volcanic rocks. The project site's elevation is 1,956 m.a.s.l. and has an elevation of about 1,266 m.a.s.l.

Climate

The annual mean temperature of the region varies from less than 10⁰c to 27.5⁰c. and the region's mean annual seasonal rainfall is about 690 mm.

Soil

The soil in the surrounding area is formed from the weathering of the acid very young pyroclastic rocks and is mainly grey soil with low fertility.

Geology

The site's geology is mainly volcanic rocks and some lacustrine and alluvial sediment. The volcanic rhyolite lava flows, basalt lava flows, ignimbrites and pumiceous pyroclastics form the volcanic massif of the Aluto Volcano and the sediments are distributed on the flat plains and depressions.

Water Resource

In the proposed Aluto geothermal deep well drilling site, there is no river, stream, well or lake. Lake Ziway, Lake Langano, Ropi (upper side of Bulbula) river are located very far away (14 – 18 km) from the site.

Effluent Discharges

The effluent discharged during excavation shall be directed to flow into retention and sedimentation ponds which will be prepared for this purpose.

Biological Environment

Flora

During the recent ESIA study, the vegetation found at the site included *Acacia* spp., *Fig /Warka/*, *Olive /Weira/*, *Croton /Bisana/*, etc.

Fauna

Cattle (ox, cow), sheep, goat, donkey, mule, and horse and apiaries are observed in the area. Among wild animals prevalent in the Woreda are, spotted hyaena, greater kudu, anubis baboon, jackal, etc.

Protected Areas in the Woreda

There is no conserved or protected area in the project area, except the Abidjatta-Shalla Park located some 40 km to the southwest.

Socio Economic Environment

Population

The total population of Adami Tulu – Jido – Kombolcha Woreda is 186,202. The population density of the Woreda 1 persons per km² and the average population growth rate is 2.9%. The average household size is 5 - 8 persons.

The population in the three project adjoining kebeles is 12,755.

Ethnic Composition

The Oromo ethnic group are in the project area and do not meet the criteria as defined in OP4.10. Outside the project area, but in the Woreda, the dominant group is Oromo, with some very small numbers of Amhara and Gurage.

Settlement Pattern, Housing and Household Economy

The settlement pattern is totally permanent type, supporting their livelihood from the traditional agricultural production and rearing of cattle. The common annual crops grown in the project area are maize, wheat, barley, teff, millet, soya bean, and lentils.

Land Use

The project area is mainly used as farmland and grazing land, with houses dotted around the farmlands.

Social Services

Education

In the Woreda, there are 87 schools and the total number of students is 38,884. At present, the educational coverage of the Woreda has reached 86 %.

Health

There are 62 health institutions in the Woreda and the total number of health workers is 173. There are also six health extension workers assigned to serve in the three kebeles (2 extension health workers in each Kebele). The health coverage in Adami Tulu – Jido - Kombolcha Woreda is 94%.

Potential Impacts

Socio Economic Impacts

Residential Houses and Land

The Aluto geothermal area and its environs support multiple land use systems consisting of grass roofed Tukuls for dwelling and other purposes,

The exact sites for the drilling of geothermal wells and the line route for the transmission line are not known at this stage. For this reason it is not possible to identify houses to be affected by the third phase of the Aluto Geothermal project.

Land Use

The proposed drilling of twenty deep geothermal wells will have an impact on the existing land use both temporarily and permanently. Some agricultural land will be affected during the drilling and while preparing the foundation pad and evaporation or sedimentation ponds.

Impacts on Farmland

Land being the major asset for farmers, some plot of farmland will be affected by the project. However, all their farm land will not be affected.

Impact on Crop Production

During the construction phase, the farmers' seasonal agricultural activities may be disrupted and on farm crop may also be affected temporarily if construction starts before harvesting crops.

Impacts on Trees

Some indigenous tree types and bushes because of the foundation pad, power plant construction, access road and along the transmission line route will be affected.

Health

The health posts are located far away from the proposed project site and will not be impacted by the project.

Education

The exact location of the deep geothermal wells to be drilled is not known and it is not possible to know the impact on schools at this stage. During the surveying of the transmission line, efforts will be made to avoid impacts on infrastructures like schools.

Noise

The potential noise sources are noise arising from geothermal fluid escaping from the drilling of wells, working noise, well testing and vibration. Machinery used to clear site and vehicles used on site would emanate noise which is temporary and limited.

Cultural and Historical Heritage

According to the study of the geothermal of December 2009 and ESIA study of 2010, the project area has no known site of culturally, historically or archaeologically important heritage or landmark, or geological or topographical important feature.

Dust /Air Quality

From the very nature of the project, there will be emissions released to the atmosphere. The contents of the emission as told by the site engineer 99% steam and the remaining 1 % constitute of CO₂, H₂S, ammonia and other non-condensable gases.

Public Health and Safety

The major impact on health and occupational safety is related to the work force engaged in construction bringing into site some alien diseases and be affected by diseases prevalent in the site.

Sexually Transmitted Infections /STIs/

Sexually transmitted infections (STIs) will spread by the influx of migrant labor to the construction areas and the interaction with local community has the opportunity to spread in the area.

Workers' Health/ Safety

The work force carries out their job with potential hazards (fall of metal on head or foot during drilling and power plant construction and transmission line construction).

The safety regulation /safety manual regarding workers' health and safety must be included in the tender document and workers receive specific and routine safety trainings /orientation and shall be issued job specific safety equipment (overalls, raincoat, gloves, helmets, safety shoes, masks and ear muffers, etc.).

Substance Abuse

Construction labor force comprising primarily of young men living away from their families, with rather stable wages and ideal time, with few recreational pursuits and no domestic responsibilities, can often lead to the overindulgence with alcohol. This can lead to abuse, fighting and injury, particularly if women are involved.

Health Effect of Electromagnetic Fields (EMF)

Electromagnetic fields (EMF) are invisible force that surrounds any electrical device. Power transmission lines, electrical wiring and electrical equipment all produce EMF.

Impacts on Biological Environment

Flora

The drilling of the proposed geothermal project will have an impact on biological environment. The main impact will be the clearance of vegetation for foundation pads and ponds, power plant, access road and transmission line.

Fauna

Most of the vegetation are already heavily degraded and deforested due to expansion of cultivation land which causes habitat loss. As a result, the wild life resources are moved to mountain or hills around the project site.

Impacts on Birds

There is one known migratory bird route i.e., through the Great Ethiopian Rift Valley, where the proposed drilling of geothermal wells is to be constructed. The project will not impact migratory birds.

Impact on Protected and Reserve Areas

There is one National Park about 40 km southwest of the project site, namely Abidjiatta-Shalla which will not be impacted.

Impacts on Wetlands

There is no wetland in the project site except the shores of the two lakes (Ziway and Langano) some 14 km and 18 km far away, respectively.

Impact on Physical Environment

Soil

During foundation pads and ponds excavation, power plant construction, access road construction and transmission line construction soil will be exposed to erosion.

Air Quality

Dust emissions, gas particles (CO₂, H₂S, ammonia and other non-condensable gases) will have short term adverse effect on air quality which escapes from the project activity and vibration, air pollutants released from mobile construction equipment could also have a potential impact affecting the immediate project area.

Water Quality

There are no rivers /streams, springs or water wells in the proposed project area, to be affected due to contamination or discharge of sludge.

Positive Impacts

- Some of the positive impacts of the project are, reducing power problems/outages, connecting more households and institutions to the national grid, enable poverty reduction, improve living standards, job opportunity creation, etc.
- Improvement in rendering social services, like health institutions, education, etc.
- Replace/reduce the consumption of woody biomass and petroleum products that is used currently for cooking, lighting, etc.
- Reduction in carbon dioxide emissions by using renewable geothermal energy compared with other fossil firing power generation.
- Replacement of imported fuel by the indigenous resource, geothermal energy, which will also save foreign currency.
- It has the potential for carbon trade among other positive benefits.

Environmental Hazard Management

The only risks or accidents that are expected to happen during the construction are like hit by objects, car accidents, etc.

Mitigation Measures

Mitigation is undertaken in order to reduce /minimize the impacts of the project.

- Drilling wells at Aluto geothermal project will use circulating surface water from the existing ponds and water pumped from Lake Ziway.
- Preparation of appropriate disposal ponds for excavated sludge, construction waste and debris.
- Use of environmental clauses for dirt and dust clouds arising from vehicles transporting equipment and materials.
- Use of environmental clauses for noise emitted from the drilling of wells.
- At completion of construction work, areas not needed anymore and sensitive areas should be replanted / reforested.
- Hazardous materials should be handled properly and placed far away from water bodies, humans and animals.
- The impacts on housing and farmlands will be mitigated significantly by the implementation of resettlement policy framework (RPF).
- Measures against the spread of HIV/AIDS and STI would be through implementation of efficient strategy concentrating on awareness and information campaigns on the work force (without neglecting the host communities).

Monitoring Program

Environmental and social monitoring is an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measures. It helps to anticipate possible environmental hazards and/or detect unpredicted/unforeseen impacts over time.

Public Consultation and Public Disclosure

Public consultation with the affected community members, elders and chairperson of the *Kebele administration* and Adami Tulu–Jido-Kombolcha Woreda has been undertaken. The team has also conducted various meetings on similar issues with different local government administrations, representatives of sector offices of Agricultural and Rural Development, Health, Education, Culture and Tourism, Water Resource and HIV/AIDS secretariats.

Cost Summary

The total project cost for environmental and social mitigation, monitoring and compensation payment is estimated to be **1,445,125.00** Birr in local currency (**77,155.63** USD), and the cost summary is depicted below:

The cost estimate considers the different project activities that require land. For the budget preparation purpose it is assumed that the land is fully farm land and average production per quintal is taken.

According to the expropriation of landholdings for public purposes and payment of compensation, Proclamation No. 455/2007, Article 9 and 10, valuation of property will be carried out by property valuation committee that will be established by the Woreda Administration.

No	Items	Method	Production Quintal/ha	Average unit price (Birr)	Estimated Total Cost (Birr)	Cost (USD)
1	Compensation for crop loss for 6 drilling wells	60m X 100m X 6 wells =3.6 ha	10	900.00	32,400.00	1,729.85
2	Compensation for crop loss for 6 ponds	50m X 40m X 6 wells =1.2 ha	10	900.00	10,800.00	576.62
3	Compensation for crop loss for power plant construction	150mX150m=2.25 ha	10	900.00	20,250.00	1,081.15
4	Compensation for crop loss for 13 km transmission line X 30m width	13,000 m X 30 m =39 ha	10	900.00	351,000.00	18,739.99
5	Compensation for crop loss for access roads	190mX6mX6 access roads =0.7 ha	10	900	6,300.00	336.36
6	Compensation for houses (tukuls)	60 m ²	400.00	24,00.00	360,000.00	19,220.50
Sub total					780,750.00	41,684.47
1	Tree plantation	2 ha	--	86,000.00	152,000.00	8,115.32
2	Water pipe and distribution centre + cattle trough	3 wells for each kebele	--	90,000.00	270,000.00	14,415.38
Sub total					422,000.00	22,530.70
Monitoring and valuation						
1	Monitoring and evaluation	Lump sum	Lump sum		96,000.00	5,125.47

2	Valuation committee per diem	Lump sum	Lump sum		15,000.00	800.85
	Sub Total				111,000.00	5,926.32
	Total				1,313,750.00	70,141.48
	Contingency 10%				131,375.00	7,014.15
	Grand Total				1,445,125.00	77,155.63

Exchange Rate: 1 USD= 18.73 ETH. Birr (Commercial Bank of Ethiopia June 29, 2013)

I. INTRODUCTION

I.1. Background

The Ethiopian Electric Power Corporation (EEPCo) is a national electricity utility established as a public enterprise by Council of Ministers regulation No. 18/1997. According to this regulation, EEPCo is mandated to engage in the business of power generation, transmission, distribution and selling of electric energy and to carry out any other activities that would enable it to achieve its stated mission.

Ethiopia has abundant rivers that provide the country with potential for large sustainable energy resources in the form of hydropower. Recent power planning studies have estimated that Ethiopia's hydroelectric potential is in the order of 45,000 MW, a potential greatly in excess of foreseeable domestic demand. Currently only about 4.58 % of the available total quantity is being harnessed for generating hydroelectric power. Preliminary investigations have indicated that the most promising sites and resources could be developed at lower costs than other power generation options.

Generation source of EEPCo is dominantly hydropower. About 99.3 % of the energy comes from the hydropower plants and the other power projects under construction are predominantly hydro based. Recently two wind power plants, Ashegoda and Adama I wind farms, with 81 MW capacities began to supply electric power to the national grid. It is obvious that Ethiopia's energy generation capacity is likely to be affected by climatic change /drought and variability. To overcome this problem the energy diversification/mix is very important.

Ethiopia has low per-capita level of electricity consumption and a small proportion of its population has access to electricity service, i.e., 48.3 % (*facts in brief, 2011/12*). The overwhelming majority of the population relies on traditional sources of energy (i.e., firewood and dung) which in turn is contributing to deforestation and soil degradation.

Currently, the Ethiopian Government has embarked upon various plans and programs to explore and develop different energy resources (i.e., from, wind, geothermal, solar and hydropower) to achieve the major goals of accelerating economic growth and reducing poverty.

Geothermal is one of the energy resources of the country. Along the Ethiopian Rift Valley, about 14 sites (i.e., *Dalol, Tendaho, Abbe, Teo, Danab, Meteka, Dofan, Fantale, Kone, Gedemsa, Tulu Moye, Aluto Langano, Corbetti and Abaya*) were investigated for their geothermal energy potential which extends some 400 km NNE from latitude of 6⁰ N to latitude of 9⁰ N. From amongst these sites, EEPCo owns and operates the Aluto Langano geothermal plant.

A feasibility study on geothermal power development at the Aluto Langano geothermal field has been conducted in March 2010 by consulting firms Ernst and Young ShinNihon LLC, Japan External Trade Organization (JETRO) and West Japan Engineering Consultants.

In order to meet the increasing demand for electricity in Ethiopia, EEPCo has established a project named Aluto Geothermal Power Plant Expansion Project Phase III to generate 70 MW electric Power from geothermal resource at Aluto.

The Aluto Geothermal Power Plant Expansion Project Phase III has the following components:

- ✚ Drilling of 20 Deep geothermal wells,
- ✚ Heat gathering system (from geothermal wells to the power house),
- ✚ 70 MW power plant construction including switchyard,
- ✚ 132 KV 13 km transmission line from the proposed Aluto power plant to Adami Tulu substation,
- ✚ Substation construction at Adami Tulu, and
- ✚ Access road construction.

The Ethiopian Electric Power Corporation (EEPCo) has prepared Environmental and Social Impact Assessment (ESIA) for Aluto Geothermal Power Plant Expansion Project Phase III to be financed by the World Bank.

The ESIA report has been prepared in accordance with the Federal Environment Protection Authority (FEPA) laws and regulations and the World Bank safeguard policies.

I.2. Project Location

The Aluto Geothermal Power Plant Expansion Project Phase III will be carried out around the existing Aluto Langanu Geothermal Power plant area, which is administratively located within the central – southern part of the main Ethiopian Rift Valley about 200 km south east of Addis Ababa in-between lakes Ziway and Langanu, in Oromia Regional State, Adami Tulu–ido-Kombolcha Woreda.

Aluto Geothermal field is located at geographic coordinates of latitude 7⁰ 793’ North and longitude 38⁰ 798’ East.



I.3. Purpose of the ESIA

The main purpose of ESIA can be stated as:

- ✚ To identify and forecast the possible positive and negative impacts to the environment resulting from the proposed project.
- ✚ To identify the impact of the project on the surrounding community and to suggest mitigation measures.
- ✚ To provide mitigation measures which up on implementation will reduce or offset the negative impacts of a project resulting in a minimal level of environmental degradation.
- ✚ To measure the level of plan implementation and the degree of effectiveness of the environmental protection provisions.
- ✚ To develop an environmental and social management plan with recommended mitigation measures and strategies.

I.4. Methodology

The methodology used to conduct the study is chosen in accordance with the nature of the information needed.

The study methodology comprises of the following activities:

- ✚ Data collection and document review: collect, collate and present baseline information on the physical and biological environmental characteristics of the existing situation around the project,
- ✚ Site inspection and discussion with site personnel: discussion on potential impacts during drilling, commissioning and operation phase of the proposed project.
- ✚ Social impact assessment: present population, land use, health, including HIV/AIDS, social infrastructures, employment opportunities, cultural and religious sites, vulnerable and indigenous groups and their economic activities.
- ✚ Public consultation meeting: meetings were held with persons that may be directly affected /PAPS/, indirectly affected, focus group discussions and local administration officials.
- ✚ Meetings with relevant stakeholders: current data on health, education, agricultural and rural development, cultural, geological survey of Ethiopia, Ethiopian metrological offices will be collected.
- ✚ Data analysis, and
- ✚ Report writing.

Field Work

Intensive field work has been conducted in the proposed Aluto geothermalsiteinJune2013.

Primary data were obtained through public meetings and bio-physical and socio- economic field survey.

Public Consultation

Public consultation was conducted with communities living around the project area. Focus group discussion (FGD) was also held with the youth and women around the project area who will be directly or indirectly affected.

During the public consultation meeting, Woreda Land Administration and Environmental Protection head, kebele administration leaders, elders, religious chiefs and interested individuals have participated.

During the discussion, various positive and negative environmental, social and economic issues most likely occur due to the proposed project have been raised and mitigation plan have been discussed.

Contact Offices

The Woreda and Kebele Administration Offices, Agricultural, Health, Education, Water Resource and Tourism and Culture Offices, Ethiopia Geological Survey, the Aluto Geothermal Power Plant Expansion Project Phase III Office, were contacted, positive and negative impacts of the project and mitigation measures was thoroughly discussed and basic data collected from the sector offices.

Material Used

- ✚ Feasibility Study Report for Aluto Langanu Geothermal project, March 2010.
- ✚ Environmental and Social Management Framework (ESMF), Additional Financing for Energy Access Project, March 2010.
- ✚ Digital camera.
- ✚ Formatted questionnaires were prepared and used.
- ✚ Different literatures, including WB guidelines were referred.

Field Assessment Team

A team consisting members of the Power System Planning /PSP/ of EEPCo took the responsibility to prepare the ESIA and RPF document of the project.

Accordingly, the following team member has participated in the assessment:

Mr. Girma Demissie	Sociologist (EEPCo)
Mr. Kidane Gizaw	Environmentalist (EEPCo)
Mr. Tadese Mamo	Geologist/Geological Survey

II. POLICY, LEGAL, INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORKS

II.1. National Policies and Strategies

The Constitution of FDRE

As the supreme law of Ethiopia, all national policies, laws and regulations as well as the institutional frameworks of the country must comply with the constitutional provisions. The constitution of the Federal Democratic Republic of Ethiopia, Proclamation No. 1/1995, contains a number of articles, which are relevant to environmental matters in connection with development projects, as well as to the environment in general.

Article 43 gives the right to people to improved living standards and to sustainable development.

Article 44 provides that all persons have the right to live in a clean and healthy environment. And states in its sub article 1 that: *“All persons have the right to live in a clean and healthy environment”*.

Furthermore, concerning compensation to project affected people (PAPs), sub article 2 provides that: *“All persons who have been adversely affected or whose rights 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”*.

Article 40.3 of the constitution provides for the public ownership of both rural and urban land as well as all natural resources. It further states that land is the common property of Ethiopian people and cannot be subject to sale or to other means of exchange.

Article 40.7 of the constitution states that *“every Ethiopian shall have full right to the immovable property he builds and to the permanent improvements he brings about on the land by his labour or capital”*. It further states, among other things, that the owner of such rights is entitled to compensation and that the particulars shall be determined by law.

Article 40.8 in turn strengthens this by providing for expropriation of private property by the Government for public purposes subject to the payment in advance of compensation commensurate to the value of the expropriated property.

The right of the public and the community to full consultations and participation as well as to the expression of their views in the planning and implementation of Environmental Policies and development projects that affect them is enshrined in the constitution (Article 92.3 and 43.2).

The right of women to full consultations in the formulation of national development policies and in designing and execution of projects especially when such projects are likely to affect their interests.

In general, the Constitution is the primary regulation on which the other proclamations and regulations have been based.

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 frame works for implementation.

Based on CSE, the Oromia Regional State have already developed Conservation Strategy document for its respective regions. The document gives details about environmental issues prevalent in the territory and outlining how the environmental issues to be addressed.

Environmental Policy of Ethiopia (EPE)

The Environmental Policy (EPE) of the Federal Democratic Republic of Ethiopia was approved by the Council of Ministers in April 1997 (EPA/MEDAC 1997). It is based on the CSE, which was developed through a consultation process over the period 1989-1995.

The policy has the broad aim of rectifying previous policy failures and deficiencies, which in the past have led to serious environmental degradation. It is fully integrated and compatible with the overall long term economic development strategy of the country, known as Agricultural Development Led Industrialization (ADLI), and other key national policies like the National Population Policy and the National Policy on Women.


EPE's overall policy goals may be summarized in terms of the improvement and enhancement of the health and quality of life of all Ethiopians and the promotion of sustainable social and economic development through the adoption of sound environmental management principles.

Specific policy objectives and key guiding principles are set out clearly in the EPE, and expand on various aspects of the overall goal. The policy contains sectoral and cross-sectoral policies and also has provisions required for the appropriate implementation of the policy itself.

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; and
- ✦ Conserve, protect and enhance water resources and the overall aquatic environment on sustainable basis.

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

Wildlife Policy

The wildlife policy covers a wide range of policies and strategies relating, amongst others, to wildlife conservation and protected areas. It is developed by the former Ministry of Agriculture /MoA/, whose prime objective is the preservation, development and sustainable utilization of Ethiopia’s wildlife resources for social and economic development and for the integrity of the biosphere.

Forest Policy and Strategies

There is no forest policy statement in place at the federal level. However, draft forest development and conservation policy is currently under discussion in the MoA and also at regional levels. They are expected to express the determination and commitment of the government to conserve and develop and rehabilitate the forest resources of the country and region.

National Population Policy

This policy was issued in April 1993 and aims at closing the gap between high population growth and low economic productivity, through a planned reduction in population growth, combined with an increase in economic returns. With specific references to natural resources, the population policy had the following specific objectives:

- ✦ Making population and economic growth compatible and the over exploitation of natural resources unnecessary.
- ✦ Ensuring spatially balanced population distribution patterns, with a view to maintaining environmental security and extending the scope of development activities.
- ✦ Improving productivity of agriculture and introducing off-farm non-agricultural activities for the purpose of employment diversification.
- ✦ Maintaining and improving the carrying capacity of the environment by taking appropriate environmental protection and conservation measures.

National Policy on Women

This policy was issued in March 1993 and stresses that all economic and social programs and activities should ensure equal access of men and women to the country’s resources and

in the decision making process so that they can benefit equally from all activities carried out by the central and regional institutions.

Research and Conservation of Ethiopian Cultural Heritage

Article 51/3 of the constitution of the FDRE declares that Federal government “*shall establish and implement national standards and basic policy criteria for public health, education, science and technology as well as for the protection and preservation of cultural and historical heritage*”. Based on this, the Council of Ministers of FDRE endorsed the Cultural Policy of Ethiopia in October 1997 and issued the Research and Conservation of Cultural Heritage (RCCH) Proclamation No. 209/2000 that also established the Authority for Research and Conservation of Cultural Heritage (ARCCH).

Protection and conservation of cultural heritage from manmade and natural hazards is one of the goals of the ARCCH. There is also an article that states that the removal of any cultural ruins is to be carried out under strict supervision of the responsible authority, ARCCH.

