

Country Name	The Project for Formulating Master Plan on Development of Geothermal Energy in Ethiopia
Federal Democratic Republic of Ethiopia	

### I. Project Outline

Background	<p>The Ethiopian electric sector addressed development of domestic energy resources such as geothermal and/or wind power, with recognition of the importance of energy diversity and energy mix. Among the domestic energy resources, geothermal energy had become more important as a baseload power. Geothermal potential surveys were commenced in Ethiopia in 1969 and the surveys had identified more than 16 promising geothermal. However, only two sites were being developed towards commercial operation. Since geothermal potential sites had been surveyed by various development partners, with different survey targets and methods, data accumulation and comprehensiveness were not sufficient to conduct resource assessments based on uniform standards.</p> <p>Under this circumstance, the Government of Ethiopia requested the Government of Japan technical assistance in formulating a master plan for geothermal development including geothermal resource assessment, prioritization of development and technical capacity building for geothermal development.</p>										
Objectives of the Project	<ol style="list-style-type: none"> <li>Expected Goals to be achieved by utilization of the proposed plan<sup>1</sup>: Geothermal power development in Ethiopia will be promoted.</li> <li>Expected utilization of the proposed plan by the project: The capacity of GSE will be developed and ready to commence geothermal development projects.</li> </ol>										
Activities of the Project	<ol style="list-style-type: none"> <li>Project site: Addis Ababa and 16 potential promising geothermal sites in the Great Rift Valley</li> <li>Main activities: Data collection and desk review, nation-wide survey of geothermal energy, training in Japan and database and masterplan development</li> <li>Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Japanese Side</td> <td style="width: 50%;">Ethiopian Side</td> </tr> <tr> <td>- Experts from Japan: 11 persons</td> <td>- Staff allocated: 10 Professional in average</td> </tr> <tr> <td>- Training in Japan: information is not confirmed</td> <td>persons (Geologists, Geochemists and Geophysicists and local administrative staff)</td> </tr> <tr> <td>- Equipment: Vehicles, MT probe</td> <td>- Land and facilities: Two project offices</td> </tr> </table> </li> </ol>			Japanese Side	Ethiopian Side	- Experts from Japan: 11 persons	- Staff allocated: 10 Professional in average	- Training in Japan: information is not confirmed	persons (Geologists, Geochemists and Geophysicists and local administrative staff)	- Equipment: Vehicles, MT probe	- Land and facilities: Two project offices
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Project Period	September 2013-May 2015	Project Cost	(ex-ante) 180million yen (actual) 236million yen								
Implementing Agency	Geological Survey of Ethiopia (GSE)										
Cooperation Agency in Japan	NIPPON KOEI CO., LTD., Geothermal Engineering Co., Ltd., Sumiko Resources Exploration & Development Co.,Ltd.										

### II. Result of the Evaluation

<Special Perspectives Considered in the Ex-Post Evaluation>

As there is no ex-ante evaluation sheet prepared, no indicators were set for this project. Under this ex-post evaluation, information on “Utilization Status of the Proposed Plan” was collected in accordance with examples of similar master plan type projects, and to what extent the proposed plan was utilized was assessed accordingly.

1 Relevance
<p>&lt;Consistency with the Development Policy of Ethiopia at the Time of Ex-Ante Evaluation and Project Completion&gt;</p> <p>The project was consistent with the development policy of Ethiopia. Under the five-year “Growth and Transformation Plan” (GTP) (2010/11-2014/15), the strategic directions of the energy sector were development of renewable energy, expansion of energy infrastructure, and creation of an institutional capacity that can effectively and efficiently manage such energy sources and infrastructure. The main objective of the energy sector was to meet the demand for energy in the country by providing sufficient and reliable power supply that meets international standards at all time.</p> <p>&lt;Consistency with the Development Needs of Ethiopia at the Time of Ex-Ante Evaluation and Project Completion &gt;</p> <p>The project was consistent with the development needs of Ethiopia for geothermal development. At the time of ex-ante evaluation, the geothermal development was limited to only two sites despite 16 potential sites had been identified. At project completion, the “Ethiopian Power System Expansion Master Plan” (2014) forecasted that the energy demand would grow from 1,445 GWh in 2013 to 146,691 GWh in 2037.</p> <p>&lt;Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation&gt;</p> <p>The project was consistent with Japan’s ODA policy to Ethiopia. Socio economic infrastructure was one of the prioritized areas under the “Country Assistance Policy to the Federal Democratic Republic of Ethiopia” (2012).</p> <p>&lt;Evaluation Result&gt;</p> <p>In light of the above, the relevance of the project is high.</p>
2 Effectiveness/Impact
<p>&lt;Status of Achievement for the Objectives at the time of Project Completion&gt;</p> <p>At project completion, the all outputs were achieved, as (i) Geothermal database was constructed using G*BASE (Geothermal data base) software to systematically store various geothermal data, and (ii) A Master Plan for geothermal energy was formulated. The master</p>

<sup>1</sup> The degree of achievement of expected goals is not to be assessed in principle at the time of ex-post evaluation, since it is defined as the medium-to-long-term goals which will be attained as a result of crystallizing the proposed plan (“output” of the project).

plan for geothermal energy obtained acknowledgment by the Ministry of Water Irrigation and Energy to use as an input for future activities. The Masterplan prioritized (ranked) the geothermal prospects of the 22 sites, set targets for short, medium and long term geothermal power development and including other factors necessary for MP preparation.