National Energy Development Policy, May 1994

Objectives of Energy Policy

- ✚ Enabling access of the largest portion of the population to modern energy at an affordable price,
- ✚ Protecting and preserving existing fuel wood resources, realization of the national energy resources potential,
- ✚ Establishment of efficient strategies for the energy sector and its different sub-sectors

The national energy policy of the country emphasizes the need to develop environmentally friendly hydropower to meet the countries energy needs and to encourage the private sector to invest in hydropower. The following are the main priorities of current energy policy in Ethiopia:

- ✚ The need for equitable development of the energy sector in parallel with other social and economic developments.
- ✚ Attainment of self-sufficiency through the development of indigenous resources with minimum environmental impact and equitably distribution of electric in all regions

In order to achieve the aforementioned objectives in an environmentally and socially sustainable manner, the following strategies have been defined by EEPCo:

- ✚ Fast development of the countries hydro power resources,
- ✚ Increasing the current low level electricity access within short period of time,
- ✚ Expanding EEPCo ‘s market to neighboring countries and beyond , through active participation in regional and bilateral power trade initiatives,
- ✚ Intensifying electric usage within already electrified towns, and
- ✚ Improving EEPCo’s service delivery capabilities through implementing reforms.

Hydro power development should reconcile the three fundamental framing principles:

- ✚ the promotion of human right;
- ✚ The protection of the environment; and
- ✚ The right to economic development.

National Environmental Impact Assessment /EIA/ Procedural Guidelines

The Environmental Protection Authority / EPA/, 2003, EIA Guidelines are based on the Constitution, the Environmental Policy of Ethiopia, the Proclamations on EIA, Pollution Control and Establishment of EPA and other Environmental Organs in the country. The document gives detailed required procedures for conducting an EIA in the country and the requirements for environmental management.

The EPA EA Procedural Guideline mainly aims particularly at:

- ✚ ensuring the implementation of the EPE and compliance of EA related legal and technical requirements,
- ✚ providing a consistent and good practice approach to EA administration in Ethiopia,
- ✚ assisting proponents and consultants in carrying out their environmental assessment related tasks,
- ✚ assisting Interested and Affected Parties, especially communities in realizing their environmental rights and roles,
- ✚ assisting Environmental Protection Organs, Competent and Licensing agencies in discharging their roles and responsibilities, and
- ✚ Establishing partnership and networking among and between key stakeholders in EA administration.

Sectoral Environmental Policies

Among the sectoral policies, the wildlife policy is the one developed by the Ministry of Agriculture aiming to preserve, develop and sustainably utilize the countries wildlife resources. Water resource policy is to enhance and promote all national efforts towards the efficient and optimum utilization of the available water resources for socio-economic development on sustainable bases. The policy is to establish and institutionalize environmental conservation and protection requirements as internal parts of water resources planning and project development.

II.2. Environmental Framework Legislation

Proclamation on Institutional Arrangement for Environmental Protection

The proclamation for the establishment of Environmental Protection Organs, No. 295/2002, was issued to establish a system that fosters coordinated but differentiated responsibilities among Environmental Protection Agencies at Federal and Regional levels. The proclamation recognizes assigning responsibilities to separate organizations for environmental development and management activities on the one hand and environmental

protection, regulations and monitoring on the other, is instrumental for the sustainable use of environmental resources, thereby avoiding possible conflicts of interests and duplication of efforts.

Proclamation on Environmental Impact Assessment

The primary aim of the proclamation on Environmental Impact Assessment (No.299/2002) is to make ESIA mandatory for specified categories of activities undertaken either by the public or private sectors and possibly, the extension of ESIA to policies, plans and programs.

Proclamation on Environmental Pollution Control

The proclamation on Environmental Pollution Control No.300/2002 is mainly based on the right of each citizen to live in a healthy environment, as well as the obligation to protect the environment of the country. The primary objective of the proclamation is to provide the basis from which the relevant ambient environmental standards applicable to Ethiopia can be developed and to make the valuation of these standards a punishable act. The proclamation states that the “polluter pays” principle will be applied to all persons. Under this proclamation, EPA is given the authority to ensure implementation and enforcement of environmental standards and related requirement to inspectors assigned by EPA or Regional Environmental Agencies.

II.3. Legal Framework for Expropriation and Compensation

Land Tenure.

Land in Ethiopia is state owned by proclamation No.31/1975, issued to deal with government ownership of rural land and proclamation No. 47/1975, issued to cover Government ownership of urban land. Under article 3 (1) of the first proclamation, all rural land shall be the collective property of the Ethiopian People.

In December 1994 the new constitution retained land under the control of the people and government of Ethiopia. Article 40 states that ownership of both urban and rural land is vested in the state and the people and is common property, which is not subject to sale or other means of exchange. Peasants have the right to obtain land without payment and are protected against eviction from land in their possession.

Forest Resources Conservation Proclamation (1994)

The proclamation has incorporated provisions that aim at ensuring the conservation of forests and determines how forest shall be developed and utilized. It also recognize that the sustainable utilization of the country’s forest resources should be achieved through the participation of the people and benefit sharing by the concerned communities, as well as by formulating policies and programs in conformity with other economic sectors particularly agricultural development

Expropriation

The power to expropriate landholdings belongs to a *woreda* (rural local government) or urban administration for a development project (*Proclamation No. 455/2005 Article 3*). The

implementing agency is required to provide written notification, with details of timing and compensation, which cannot be less than 90 days from notification (Proclamation No. 455/2004 Article 4). Any entitled landholder who has been served with an expropriation order shall hand over the land to the local *woreda* or urban administration within 90 days from the date of payment of compensation should the leaseholder accept payment. Furthermore, where there is no crop or other properties on the expropriated land, the title holder shall hand over the land within 30 days of receipt of expropriation order. *Article 4* gives power to use police force if a landholder is unwilling to hand over land.

The implementing agency is responsible for gathering data on the land needed and works, and sending this to the appropriate officials for permission. It is also required to compensate affected landholders (*Proclamation No. 455/2005 Article 5*). Proclamation No.455/2005 “Expropriation of land for public purposes and payment of compensation proclamation”. This law provides for the compensation of displaced persons for their lost assets and to restore their livelihood. *Article 14 (1) and Article 14(2)* provides for replacement of land for the construction of houses.

Regarding the removal of utility lines, the relevant government body must give a written request to the affected landholder, and this body must determine a fair compensation within 30 days (*Proclamation No. 455/2005 Article 6*). Compensation must be paid within 30 days of the receipt of the valuation, and the landholder must vacate the land within 60 days of receipt of compensation.

The Constitution also guarantees people whose livelihood is land based and pastoralists the right to have access to land as well as the protection against eviction from their possession (Article 40.4 and 40.5). In article 40.8, it also states that, private property may be expropriated for public use subject to payment in advance of compensation commensurate to the value of the property”.

In July 2005, the Government of Ethiopia has issued a new proclamation entitled, “*Proclamation to provide for the expropriation of land holdings for public purposes and payment of compensation*” proclamation No.455/2005. This new proclamation has several articles on determination of compensation, on displacement compensation, valuation procedures, property valuation committees and on complaints and appeals in relation to compensation.

In part two, article 3, No.1 of the proclamation it states that; “ *A Woreda or an urban administration shall, up on payment in advance of compensation in accordance with this proclamation, has the power to expropriate rural or urban land holdings for public purpose where it believes that it should be used for a better development project to be carried out by public entities, private investors, cooperative societies or other organs, or where such expropriation has been decided by the appropriate higher regional or federal government organ for the same purpose*”.

Proclamation No. 455/2005 provides a better displacement compensation for rural land holdings compared to previous laws.

In part 3 of article 8 it states that:“ *A rural land holder whose land holding has been permanently expropriated shall, in addition to the compensation payable under Article 7 of this proclamation, be paid displacement compensation which shall be equivalent to ten*

times the average annual income he secured during the five years preceding the expropriation of the land”.

The proclamation also states that in urban areas PAPs will be provided with a plot of land (land for land compensation) for their expropriated land to be used for the construction of house and also be paid with compensation for displacement.

Recently, Council of Ministers Regulation No. 135/2007 was issued on the payment of compensation for property situated on land holdings expropriated for public purposes, for the proper implementation of the proclamation No. 455/2005. This regulation was issued for the purpose of not only paying compensation but also to assist displaced persons to restore their livelihood.

This regulation set forth details to determine the amount of compensation for different assets found on land holdings expropriated for public purpose and stipulated the formula to calculate the amount of compensation payable for different assets.

(Please refer to Annex III)

Acquisition, valuation and Compensation of land and Other Assets

1. *Directive No.135/2007* “Payment of compensation for property situated on landholding expropriated for public purposes Council of Ministers Regulation” This Regulation deals in detail with compensation for loss of property. Although Proclamation No.455/2005 stipulates assisting displaced persons to restore their livelihood, this regulation does not deal with this issue. The Regulation determines the payment of compensation for assets based on current cost, cost of demolishing, lifting, and reinstalling where applicable, and the provision of replacement of land. The compensation categories include the following:

- ❖ Compensation for building: All components of building structures will be considered and current cost per square meter will be used to calculate amount of compensation.
- ❖ Compensation for crops: This category is logically sub-divided into crops and perennial crops. In both cases the amount of compensation is calculated based on yield per square meter of land multiplied by current price per kilo gram
- ❖ Trees: Trees could be cut and used by owner plus payment of compensation for loss of continued income.
- ❖ Permanent improvement of land: The cost of machinery, labour for improvement, and any infrastructure built as part of the improvement have to be compensated based current cost.
- ❖ Property relocation: Amount of compensation for any property that could be relocated and used again without being damaged is calculated based on cost to relocate he property.
- ❖ Protected grass: Amount of compensation for loss of land that is used for grazing or production of grass is based on area of land and the current price per square meter.

Land valuations are often done at the *woreda* and urban administration levels. These local government units establish valuation committees to value private properties (*Proclamation No. 455/2005*). In the case of publicly owned infrastructure with a designated right-of-way

(ROW), the owners of the structures within the ROW would assess the value of properties to be removed. However, the law does not take into account depreciation values. The landholder is entitled to compensation for the property on the basis of replacement. Permanent improvements to the land, equal to the value of capital and labor expended (*Proclamation No. 455/2005 Article 7*), are specified as valid basis for determining replacement value. Where property is on urban land, the law specifies that compensation “may not be less than constructing a single room in low cost house as per the region in which it is located.” It is also required that the cost of removal, transportation, and erection be paid as compensation for a relocated property, continuing its service as before. Compensation will also be based on current cost, cost of demolishing, lifting, and reinstalling. Valuation formulae are to be provided by regulations (*Proclamation No. 455/2005 Article 7*).

Assets will be broken down into components to assess value (*ANRS 28/2007 and Directive No. 135/2007*). Components for building costs include cost per square meter. Crops are subdivided into crops and perennial crops, and calculated based on yield per square meter of land multiplied by price per kilogram. Trees could be cut and used by owner plus payment of compensation for loss of continued income. The cost of machinery, labor for improvement, and any infrastructure as part of the improvement will be compensated based on current costs. Property relocation is based on the cost to relocate property given that it is not damaged while being moved. The amount of compensation for loss of land that is used for grazing or production of grass is based on the area of land and the current price per square meter. (Note: more detailed instructions for compensation are included within *Directive No. 135/2007*.)

Further, assets will be classified as movable and immovable. For movable assets, compensation will be paid for inconvenience and other transition costs (*Proclamation No. 455/2005 Article 7(2) and ANRS Regulation No. 51/2007*). Urban immovable assets include residential houses, business installations, institutional structures, stores, fences and public service providing installation. In rural areas, they include seasonal crops, perennial fruit trees, timber trees and other cash crops.

For losses that cannot be easily valued or compensated in monetary terms (e.g. access to public services, grazing areas, water points, fishing ponds, etc.), an attempt will be made to establish access to equivalent and culturally acceptable resources and earning opportunities (*Proclamation No. 455/2005 Article 7(2)*).

In addition to compensation according to *Proclamation No. 455/2005 Article 7*, displacement compensation shall be paid equivalent to ten times the average annual income he/she secured during the five years preceding the expropriation of the land (*Proclamation No. 455/2005 Article 8(3) and ANRS Regulation No. 51/2007*). Compensation will be in an amount sufficient to reinstate displaced people to their economic position prior to displacement; the regionally relevant administration is required to give another piece of land to any person who lost his land in favor of a public project (*Proclamation No. 455/2005 and ANRS Directive No. 28/2007*). The assessment of compensation does not include the value of the land itself because land is a public property and not subject to sale in Ethiopia.

Those with informal, or undocumented rights, and those without titles or use right (e.g. squatters, encroachers) are eligible for specific assistance. Such assistance recognizes some “typical claim to use rights or even ownership” after occupation of unused or unprotected

lands has been established. Informal use-rights are likely to have structures or land improvements that are eligible for compensation, as stated in *Proclamation No. 455/2005*.

In general, valuation of property is to be carried out by a certified private or public institution or private consultants as per the valuation formulae (*Proclamation No. 455/2005 Article 9*). The committee must be made up of experts with relevant qualifications (*Proclamation No. 455/2005 Article 10*). This must be not more than 5 experts in rural areas and be designated by the *woreda* or urban administration. A specialized committee of experts may also be set up separately if required.

The local and federal governments have different roles in compensation. The *woreda* and urban administrations are responsible for payment of compensation and rehabilitation support to the extent possible, and maintain data regarding properties removed from expropriated landholdings (*Proclamation No. 455/2005 Article 13*). The Ministry of Federal Resources has the power and duty to ensure there is compliance with *Proclamation No. 455/2005* at the regional level, to provide technical and capacity building support in implementation at the regional level, and prepare the valuation formulae (*Proclamation No. 455/2005 Article 12 and ANRS Proclamation No. 133.2006*).

Proclamation No.456/2005 “FDRE Rural land administration and land use proclamation” This proclamation regulates the use and administration of rural land and provides for registration of land, the obligation to pay compensation to land holders if the holder is displaced or to provide replacement with compensation for lost assets. The proclamation decrees that rural land holders expropriated for federal projects have to be compensated based on federal compensation laws or if displaced for regional projects they have to be compensated according to regional regulations.

Regarding the determination of compensation in part three, article 7 of this proclamation (Proclamation No. 455/2005), the basis and amount of compensation is clearly explained. In this article, sub article 1, a land holder whose holding has been expropriated shall be entitled to payment of compensation for his/her property situated on the land and for permanent improvements he/she made such land.

Article 7(2) states that the amount of compensation for property situated on the expropriated land shall be determined on the basis of replacement cost of the property.

Under Article 8(1) of proclamation 455/2005, a survival landholder whose land holding has been permanently expropriated shall in addition to the compensation payable under Article 7 of this proclamation be paid displacement compensation, which shall be equivalent to ten times the average annual income he secured to bring the five years preceding the expropriation of the land.

All PAPs and organizations (whether public or private) that losses houses, crops or sources of income will be compensated or rehabilitated according to the types and amount of their losses. The cut-off-date for compensation eligibility will be set once all detailed measurements have been completed. Compensation will not also be paid for any structure erected or crops and trees planted purely for the purpose of gaining additional compensation. Cultivating land, constructing settlement in project affected areas after the cut-off-date will not be eligible for compensation or subsidies.

(Please refer to Annex III).

Administrative arrangements to implement policies: Compensation for loss of assets and relocation of displaced persons are handled on the basis of regulations governing the issue. The federal law on compensation (Proc. No.455/2005) requires that inventory and valuation of assets should be done by an agency consisting of 3-5 persons established for the purpose. The agency implementing and assessing compensation and relocation depends on who carries out the project that is cause for relocation. In most cases, displacement in urban areas is dealt with by urban administrations while displacements in rural areas are handled by the project owner (private investor, federal or regional government agency).








Grievance and Redress Mechanism (GRM): A number of regional states (most notably Amhara and Tigray) have begun the process of creating grievance procedures approximating international standards which provide grievants in those states with a forum to complain about governmental maladministration and seek redress for any harm done to the grievant. Amhara has grounded its grievance redress mechanism in legislation approved by the regional cabinet council. Tigray used Amhara's GRM procedures as a "benchmark" for its draft regulation and procedures manual. These two early adopters have provided other regional states, such as SNNPRS, Benishanghul Gumuz and Oromia, with a template for strengthening existing GRMs based on the BPR or enacting regulations which provides new GRMs strong legal underpinnings. These regional initiatives are manifestations of the impact of Ethiopia's decentralization policies and the ability of federalism, as it currently operates in Ethiopia and elsewhere, to provide a variety of "laboratories" where experiments in good governance can flourish.

EEPCo's Strategy for Expropriation and Compensation

It is the objective of EEPCo to avoid or reduce the environmental and social impacts of its power projects to a minimum level. If adverse social impacts that will occur are unavoidable, EEPCo then will open consultation with PAPs and perform legal compensation for loss of all their properties. To achieve the social mitigation goal, EEPCo will allocate adequate budget for compensation before the project implementation. EEPCo in consultation with the administration of Regional State, Zones, Woredas and Kebele Associations shall establish property valuation committee as per the proclamation No. 455/2005. It is the project's prime task to initiate the establishment of property valuation committee to properly implement compensation payment for PAPs on time before the implementation of the project.

II.4. Multi-lateral Agreements

The Federal Democratic Republic of Ethiopia has ratified several international conventions and protocols as listed below:-

-  Vienna Convention for the Protection of Ozone Layer (1996)
-  Montreal Protocol for Substances Depleting the Ozone Layer (1990)
-  United Convention on Law of the Sea.
-  Convention on Biodiversity (Rio convention) 1994
-  Framework Convention of United Nations on Climate Change (1994)
-  Basel Convention on the Control of Trans-boundary movement of Hazardous Substance (2002)
-  African Convention on the Conservation of Nature and Natural Resources

- ✚ Convention on Wetlands of International Importance especially as waterfowl habitat (Ramsar)
- ✚ Convention to Combat Desertification (CCD), ratified in 1997
- ✚ Convention Concerning the Protection of World Cultural and Natural Heritage, ratified 1972
- ✚ Convention on International Trade in Endangered Species (CITES) (1970)
- ✚ Stockholm convention on persistent organic pollutants (PAPs, 22nd May 2001)
- ✚ International Plant Protection Convention

II.5. International Banks' Requirements

The Regional Development Banks, such as the European Bank for Reconstruction and Development (EBRD), the African Development Bank (AfDB) and the Asian Development Bank (ADB), all have environmental policies and guidelines which in most respects resemble those of the World Bank Policies.

The Regional Development Banks use environmental screening to place projects as category A, B or C (ADB & EBRD) or as category I, II or III (AfDB). These categories are similar in principle to those of the World Bank with only minor differences between each Bank. ADB and EBRD procedures are developed from the World Bank procedures (Hydro power development, Environmental effects, 1995)

Common to all Regional Development Banks, including the World Bank, is that the responsibility for meeting the environmental requirements rests on the hand of the borrower. The FEPA report shall be commissioned and /or carried out by the authorities of the country seeking a loan. The World Bank's Requirements

According to the World Bank project screening criteria, the Aluto Langanu geothermal deep well drilling Project is categorized as "Category A Project". That is, environmental analysis is appropriate, as the project may have specific environmental impacts.

The World Bank provides guidance on requirements in the Environmental Assessment Sourcebook, which includes the most recent versions of the World Bank Operational Policies as well as the updates. The World Bank has ten "*Safeguard Policies*" whose primary objective is to ensure that Bank operations do not cause adverse impacts. The ten safeguard policies are grouped into Environment and Social Policies.

On OP4.10, as part of its due diligence, the World Bank has conducted social screening of the Aluto site to assess safeguards risks and potential impact of the proposed project on humans and environment, particularly, to determine whether the physical and sociocultural characteristics of Aluto Langanu meets the OP4.10 requirement of distinct, vulnerable, social and cultural group, possessing the following characteristics, in varying degrees: (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (b) collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; (c) customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and (d) an indigenous language, often different from the official language of the country or region. The finding indicates that majority of the community members are farmers, few are herders and community members are part of the

dominate Oromia ethnic groups and speak Amharic. The screening observed no visible or unique socio-cultural characteristics similar to the OP4.10 requirements; and concludes that the project will involve land take and restriction in economic activities. The project has also reviewed some of the social assessment conducted by the government on the bases of economic and sociocultural profile of underserved groups, within the Oromia region, and Aluto was not included as community meeting the defining characteristics in OP4.10.

Therefore, among safeguard policies, three are not applicable as they relate to international law on waters and disputed areas, and the safety of dams. The following safeguard policies have been considered in this study.

The Bank's Safeguard Policies

The following are the World Bank Safeguard Policies that are pertinent to the Program under consideration.

OP 4.01 Environmental Assessment

The core requirement of this Policy is that screening should be done as early as possible for potential impacts and select appropriate instrument to assess, minimize and mitigate potentially adverse impacts.

Environmental Assessment (EA) ensures that appropriate levels of environmental and social assessment are carried out as part of project design. It also deals with the public consultation process, and ensures that the views of PAPs and local NGOs are incorporated as early as possible for Category A and B projects.

It is worth noting that OP 4.01 applies to all components of a project with financing from the World Bank, including co-financed components by the Borrower or by other funding agencies.

OP 4.11 Physical Cultural Resources

Protection of cultural, historical archeological sites as stated in OP/BP 4.11. The policy requires the project avoid or mitigate adverse impacts of development projects on physical cultural resources.

The Policy bases itself on investigating and inventorying any chance finds and cultural resources potentially affected. It includes mitigation measures when there are adverse impacts on physical cultural resources.

The Borrower assesses the project's potential impacts on physical cultural resources as an integral component of the Environmental Assessment (EA). The process steps for the physical cultural resources component of the EA are the same for Category A and B projects.

The physical cultural resources component of the EA provides for (a) an assessment of physical cultural resources likely to be affected by the project, (b) documentation of the

characteristics and significance of these resources, and (c) an assessment of the nature and extent of potential direct and indirect impacts on these resources.

Where the EA predicts adverse impacts on physical cultural resources, the cultural resources component of the EA includes a management plan which includes: (a) actions to mitigate adverse impacts, (b) provisions for the treatment of physical cultural resources discovered during project implementation and operation (hereafter referred to as “chance finds”), (c) any necessary measures for strengthening institutional capacity to implement the management plan, and (d) a monitoring system to track progress of these activities.

The management of cultural property should be undertaken in conjunction with consulting the appropriate agencies including NGOs and academic institutions.

The Bank avoids projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage.

OP 4.12 Involuntary Resettlement

Avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs. Assist displaced persons in improving their former living standards, income earning capacity, and production levels, or at least in restoring them.

Encourage community participation in planning and implementing resettlement. Provide assistance to affected people regardless of the legality of land tenure.

The policy covers not only physical relocation, but any loss of land or other assets resulting in: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; and (iii) loss of income sources or means of livelihood, whether or not the affected people must move to another location.

The impetus of this Policy is that development projects should not cause the impoverishment of the people who are within the area of influence of the projects. In cases where resettlement of people is inevitable, proper resettlement action plan should be undertaken to at least restore or improve, as stated above, their standard of life prior to the projects.

Concerning public consultation, resettlers as well as the host communities should be consulted for the successful implementation of the resettlement process. The views of the consulted resettlers and the host communities should be incorporated into the resettlement action plan (RAP) including the list of their choices.

OP 4.36 Forests

The Policy envisages the protection of forests through consideration of forest-related impact of all investment operations, ensuring restrictions for operations affecting critical forest conservation areas, and improving commercial forest practice through use of modern certification systems.

In the process of forest conservation interventions, especially the local people, the private sector and other pertinent stakeholders should be consulted.

In general, the Policy aims at reducing deforestation and enhancing the environmental and social contribution of forested areas. Experience with the Bank reveals that the Bank does not support commercial logging in primary tropical moist forest.

Bank's Policy on Disclosure

It is a requirement of the Bank that the peoples residing in the project areas have the Right to be informed of the proposed development project(s) in their respective areas. Therefore, prior to project appraisal, the summary of the study of projects along with other relevant information should be disclosed at the Bank's as well as project area (local) level.

The Disclosure Policy requires that Category B Environmental Assessment reports should be self-standing documents, and thus disclosure is a pre-requisite for appraisal of the project for the power transmission line to Addis Ababa. These effects can lead to the improvement of the infrastructure related to agriculture, commerce and the activation of the regional economy.

II.6. Institutional and Administrative Frameworks

The Federal Democratic Republic of Ethiopia (FDRE) was formally established on August 21, 1995. The FDRE comprises of the Federal states with nine Regional State members.

The following paragraphs discuss the institutional and administrative frameworks at the federal and regional level and organizations responsible for the preparation of environmental policy and technical guidelines.

Federal Democratic Republic of Ethiopia

The Federal Democratic Republic of Ethiopia (FDRE) comprises of the Federal State and nine Regional States. The power and duties of the Federal, Regional and Local governments have been defined by proclamation numbers 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.

Regional Governments

The Oromia Regional State is the regional state established by the Federal Government of Ethiopia. The proposed drilling of twenty deep geothermal well project of Aluto Geothermal Power Plant Expansion Project Phase III is fully located in this Regional State. The Region has Zones and Woredas. Within each Woreda there are many Kebele administrations. Each administrative unit has its own local government elected by the people. The Regional Government has established sectoral Bureaus, Commissions and Authorities.

Ministry of Water, Irrigation and Energy (MoWIE)

The Ministry of Water and Energy is the regulatory body for the energy sector. Based on the delegation from EPA, the whole draft ESIA document will be submitted to the Ministry for reviewing purpose, and then they will give their comments and recommendations and

finally provide approval /certify the implementation of the project and monitoring the performance of the development project will also be undertaken by the Ministry.

Ministry of Environment and Forest (MoEF)

The rights and obligations of the former Federal Environmental Protection Authority (FEPA) established under the Proclamation No. 295/2002 are transferred to the Ministry of Environment and Forest. FEPA was an autonomous government body reporting directly to the prime minister until it was folded into the newly established Ministry of Environment and Forest (MoEF).

Ministry of Environment and Forest has the following powers and duties

- Coordinate measures to ensure that the environment objectives provided under the constitution 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;
- Prepare a mechanism that promotes social, economic and environmental justice and channel the major part of any benefit derived thereof to the affected communities to reduce emissions of greenhouse gases that would otherwise have resulted from deforestation and forest degradation;
- Establish a system for the evaluation of the environmental impact assessment of investment projects submitted by their respective proponents by the concerned sectoral licensing organ or the concerned regional organ prior to granting a permission for their implementation in accordance with the Environmental impact Assessment Proclamation
- Establish an environmental information system that promotes efficiency in environmental data collection, management and use;

Promote and provide non formal environmental education program and cooperate with competent organs with a view to integrating environmental concerns in the regular educational curricula.

EEPCo's Environmental Guidelines for the Power Sector

The Ethiopian Electric Power Corporation (EEPCo) is a national electricity utility established as a public enterprise by Council of Ministers regulation No. 18/1997. According to the regulation, EEPCo is mandated to engage in the business of power generation, transmission, distribution and selling of electric energy and to carry out any other activities that would enable it to achieve its stated mission.

On the basis of the Constitution as well as the Environmental Policy, and based on the peculiar functional and operational characteristics of EEPCo, it has produced an Environmental Guidelines that is currently serving the Environmental and Social experts of EEPCo for their day-to-day environmental activities.

Environmental Protection, Land Administration and Use Authority of Oromia Regional State

The Ministry of Agriculture and the Federal Environmental Protection Authority (FEPA) have delegated their authority to the regional bureau of Agriculture and Rural Development and Environmental Protection, Land Administration and Use Authority.

Environment Monitoring Team /EMT/ of EEPCo

Environment monitoring Team of EEPCo comprises environmentalists and sociologists to address environmental and social issues that may arise due to its operation.

The following are the major duties and responsibilities of the Environmental and Social experts within the functional or operational framework of the EEPCo:

- Responsible to carry out Initial Environmental Examination or Environmental Screening in the preliminary design phase. The experts are not expected to conduct a full EIA study, because the Environmental Protection Authority (EPA) demands EIA studies to be performed by an independent consultant.
- Prepares TOR to conduct a full EIA study. Power System Planning is taking full responsibilities to short list Environmental Consultants, prepare RFP or tender documents and evaluate the technical and financial proposals of the short listed firms
- The Environmental and Social experts of EEPCo are responsible to monitor the environmental and socio-economic activities in different power project areas, to make sure that contractors are complying according to the technical specification stated in the contract agreement.
- The Environmental and Social experts of EEPCo may also conduct the monitoring of resettlement activities either independently or in company with the government and non-government stakeholders on regular basis.
- Monitoring of forest clearing operation is preferably to be conducted jointly with the government stakeholders
- Review of documents related to environmental and social management undertakings by consultants
- Power System Planning represents EEPCo in all the matters that are related to the Environmental study of a project.

Economic benefit can be obtained by the reduction of the need to import fossil fuels. Furthermore, electricity supply to the central part of Ethiopia can also be expected by connecting Adverse environmental and social impacts caused by the EEPCo's project operations will be jointly monitored by the EEPCo's, Power System Planning and the project office. The Environment monitoring Team and the project office are responsible for the monitoring of adverse environmental and social impacts and coordinate the preparation and implementation of the EIAs, EMPs, and the RAPs where it is deemed necessary.

II.7. Aluto Geothermal Power Plant Expansion Project Phase III Project Office

EEPCo has established a project office named, Aluto Geothermal Power Plant Expansion Project Phase III, to execute the drilling of geothermal wells, construction of power house, transmission line and substation construction. The Project Office is located in Addis Ababa and reports to Generation Construction Executive Officer.

II.8. Relevant Guidelines

The Ethiopian Environmental Protection Authority has issued guidelines for environmental and social impact assessment of projects in different sectors.

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.
- ✚ Environmental Impact Assessment Procedural Guidelines Series 1, EPA, 2003.
- ✚ 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
- ✚ Guidelines on Hydropower Production, Transportation and Distribution.
- ✚ Guideline on ambient water quality of domestic, agricultural and industrial wastes
- ✚ EEPCo's environmental guideline.

III. PROJECT DESCRIPTION

General

The Aluto Geothermal Power Plant Expansion Project Phase III has the following components:

1. Drilling of 20 Deep geothermal wells,
2. Heat gathering system (from geothermal wells to the power house),
3. 70 MW Power Plant Construction including switchyard,
4. 132 kV transmission line (from Aluto power plant to Adami Tulu substation),
5. Substation Construction at Adami Tulu, and
6. Access road construction.

III.I Drilling of Geothermal Wells

Drilling of twenty (20) deep geothermal wells was planned in the third phase of the Aluto Geothermal Power Plant Expansion Project. The drilling of the twenty deep geothermal wells will be carried out around the existing Aluto Langano geothermal power plant.

In order to expand the Aluto Geothermal Resource to its full potential, a study on the power development has been conducted by GSE and Japanese Consultants.

The deep geothermal wells were intended to produce 70 MW electric power, adding to the generation capacity of the country. Energy diversification is also very important, since most of the country's power generation (about 99.3 %) depends on hydropower.

The twenty geothermal deep wells will be excavated in the project component with the following main activities:

- ✦ Drill well site preparation, that is excavation of top soil and compaction of the ground at the drill pads in order to create stable ground capable of carrying the “*rig and its structure*”. Usually the pads have dimensions of: 170 m(L) X 75 m(W), 100 m(L) X 50 m (W) and 100 m (L) X 80 m (W).
- ✦ Excavation of the soil to form ponds for the disposal of drilling effluents. The ponds have dimensions of: 50 m (L) X 25 m (W) X 2 m (D) (D=depth), 50 m (L) X 40 m (W) X 2 m (D) and 40 m (L) X 40 m (W) X 2 m (D).
- ✦ Transportation of the rig and its accessories to the project site.
- ✦ Drilling of 2,500 m deep four geothermal wells using circulating water and testing.
- ✦ Disposal of the drilling effluents to evaporation ponds.
- ✦ Well testing of the twenty wells to be drilled,

III.2 Heat Gathering System

Heat gathering system includes pipe lines that took steam from geothermal wells to the power house. The pipes will be laid on the surface of the earth which has limited impact related to hindering movement of people and cattle from one site to the other. The pipes are also hot and as a mitigation measure the pipes have to be shielded.

III.3 Power Plant Construction including Switchyard

70 MW power plant construction including switchyard are planned in the phase III Geothermal Power Plant Expansion Project. The power plant requires 150 m X 150 m of land and the location is already identified. It has permanent impact on the farm land.

III.4 Transmission Line Construction

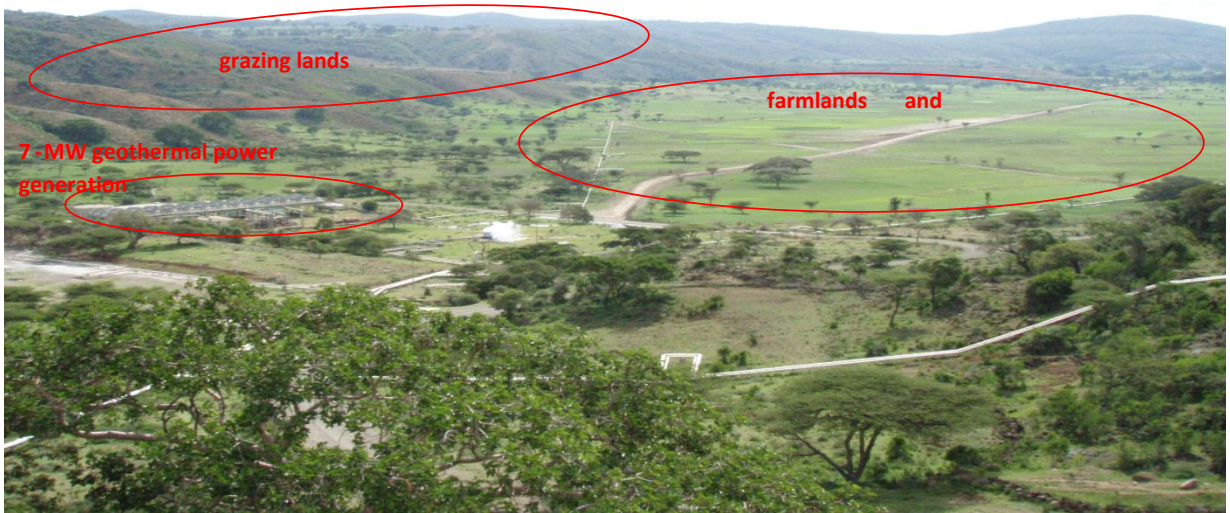
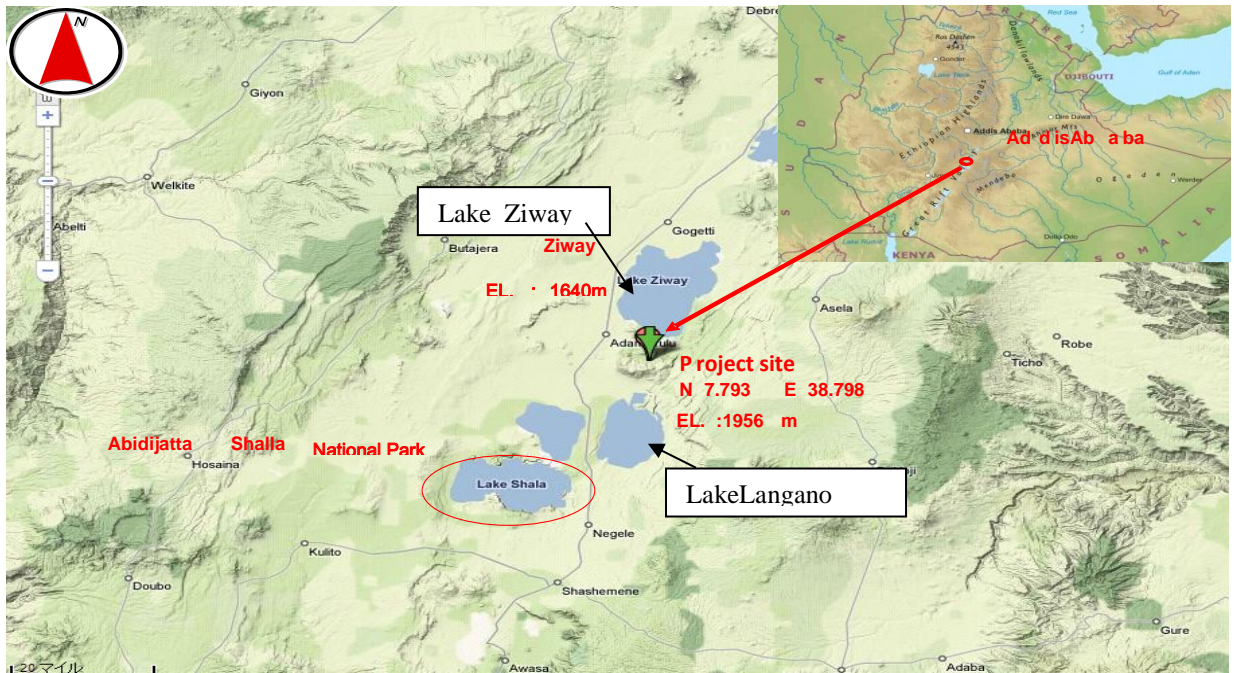
132 kV transmission line from the proposed Aluto power plant to Adami Tulu substation, 30 km is planned in the project. According to Ethiopian Electricity Agency Directive 132 kV overhead electric lines requires 30 m right-of-way (ROW).

III.5 Substation Construction

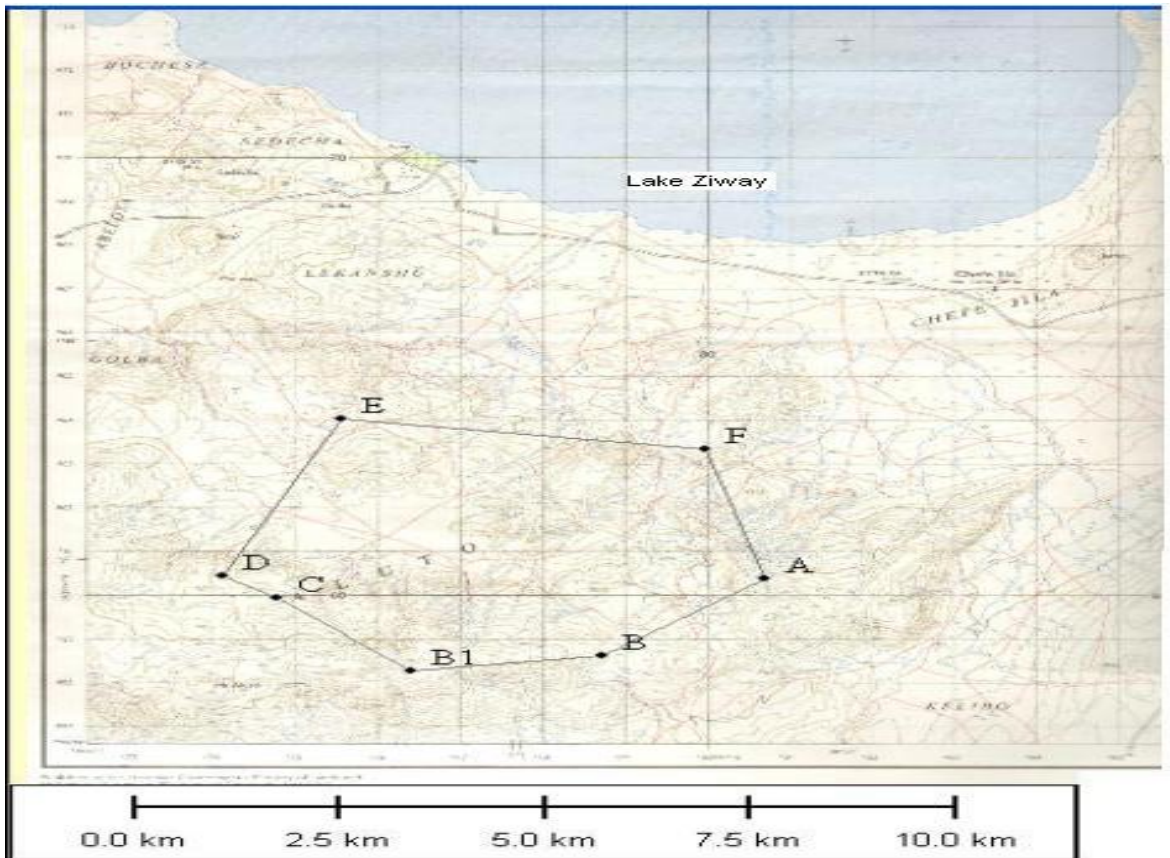
Substation construction is planned at Adami Tulu existing substation. EEPCo owns the substation at Adami Tulu with sufficient land to accommodate the new proposed substation. No land acquisition is anticipated for this project component.

III.6 Access Road Construction

Access road construction is anticipated to the proposed drilling pads and ponds and requires land acquisition.



Proposed Site for the Aluto Geothermal Power Plant Expansion Project Phase III



Proposed Project site at Aluto

IV. PROJECT ALTERNATIVES

Currently electricity access in Ethiopia reaches an estimated 48.5% (*EEPCo, Strategic Management and planning Office*) of the population. Further electricity generation is therefore necessary in order to reach a greater percentage of the population to promote economic growth. The situation is aggravated by the fact that 99.3 % of the electric power produced is based on hydropower which has often been unreliable especially during the dry seasons. Persistent shedding is affecting the productivity of the industrial and agricultural sectors, leading to reduction in economic growth.

The Ethiopian Government has embarked upon various plans and programs to explore and develop different energy resources (i.e., hydropower, geothermal, wind and solar) to achieve the major goals of accelerating economic growth and reducing poverty

To overcome the growing demand, planning for energy diversification is very important. Therefore, the proposed drilling of twenty deep geothermal wells at Aluto is one of the most important steps to generate electricity which will enable to back-up the other energy sources.

IV.1. Alternative 1: Do-Nothing Alternative

From a purely physical environmental viewpoint, the “*do-nothing*” alternative is preferable than for project implementation, since it would avoid creation of any of the adverse impacts associated with any development projects. However, the potential social and socio economic benefits to the nation would be foregone and quality of life would remain at a low level /worsen for many of those who live in the country. If this option is accepted, long term development plans for the country would be compromised and slowed down, since reliable power supply and improved services associated with it are fundamental to achieving the full benefits.

The majority of the nation’s energy needs are covered by biomass, mostly in the form of fuel wood and charcoal for cooking. The extraction of wood has led to large scale deforestation. Deforestation leads to increased soil erosion, changes in natural habitat and as a consequence, loss of bio-diversity.

The “*do-nothing*” alternative will worsen the deforestation problem, because it will not reduce the need for fuel wood, halt the clearing of forests, conserve the nation’s soils, stop environmental degradation, etc. This alternative will not also help to promote educational, commercial and industrial development.

IV.2. Alternative 2: Exploration and Expansion of Geothermal energy

Geothermal energy is a renewable energy source and environmentally friendly as compared to other energy sources especially fossil fuel, which is a naturally endowed resource, which cannot be found everywhere. Development of geothermal energy thus has a minimal negative impact on the environment compared with development associated with conventional energy sources. In addition to this, geothermal power plants require relatively little land, taking up only a fraction of that needed by other energy sources. Geothermal facilities have neither huge piles of ash, nor slag, nor bags of radiation-tainted sulfur to contend with. Greenhouse gas emissions are almost zero, ozone depleting chemicals from

both direct and indirect sources are also almost zero, sulfur oxide emissions are virtually zero because, by design, geothermal modern closed-cycle systems re-inject almost everything but the extracted heat and geothermal facilities present light demands on land use, looking much like any light industry facility. Its initial cost is much less as compared to other sources of energy. The impact it causes on the environment and community is also localized and insignificant. This option has to be also explored in order to supply diversified energy sources which make energy supply sustainable.

IV.3. Alternative 3: Conservation and Demand Management

Conservation and demand management is becoming one of supply option. They free up existing energy to be used elsewhere, thus postpone the need for new capacity. Although environmentally this option is preferable, the demand forecast still call for a significant increase in generation capabilities to maintain economic growth and development (*Please, refer to Ethiopian Power System Expansion Plan – April 2004*).

To keep pace with the growing population and fast economic growth of the country, the electricity generating requirement must also grow annually, so that for the period of Growth and Transformation Plan (GTP), the total electricity generating requirement is 10,000 MW. To reach this target is a great challenge, but the benefits to the environment alone will be immense with huge knock-on benefits for social and economic development. Therefore, EEPCo has developed an expansion plan in the area of generating capacity.

IV.4. Alternative 4: Thermal Power

The high costs of importing fossil fuel preclude thermal power option that would depend on foreign fuel. Fossil fuel resources in the country have not been developed or proven to the extent that a thermal station would be feasible. Therefore, from an environmental viewpoint, the thermal alternative is not preferable. Besides, thermal power increases the emission into the atmosphere of CO₂, which is the most important Green House Gas contributor.

IV.5. Alternative 5: Renewable Energy (Wind and Solar)

The prospects for solar and wind power generation in Ethiopia is significantly attractive. According to the 2003 Master Plan Study, the specific generation cost of wind power was estimated at over US cents 40 per kWh, more than five times the price of thermal energy. The cost of solar power was computed as over US cents 90, which is more than ten times that of a thermal plant. There are efforts being undertaken by EEPCo to establish wind farm at two locations. Solar energy may well be of interest for remote small load centers. However, due to its significant generation cost the development of solar energy sources is not at this point considered feasible.

IV.6. Alternative 6: Other Hydropower Schemes

Studies have shown that the potential for hydropower construction, given that there are many rivers, is another alternative to be undertaken. However, a considerable amount of money will be invested in the construction period of hydropower plants. Also, from the past experience of the country, the hydro power energy generation capacity will be altered by seasonal fluctuation of rain due to drought.

IV.7. Analysis/ Evaluation of Alternatives

In contrast with other energy generation sources, the geothermal energy source, being a renewable energy and environmentally friendly, it is the one most preferred.

The “Aluto Geothermal Power Plant Expansion Project Phase III” is feasible, and is exceptionally attractive, from the technical, economical and environmental viewpoints. Such a worthwhile scheme, which will bring net benefits to the nation in general and to the local communities in particular, should be implemented at the earliest possible date, the drilling of deep geothermal wells and construction of the power plant take place at the existing Aluto Langano geothermal pilot energy production site.

V. BASELINE ENVIRONMENTAL CONDITIONS

V.1. Biophysical Environment

Location

The Aluto Geothermal Power Plant Expansion Project Phase III will be carried out around the existing Aluto Langano Geothermal Pilot Power Plant. Aluto Geothermal field is located at geographic coordinates of latitude 7° 793' North and longitude 38° 798' East, within the central-southern part of the main Ethiopian Rift valley about 200 km south of Addis Ababa Ethiopia, between Lakes Ziway and Langano in Oromia Regional State of Adami Tulu-Jido- Kombolcha Woreda.

The national highway No. 6 and 230 kV power transmission line runs from Aluto in north-northeast direction.

Topography

The landscape in the Woreda falls mostly in the central Ethiopian Rift Valley and is a plain land except towards the proposed geothermal project site; the area is located on a flat land with loose pyroclastic material, dotted by hilly morphologies around the peripheries, composed of mainly volcanic rocks.

The site is situated between two lakes, Lake Ziway to the north and Lake Langano to the south. There are fumaroles seen here and there. Most of the deep geothermal wells to be drilled are at the foot of these mountains. Since the area is a plain land, farmers living in the area cultivate annual agricultural cereals and rear cattle. The plain land has some scattered acacia trees whilst on the mountains there are many types of shrubs and bushes.

Geology

The project area is composed of mainly volcanic rocks and some lacustrine and alluvial sediment. The volcanic rhyolite lava flows, basalt lava flows, ignimbrites and pumiceous pyroclastics form the volcanic massif of the Aluto Volcano and the sediments are distributed on the flat plains and depressions.

Soil

The soil in the surrounding area is formed from the weathering of the acid very young pyroclastic rocks and is mainly grey soil with low fertility.

Air Quality

The geothermal power station assessed in this report operates by collecting steam from the geothermal fields. The steam is used to drive turbines which generate the electrical energy. The used steam is discharged as liquid water and vapour /steam into the re-injection well. The water vapour or steam which is 99 % harmless in the atmosphere, but it is associated with non condensable gases of about 1 %, including CO₂, H₂S, Ammonia and others.

Some amount of H₂S will be released during well testing. It is potentially noxious and toxic gas with the odour of rotten eggs. Small quantities of air pollutants will be released from mobile construction equipment and other vehicles. Furthermore, air pollutants in particular oxides of nitrogen will be released from the drilling rig engines during well drilling.

Table 1:- Hydrogen sulfide guideline values

Substance	Guideline value	Averaging time
Hydrogen sulfide (H ₂ S)	150 µg/m ³	24 hours

Source: Guideline ambient environment standards for Ethiopia (FEPA, August 2003)

Water Quality

In the proposed Aluto geothermal power plant site, there is no river, stream, well or lake. There is one pond which collects rainwater for cattle near the existing LA 7 re-injection well during the dry season. The farmers living in and around the site collect water for domestic use from Lake Ziway, Lake Langano, Ropi (upper side of Bulbula) river, located very far away (14 – 18 km) from their residence. The cool water released from geothermal wells is used by the locals for bathing and washing purposes.

Near Lake Langano, there are hot springs mainly located in the south and south east of Aluto, whereas the steam vents (fumaroles) are widely distributed within the Aluto volcanic complex. A number of hot springs, with relatively high discharge flow rate, are recognized mainly along the northern shore of Lake Langano. The geothermal water in the Aluto Langano field is basically bicarbonate chloride (HCO₃-Cl) water with alkali or neutral pH, due to the high CO₂ concentration in the reservoir, though the discharge water after steam separation exhibits pH around 9.0. The geothermal wells produce a two phase fluid (water + vapour).

Table 2:- Environmental Water Quality Standard

Parameters	Unit	Limit value	Remark
Temperature	⁰ C	± 3	
pH	-	6 – 9	-
Total suspended solids (TSS)	mg/L	50	
Biochemical oxygen demand (BOD ₅)	mg/L	< 5	20 ⁰ C
Dissolved oxygen (DO)	mg/L	>6	
Nitrate (NO ₃)	mg/L	50	
Ammonium (NH ₃)	mg/L	0.02	NH ₃ un-ionized
Arsenic (AS)	mg/L	0.05	
Fluoride (F)	mg/L	1	
Chloride (Cl)	mg/L	250	
Mercury (Hg)	mg/L	0.001	
Sulphate	mg/L	200	

Source: Guideline ambient environment standards for Ethiopia (EPA, August 2003)

Effluent Discharges

There is no existence of surface water such as rivers, streams, lakes and springs in the project area. However, for precautionary measures, the effluent discharged during excavation shall be directed to flow into retention and sedimentation pond which will be prepared for this purpose.

Table 3:- Standard for effluents discharged on land

Parameters	Unit	Limit value	Remark
Temperature	-	40	-
pH	⁰ C	5.5 - 9.0	-
Total dissolved solids (TSS)	mg/L	2100	
Biochemical oxygen demand (BOD ₅)	mg/L	500	20 ⁰ C
Fats, oils and grease	mg/L	30	
Mercury (Hg)	mg/L	0.001	
Boron (B)	mg/L	5	
Arsenic (AS)	mg/L	0.25	
Fluoride (F)	mg/L	20	
Chloride (Cl)	mg/L	1000	
Sulphate (SO ₄)	mg/L	1000	

Source: Guideline for industrial Pollution Control in Ethiopia (EPA, September 2003)

Noise

Noise will be emitted from geothermal fluid escaping during the wells drilling, working noise and vibration and well testing are the only temporary noise sources. Thus, it is deemed to have an impact on the environment and surrounding community.

The environmental standards for noise are established by the zone type for residential, commercial and industrial and by time division into daytime and nighttime.

Table 4: - Noise standards

S.No.	Category of area	Limits in decibel (dB)	
		Day time (6 am to 9pm)	Night time (9pm to 6 am)
1	Industrial area	75	70
2	Commercial area	65	55
3	Residential area	55	45

Source: 1) *Guideline for industrial Pollution Control in Ethiopia (EPA, September 2003)*
 2) *Guideline ambient environment standards for Ethiopia (EPA, August 2003)*

Table 5: - The World Bank Requirement on Noise level (World Bank 1998)

World Bank's Maximum Allowable Ambient Noise Level		
Receptor	Maximum Allowable Limit (Hourly) in dB	
	Day time (0700 – 2200 hr)	Night time (2200 – 0700 hr)
Residential, Institutional and educational	55	45
Industrial and commercial	70	70

Climate

From 2005 - 2009, the mean annual temperature is around 20.75⁰ C and mean maximum and minimum annual temperature ranges from 27.26⁰ C to 13.93⁰C.

The mean annual precipitation from the three adjoining meteorological stations / Adami Tulu, Bulbula and Ziway/ are 113.18, 57.34 and 72.72 mm, respectively. June to September are the wet seasons, while November to January is the dry season with low level of rainfall.

Table 6:- Mean annual temperature at Ziway Meteorological Station /the only station in the area/

Station	Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Maximum Mean
Ziway	2005-2009	27.3	28.6	30.0	29.13	29.12	27.84	25.28	25.54	26.88	27.68	26.8	26.57	27.56
“	“	12.3	13.54	14.6	15.72	16.08	15.62	15.14	14.92	14.54	12.74	11.53	10.37	13.93 Minimum Mean

Source: National Meteorological Services Agency /NMSA/

Table 7:-Mean monthly rainfall /precipitation in the three adjoining meteorological stations

Station	Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
Adami Tulu	2005 - 2009	27.73	21.77	52.76	102.45	155.8	106.7	251	233.6	150.9	46.7	196	12.8	113.18
Bulbula	“	19.13	8.15	32.85	55.56	86.6	123	108.3	69.2	72.8	32	77.8	2.8	57.34
Ziway	“	31.2	20.27	33.98	74.54	108.7	98.6	192.6	103.2	79.1	47.6	75.7	7.3	72.72

Source: National Meteorological Services Agency /NMSA/

The wind direction from Ziway meteorological station, for 2003 and 2004, (data only available for these two years only) which is the nearest station to the project site, indicates that, from October to April the wind direction is from North East and North side of the project site and in the rest of the year from South West and South side.

Altitude

The project site's elevation is 1,956 m.a.s.l. and rises about 690 m above the surrounding Adami Tulu plain, which has an elevation of about 1266 m.a.s.l.

Flora

During the recent ESIA study, the community and Woreda Agricultural Office informed the team that there is vegetation such as, Acacia sp., Fig /Warka/, Fig /Denbi/, Olive /Weira/, Croton /Bisana/, Sand olive /hopbush /Kitkita/, Giant heath /Asta/, Yellow wood /Zigba/, Wild date palm /Zenbaba/ and Giant St. John's Wort /Amija/. Grass and shrubs/bushes are seen on all surrounding mountains/hills in the proposed project area, dotted with Acacia.

Table 8: - Common flora in the project site:

S.No.	Common name	Scientific name
1	Fig /Warka/	Ficus vasta
2	“ /Denbi/	“ “
3	Olive /Weira/	Olea africana
4	Acacia /Girar/	Acacia sp.
5	Croton /Bisana/	Croton macrostachys
6	Sand olive /hopbush /Kitkita/	Dodonaea viscosa
7	Giant heath /Asta/	Erica arborea
8	Yellow wood /Zigba/	Podocarpus glacialior
9	Wild date palm /Zenbaba/	Phoenix reclinata
10	Giant St. John's Wort /Amija/	Hypericum revolutum

Source: Field visit survey and questionnaire for Agricultural and Rural Development Office

The dominant annual agricultural products in the Woreda are wheat /Sinde/, barley /Geba/, Maize /Bekolo/, Millet/Zengada/and Lentils /Telba/ are primarily cultivated and grown on the farmlands.

Table 9: - Common agricultural product in the project site:

S.No.	Common name	Scientific name
1	Barley / <i>Gebes</i> /	Hordeum vulgare
2	Wheat / <i>Sinde</i> /	Triticum sativum, T. durum
3	Maize / <i>Bekolo</i> /	Zea mays
4	Millet / <i>Zengada</i> /	Sorghum bicolor
5	Lentils / <i>Telba</i> /	Lens culinaris
6	Teff / <i>Teff</i> /	Eragrostis teff
7	Beans / <i>Bakela</i> /	Vicia fava, Phaseolus radiatus
8	Soybean / <i>Boloke</i> /	Glycine max.

N.B: Words written in asterisk are local Amharic names

Source: Field visit survey and questionnaire for Agricultural and Rural Development Office

Table 10: - Common perennial crops in the Woreda

S.No.	Common name	Scientific name
1	Papaya	Carica papaya
2	Mango	Mangifera indica
3	Banana	Musa sapientum, M. nana
4	Avocado	Persea americana

Source: Field visit survey and questionnaire for Agricultural and Rural Development Office

Fauna

Cattle (ox, cow), sheep, goat, donkey, mule, and horse and apiary are observed in the area. Furthermore, according to information from local residents, rats, snakes and several kinds of birds are seen in the area.

Table 11: - Common domestic animals in the project site:

S.No.	Common name	Number	Remark
1	Horses /mule/ donkey	787	
2	Oxen /cows /	5,677	
3	Sheep /goats	3,593	
4	Beehives	3,409	Traditional + modern

Source: Field visit survey and questionnaire for Agricultural and Rural Development Office

Among wild animals prevalent in the Woreda are, Spotted hyaena, Greater kudu, Anubis baboon, Black backed jackal, Bush duiker, Vervet monkey, Porcupine, Leopard, Forest hog, Hare, Bushbuck and Warthog are living around the project area on the mountainous/hill sides. The existing environment presents a lower degree of preserved nature resulted from human intervention.

Table 12: - Common wildlife in the project site

S.No.	Common Name	Scientific Name
1	Spotted Hyaena	Crocuta crocuta
2	Greater Kudu	Tragelaphus strepsiceros
3	Anubis Baboon	Papio anubis
4	Jackal, common / golden	Canis aureus, C. mesomelas
5	Bush duiker	Sylvicapra sp.
6	Vervet monkey	Cercopithecus aethiops
7	Crested porcupine	Hystrix cristata
8	Leopard	Panthera pardus
9	Bush pig	Ptamochoerus larvatus
10	Abyssinian hare	Lepus habessinicus
11	Bushbuck	Tragelaphus scriptus
12	Warthog	Phacochoerus africanus
13	Duiker	Sylvicapra grimmia

Source: Field visit survey and questionnaire for Agricultural and Rural Development Office

Furthermore, according to information gathered from local residents, rats, snakes and several other insects are living in the project area.

Table 13:- Common types of birds in the project area

S. No.	Common Name	Scientific Name
1	Ibis	Bostrychia sp.
2	Goose	Cyanochen sp.
3	Duck, African black	Dendrocygna sp, Anas sparsa
4	Flamingo	Phoenicopterus sp.
5	Marabou stork	Leptoptilos crumeniferus
6	Great white pelican	Pelecanus sp.
7	Francolin	Francolinus sp.
8	Guinea fowl	Acryllium sp.
9	Black headed gull	Larus ridibundus
10	Heron	Egretta sp.
11	Egrets	Bubulcus sp.
12	Cormorants	Phalacrocorax sp.
13	Crane	Grus sp
14	Pigeon	Treron sp.
15	Dove	Streptopelia sp.

Source: Field survey and Woreda Agricultural and Rural Development Office

V.2. Socio- Economic Environment from the Project Site

Location

The proposed project is found in the Oromia Regional State, Eastern Shewa Zone, Adami Tulu-Jido-Kombolcha Woreda. The project site is located in three adjacent Kebeles namely Golba Aluto, Abeyi Deneba and Aluto.

Demographic Characteristics

The total population of the Project surrounding Woreda, Adami Tulu-Jido-Kombolcha Woreda, according to information gathered from the Woreda Administration office is 186,202 and the Woreda land size is 141,990 km².

In the project area Woreda 85% of the population live in rural areas. The number of male population in the Woreda slightly exceeds that of the female population. The average household size for the Woreda is 6.5.

The total head of households in the Woreda is 25,070 (male HH = 20,287 and female HH = 4,783). The average population density of the Woreda is 1 person per km² and the average population growth rate is 2.9%.

Table 14: - Total population of Adami Tulu–Jido–Kombolcha Woreda

Urban Population		Rural Population		Total Population	
Male	Female	Male	Female	Male	Female
12,472	11,266	81,083	81,341	93,555	92,607

Source: Woreda Administration Office

Currently the total population size in the three adjacent Kebeles, where the project is located, is about 13,183. The number of female exceeds the male population except in Abeyi Deneba Kebele.

The number of household heads in the three kebeles is 605, 732 and 381, respectively. The average household size of the three kebeles is 5.11, 10.85 and 5.64, respectively.

The average household size recorded in all the Project area Kebeles is 7.7. The average household size of the three Kebeles is higher than the Woreda household size which is 6.5 .

Table 15: - Demographic characteristics in the Project area Kebeles (2010)

Kebele	Population Size			Household Size	
	Male	Female	Total	Number	Average
Golba Aluto	1,270	1,822	3,092	605	5.11
Abeyi Deneba	4,191	3,750	7,941	732	10.85
Aluto	846	1,304	2,150	381	5.64
Total	6,307	6,876	13,183	1,718	7.67

Source: - Woreda Administrative Office

Ethnic Composition

The Oromo ethnic group are in the project area and do not meet the criteria as defined in OP4.10. Outside the project area, but in the Woreda, the dominant group is Oromo, with some very small numbers of Amhara and Gurage.

Settlement Pattern, Housing and Household Economy

The settlement pattern of the population is totally permanent type of settlement. Most of the population in the project area is sedentary cultivators supporting their livelihood from the traditional agricultural production and rearing of cattle.

The farming techniques they practice are still traditional type of cultivation system mainly of oxen ploughing.

The common annual crops grown in the project areas are maize, wheat, barley, teff, millet, Soyabean, and lentils.

The major economic activities around the project area are mixed farming, that is, make their living out of agriculture and rearing of domestic animal.

Land use

The area of Adami Tulu – Jido – Kombolcha Woreda is 141,990 km² and the total number of the kebeles under this local administration is 43. The average land holding size in the Woreda is 3 – 4.5 hectare per person.

The agricultural land cover of the Woreda is about 58.2% which is the largest of all land use. The water body (Lakes Ziway and Langano) also constitutes about 20.6%, of the total land use system, the forest land cover is about 11 %, land allocated for construction purpose is about 6.2% and uncultivable land cover is about 3.8%.

The project area is used mainly as farmland and grazing land, with houses dotting around the farmlands. EEPCo owns this area which has existing geothermal pilot power generation facilities in service, with eight geothermal wells drilled around them. Currently one deep geothermal well known as LA 9 is under construction.

Social Services

Health and education are one of the fundamental social development indicators of a country. Getting health and educational services are part of human right and without which the economic development of a country becomes unimaginable.

The development of social services particularly, health and education, in the project area Woreda is improving.

Education

Education plays a crucial role in the social and material progress of a country including the development and appropriate use of environmental resources.

In the last decade, efforts have been made in the Woreda to expand educational opportunity to reach unaddressed section of the population.

In Adami Tulu-Jido-Kombolcha Woreda, there are 3 kindergartens, 35 primary schools (1-4 grade) 46 primary schools (5-8 grade) and 3 high schools (9-10 grades). For preparatory education, that is, from grade 11-12 and for technical and vocational training, pupils have to go to Ziway, the Woreda town.

At present, the educational coverage of the Woreda has reached 86 %.

Table 17:- Education Status of project area Kebeles

No.	Kebele	Name of school	Number of Students				Total No. of Students
			Grade 1-4		Grade 5-8		
			M	F	M	F	
1	Golba Aluto	Harawa Aluto	90	61	69	38	258
		Hulo Aluto	127	97	34	43	301
2	Abeyi Deneba	Sedisho	228	203	145	135	711
		Lekesho	111	146	--	--	257
3	Aluto	Aluto	122	108	50	45	325
		Dulolo	85	80	--	--	165
Total			763	695	298	261	2,017

Source: Woreda Education Bureau

At present, each project area Kebele has got 2 primary schools from Grade 1 to 8, with only one exception, Lekesho primary school which has grade 1 to 4. There are 2,017 students in all the three Kebeles. The number of male students slightly exceeds the number of females in the six primary schools of the project area Kebeles.

Health

Health is an important social indicator that has enormous development implication. The health coverage in Adami Tulu – Jido - Kombolcha Woreda is 94%.

There are seven health centers in the Woreda with three health officers. There are three health posts within the three project affected kebeles. There are six health extension workers assigned to serve in the three kebeles (2 extension health workers in each Kebele). The nearest clinic is in a village located 13 km away from the project area (Adami Tulu town).

Table 18:-Top common diseases in the Woreda

S. No.	Common diseases	No. of cases	Percent	Remark
1	Malaria	4651	17.4	
2	AFI	4246	15.88	
3	Pneumonia	4003	14.97	
4	P. falciparum	3593	13.44	
5	Acute URI	2851	10.67	
6	Diarrhea	2477	9.27	
7	Epidemic Typhus	1837	6.87	
8	Helminthiasis	1063	3.98	
9	Typhoid Fever	1015	3.8	
10	Skin Infection	996	3.75	
Total		26,732	100	

Source: Woreda Health Office

According to the information gathered from the Woreda health office malaria is the most prevalent and common disease in the Woreda.

HIV/AIDS

HIV/AIDS has become a national health problem and the disease is availing itself everywhere in the country. Tuberculosis is known to be one of the opportunistic infection for HIV carriers and for AIDS patients.

HIV/AIDS infection occurs among adults between the ages of 15 and 49 and mostly women. This age group encompasses the most economically productive group of the population. This infection negatively impacts on labour productivity and work time is lost through frequent absenteeism and decreased capacity in performing the normal work.

According to the information gathered from Adami Tulu-Jido-Kombolcha Woreda HIV/AIDS office, the prevalence rate among examined patients is 1.6 %.

The institutions engaged in the prevention of the disease are Ziway health centre, Adami Tulu clinic and other private clinics.

To decrease or minimize the spread of HIV/AIDS the Woreda HIV/AIDS office is working on community communication, avoiding inheritance of brother's wife after his death and awareness creation among the population.

Cultural and Historical Heritage

According to the study of the geothermal of December 2009, the project area has no known site of culturally, historically, archaeologically, geological or topographical important feature.

However, during project implementation, if there are any accidental or “*chance findings*” of archaeological artifacts, the contractor shall immediately inform EEPCo's Project Office and the Project Office shall report to the Power System Planning /PSP/ of EEPCo. The

Office will then report to the Authority for Research and Conservation of Cultural Heritage (ARCCH) for further investigation.

Electric Power

There is a power substation owned by EEPCo in Adami Tulu town. This substation connects the Aluto geothermal pilot power station with Ethiopian national electricity grid through a 132 kV transmission line.

VI. ENVIRONMENTAL AND SOCIO ECONOMIC IMPACT

An environmental and social impact is any change to the existing condition of the environment caused by human activity or an external influence.

The impacts may be:

- + Positive (beneficial) or negative (adverse),
- + Direct or indirect, long term or short term in duration and wide spread or localized in the extent of their effect.

The Aluto Geothermal Power Expansion Project Phase III can have negative impacts which if not mitigated can make this resource not environmentally viable.

Summary of the environmental impacts anticipated from the proposed project include the following:

- + Impacts on flora and fauna,
- + Noise of geothermal fluid escaping from the drilled wells, from rigs, well testing and vibration,
- + Degradation of air quality from emissions of H₂S ammonia and CO₂,
- + Discharge of excavation sludge, construction waste and debris that will be generated during drilling operation and geothermal operations,
- + Vehicles transporting equipment and material will raise dirt and dust clouds, and
- + Civil engineering work will generate waste soil.

VI.1. Socio Economic Impacts

Land Acquisition

The Aluto geothermal power plant Project requires land for Phase III activities. The project activities that require land are:

- + Drilling of twenty deep geothermal wells,
- + Power plant construction including switchyard,
- + Transmission line construction
- + Access Roads

Land requirement could be temporary or permanent and it differs during construction phase and operation phase of the project.

Construction Phase Activities and related impacts

Construction phase entails the following activities:

- i. Construction of new access roads from existing road to drilling pad sites, (L=190m, W=6.0 m)
- ii. Construction of drill pads.

The size of the pad measures approximately 170m by 75m for 6 drilling pads (According to the information from the project office, wells can be drilled vertically or at an angle. The proposed project will be drilling directional wells and about 6 pads will be required)

The drill pads construction activity involves preparation of drilling sites that will accommodate all drilling equipment and crew and discharge pond as per the approved well pad layout. Taking into account the experience of LA 9, that is under construction at Aluto geothermal fields, 60m X 100m X 5 required for the five pads.

iii. Power plant construction

The total area required according to the section plan for the power plant construction is 150m X 150m. The Power Plant construction might take place near the existing power plant at Aluto and likely to be an agricultural land.

iv. Transmission line construction

A 132 kV power Transmission line from Aluto power plant to Adami Tulu Substation, 13 km is proposed in the project. Impacts are related to the Right of Way (ROW).

According to The Ethiopian Electric Agency Directives there is a need for 15 m clearance from vegetation for 132 kV overhead electric lines Right of Way (ROW) in each side of the electric towers. The exact line route is not known at this stage and line route surveying shall be done to determine the land requirement and associated impacts on agriculture and houses.

v. Other Project Components

- Substation Construction: Power Substation construction will take place in the existing Adami Tulu Substation and no impact is anticipated.
- Heat Gathering System: pipes from geothermal wells to the new power house will be laid down. Pipes may hinder pathway for communities and their cattle. In some cases the pipes may require piece of land to lie of pipes. Generally, the heat gathering system's Impacts are minimum.

The environmental standards of EPA and the World Bank established noise emission by the zone type for residential, commercial and industrial and by time division into daytime and nighttime. For residential area, the day time limit in decibel (dB) is 55 and for night times it is 45. Noise level during drilling and testing will be above permissible levels and dwelling houses shall be far from (some 200 m away) from the drilling wells.

Residential Houses

The Aluto geothermal area and its environs support multiple land use systems consisting of grass roofed tukuls for dwelling and other purposes, agricultural land, grazing land, existing Aluto geothermal power plant, 7 geothermal wells and 1 reinjection well, a 9th well is under construction.

The exact sites for the drilling of geothermal wells and the line route for the transmission line are not known at this stage. For this reason it is not possible to identify houses to be affected by the phase III of the Aluto Geothermal project.

After identifying the exact location for drilling of the 20 deep geothermal wells and the line route for the 132 kV transmission line, the project office needs to identify affected houses and make necessary measures according to the Ethiopian Expropriation of Land Holdings for Public Purposes and Payment of Compensation Proclamation and the World Bank Involuntary Resettlement Policy. For this purpose preparation of Resettlement Policy Framework (RPF) is recommended.

Public consultation has been made with people living around the project area and project impacts are discussed. The community is aware of the phase III of the Aluto Geothermal project and the need for land acquisition.

Agricultural Land

Land is the main source of livelihood for the PAP's on the project area. The existing land use of the project will be affected because of an area required for the drilling pad, creation of ponds for the discharge of effluents, access roads and for working area. Power Plant construction and transmission line route is also the other project component that affects agricultural land.

The exact location of the drilling pads and line route of the transmission line is not known at this stage hence the magnitude of the project on agricultural land is not known. The project office shall make assessment after the exact locations for the geothermal wells and line route of the transmission line are known and take action according to the Resettlement Policy Framework (RPF).

Community Service

Public infrastructures are limited around the project area; there are no facilities such as churches, mosques, schools, health facilities and other major community service to be affected by the project area. The only impact seen is, one primary school located at Golba Aluto will be affected (is located in the land to be expropriated, however, as explained above, during the final location of the pads, ponds and transmission line routing, it will be considered accordingly).

Historical, Cultural, Archaeological and Religious Sites

There are no known historical and cultural sites to be affected by the project. However, during construction, if there are any accidental "*chance findings*" of some archaeological artifacts, the contractor shall inform EEPCo's Project Office and the Project Office shall report to the Power System Planning /PSP/ of EEPCo. The Office will then report to the Authority for Research and Conservation of Cultural Heritage (ARCCH) for further investigation.

Impacts on Women

The proportion of female population is slightly higher in two kebeles (in Golba Aluto and Aluto) than that of male in the project affected Kebeles.

Most of the constraints in the project area are related with cultural, social, economic, legal environmental factors and affect both genders. However, the magnitude of the problem is found to be critical when it comes to women. It is known that rural women have total responsibility for fetching water and collecting fuel wood. The availability or non-availability of these resources within a reasonable walking distance is of particular interest to women. Therefore, the depletion or total degradation of natural resource has adverse effects on women's status. Ecological disturbance, deprivation of water supplies and other related environmental damage expose the rural women to excessive hard work and destitution.

Around the project site, water is in short supply; women have to go as far as 13 km only to fetch water in the dry season. In the rainy season, there is a pond near the existing well No. 7 that is used by the surrounding community for household consumption. This place is one of the proposed sites for Phase III of the Aluto geothermal project.

The relocation of houses will adversely affect especially women because of the distance from their new location to the pond.

Special assistance needs to be rendered to vulnerable groups, which may include the following:

- ✦ Provision of water supply within a reasonable distance. After careful site survey, the project office could provide potable water supply to communities directly affected by the project and to the host community living around the project area.
- ✦ Priority in site selection in the relocation areas.
- ✦ Relocation near to kin and former neighbors.
- ✦ Assistance and help in dismantling salvageable materials from their original home.
- ✦ Priority access to all other mitigation and development assistance.

The easy and sustainable access to electric power supply in villages and towns would ease the burden on women. Dwelling houses around the project area are scattered and is difficult to supply electric to each household. In the relocation process, it will be advantageous to build dwelling houses near to each other so that communities will have access to electric power. Relocation activities shall consider formation of villages in the new relocation sites.

Occupational Health and Safety

The anticipated major occupational health and safety impacts are:

- ✦ **Geothermal gases:** Exposure mainly to H₂S gas may occur during non-routine release of geothermal fluids (for example, pipeline failure),
- ✦ **Confined spaces:** Entry into confined space by workers and the potential for accidents may vary among geothermal facilities,
- ✦ **Heat:** Exposure to heat occurs during construction activities and non-routine cases which include potential blowout accidents during drilling,

- ✚ **Noise:** Its main sources are related to well drilling, steam flushing and venting. Other sources include, equipment related to pumping facilities, turbines and temporary pipe flushing activities. Temporarily noise level may exceed 100 dB during certain drilling and steam venting activities.

Community Health and Safety

The anticipated major community health and safety impacts are:

- ✚ **Exposure to hydrogen sulphide /H₂S/:** The potential exposure to members of the community should be carefully considered during the planning process and necessary precautions implemented.
- ✚ **Infrastructure safety:** Communities may be exposed to physical hazards associated with the wells and related pipeline networks. Hazards may result from contact with hot components, equipment failure, or the presence of active and abandoned well infrastructure which may generate confined space or falling hazards, transporting of machineries, installation of the drilling machine will cause accidents /incidents.
- ✚ **Impacts on water resources:** The extraction, re-injection and discharge of geothermal fluids may affect the quality and quantity of surface and ground water resources.

Noise

There will be noise arising from geothermal fluid escaping from the drilling of twenty wells, working noise, well testing and vibration are the potential noise sources of the project. These noise sources deemed to have an impact on the environment and surrounding community.

Hazards/ Risks

This impact might affect human health and the natural environment and the reasonable project scenarios (cause and effect) that might result in damage to health, the environment or the financial viability of the project.

The risks expected from the drilling of geothermal wells are spill of chemicals (used oil and lubricants), unsafe working condition during drilling (fall from above, hit by objects, etc).

Incidents /accidents might arise due to increased traffic during transporting of materials and personnel.

Sexually Transmitted Infections /STIs/

The major impacts on health and safety are related to the work force engaged in the drilling of the geothermal wells.

Communicable diseases like sexually transmitted infections (STIs), hepatitis, malaria, etc can easily spread around the construction areas.

The influx of migrant labour to the drilling areas and the interaction with the local people can cause tensions and opportunities for the spread of communicable diseases in the area.

HIV/AIDS

The Ethiopian Government issued a policy, which calls for an integrated effort involving a multi-sectoral response, to control the epidemic. The Ethiopian Government's HIV/AIDS policy urges communities at large, including government ministries, Woreda level government institutions and the civil society to assume responsibility for carrying out HIV/AIDS awareness and prevention campaigns.

In line with this policy, EEPCo has taken the initiative to develop and implement an HIV/AIDS awareness and prevention strategy. The strategy will comprise three phases:

- (a) Awareness creation campaign for EEPCo's management personnel,
- (b) Awareness creation, educational program and campaign to be organized for EEPCo district and project staffs (2,000 persons); and
- (c) Continuation and consolidation of awareness creation and education program and campaign for domestic and international contractors and their work force.

The overall objective of the EEPCo's HIV/AIDS awareness creation strategy is to contribute reducing HIV/AIDS infection and incidents. This will not only contribute to strengthening national efforts to halt the epidemic but also support international initiatives to stop the spread of the disease.

Operational Objectives

The operational objectives are:

- ✚ To promote continuous sectoral, gender related information, education and communication (IEC) messages about HIV/AIDS infection, protection, counseling and care;
- ✚ To increase availability and accessibility of condoms;
- ✚ To establish a sectoral policy that will safeguard human and civic rights and avoid discrimination of EEPCo staff who are infected with HIV/AIDS;
- ✚ To contribute to the national efforts in establishing indicators that will ensure effective monitoring and evaluation.

EEPCo's strategy on HIV/AIDS was prepared in 2005 and following its preparation, a number of workshops were held to familiarize its staff with the objectives of the strategy. EEPCo has now received funding support from the National HIV/AIDS Prevention and Control Office for the implementation of the HIV/AIDS strategy.

In the Woreda, institutions engaged in the prevention of the disease are Ziway health centre, Adami Tulu clinic and other private clinics.

To decrease or minimize the spread of HIV/AIDS, the Woreda HIV/AIDS Office is working on community communication, inheritance of brother's wife after his death and awareness creation among the population.

However, due to immigration of workers from other parts of the country, it will pose a threat of spreading the disease.

Substance Abuse

A large construction labour force comprising primarily of young men living away from their families, with rather stable wages and ideal time, with few recreational pursuits and no domestic responsibilities, can often lead to the overindulgence of alcohol. This can lead to abuse, fighting and injury, particularly if women are involved. Men who live in the area who work in the drilling of the geothermal wells return home in an inebriated state and can abuse and injure family members and generally can cause a good deal of domestic upheaval. The problem of alcohol abuse must be explained to workers as part of health education program. Recreational facilities shall be made available at the camp and additional activities should be a normal part of camp living.

Severe penalties for drunkenness and disorderly behavior must be given out along with the provisions of counseling services for substance abuse.

Polychlorinated Biphenyl (PCBs)

The problem of PCBs chemical is significant. It poses major and increasing health threat to human being and environment. In the Stockholm Convention of 2001 (to which Ethiopia is a signatory), PCBs are one of the twelve Persistent Organic Pollutants (POPs) to be eliminated from production for use in transformers and capacitors.

Gender Issues

Most of the constraints in the project area are related to cultural, social, economic, legal and environmental factors and affect both genders. However, the magnitude of the problems is found to be critical when it comes to women. It is known that rural women have total responsibility for fetching water and collecting fuel wood. The availability or non-availability of these resources within a reasonable walking distance is of particular interest to women. Therefore, the depletion or total degradation of natural resource has adverse effects on women's status. Ecological disturbance, deprivation of water supplies and other related environmental damage expose the rural women to excessive hard work and destitution. Presently, employment opportunity should be given to women on equal basis as male.

Vulnerable Groups

Vulnerable groups include women headed households, households victimized by HIV/AIDS that are headed by children, households made up of the aged or handicapped and whose members are socially stigmatized (as a result of traditional or cultural bias) and economically underserved.

However, during the recent ESIA study in and around the project area, there are no vulnerable groups which need special assistance.

Health Effect of Electro Magnetic Fields (EMF)

Electro-magnetic fields (EMF) are invisible lines of force that surround any electrical device. Power transmission lines, electrical wiring and electrical equipment, all produce

EMF. There are many other sources of EMF as well. Electromagnetic fields are produced by voltage increase in strength as the voltage increases.

Most electrical equipment has to be turned on i.e., current must be flowing for any magnetic field to be produced. Electric fields are often present even when the equipment is switched off, as long as it remains connected to the source of electric power. Electric fields are shielded or weakened by materials that conduct electricity - even materials that conduct poorly, including trees, buildings and human skin. Magnetic field, however, passes through most materials and is therefore more difficult to shield. However, both electric fields and magnetic fields decrease rapidly as the distance from the source increases.

The World Health Organization (WHO) has concluded that “despite extensive research to date, there is no evidence to conclude that exposure to low level electromagnetic field is harmful to human health” (*Ethiopia – Sudan Power System Interconnection ESIA, 2005, P.62*). This project, however, do not pose any threat as it mainly engages in drilling of geothermal wells.

The table below briefly summarizes the potential implementation risks and challenges, and mitigation actions to address them.

VI.2. Impacts on Biological Environment

Flora

Ethiopia has a rich biodiversity with a high proportion of endemic species (those that are only naturally present in Ethiopia). Owing to the long history of agriculture coupled with the degradation of the environment, Ethiopia is still one of the 12 Vavilov centers of crop genetic diversity. The Ethiopian flora is estimated to contain nearly 7,000 species of higher plants, of which 125 are endemic. Ethiopia is the center and origin for various crop species including *Coffee arabica*, *Teff*, *Enset* and *Sorghum* (*State of the Environment Report, Ethiopia, August 2003*)

The drilling of the proposed geothermal project will have negative impact on biological environment, albeit localized, minimal and easily to be mitigated. The main source of impact will be the clearance of vegetation for the preparation of foundation pads and evaporation ponds, which causes minimal habitat loss.

As observed during field survey, the project impacts some bush /shrubs located near the hill side, consisting of *Acacia* species, *Ficus* species, *Cordia africana*, etc. However, the affected vegetation area would be minimal. These species are not threatened, endangered; they are found abundantly in the vicinity of the project area and beyond its boundary of influence. But, it is still very important to carry out compensatory reforestation activities in collaboration with concerned sector offices to plant any highly disturbed, sensitive and open areas, in order to maintain the ecosystem as a mitigation measure to the lost woody biomass.

Furthermore, during field survey, no threatened or endangered species, or endemic tree species were found in the proposed drilling deep geothermal well sites.

Fauna

During field assessment, it was confirmed that most of the vegetation are already heavily degraded and deforested due to expansion of cultivated land. As a result, the wild life resource in the project area is less due to habitat loss except in the mountain or hills all around the project site. Some of their shelters /habitat would be exposed to the noise and they will be forced to evacuate the site or be exposed to illegal hunting.

Impact on Birds

Various migratory birds are considered endangered as they visit fifty sites in Ethiopia every year (*according to, Ethiopian Wildlife and Natural History society, there are 69 sites so far registered as important bird areas in Ethiopia*).

However, in the study area, there is one known migratory bird route i.e., through the Great Ethiopian Rift Valley, where the proposed geothermal power station is to be constructed. Furthermore, the wetlands around the lakes are very far away from the project site, which will not cause any hindrance to migratory or endemic bird species.

Impact on National Parks and Forest Reserve /Protected Areas

The rich wildlife areas today are mostly assigned as National Parks or natural reserve areas.

However, about 40 km south west of the project area, there is the *Abidjiatta-Shalla* National Park, which is designed as a national park for flamingo and pelican sanctuary, which of course will not be affected by the proposed geothermal power project.

This project will not affect any protected /forest reserve areas.

Impacts on Wetlands

Wetlands occur in many different forms and serve vital functions, including storing runoffs, regenerating ground water, filtering sediments and pollutants and providing habitat for aquatic species and wildlife. In general terms, any construction activity can damage wetlands in: (a) heavy machinery can crush wetland vegetation and wetland soils, (b) wetland soils, especially very peaty soils can be easily compacted, increasing runoff, blocking flows and greatly reducing the wetlands water holding capacity, (c) the construction of access roads can change the quality or direction of water flow, causing permanent damage to wetland soils and vegetation, (d) construction and maintenance equipment that cross wetlands can stir up sediments, endangering aquatic life, (e) clearing forested wetlands can expose the wetland to invasive and shrubby plants, thus removing habitat for species and (f) vehicles and construction equipment can introduce exotic plant species with few natural controls, these species may out-compete high quality native vegetation, destroying valuable wild life habitat.

The two lakes, one to the north (Lake Ziway) and another to the south (Lake Langano) whose shore has wetlands are located very far away from the proposed project site, hence there will be no wetland and there will be no impact.

VI.3. Impacts on Physical Environment

Land Use

The proposed drilling of deep geothermal wells will have an impact on the existing land use both temporarily and permanently.

Totally, about 1 ha of agricultural land, that is, 8,000 m² for the preparation of one foundation pad and 1,600 m² for one pond will be affected during the drilling.

The impact on grazing land is found to be quiet minimum and not significant as cattle can graze on the hillside and mountains where there is abundant grazing land.

Soil

The soil in the surrounding area is formed from the weathering of the acid very young pyroclastic rocks and is mainly grey soil with low fertility. During foundation pads and ponds excavation, soil will be exposed to particularly erosion.

Air Quality

Besides creating noise, from the very nature of the project, there are emissions that will be released to the atmosphere. The contents of the emission according to the information gathered during the field assessment, 99% steam and the left 1 % constitute of CO₂, H₂S, ammonia and other non-condensable gases

The dust arising during the proposed construction activity and vibration, air pollutants released from mobile construction equipment could also have potential impact affecting the air quality on the immediate project area. Any dust associated with construction activities would be short term, lasting only through the drilling phase of the project.

Water Quality

Disposal of the drilling effluents into evaporation ponds has the potential to contaminate the shallow ground water from the drilling fluid chemicals, caustic soda and bentonite mud. Since there are no rivers /streams, springs or water wells for use in the proposed project area, hazards to be posed to people due to contamination or discharge /sludge are not foreseen. Therefore, there is no project impact on the water quality.

However, during drilling, the machinery uses water which will come out as sludge/ effluent to the surface shall be confined and collected in enclosed ponds with its wall covered with plastic linings.

VI.4. Positive Impacts

Ethiopia is a developing country with very low income per capita, the proposed project will stimulate economic growth of the country, by providing power supply to areas where electrical energy were not supplied before and reduce power outages through connecting more households and institutions to the national grid.

By ensuring more regular and sustainable supply of electricity, it will contribute to an improvement of the living standard of the population and reduce poverty through energy mix (geothermal, hydropower, wind, etc.).

The most immediate benefit the local people get from the project will be in the form of temporary employment opportunity by recruiting local labor. The proposed geothermal energy development would encourage investors to invest in the region, ultimately creating more job opportunities.

Moreover, there will also be a temporary surge in the economy during the construction phase as new markets and services will develop in the area to provide goods and services for the workforce.

There will also be improvement in rendering social services, like health institutions, education, etc.

Besides, supplying electricity to rural towns and villages, it will replace/reduce the consumption of woody biomass and petroleum products that is used currently for cooking, lighting, etc.

The environment improving effect of this project is the reduction of carbon dioxide emissions from electricity generation using renewable geothermal energy comparing with other fossil firing power generation.

As the economic activity grows, there will be high demand for electricity, for example, in the agricultural sector for (irrigation pumps, poultry farming, animal husbandry, preservation of food products), in the commercial sector for (shops, bars, restaurant, etc.), in small and medium industries for (flour mills, oil mills, rural water supply installations, tanneries, coffee processing plants, etc.), in the residential sector for (lighting, heating, cooking, etc.) and in the health sector for (pharmacies, clinics, health centers, hospital activities, sterilization of medical equipment, cold storage of vaccines, etc.).

The easy and sustainable access to electric power supply in villages and towns would ease the burden on women.

It is assumed also that for irreversible negative impacts, appropriate compensation payment will be undertaken by EEPCo (for demolition and relocation of houses, for homestead vegetation loss, etc.). Furthermore, for temporary impacts, such as loss of agricultural products during drilling, EEPCo will pay compensation for one year's loss. Replacement of imported fuel by the indigenous resource, geothermal energy, will save foreign currency.

In addition to the above mentioned issues, it is likely to have the potential for carbon trade among other positive benefits.

VII. MITIGATION MEASURES

VII.1. Socio-Economic Mitigation

The social assessment undertaken has revealed that project activities potentially affect communities living around the project area. Main impacts are associated with impacts on farm land, dwelling houses, noise emission above the threshold level which will potentially affect people living near the drilling sites. It is recommended that households near the drilling sites and along the 13 KM transmission line from the proposed power plant to Adami Tulu substation should be relocated and damage to properties shall be compensated. The exact number of households to be affected by the geothermal resource development is not known at this stage, due to the fact that, the exact location of the 20 deep geothermal wells as well as the 13 km 132 kV transmission line is not known. Following the World Bank policy and procedure, it is recommended to prepare Resettlement Policy Framework (RPF) for Aluto Geothermal Power plant Expansion Project Phase III.

Impacts on the community likely to happen and Socio-economic survey shall be made by competent social expert and Resettlement Action Plan or Abbreviated Resettlement Action Plan (as it is appropriate) shall be prepared.

Compensation for Loss of Crop

The project proponent should ensure that appropriate measures are taken to ensure that affected persons are compensated in accordance with the principles and procedures and the national proclamation on compensation and land appropriation (Proclamation No. 455/2005). Any permanent loss of crops due to the geothermal resource development need to be identified and project affected persons (PAPs) compensated prior to commencement of geothermal plant construction activities.

Valuation Committee Formation

In order to compensate and value property lost / residential houses, annual and perennial crops/ due to project activities, a committee should be formed which will handle the appropriation of land and compensation issue according to Proclamation No. 455/2005 and Regulation No.135/2007.

Land

Depending on the availability of land, permanently cultivated land and grazing pasture lost to the Project will be compensated on a land for land basis.

Land temporarily expropriated should be compensated for and returned to the right owners immediately after demobilization. If there would be project delay and the land return schedule accordingly delayed, compensation should be effected for the prolonged time.

For those whose land holding is very small and could not re-establish their houses and farming activity within their previous holdings, the Woreda administration shall arrange for a replacement land for the Project affected persons. A detailed process for compensation is included in the entitlement matrix of the resettlement policy framework prepared for the project.

Education

One school located at Golba Aluto which might be affected, will be rebuilt in consultation with the affected people on appropriate location.

Health and Safety

Occupational Health and Safety

The mitigation measures recommended for “*geothermal gases*” are:

- ✚ Installation of H₂S monitoring and warning system,
- ✚ Development of contingency plan for H₂S release events,
- ✚ Provision of facility emergency response team and workers in locations with high risk of exposure, with personal H₂S monitors, self-containing breathing apparatus,
- ✚ Provision of adequate ventilation,
- ✚ Development and implementation of a confined space entry program for areas designated as confined spaces, and
- ✚ Provision of workers with a fact sheet or other readily available information about the chemical composition of liquid and gases.

Mitigation measures for “*confined spaces*” is to set alarm threshold for facility or personal H₂S monitors should be set well below the recommended safety standard based on the advice of Occupational Safety Specialist.

The mitigation measures to “*heat exposure*” are:

- ✚ Reducing the time required for work in elevated temperature environment and ensuring access to drinking water,
- ✚ Shielding surfaces where workers come in close contact with hot equipment including generating equipment, pipes, etc.,
- ✚ Use of personal protective equipment /PPE/, and
- ✚ Implementing appropriate safety procedures during the drilling process.

The mitigation measures to “*noise exposure*” are:

- ✚ Use of rock mufflers,
- ✚ Sound insulation, and
- ✚ Barriers during drilling.

Community Health and Safety

The mitigation measure for exposure to *hydrogen sulphide gas* includes:

- ✚ Siting of potential significant emission sources with consideration to nearby communities (considering key environmental factors such as proximity, morphology and prevailing wind directions),
- ✚ Installation of H₂S monitoring network with the number and location of monitoring stations determined through air dispersion modeling –emission sources and areas of community use and habitation,

- ✚ Continuous operation of H₂S gas monitoring systems to facilitate early detection and warning, and
- ✚ Emergency planning involving community input to allow for effective response to monitoring system warnings.

For communities exposed to *physical hazards* associated with the wells and related pipeline networks, the mitigating measures include:-

- ✚ Placement of access deterrents, such as fences and warning signs,
- ✚ Minimizing of length of necessary pipeline systems,
- ✚ Consideration of the feasibility of subsurface pipelines or heat shields to prevent public contact with hot geothermal pipelines,
- ✚ Managing closure of infrastructure such as pipelines and access roads, including cleaning disassembly and removal of equipment, analysis of soil quality with cleanup where warranted, re-vegetation of site and blockade and reclamation of access roads where necessary,
- ✚ Managing closure of well heads including sealing well with cement, removing the well heads and backfilling depression around the well heads, as necessary, and
- ✚ As a precautionary measure, safety and health standard manual shall be used in work place and for the community living around the project area.

Noise

- ✚ It is recommended to relocate people living near the drilling well sites with a reasonable distance (some 250 meters radius) from drilling sites, and
- ✚ Use of personal protective equipment /PPE/ recommended to workers.

Hazardous Material

During transporting and construction, the contractor shall comply to safely handle and store hazardous materials, seek direction from the engineer for disposal of hazardous material, clean up spills of hazardous materials immediately, suppress fires on or adjacent to construction or ancillary sites and in case of spill, relevant departments will be informed at once and deal with it in accordance with the spill contingency plan.

PCBs chemicals

Strict procedures would be followed to order supplying companies and import of PCBs free transformers, capacitors and other electrical equipment.

Health

All the three health posts are located far away from the proposed project site and will not be impacted by the project.

Dust /Air Quality

The drilling of the geothermal wells would also have short term adverse effect on air quality due to dust emissions and gas particles (CO₂, H₂S, ammonia and other non-condensable gases) which escapes from the drilling activity.

Heavy trucks and other vehicles delivering materials shall be covered to reduce spills and dust blowing off the load throughout the construction period.

The air quality should be monitored according to the standard set.

Watering of roads and control of traffic speed limit will be undertaken by the contractor to minimize dust arising from access roads during construction.

Noise and Vibration

During the construction period workers should wear ear muffers and other safety equipment /PPE/. Noise level shall be kept low and monitored according to the limited standards.

Machines and vehicles shall be maintained regularly to keep noise at a minimum.

Sexually Transmitted Infections (STIs) and HIV/AIDS

There should be an aggressive approach to fight against STIs and HIV/AIDS through health education programs, control informal sector activities near the project to the workers and surrounding communities during construction. The local administration should play vital role in controlling informal sector activities near the project camp and the contractor is expected to provide free condom to construction workers.

Electro Magnetic Fields (EMF)

Most electrical equipment has to be turned on, that is, current must flow for any magnetic field to be produced. The World Bank has concluded that “despite extensive research to date, there is no evidence to conclude that exposure to low level of electromagnetic field is harmful to human health” (Ethiopia – Sudan Power System Interconnection ESIA, 2005, page 62). Keeping some distance between the residents and the project can help the impact of EMF. Hence, there is no health threat because of EMF due to the project.

Substance Abuse

The problem of substance and alcohol abuse must be explained to workers as part of health education program and given due emphasis to be strictly followed by each employee.

Recreational facilities shall be made available at the camp and additional activities should be a normal part of camp living. Severe penalties for drunkenness and disorderly behaviour must be given along with the provisions of counseling services for substance abuse.

Gender Issue

It is known that rural women have total responsibility for fetching water and collecting fuel wood. Customary and traditional practices prevent women from controlling and inheriting

land and other resources on an equal footing with men, which is not the case in Ethiopia nowadays.

Ethiopia recognizes that, failure to capture women's contribution may lead to inadequate consideration of their needs for income, training, credit and technology during project development.

Equal employment right has to be given to women as that of male during the implementation of the project.

Vulnerable Groups

Vulnerable groups include women headed households, households victimized by HIV/AIDS that are headed by children, households made up of the aged or handicapped whose members are socially stigmatized (as a result of traditional or cultural bias) and economically underserved groups. Vulnerable groups shall be identified during the socio-economic survey and special assistance need to be given.

Protection of Cultural Heritage

During the recent ESIA study, there are no cultural, historical, religious and archaeological sites which will be affected. When there is "*chance findings*" the contractor will immediately inform EEPCo on such findings and the Authority for Research and Conservation of Cultural Heritage (ARCCH) will be informed for further investigation.

The following are procedure when "*chance findings*" occurs:

- a) Upon discovery of ancient heritage, relics or anything that might or believed to be of archaeological or historical importance during the execution of works, immediately suspend the work and report such findings to the supervising engineer (SE) so that the appropriate authorities may be expeditiously contacted for fulfillment of the measures aimed at protecting such historical or archaeological resources.
- b) The contractor shall take the necessary measure for preventing that any person or equipment may damage the article or things and shall provide barricades, fences and signals, if necessary, protect against atmospheric agents, as directed by the engineer. Also guard service may be required by the engineer.
- c) The supervising engineer (SE) shall take the following measures:
 - ✚ Notify to the Project Office of EEPCo,
 - ✚ EEPCo will notify the relevant Regional Department of antiquities and ARRCH,
 - ✚ Request for representative to make site inspection,
 - ✚ Secession of work in the vicinity of the finding until the visit by ARCCH representative, and
 - ✚ Decision by the department of antiquities on possible salvage or excavation within 48-72 hours of notification,

Hazards /Risks

Risk of accidents /incidents will be heightened with any construction activities. Apart from the regular training on health and safety, working staff should be sensitized on how to work within varying ecological and social areas.

Occupational health and safety standards and guidelines /method statement/ for the project should be prepared at the early stage by the contractor. These standards and guidelines shall be made part of contract document to be signed with the contractor.

First aid kits, warning tapes and safety belts, etc., should be provided to the workforce. In case of any accident, there should be a referral health where patients should be treated.

In general, all work operations should be considered in a systematic manner to reduce the short term and long term risks to health (disease, injury and death) of the work force.

VII.2. Mitigation of Biological Impact

Flora

The proposed project site has bush land, grassland, shrub land, rock outcrops and barren land. The implementation of the drilling activity will be undertaken in a cleared site. Some disturbance will be expected to the vegetation in the process of foundation pads and ponds preparation. However, it is unlikely that any sensitive floral species will be affected. It is therefore, necessary to plant indigenous species of plants around the camp and other disturbed area and the removal or cutting of unnecessary vegetation shall be avoided.

Fauna

During recent ESIA study, it is confirmed that most of the plain or farmland area are already heavily degraded and deforested due to the expansion of cultivation land. There is still wildlife habitat in the mountains surrounding the proposed project site. The drilling of deep geothermal wells being located in a small plot of land, its impact on wildlife is minimal.

Birds

There are some species of birds as indicated in the base line data. The proposed project does not cause any kind of threat to either the indigenous types nor to the migratory birds. The migratory birds are assumed to pass over the Ethiopian Rift valley.

The reason for not causing any threat is that, the project site is far from the Lakes (Ziway and Langano), so there will be no impact on birds.

National Parks /Protected Areas

The only national park located near to the project site is Abidjatta-Shala National Park, located some 40 km south of the project site, which serves as flamingo and pelican sanctuary. It will of course not be affected by the proposed drilling geothermal wells.

Wetland

There two lakes, one to the north (Lake Ziway) and another to the south (Lake Langano) whose shore have wetlands, located very far away, 14 and 18 km, respectively, from the proposed drilling site, hence there will be no impact on wetlands.

VII.3. Mitigation on Physical Impact

Land use

The project site is located in the mountains and plain farm land of Aluto. During the assessment, it is observed that the plot of land where the drilling is to be undertaken is the surrounding area already owned by EEPCo. At present, there are eight drilled wells and the new drilling site will be near the existing drilled wells. The project will pose insignificant threat on land use of the area due to the fact that most potential sites are on mountainous and bush land areas.

Soil

Some soil disturbance will inevitably occur during the construction phase but this can be minimized by re-vegetating and landscaping the disturbed area as soon as possible so that soil erosion does not take place.

The soil in the project site will be contaminated with used oil, excavation sludge, construction waste and debris generated, temporarily.

The used oil should be collected in barrels and be disposed of according to the supervising engineer's approval.

The excavation sludge and construction liquid waste should be collected in an evaporation pond and should not spill over the bund of the pond. It should be regularly collected and dumped in the appropriate site chosen by the Supervising Engineer (SE).

The solid waste collected from the work site and camp should be collected in covered barrels / dust bins and dumped in the dumping site or burned.

After the completion of the drilling process, the contractor has to reinstate /landscape the site to its previous state not to have any aesthetical and soil erosion impact.

Air quality

The air quality of the site will be impacted by the steam escaping and coming out of the wells during drilling. The composition of the fumaroles that is escaping from the wells is 99% steam and the rest 1 % constitutes CO₂, H₂S, Ammonia and other non-condensable gases. Because of extremely little amount of CO₂ in the steam and total re-injection to the ground of the high temperature water, geothermal as a renewable energy source is very friendly to the environment in comparison with the fossil fuel energy source (diesel power).

Monitoring of the amount of the pollutants to be released shall be conducted in order not exceed the thresh hold value at any time. Concentration of the sulfide in the surrounding air

above the standard value is not expected, since the project area is an open space with adequate winds to disperse the emissions.

Vehicles delivering soil material shall be covered to reduce spills and vehicle speeds shall be limited to minimize the generation of dust.

Water quality

There is no river /stream or well in the proposed project area. Therefore, there is no threat to any natural water body. The only threat is when the sludge and excavation wastes spill over the bund and contaminate the runoff water. This needs thorough supervision by the SE not to occur frequently and if it happens, the contractor has to take the necessary remedial action by his expense.

Table 19:- Potential Impacts and Mitigation Measures

Potential Environmental and Social Impacts	Proposed mitigation measures	Implementation /Monitoring Responsibility
Vehicles transporting equipment and materials will raise dirt and dust clouds	Use Environmental and Social clauses for Contractor	Contractor / EEPCo
There will be noise emitted from geothermal fluid escaping from the drilled wells; working noise and vibration are only temporary, and thus deemed to have an impact on the environment and surrounding community.	-Workers should wear ear mufflers and other safety equipment /PPE/. -To relocate houses that are found near the drilling well sites with a reasonable distance	Contractor / EEPCo EEPCo
Excavation sludge, construction waste and debris will be generated	Prepare appropriate methods for disposal and prepare dumping site	Contractor / EEPCo
Civil engineering work will generate waste soil.	Reduction of the volume and appropriate disposal	Contractor / EEPCo
Excavation of deep wells will use surface water/ground water which may affect the surface or underground water level.	-Strictly use of circulating water during excavation from the existing ponds only. -Sedimentation ponds should be prepared in order to keep the sludge not to flow on agricultural and grazing land.	Contractor
Drilling of geothermal wells could cause some unsightly changes in the topography.	-Use appropriate dumping site -Restore /landscape the site after the completion of construction activity.	Contractor / EEPCo
Bare ground will be exposed due to pad and pond preparation during well drilling.	Use Environmental and Social clauses for Contractors	Contractor / EEPCo
Fauna may be temporarily affected by noise during the construction period.	Use Environmental and Social clauses for Contractors	Contractor / EEPCo
Flora will be affected during excavation	Re-vegetation of affected sites	Contractor
Impacts on cultural heritage	- Inform concerned authorities when there are any “ <i>chance findings</i> ”.	Contractor / EEPCo
Degradation of air quality	Should not exceed threshold value	Contractor
Affected residential houses and crop land	Compensation payment	EEPCO
Community health and Safety	Apply Community health and Safety mitigation measures	Contractor / EEPCo
Occupational health and Safety	Apply Community health and Safety mitigation measures	Contractor / EEPCo

VIII. PUBLIC CONSULTATION AND DISCLOSURE

During the field assessment, various “Information Dissemination and public consultations meetings” were conducted with the affected communities, sector offices and local Administration Officials.

VIII.1. Why Public Consultation: Objectives

Public consultations were held with PAPs, community elders and local officials with the following key objectives, among others:

- ✚ To inform the PAPs about the project and discuss on the nature and scale of adverse impacts on their livelihood in a more transparent and direct manner and seek their participation in the project cycle.
- ✚ To give PAPs and affected communities a chance to have a say and express their views in the planning and implementation of the drilling activity that will affect them directly.
- ✚ To obtain qualitative as well as quantitative information on viable income generation and livelihood interventions which PAPs could engage themselves, in order to restore their income and livelihood in a self -sustaining manner.
- ✚ To inform local authorities of all the potential impacts, agree on a cut-off-date, solicit their views on the project and discuss their share of the responsibility for the smooth functioning of the overall project operations.

VIII.2. Consultation Methodology

Consultation was carefully planned and conducted in such a way that it ensures efficiency and effectiveness in covering key issues both from the PAPs and communities on one hand and the project on the other. Consultation was carried out with PAPs, community elders and with local officials at Woreda and Kebele levels.

VIII.3. Major Findings of Public Consultations

During public consultations with PAPs and community groups, a number of important points were raised and discussed. Key agenda that were forwarded for discussion with PAPs and community groups include both positive and negative impacts of the project on local community members, issues regarding compensation payments and related problems from the Phase II experience (Drilling of Four Geothermal Wells) availability of skills and opportunities for employment, income and livelihood restoration schemes were main issues. Since the details of the consultations are too wide ranging and broad to be presented here, only a summary of key issues discussed and major findings are sub-divided into relevant categories and presented in the section below.

These broader categories into which key findings of consultations are regrouped include anxiety, fears, uncertainties, preferences, needs, demands, reservations, expectations, hopes, aspirations, general comments, commitments, appreciation and questions for clarification.

Public consultation and participation is not an event and is a continuous process which identifies and discusses key issues and impacts of the proposed project. Views from local

residents, local leaders, institutions and development partners who in one way or another would be affected or have interest were sought through interviews and public meetings.

Public participation includes both the information exchange (dissemination and consultation) and collaborative forms of decision making and participation. Dissemination refers to transfer of information from project authorities to the affected population. While consultation generally refers to joint discussion between project authorities and the affected population serving as a linkage for transfer of information and sharing of ideas. Public participation is an ongoing process throughout the implementation of the project not an event. The level of information which is disseminated or the issues on which consultation takes place vary with the progress in the project process.

Environmental and social assessment was conducted in three ways, namely, (i) focus group and key informant interviews and discussions, (ii) field surveys and observations and (iii) public meetings.

The public consultation was conducted at the project site from May 27 to June 2 /2013.

The team has also conducted various meetings on similar issues with different Woreda sector offices such Woreda Administration, Agricultural, Health, Education, Culture and Tourism offices, Water Resource and HIV/AIDS secretariats. Discussion was also conducted with EEPCo's Project office (Aluto Geothermal Power Plant construction Project, Phase III) and Geological Survey of Ethiopia (GSE).

In all the meetings, the discussions were focused on the following major issues:

- ✦ Dissemination of information about the project and potential positive and negative impacts,
- ✦ Description of the project's impact on the existing bio-physical environment and socio-economic conditions,
- ✦ The predicted negative and positive impacts during construction, operation and maintenance phases,
- ✦ The possible mitigation measures to be undertaken especially during the drilling of the geothermal wells,
- ✦ Attitude of community, local government officials and technical personnel towards the project.

VIII.4. Meeting Held on May 31, 2013, 10:30a.m.

Meetings held in two separate places are:

1. The first meeting was held with communities living in Abeyi Deneba and Aluto Kebeles, attendance: 31 participants
2. The second meeting was held with Golba Aluto Kebele, attendance: 88

Agenda

- ✦ Introducing the assessment team,
- ✦ Purpose of the meeting,
- ✦ Briefing on the Drilling of deep geothermal wells at Aluto,
- ✦ Positive and negative impacts of the Project,

- ✚ Discussion on mitigation measures, and
- ✚ Discussion on mode of compensation, grievance procedures, etc.

Briefing on the Aluto Geothermal Power Plant Expansion Project, Phase III

After introducing the assessment team and explaining the purpose of the meeting, the assessment team has discussed the positive and negative impacts of the project with the project affected people (PAPs).

On the positive side, the contribution of the project to socio-economic development of the country was discussed. The potential negative impact of the project on houses and crops that are found near the drilling site, power plant and transmission line constructions and the corresponding mitigation measures, valuation methods and grievance redress mechanism were discussed during the meetings.





Meeting held with Aluto and Abeyi Deneba Kebele residents.

Views of the Community on the Project and Raised Issues

Communities in the two Kebeles namely Abeyi Deneba and Aluto, participated in the meeting where several issues were raised and discussed.

- ✚ The Aluto Geothermal Power Plant Expansion Project, Phase III will increase the capacity of the power plant and this will greatly contribute to the country’s socio-economic development therefore PAPs will support the Project
 - ✚ Participants have asked whether additional land required for the Phase III project and specific location of land required by the project. The ESIA assessment team has explained that additional land is required for the Phase III Aluto Power Plant Expansion Project components. The main project components that require land are drilling of deep geothermal wells, the power plant construction, transmission line construction from Aluto proposed power plant to Adami Tulu Substation, and access road. It is further explained that compensation will be made to affected houses, crops and substitute land will be given to those who lost much of their land.
- Discussion was also been made on the experience of the Phase II project (Four deep geothermal well drilling) where some farmers get it difficult to handle large sum of money and lack of know how or experience in trade or other business. To solve the problem, using banking system, training, business consultation and skill development shall be organized in the Phase III Aluto Geothermal Project.
- ✚ Though electric power is generated from the Aluto Langanu pilot power plant, the community around the power plant does not get electric power. During the discussion, it is explained that the problem was the scattered settlement pattern in the area which make it difficult to supply electric power.

- ✦ Steam and excavation sludge that come out of the geothermal wells are damaging crops and water (the effluent coming out of LA 4 geothermal well is contaminating drinking water). Solution is required for the problem. It is explained that the project office will be informed about the problem and solution will be sought.
- ✦ We were told to get job opportunity for the three Kebeles in the project construction but the promise was not kept.
- ✦ The community expect Infrastructure like schools, electric light service, drinking water, from the project
- ✦ Some other issues related to compensation payment, replacement of land, in the Aluto Phase II Project has been discussed.

Views of Communities at Golba Aluto Kebele

Communities at Golba Aluto Kebele, participated in the meeting and several issues were raised and discussed.

Participants raised questions on different issues and expressed their expectation in terms of benefits from the project in relation to the project impact.

The following are the issues raised and discussed with community members:

- ✦ There is a problem flood at Golba Aluto Kebele because of the road structure. The problem could not get solution. The Woreda Administration took the issue to EEPCo,
- ✦ The area around the project does not have electric power. The school in particular do not have electric power,
- ✦ We expect provision of school materials for the school in the area by the project,
- ✦ Payment for daily labourers is too small,
- ✦ Where there is a problem with the project there is no means to tell our complaint, therefore there must be some way /system to tell our problem
- ✦ There is water shortage in the area and the project could supply drinking water to the communities.





Scene from the Public Consultation meetings at Golba Aluto school compound

Discussion with the Youth

Discussion was made with a group of youngsters living around the project site concerning the proposed project. Information is given about the proposed Aluto Geothermal Power plant Expansion Project phase III, the positive and negative impacts of the project on the environment and on the surrounding community was discussed.

Views and Issues Raised by the Youth at Golba Aluto Kebele on the Project

- ✚ The Aluto Geothermal Power plant Expansion Project Phase III will contribute to the national social and economic development therefore we support the project.
- ✚ Before the power plant construction, there was no road and now we have road because of the geothermal project. However, the road has made some problems associated with rain runoff flood and this makes water logging in one part of the farm land and this makes crop damage.
Solution is needed for the problem after careful investigation by professionals.
- ✚ The steam is harming crops of the farmers and there is decrease of crop production, it also harms natural vegetation. The expansion of the project take land from farmers and this will make the farmers lose production.
Discussion has been carried out related to the nature of the area with natural steams that result in increased heat and associated impacts in the farmland. Farmlands shall be far from the geothermal wells as well as areas with natural heat.
- ✚ Discussion was made on the employment opportunity for the young living around the project area. Every effort will be made to influence the contractor to hire labour

force from the surrounding area except for positions that needs special skills.

- ✚ The problem of drinking water in the area was the other issue raised during the discussion. The assessment team has observed that there is acute water shortage in the area and the team will raise the issue on its assessment report.

Generally, the attitude towards the project is positive and local officials have expressed their willingness to support the Project in every necessary means. Participants of the meetings have agreed on the general principles of compensation payments and provision of replacement land to those who loose land and requested reasonable, adequate and timely compensation payments for their lost assets.



Scene from discussion with Young people living around the project area

(Please refer to Consultation Minuets of meeting in the ANNEX I)

Discussion with Women Group

Discussion was held with a group of women living around the project site concerning the proposed project and project Information was provided and discussion on the positive and negative impacts of the project on the environment and the surrounding community was discussed.

Views of Women Group on the Project and Raised Issues

Discussion at Abeyi Deneba and Aluto Kebeles

The following issues were raised and discussed with women group at Abeyi Deneba and Aluto Kebeles:

- ✦ During the Phase II of the Aluto geothermal project, PAPs were paid cash compensation payment. ‘We are farmers and we do not know any other job, we do not have the skill to do business rather than farming. We do not have the experience to handle large sum of money and we do not know what to do with this money’. There are elderly people who are not able to work even if large amount of money paid. Payment of compensation alone could not sustain our life. We need permanent living area and permanent solution.
- ✦ They expressed their worry that if replacement land is not available in the surrounding area near their house they have to move far away which make them away from relatives and neighbors and make their life much harder.
- ✦ We have a problem getting drinking water. We travel 13 km, about 2 hours to fetch water, we are suffering because of water. The project pump water for its drilling purpose and they can provide us water in our living area.
- ✦ The assessment team has assured them that the purpose of the discussion with women is to assess the problem women could face because of the project’s development and appropriate mitigation measures will be proposed in the assessment report.
- ✦ The steam that came out of the geothermal wells harms our farms and people living or working around the wells.



Scene from discussion with women living around the project area

Discussion with Adami Tulu-Jido-Kombolcha Woreda Administration

Discussion was made with sector offices namely, Land Administration and Environmental Protection office, Agriculture, Education and Health Office, HIV/AIDS Office, Culture and Tourism Office, Water Resource Office and Woreda Administration of Adami Tulu-Jido-Kombolcha Woreda.

Information is given about the proposed Aluto Geothermal Power Expansion Project Phase III, the positive and negative impacts of the project on the environment and on the surrounding community was discussed.



Meeting at the Woreda Administration

(Please refer to Annex II for contacted persons and organizations)

VIII.5. Positive Impacts

The following is a summary of the views of the officials interviewed:

- ✚ The Aluto Geothermal Power construction Project Phase III is essential for increasing the power generation of the country which is very important for socio-economic development of the country. Being a renewable energy with very minimum environmental impact, the geothermal project is very friendly; the Woreda Administration will support the project during the planning and implementation period in every necessary way.
- ✚ The Environment and social Impact assessment conducted by EEPCo is very essential in identifying potential environmental and social problems and helpful for the success of the project. Public consultation makes the community to be aware of the land requirement and make ready for possible relocation.
- ✚ Awareness creation is important in relation to the land requirement for the geothermal power plant construction project as well as for the geothermal drilling wells. Instruction was given to the Woreda Land Administration and Environment Protection Office and Kebele Administration to facilitate public consultation and in every other necessary information.

VIII.6. Negative Impacts

- ✦ The steam released from the geothermal wells will have negative impacts on crops, trees and community health. Mitigation measures should be proposed to tackle the problem.
- ✦ The kebeles around the existing geothermal power plant do not get electric power even though electric power is generated in the area. The schools, health posts and residential houses around the power plant do not have electrical service which is a source of dissatisfaction to the community.

VIII.7. Suggestions





- ✦ Based on the experience of Phase II Project compensation payment should be paid on time.
- ✦ Residential houses shall be relocated with a reasonable distance from the geothermal wells to avoid negative impacts induced because of the noise pollution during the drilling period and release of steam from the wells during maintenance period.
- ✦ EEPCo, through the Project Office shall provide electric power to the project area Kebeles, therefore the community will be compensated for possible negative impacts. People will also have positive attitude towards the project.
- ✦ Where ponds will be constructed to hold discharge and waste water for drilling purposes, malaria will spread. Eradication of the spread of malaria will be additional burden for the administration and therefore the project office shall support the health bureau in providing materials.
- ✦ Tree plantations by the project around the sensitive area will help to replace trees that will be damaged due to the project activity.
- ✦ There is potable water shortage in the project area. Ground Water could not be used because of its high fluoride content. Therefore, it is suggested that the spring water that is found at Golba Aluto and Aluto area can be pumped and supplied to the community.

PUBLIC DISCLOSURE

The ESIA and RPF will be disclosed in Ethiopia by making copies available at EEPCo's Corporate Communication Office at the head office of EEPCo and posted in EEPCo's website. The disclosure will also be announced locally on the Ethiopian newspaper.

The project funding agency, The World Bank will also disclose the ESIA and RPF electronically through its website prior to the processing of the project.

Summary of Potential Risks and Challenges related to social development

Potential risks and Challenges	Mitigation Action
<p>The Aluto Geothermal power plant Project requires land for Phase III activities. The project activities that require land are:</p> <ul style="list-style-type: none">  Drilling of deep geothermal wells  Power plant construction  Transmission line construction  Access Roads 	<p>The project will complete all necessary land acquisition prerequisite for the project activity in accordance with land administration of the Woreda (Local Administration) and in accordance with OP4.12. Therefore, a Resettlement Policy Framework (RPF) has been prepared and will be disclosed to ensure that appropriate measures are in place to address any issues which might arise from potential land acquisition and or restriction of access to communal natural resources under the Project.</p>
<p>Under the project, the following are the anticipated community health and safety impacts: (1) Exposure to hydrogen sulphide /H₂S/: The potential exposure to members of the community should be carefully considered during the planning process and necessary precautions implemented; (2)Infrastructure safety: Communities may be exposed to physical hazards associated with the wells and related pipeline networks. Hazards may result from contact with hot components, equipment failure, or the presence of active and abandoned well infrastructure which may generate confined space or falling hazards, transporting of machineries, installation of the drilling machine will cause accidents /incidents.(3)Impacts on water resources: The extraction, re-injection and discharge of geothermal fluids may affect the quality and quantity of surface and ground water resources.</p>	<p>The following mitigation measures will be implemented, including installation of H₂S monitoring network with the number location of monitoring stations; Continues operation of H₂S gs monitoring systems to facilitate early detection and warning; Emergency planning involving community input to allow for effective response to monitoring system warning</p>
<p>Possibility of impacting historical, cultural, archeological and</p>	<p>The ESIA indicates that there are no known historical and cultural sites to be affected by the</p>

<p>religious sites during construction phase</p>	<p>project. However, during construction, if there are any accidental “<i>chance findings</i>” of some archaeological artifacts, the contractor shall inform the EEPCo’s Project office</p>
<p>The influx of project workers from other areas during the construction phase may cause short term social concerns in the area. Such concerns might include: spread of HIV/AIDS and Sexually Transmitted Diseases.</p>	<p>The project will give priority to Health education especially on HIV/AIDS and STIs; and will recruit work forces from the project area in order to avoid any new cases coming with migratory workforce.</p>
<p>pa The experience in phase II is that community youth were not employed on site and much needed electricity supply was not extended to the community</p>	<p>The project will give priority to local hire depending on their qualification and provide basic services including water and electricity to the directly impacted communities..</p>
<p>Changing patterns in resource use, and livelihood pattern and land acquisition might result in economic displacement and conflict.</p>	<p>The project will provide affordable and accessible procedure for grievance redress, including third party settlement of dispute arising from relocation such as grievance mechanisms which should take into account the availability of judicial resources and community traditional dispute resolution mechanisms. The project will provide alternative livelihood for the PAPs that are impacted by economic dislocation</p>
<p>In Ethiopia, there is no law on benefit sharing mechanism and the communities might not benefit directly from the development objectives of the project.</p>	<p>While there is no law on benefit sharing arrangement, the constitution of Ethiopia recognizes the participation of the communities in development agenda and the project as part of its corporate social responsibility has met and discussed with the communities and other stakeholders during public consultation. The communities have requested for job opportunities, water supply, electricity connection, and adequate compensation, including land for land option. The project will continue to consult with the communities and will provide these utilities. The project will also partner will other projects in the area to provide basic services to these communities</p>

Social safeguards Screening Information:

	Social safeguards screening information	Yes	No
1	Will the project reduce other people's access to their economic resources, like land, pasture, water, public services or other resources that they depend on?		
2	Will the project result in resettlement of individuals or families or require the acquisition of land (public or private, temporarily or permanently) for its development?		
3	Will the project result in the temporary or permanent loss of crops, fruit trees and Household infra-structure (such as granaries, outside toilets and kitchens, etc.)?		
4	Will the project require excavation near any historical, archaeological or cultural heritage site?		
5	Might the project adversely affect vulnerable people (e.g., elderly poor pensioners, physically challenged, women, particularly head of Households or widows etc.) living in the area?		
For all issues indicated by "Yes", the applicant is expected to explain how he/she intends to mitigate them. Implementation of the mitigation measures will require using the complementary Resettlement Policy Framework			

IX. SYNTHESIS OF ENVIRONMENTAL IMPACT

The possible negative and positive impacts predicted were classified as very important, more important, important, fair important, and less important. They are seen in the environmental matrix table below.

The impacts identified are also discussed in the matrix table below.



Table 20: - Synthesis of Environmental Impact Matrix

No.	Environment components	Pre-drilling phase		Drilling stage activity components			Operation phase		
		Site survey	Land acquisition	Equipment and material mobilization	Foundation pad preparation	Excavation of foundation ponds	Induction influence	EMF Wave effluence	Radio interference
I	Social -economic Environment								
	▪ Residential houses	0	a	0	0	0	0	0	E
	▪ Income	0	c	E	E	E	0	0	0
	▪ Cultural and historical sites	0	0	0	c	c	0	0	0
	▪ Health & safety	0	0	c	c	c	0	0	0
	▪ Quit daily life	0	0	d	d	d	0	0	0
	▪ Society unrest	0	c	0	0	0	0	0	0
II	Physical Environment								
	▪ Soil	0	0	e	c	c	0	0	0
	▪ Air quality	0	0	c	c	c	0	0	0
	▪ Land use	0	c	0	c	c	0	0	0
	▪ Water	0	0	0	0	0	0	0	0
III	Biological Environment								
	▪ Flora	d	d	e	c	c	0	0	0
	▪ Fauna	e	d	0	e	e	0	0	0
	▪ Parks and reserves	0	0	0	0	0	0	0	0

Positive Impact

- A=Very important
- B=More Important
- C=Important
- D=Fair Important
- E=Less Important

Negative Impact

- a=Very important
- b=More Important
- c=Important
- d=Fair Important
- e=Less

O=Not important

X. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

In the context of a project, Environmental Management Plan (EMP) is necessary to avoid, minimize or offset adverse impacts, enhance positive impacts and also enhance beneficial impacts during implementation.

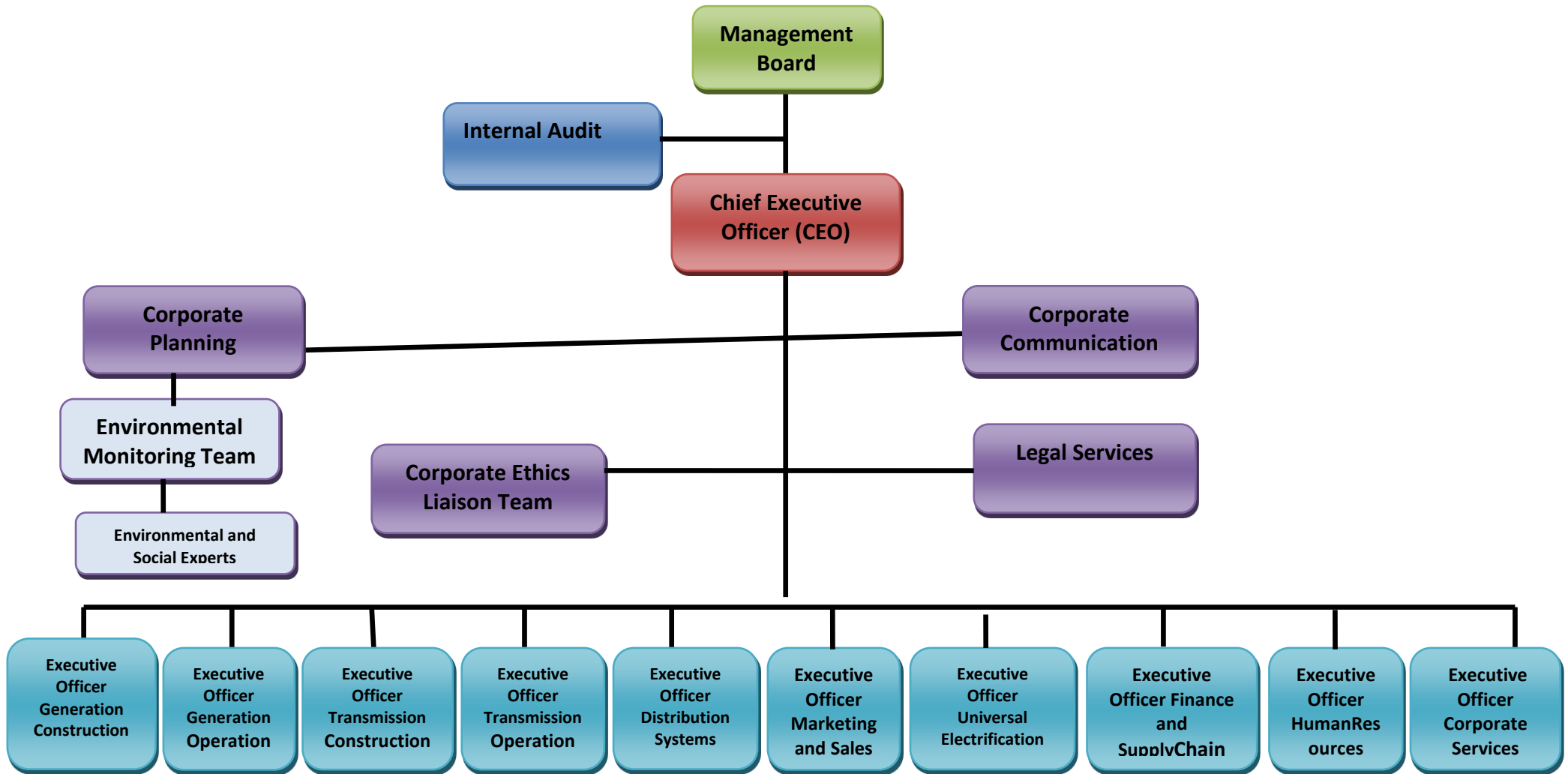
Environmental Management Plan /EMP/ must be fully integrated with the overall project management effort at all levels, which should be aimed at providing a high level of quality control, leading to a project which has been properly designed and constructed and functions efficiently throughout its life.

X.1. Institutional Arrangement

The implementation responsibility of the EMP rests on EEPCo or EEPCo's contracted representative unless noted otherwise.

To a considerable degree, construction contractors will be responsible for implementing mitigation measures but the ultimate responsibility to ensure the proposed mitigation measures properly lies with EEPCo.

ETHIOPIAN ELECTRIC POWER CORPORATION PROCESS CENTERED ORGANIZATIONAL CHART



The Ministry of Water, irrigation and Energy (MoWIE) and the newly established Ministry of Environmental and Forest (MoEF) will oversee all the environmental activities related to the project.

The Agricultural, Health and Education Offices and other stake holders will be involved with their specific responsibilities in the environmental and socio economic activities.

Their responsibilities are exercised in different stages, i.e., pre-construction, construction, and operation and maintenance phases.

X.2. Pre-Construction Phase

Prior to contractor's mobilization and commencement of drilling twenty deep wells, environmental management will be considered with the following principal activities:

- ✚ Ensure that all government and funding agency's requirements and procedures relating to ESIA are complied with.
- ✚ Ensure environmental and social considerations have been given due consideration /attention and the major clauses are incorporated in the contract document.
- ✚ Implementation of compensation payments for land or property acquisitions.

As a proponent, EEPCo will be responsible for submitting the ESIA report to the authorized body for their evaluation and comment.

X.3. Construction Phase

All the environmental management activities would be carried out during the drilling phase. All the impacts are expected to occur at this stage and the impacts to occur in this phase can be reduced or avoided through the application of sound construction guidelines.

Management is much concerned with controlling impacts that may result from the action of the contractor, through enforcement of construction contract clauses related to protection of the environment as a whole and of the components within it.

It is important to recognize that successful mitigations can only be achieved if the environmental protection measures, as set out in the construction contract are properly enforced.

X.4. Operation Phase

Environmental management and monitoring at this stage will be the responsibility of Environmental and Social Staff of EEPCo, with the implementation being carried out either by the members themselves or by contractor. Environmental and Social Staff is expected to take a general overall advisory role during the operational phase.

X.5. Socio- Economic

Compensation

EEPCo is fully committed to prepare resettlement action plan /RAP/ ARAP, as the case may be and pay full compensation for each lost item (tukuls /houses and other properties) as per the Federal Proclamation No. 455/2005. The compensation shall be completed before commencement of the drilling activities.

For the successful implementation of compensation, there will be a property valuation committee designated by the Woreda administration (i.e., the local government administration) of the specific project area. The committee would consist of different experts with relevant qualifications to value the properties thereon.

The affected households and their family members would be adequately compensated considering the assets and opportunities they leave behind and expenses that are required for the support of their livelihood.

The scheme would be fully backed by appropriate technical and administrative supports.

Residential Houses

For the residential tukuls /houses to be affected, proper compensation will be paid for each household, right before the commencement of the construction works.

The project affected households has to fully agree and accept to remove their existing tukuls from the drilling site and rebuild their new houses by themselves on their own land holdings, as soon as they get due compensation payments.

Health and Safety

Safety

The contractor is responsible to organize on site environmental management and safety trainings for the construction work force at least one month prior to the commencement of the construction. Environmental and Social Staff of EEPCo will supervise and monitor these activities.

The contractor, during the whole drilling period should regularly provide adequate personal safety equipment /PPE/ and give orientation to its employees on how and why it is used and obligatory.

The contractor and/or sub – contractors throughout the construction period, will be required to use appropriate vehicles and comply with legal gross vehicle and axle load limits. They are also required to repair damages at their own expenses.

The contractor should minimize road safety hazards and inconveniences to other road users by taking all appropriate measures during the construction period.

Public safety to PAPs may not be a significant problem since residents within the drilling area will be relocated.

Hazardous Material

During the drilling activity, the contractor shall comply with the following:

- ✦ Safely handles and stores hazardous materials,
- ✦ Seek directions from the supervising engineer for disposal of hazardous material,
- ✦ Clean up spills of hazardous materials immediately,
- ✦ Suppress fires on or adjacent to construction or ancillary sites, and
- ✦ In case of spill of hazardous materials, relevant departments will be informed at once and deal with it in accordance with the spill contingency plan and the law.

PCBs Chemicals

- ✦ Strict procedures should be followed to order companies to import PCBs free transformers, capacitors and other electrical equipment.
- ✦ As per the Stockholm Convention, most companies or manufacturers have already stopped manufacturing PCBs containing transformers and capacitors.

Health

Dust Nuisance

- ✦ Heavy trucks and other vehicles delivering materials shall be covered to reduce spills and dust blowing off the load throughout the construction period.
- ✦ Watering of roads and traffic speed control limit will be followed by the contractor to minimize dust arising from access roads during the construction period.

Noise

- ✦ During the construction period, workers in the vicinity of strong noise will wear ear muffler and masks.
- ✦ Machines and vehicles will be regularly maintained in order to keep their noise at a minimum.

Sexually Transmitted Infections (STIs)

- ✦ There should be an aggressive approach to fight against STIs, including HIV/AIDS.
- ✦ Health education should be provided to the construction work force and local communities nearby during construction period.
- ✦ The local administration should play vital role in controlling informal sector activities near the project camp and construction sites.
- ✦ The contractor is expected to provide free condoms to construction employees during construction period.

Other Infectious Diseases

The contractor during construction period should comply with the following:

- ✦ The contractor should construct pit latrines above water table at major drilling sites at each work site.

- ✦ Provide and maintain potable drinking water.
- ✦ Establish workers health check-up schedule and sewage disposal facilities at camp.
- ✦ Camps shall be located away from water source (at least 100 meters).
- ✦ Sufficient measures would be taken by the contractor in the construction camp, like provision of garbage tanks/containers and sanitation facilities, including septic tank and soak away pits.
- ✦ Liquid waste from septic tanks will be cleaned and safely disposed off periodically.
- ✦ Solid garbage will be collected in covered bins /barrels and disposed off daily.
- ✦ Make certain that there is a good drainage system to avoid creation of stagnant water bodies including water in old tires as it will create a favorable breeding area for mosquitoes and other insects.
- ✦ Provide adequate health care facilities for workers.
- ✦ Comprehensive occupational health standards established by the government would be followed by the contractor.

X.6. Bio-physical Environment

Vegetation Clearance

During the construction period:

- ✦ Vegetation clearance shall be undertaken once consent to clear a strip of plantation /individual trees along the alignment has been obtained from SE.
- ✦ Instruct all construction workers to restrict clearing to the marked areas only and not to harvest any forest products for personal consumption.
- ✦ Ensure that all clearing is undertaken with minimal disturbance to the surrounding environment with the extent of approved sites only.

Protection of Vegetation

Prior to commencing the construction activities the contractor should:

- ✦ Identify vegetation type and number that is to be removed / protected.
- ✦ Remove identified trees in such a way as to minimize damage to surrounding vegetation and damage to sensitive soil.
- ✦ Ensure the construction crew is aware of the remaining vegetation that they must not be cut or damaged.

Erosion Control Measures

- ✦ Prior to the commencement of vegetation clearing, the contractor should clearly mark the areas to be cleared. No clearing of vegetation shall be done outside these areas.
- ✦ Ensure re-vegetation at all work sites at the earliest time immediately following the construction works and select tree and grass species suitable for soil conservation purposes.
- ✦ Following the completion of works, the contractor shall prepare areas for rehabilitation by re-vegetation and landscape. It is preferred to engage local communities to plant different trees.

Water Pollution

During construction period the contractor shall train work crews in safe handling of petrochemicals and other discharges.

Waste Management

During the construction period and site cleanup, the contractor should:

- ✦ Remove disabled equipment including machineries from the area.
- ✦ Crush burn and bury all inorganic solid wastes in an approved disposal area only.
- ✦ Contain all solid wastes at designated location within construction sites only.

Reinstatement of Services

- ✦ The contractor would take all inventories of services to be reinstated prior to interruption of any services.
- ✦ Maintain or provide temporary services during construction including potable water supply.
- ✦ Progressively reinstate /landscape or repair all interrupted services and sites to their previous position.
- ✦ The SE would inspect and certify for adequate reinstatement of services.
- ✦ The contractor shall fill excavated sites with appropriate fill and finally cover with reserved top soil.

Loss of Trees

- ✦ During the clearing operation the contractor should avoid tree clearing outside what is required for construction activities.
- ✦ The contractor after completion of construction work shall re-vegetate areas that have been cleared for temporary works according to a re-vegetation action plan.

Re-vegetation

- ✦ Progressively sow all disturbed construction and ancillary site surfaces with a cover crop mix.
- ✦ Progressively implement re-vegetation works commencing in the correct planting season.
- ✦ Environmental and Social Staff of EEPCo will monitor the effectiveness of re-vegetation measures, possibly in every six months for two years.

Table21:- Environmental and Social Management Plan

Environmental Impact Issues	Mitigation Measures	Location	Timing	Responsible Organization	
				Implementation	Supervision Monitoring
Pre-Construction Stage					
<i>Land acquisition</i>	Complete all land acquisition necessary for the project activity in accordance with land administration of the Woreda (Local Administration)	Drilling Site	Before the commencement of construction	EEPCo	EEPCo
	Provide copies of land acquisition details to the SE and contractor.	Drilling site	Before the commencement of construction	EEPCo	Engineer
	Provide a list of affected land owners to the contractor.	Around the Project area	Before the commencement of construction	Contractar/EEPC O	EEPCo/ Engineer
<i>Safety and health issues</i>	Notify students, teachers, women children, the elderly and the community's at large living around the project area about the commencement of the project activity, increase of traffic movement, safety precautions, etc.	Around the Project area	Before the commencement of construction	Contractar/EEPC O	EEPCo/ Engineer
	Notify the community and schools around the project area about noise emissions.				
HIV/AIDS	Create awareness program to workers and to the community living around the project area. During the implementation the project work closely with the Woreda Health Bureau, HIV/I/AIDS Coordination office.	At the project site and around the project areas			

Health and Safety issues	Organize environmental management and safety training. All contractor and subcontractor and supervising consultant's field supervisors shall attend the training.	Drilling site	Before the commencement of construction	Contractor	Engineer
	Provide safety orientation to workers	On site	At list one month prior to commencement of construction	Supervision consultant contractor	Engineer
	Provide PPE and other gadgets to workers				
	Place warning signs wherever deemed necessary	On site	During the construction period	Contractor	
	Collection and proper disposal of waste	On site			
	Management of pollution incident	On site			
	Ensure that debris is disposed of at specified and approved dumping area.	On site	Before the commencement of construction		
	Compliance with standard health and safety regulations	On site	During construction		
	Provision of standard first aid kit at the construction sites.	On site			
	Public safety issues	Make Fire- fighting equipment available	On site	Before the commencement of construction	
Keep non- authorized personnel away from construction areas		On site			
Post warning signs wherever it is necessary		On site	Before the commencement of construction		
Begin educational programs in schools and communities. Educate people about hazards and safe practice when working and playing.		Around the project area			
Schools and other noise sensitive areas shall be notified at least 5 days before construction is due to commence.		Around the project area			

Construction Stage					
Impacts on Flora	Vegetation monitoring will be taken seriously, mainly near the drilling wells and along the steam pipes and monitoring of potential long term effect on natural vegetation will be carried out in the area.	Drilling Site And excavation sites of ponds	Before clearing of the vegetation along a section of the drilling site	Engineer	EEPCo
	The brine and condensed discharges will be deeply re-injected in order to avoid potential toxic effects on flora or soil	Drilling Site And excavation sites of ponds	Before clearing the vegetation.	Contractor	Engineer
Vegetation clearance	Inspect and approve all correctly located and pegged clearing sites. Vegetation clearance shall only be undertaken once consent to clear strip of plantation is decided. Individual trees along the alignment have been obtained from each owner.	Drilling Site And excavation sites of ponds	Before clearing the vegetation.	Contractor	Engineer
	Instruct all construction workers to restrict clearing to the marked areas only and not harvest any forest products for personal consumption.	<<<<	<<<<	<<<<	<<<<
	Ensure that all clearing is undertaken with minimal disturbance to the surrounding environment, within the extent of approved sites only.	<<<<	<<<<	<<<<	<<<<

Erosion	Clearly mark the areas to be cleared of vegetation before clearing commences. No clearing of vegetation shall occur outside of approved areas.	Within the drilling site	Prior to commencement of vegetation clearing	Contractor	Engineer
	Whenever possible, avoid unnecessary clearing, access trucks and construction camp on steep slope / productive agricultural land.	Drilling area	Prior to commencement of construction	Contractor	Engineer
	Following completion of works, prepare areas for rehabilitation by re-vegetation and engage local community in the plantation program.	Drilling sites	Immediately following completion of works	Contractor	Engineer
	Ensure topsoil is left in a non-compacted condition following completion of works.	Drilling and dumping sites	Immediately following completion of works	Contractor	Engineer
	Ensure re-vegetation at the earliest time	At all work sites	Immediately following completion of works	Contractor	Engineer

<p>Water Pollution</p>	<p>Ensure that potential sources of petro-chemical pollution are handled in such a way as to reduce chemical spills and leaks.</p> <p>Train work crews in safe handling of petro- chemicals.</p> <p>Minimize soil sedimentation as outlined under sediment control</p> <p>Put in place measures that will ensure wastage of water resources. Re-injection of water and recycling has been considered in the design to use brine for drilling to minimize obstruction.</p> <p>Accidental leakages and bursts to water supply pipe lines should be reported and repaired immediately; Recycling of water in as much as possible should be encouraged,</p> <p>Control of water flows and water consumption records must be kept and availed to the supervising engineer at the end of working days.</p> <p>All employees should be trained on water usage practices</p>	<p>At all work sites</p>	<p>Prior to commencement of construction</p>	<p>Contractor</p>	<p>Engineer</p>
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Waste management	Adequate waste management facilities should be provided and compliance is necessary	At all work sites	Throughout drilling	Contractor	Engineer		
	Contain all solid wastes at designated location within construction sites.		Throughout drilling			Contractor	Engineer /supervisor
	Crush burn and bury all inorganic solid waste in an approved disposal area.		Throughout drilling activity			Contractor	Engineer /supervisor
	Remove disabled equipment, including machinery from the area.		Throughout Drilling			Contractor	Engineer /supervisor
	Use above water table pit latrines at major construction sites.		Throughout Drilling			Contractor	Engineer /supervisor
	Compost all green or bio-degradable waste.		Throughout Drilling				
	Cleared areas should be rehabilitated with indigenous vegetation as soon as possible to restore habitat.		Throughout Drilling				
Noise issues	Workers in the vicinity of high level noise has to wear protective device	Throughout drilling activity	Throughout construction period	Contractor	Engineer		
	Use well maintained equipment (with mufflers where appropriate).						
	Use noise screens or mounds near residences, schools and health centers.						
	Carry out noisy construction activities during day time where ever possible						
	Advise local people when there will be unusually high levels of noise						

Protection of environmentally sensitive areas	Identify natural areas on site plans, especially environmentally sensitive or ecologically fragile areas.	Throughout drilling activity	Prior to commencement of works	Contractor	Engineer
	Locate construction sites/activities away from sensitive areas.	Throughout drilling activity			
	Provide training to construction crews to ensure that an understanding of the requirements regarding environmental protection of sites.	Throughout drilling activity	Throughout construction		
Protection of vegetation	Identify vegetation that will need to be removed /protected.	Throughout drilling site	During site preparation	Contractor	Engineer
	Remove identified trees in such a way as to minimize damage to surrounding vegetation	Throughout drilling activity	Prior to construction		
	Ensure the construction crew is aware that the remaining vegetation must not be touched or damaged.	Throughout drilling activity	Prior to commencement of construction		
Workers' Camp	Contractor to prepare for approval detailed site environmental plans for the base camp and other work sites, and make adequate provision for safe disposal of all wastes and prevention of spillages and leakages of polluting materials, etc.	Before Drilling starts	Throughout construction	Contractor	Engineer
	Contractor required to pay all costs associated with clearing up any pollution caused by his activities and to pay full compensation to those affected.	Post use of the site	Throughout construction		
	If necessary solid waste from the camp shall be disposed of in a sanitary landfill.	Camp site			

Archaeological sites	Fence off archeological sites, if any sighted /uncovered during excavation works and report it to the appropriate authority “ <i>chance findings</i> ”.	At all drilling sites	Prior to the commencement of works and throughout construction	Contractor	Engineer
Socio-environmental issues	<p>Advise the local community on project plans in advance of construction and involve them in the site construction planning process.</p> <p>Identify cultural sensitive areas and avoid disturbing them.</p> <p>Control run-off and manage sediment near residential areas.</p> <p>Arrange for local people to be employed and trained.</p> <p>Include women, poor and vulnerable groups in the implementation of the project activities.</p> <p>Negotiate and agree with community about disposal areas and stockpiles sites.</p>	<p>For the whole drilling time</p> <p>At all drilling sites</p> <p>For the whole project duration</p> <p>During the implementation period</p> <p>For the whole project duration</p> <p>During the implementation period</p>	<p>Prior to commencement of works.</p> <p>Prior to commencement of and throughout construction</p> <p>Throughout construction</p> <p>Prior to commencement of and throughout construction</p>	Contractor	Engineer

Drainage	<p>Construct all designed drainage works prior to, during or immediately following excavation work in order to minimize the erosion hazard.</p> <p>Inspect all works and ancillary sites for drainage and erosion problems after each major storm event during construction period. Repair all failed drains and take additional and appropriate action as directed by the Engineer</p>	Throughout drilling period	Beginning with and continuing throughout construction	Contractor	Engineer
Disposal of materials	<p>Instruct the construction workforce on approved fill /material disposal locations and strictly supervise the correct placement of fill at these sites.</p> <p>Identify, peg and seek approval from the Engineer for permissible disposal locations.</p> <p>Inspect and approve all correctly located disposal locations.</p>	Throughout project site	Throughout construction	Contractor	Engineer
Reinstatement of services	<p>Inventory all services to be reinstated.</p> <p>Progressively reinstate or repair all interrupted services to their previous capacity.</p> <p>Inspect and certify the adequate reinstatement of services.</p>	Throughout drilling site	<p>Prior to interruption of any service</p> <p>Following construction</p>	<p>Contractor</p> <p>Engineer</p>	<p>Engineer</p> <p>EEPCo</p>

<p>Stockpiling of construction materials</p>	<p>Locate, peg and seek approval from Engineer for the use of stockpile site</p> <p>Obtain written permission from landowners for stockpiling on their temporarily acquired land</p> <p>Inspect and approve all correctly located stockpile sites</p> <p>Site plans shall include all drainage provisions for construction sites</p> <p>Locate stockpiles or spoil heaps so there is no blocking of drainage lines.</p>	<p>Throughout drilling site</p>	<p>Whenever encountered during construction</p>	<p>Contractor</p>	<p>Engineer / EEPCo</p> <p>Engineer</p>
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<p>Work force Camp</p>	<p>Locate, peg and seek approval from the Engineer for work force campsite.</p> <p>Inspect and approve correctly located campsite.</p> <p>Provide and maintain proper drinking water, worker's health check- up and waste disposal facilities at the camp.</p> <p>Recycle or dispose of solid wastes as directed by the Engineer.</p>	<p>Construction camp area</p>	<p>Throughout construction</p>	<p>Contractor for</p>	<p>Engineer/ EEPCo</p>
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Work force Management	<p>Ensure workers act in a responsible manner to local people and do not harvest or take personal resources, forest products or wildlife.</p> <p>Ensure that no or minimal wood is burnt by any construction worker on or off site.</p>	Near camp sites	Before and during building of construction camps.	Contractor	Engineer EEPCo.
Dust Nuisance	Heavy truck delivering materials shall water / sprinkle roads to reduce dust problem.	Throughout project site	Beginning with and continuing through out construction.	Contractor	Engineer
Noise	<p>Vehicles will be maintained to keep noise at minimum</p> <p>Noise level shall be kept within acceptable limits and practice</p> <p>Workers in the vicinity of high level noise to wear protective device</p> <p>Schools and other noise sensitive areas shall be notified at least 5 days before construction is due to commence.</p>	Throughout drilling period	Beginning with and continuing through out construction.	Contractor	Engineer
Siltation	Construction materials containing fine particles e.g. aggregates, limestone etc. will be stored in an enclosure away from water bodies to ensure that sediment laden water does not drain into nearby water courses.	Near cross-drainage structures and water bodies	Through construction	Contractor	Engineer

Alteration of Drainage	In sections along water courses earth and construction waste will be properly disposed of so as not to block rivers and streams, resulting in adverse impact on water quality.	Near cross-drainage structures	Whenever encountered during construction	Contractor	Engineer
	All necessary measures will be taken to prevent earth works from impeding cross drainage at rivers/streams, canal/existing irrigation and drainage systems.	Near cross drainage structures	Whenever encountered during construction	Contractor	Engineer
Contamination from wastes	All justifiable measures will be taken to prevent waste water produced at construction camps from entering directly into rivers and irrigation systems. A minimum distance of any sewage source or toilet facility should be 100 m from water sources.	Near camps drainage structures and rivers/ streams	Through drilling activity	Contractor	Engineer
Contamination from fuel and lubricants	Vehicle maintenance and refueling will be confined to construction camps designed to contain spilled lubricants and fuels. Waste petroleum products must be collected, stored and taken to approved disposal sites, according to FEPA regulation.	Construction camp area	Through construction	Contractor	Engineer

<p>Sanitation and waste disposal in construction camps</p>	<p>Camps shall be located at a minimum distance of 100 m from any water sources.</p> <p>Sufficient measures will be taken in the construction camps, septic tanks and sanitation facilities including soak pits. Waste in septic tanks will be cleaned periodically.</p> <p>Drinking water should meet national standards.</p> <p>Garbage will be collected in covered bins and disposed of daily.</p> <p>Special attention shall be paid to the sanitary condition of camps.</p> <p>The contract document shall specify the proper disposal of waste during construction period.</p>	<p>At all construction and camp sites</p>	<p>Before and during building of construction camps.</p> <p>Throughout construction period</p>	<p>Contractor</p>	<p>Engineer</p>
<p>Increase in Water-borne, Insect-borne Communicable Diseases</p>	<p>Make certain that there is good drainage at all construction areas, to avoid creation of stagnant water bodies especially in old tires.</p> <p>Provide adequate health care for workers and locate camp away from vulnerable groups.</p>	<p>At all drilling and camp sites</p>	<p>During construction</p>	<p>Contractor</p>	<p>Engineer</p>
<p>Cultural Resources</p>	<p>If archaeological relics or remains are discovered, that is, “<i>Chance finds</i>”, the appropriate authority should be notified immediately. The construction should be stopped until the authorized organization assesses the remains and approves the continuation of work after appropriate measures are complemented.</p>	<p>Whenever such archaeological remains are discovered</p>	<p>Throughout drilling activity</p>	<p>Archeological organization (ARCCH)</p>	<p>Engineer EEPCo</p>

<p>Hazards and Hazardous Materials</p>	<p>Safely handle and store hazardous materials.</p> <p>Provide disposal directions to the contractor when requested.</p> <p>Clean up spills of hazardous materials immediately.</p> <p>Suppress fires on or adjacent to construction or ancillary sites.</p> <p>In case of spill of hazardous materials, relevant departments will be informed at once and will deal with it in accordance with the spill contingency plan.</p> <p>Chemicals and fuel shall be stored in storage tanks within a secure compound. All chemicals and fuels shall be stored in accordance with manufacturer's instructions.</p> <p>Comply with standard fire safety regulations</p>	<p>Throughout construction period</p>	<p>Throughout construction as and when required</p>	<p>Contractor</p>	<p>Engineer</p> <p>EEPCo</p> <p>Engineer</p> <p>Engineer</p> <p>EEPCO</p> <p>EEPCO</p>
<p>Compaction of Soil</p>	<p>Construction vehicles should operate within the demarcated and land owned by EEPCo to avoid damaging of soil and vegetation</p>	<p>Throughout drilling especially in productive areas</p>	<p>During construction</p>	<p>Contractor</p>	<p>Engineer</p>
<p>Loss of trees</p>	<p>Tree clearing outside the project site should be avoided and beyond what is required for construction activities and /or to provide adequate clearance.</p> <p>All vegetated areas cleared for temporary work sites will be re-vegetated</p> <p>Plantation of trees along the gully and susceptible areas</p>	<p>Throughout construction</p> <p>Areas of proposed tree plantings</p>	<p>During clearing/grubbing activities</p> <p>After completion construction activities</p>	<p>Contractor</p> <p>Contractor</p>	<p>Engineer</p> <p>Engineer</p>

Post Construction Stage					
Re-vegetation	<p>All the areas that are cleared during the construction shall be rehabilitated. Re-vegetation will be with local indigenous plants, grass, shrubs and trees.</p> <p>Progressively sow all disturbed construction and ancillary site surfaces with a cover crop mix immediately following final use of each ancillary site.</p> <p>Progressively implement re-vegetation works commencing in the correct planting season.</p> <p>Regularly monitor the effectiveness of re-vegetation measures</p>	Throughout project lifespan	After completion construction activities	Contractor	Engineer
Site decommissioning	Establish a site re-vegetation plan. Where possible involve local community and the Woreda Agricultural Office to provide materials and implement re-vegetation.	An ancillary sites	Immediately following completion of construction work	Contractor	Engineer
Ancillary site Rehabilitation	<p>Rehabilitate ancillary sites such as borrow areas, camp sites, material storage sites etc. within one month of the final use, including the removal of structures, refuse, stock piles and other temporary features.</p> <p>Re-vegetate the sites with a cover crop and permanent vegetation as appropriate.</p>	At all ancillary sites	Within 1 month of final use of the ancillary site	Contractor	Engineer

XI. ENVIRONMENTAL MONITORING PLAN

Environmental monitoring is an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measures, as required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Methods of monitoring includes: -

- ✚ Visual observation.
- ✚ Selection of environmental parameters at specific locations.
- ✚ Sampling and regular testing of these parameters.

Monitoring provides a very useful feedback, which permits to correct the incidence of environmental problems at the right moment during the project construction and operation periods.

XI.1. Water Quality Monitoring

Construction camps are often sources of significant surface and ground water pollution if not managed and sited properly. It is recommended, therefore, that the contractor should undertake monitoring of any effluent, wastewater or rainfall run-off drains from campsite. This would encourage the contractor to implement proper wastewater treatment facilities in the site through the use of settling/sedimentation, evaporation and treatment ponds.

XI.2. Noise Level Monitoring

During construction, noise is expected to be a problem, periodic sampling of contractor's equipment at work sites should be undertaken to confirm that it is according to standard. Noise level monitoring could be supplemented by consulting project affected people to identify the level of monitoring required.

XI.3. Soil Erosion Monitoring

During earth excavation, temporary and permanent access roads, work camp sites and storage facilities will exacerbate soil erosion. It will therefore be the responsibility of the contractor to effectively handle erosion control measures. Focus should be given to work sites where soil is disturbed and its immediate environs during and after vegetation clearing.

XI.4. Vegetation Clearing Monitoring

Unique patches of indigenous trees should not be removed for this purpose. The contractor's environmental inspector should make sure that the unique tree species Identified during the study should not be removed.

Monitoring rehabilitation of work sites, the contractor should ensure that areas used as temporary campsite for workers are progressively rehabilitated, as they are no longer required. Once a site is rehabilitated, it should be “signed off” by EEPCo's environmental staff.

XI.5. Monitoring of Accidents/Health

The contractor must make sure that appropriate signs are posted at appropriate locations /positions to minimize /eliminate risk of accidents /incidents and electrocutions.

In addition to this, the contractor should make sure that:

- ✦ Measures to create awareness regarding sexually transmitted diseases(STIs), HIV/AIDS, and other diseases such as malaria, schistosomiasis, leishmaniasis, and onchocerciasis are taken,
- ✦ Preventive measures to reduce /eliminate malaria, schistosomiasis, leishmaniasis, and onchocerciasis infections where /whenever appropriate and measures are put in place,
- ✦ Periodic health survey should be carried out during the implementation period.

XI.6. Monitoring Responsibilities

EEPCo will have an overall responsibility to oversee that all environmental measures are put in place and that regulations are enforced. The construction consultant should assist EEPCo in this process in order to make sure that the contractor fulfills the environmental requirements. Some relevant stakeholders, like the Ministry of Water and Energy (MoWIE), Federal or Regional EPA, ARCCH and other relevant sector ministries may also conduct joint monitoring as deemed necessary.

XI.7. Monitoring Indicators

The following parameters could be used as indicators:

- ✦ Presence of posted visible signs.
- ✦ Presence of sanitary facilities at camp sites.
- ✦ Level of awareness of communities pertaining to danger /risk associated with drilling.
- ✦ Presence /absence of unique stands of indigenous trees in the proposed project site; and
- ✦ Accident /incident report records on actual accidents associated with the project and kept recorded with the help of local Kebele officials, teachers /students of local schools.

XI.8. Social Monitoring

Monitoring and evaluation will be a continuous process. EEPCo will continuously take stock of all expropriation compensation reports and discuss it on regular basis.

After completion of the resettlement/rehabilitation operation, it is expected that PAPs will have a better or improved way of life compared to their prior resettlement situation.

Therefore resettlement /rehabilitation operation needs to be monitored with regard to performance and compliance with the above objectives.

The Actors in the monitoring and evaluation process include:

- The EMT Social Experts of EEPCo (for planning and monitoring)
- Woreda Administration (for monitoring and evaluation)
- Project Affected Persons (PAPs)

Field visit by the Project Office will be conducted at least once in a month. Woreda Administration will conduct their own monitoring, but when possible, this will be done together with Project Office and PSP.

(Please refer Environmental and Social Clauses, Annex V)

Table 22:- Synthesis of Environmental Monitoring Matrix

Activity Phase	Resource	Environmental Components	Environmental Indicators	Weight Effect	Standardization	Location of the observations	Observation frequency
I:Pre- construction	Site survey	Plants belonging to residents	Plant damage	e	The width of the damaged plant area.	Areas around foundation pads	Once
	Land acquisition	The society where the lower basis are	Society complaint	b	The land acquisition is suitable with the rules.	Areas around foundation pads	Time before and after land acquisition
II: Construction	Labour, equipment and material mobilization	Workers' recruitment	Society complaint	D	Level of labour recruitment	Around and close to residence	Once every six month
		Air quality	Dust pollution	d	Air quality standard	Close to residence, foundation pads close to residence	Once every six month
		Noise	Noise	b	Noise quality standard	Part of foundation pad close to residence	Once every six month
	Route clearance	Societies land	Plant damage	0	New land functions	Part foundation pads close to residence	Once
III: operation	Electric power transmission	Free area	EMF	0	Free area according to the rules	Around the foundation pads	At the beginning of operations and every six months
	Maintenance	Society's plants	Plant damage	e	How many plants are damaged	Foundation pads close to residence	Once every six months
		Excavation activity	Land slide /erosion		e	How much erosion appears	The foundation pad

Positive Impact

A = Very important
 B = More Important
 C = Important c = Important
 D = Fair Important d = Fair Important
 E = Less Important e = Less Important

Negative Impact

a = Very important
 b = More Important
 O = No important

XII. ESTIMATED MITIGATION COSTS

The total project cost for environmental and social mitigation, monitoring and compensation payment is estimated to be **1,445,125.00** Birr in local currency (**77,155.63** USD), and the cost summary is depicted below:

The cost estimate considers the different project activities that require land. For the budget preparation purpose it is assumed that the land is fully farmland and average production per quintal is taken.

According to the expropriation of landholdings for public purposes and payment of compensation, Proclamation No. 455/2007, Article 9 and 10, valuation of property will be carried out by property valuation committee that will be established by the Woreda Administration.

Table 23:- Cost Estimate

No	Items	Method	Production Quintal/ha	Average unit price (Birr)	Estimated Total Cost (Birr)	Cost USD
1	Compensation for crop loss for 6 drilling wells	60m X 100m X 6 wells =3.6 ha	10	900.00	32,400.00	1,729.85
2	Compensation for crop loss for 6 ponds	50m X 40m X 6 wells =1.2 ha	10	900.00	10,800.00	576.62
3	Compensation for crop loss for power plant construction	150mX150m=2.25 ha	10	900.00	20,250.00	1,081.15
4	Compensation for crop loss for 13 km transmission line X 30m width	13,000 m X 30 m =39 ha	10	900.00	351,000.00	18,739.99
5	Compensation for crop loss for access roads	190mX6mX6 access roads =0.7 ha	10	900	6,300.00	336.36
6	Compensation for houses (tukuls)	60 m ²	400.00	24,00.00	360,000.00	19,220.50
Sub total					780,750.00	41,684.47
1	Tree plantation	2 ha	--	86,000.00	152,000.00	8,115.32
2	Water pipe and water distribution centre + cattle trough	for the 3 kebeles	--	90,000.00	270,000.00	14,415.38
Sub total					422,000.00	22,530.70



Monitoring and valuation						
1	Monitoring and evaluation	Lump sum	Lump sum		96,000.00	5,125.47
2	Valuation committee per diem	Lump sum	Lump sum		15,000.00	800.85
Sub Total					111,000.00	5,926.32
Total					1,313,750.00	70,141.48
Contingency 10%					131,375.00	7,014.15
Grand Total					1,445,125.00	77,155.63

Exchange Rate: 1 USD= 18.73 ETH. Birr (Commercial Bank of Ethiopia June 29, 2013)

XIII. CONCLUSION AND RECOMMENDATION

XIII.1. Conclusion

The major environmental improving effect of this Project is the reduction of carbon dioxide emission for electricity generation using renewable geothermal energy as compared with other fossil-firing power generation.

The geothermal energy is considered clean energy for the following reasons:

- ✚ Emissions associated with generating electricity from geothermal technologies are negligible because no fuels are combusted,
- ✚ Geothermal power plants usually re-inject brine (spent geothermal fluids), eliminating impacts of pollution to surface and ground water resources, and
- ✚ Geothermal can coexist successfully with other land uses.

Furthermore, geothermal energy is considered to be renewable because the reservoirs are continuously being replenished. It is also sustainable, in that, it will replenish naturally into the future and faster than they can be used.

The proposed geothermal project has great significance in increasing the power supply of the country and the energy mix is an important factor in the country where energy supply is dominated by hydropower generation.

The proposed geothermal development would encourage investors to invest in the country, ultimately creating more job opportunities. As a result, it will effectively enhance the income of the society, reduce production costs and increase the purchasing power of the consumer and by extension contributes to poverty reduction effort of the government both at local and national level. Improved economy and availability of sufficient social services due to the development will rapidly change the way of life of the community.

Therefore, the proposed geothermal development project will have great contribution for the socio economic development at both local and national levels.



The study has also established a number of negative environmental and social consequences that the project activities are likely to induce. The negative impacts include vegetation clearance due to preparation of drilling pads and ponds, power plant, access road and transmission line constructions. Noise emitted during the drilling and testing period will have impacts related to health and safety, are some of the negative impacts of the project.

Generally, geothermal resource development projects can coexist with surrounding community. The existing Aluto Geothermal Power plant is a good example in this case. The Phase III Aluto Geothermal Power Plant Expansion Project requires land for the drilling of deep geothermal wells, power plant construction and for transmission line. Therefore, land acquisition is anticipated as the main social impacts in the project implementation. Proper mitigation measures are recommended related to compensation payment, preparing replacement land, relocation of affected households, provision of training for project affected persons in skill development, etc.

The project should comply with national laws and the World Bank environmental and social policies which seek to ensure that the geothermal project does not adversely affect the environment and social community resources.

With proper implementation of the environmental and social mitigation measures indicated in this ESIA, Resettlement Policy Framework /RPF/, Environmental and Social Management Plan /ESMP/any adverse impacts induced by the project can be mitigated.

Cost for implementing the environmental and social mitigation is estimated to be **Birr1, 445,125.00(77,155.63)**. The total mitigation cost covers the cost for compensation payment, Resettlement implementation, Environmental and social monitoring.

Provided that the recommended mitigation measures and environmental management measures are effectively implemented during the drilling of the Aluto Geothermal Power Expansion Project Phase III, it can be concluded that the anticipated environmental and social impacts will have low significance.

As the project moves towards implementation, the following recommendations are given.

XIII.2. Recommendation

- ✚ Aluto Geothermal Power Plant Expansion Project Office of EEPCo shall identify the exact location of the drilling pads, access roads and transmission line and Socio-economic survey shall be conducted.
- ✚ The Project Office will be responsible for the inclusion of the Environmental and Social Clauses to the contract document and make sure that health and safety manual /method statement/ prepared and implemented during the implementation of the Project.
- ✚ Public consultation and disclosure plays an important role in enabling the public to participate in the planning and implementation of the project. Public consultation and focus group discussion has been conducted during the Environmental and Social Impact Assessment. It is very important that the public consultation process

continue throughout the project implementation period and that local residents' feel that they are involved in the project and their views and concerns are being adequately considered as an input in the project planning and implementation process.

- ✚ Grievance resolution mechanism should be put in place to ensure that potential problems are addressed promptly and efficiently.

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