< Utilization Status of the Proposed Plan at the time of Ex-post Evaluation>

Most of the recommendations and prioritization of the project have not been materialized. The project concluded that 610 MW of the priority S<sup>2</sup> should be developed from 2014-2018. Tendaho-2 (Ayrobera), Boseti and Meteka sites from priority A and B were nominated as priority sites. The first two sites (Tendaho 2 and Boseti) were proposed to conduct well test as early as possible. However, no power generation has started at Priority S sites until now. Except the surface exploration, there is no development in the three priority sites. Main reasons for the slow progress in the public sector are limited capacity in procurement, excess time consumed in environmental studies, slow implementation in resettlement plan etc. And in private sector, very long negotiation to settle Power Purchase Agreements and so on. According to GSE, measures on institutional restructuring and strengthening have been planned and maybe implemented in the short term and efforts have been underway to shorten negotiations and emplacement of new regulation to secure investment. However, there is no clear schedule about the plan and the implementation

The contents of the final report been utilized for geothermal development to some extent. According to the Master Plan, GSE is going to develop 22 sites instead of its initial plan to develop 16 sites. The environment issues raised in the Master Plan and proposed establishment of geothermal enterprise (Ethiopian Enterprise for Geothermal Energy Development, EEGeD) is considered by GSE.

<Status of Achievement for Expected Goals through the Proposed Plan at the time of Ex-post Evaluation>

At the time of ex-post evaluation, the installed capacity of 7.2 MW has been developed, though 700 MW was the targeted installed capacity in 2018. The main problems are the long procurement procedure in government offices and the delay of formulating laws & regulation to determine the involvement of private sector.

<Other Impacts at the time of Ex-post Evaluation>

According to GSE, no negative impact on the natural environment by this project has been observed, and no land acquisition and resettlement occurred.

<Evaluation Result>

Therefore, the effectiveness/impact of the project is fair.

### 3 Efficiency

Both the project cost and project period slightly exceeded the plan (the ratio against the plan: 131%, 117%). The project period was extended due to due to administrative delays in clearance of equipment. The outputs were produced as planned. Therefore, the efficiency of the project is fair.

### 4 Sustainability

<Policy Aspect>

There have been geothermal law and policy, legal and regulatory framework to support the geothermal power development. “Geothermal Resource Development Proclamation No. 981/2016” was introduced on September 16, 2016 to govern Ethiopians geothermal sector. Also, the “Geothermal Policy, Legal and Regulatory Framework” was formulated to give priority for geothermal energy development. The “National Energy Policy” issued in 1994 states that “solar and geothermal energy will be used, wherever possible for process heat and power generation”. At the time of ex-post evaluation, the policy was being revised and waiting for endorsement from the concerned government bodies. Under the first policy objective, the revised policy states that: “Maximize development and utilization additional indigenous energy resource such as bio energy, wind, solar, geothermal, and hydro and hydrocarbon”.

<Institutional Aspect>

Organizational setting for geothermal development is as follows:

- GSE conducts surface exploration and exploratory drilling and testing, if required.
- Ethiopia Electric Power (EEP, a power generating company) has various drilling projects under preparation for subsequent power plant construction.
- Ethiopia Energy Agency (EEA) regulates both public and private geothermal exploration and developments.

However, there have not been appropriate demarcation and the mandate overlaps. Necessary personnel for each agency has not sufficiently deployed. At EEP the staffing plan for deployment has not yet been approved, at EEA, due to low salary scale, it has been difficult to find employs from the market and at GSE, also salary scale and incentives have been low to obtain sufficient qualified personnel.

EEGeD, which was recommended to be established by the project, has not been established, as the government thinks necessary financial and in-kind inputs required for its functionality should be available. Such resources have been still being looked for, nonetheless, GSE submitted proposed to the government to establish it.

<Technical Aspect>

The technical level of each responsible agency has not been sufficient enough and technical level needs to be improved through time. For example, GSE needs foreign expert coaching to use instrumentation and interpret in geology, geochemistry and geophysics. Also, supervisors are required to conduct deep drilling. In case of EEA, additional professionals are required for evaluation of applications and follow up.

There has been number of efforts to sustain the effects by way of on the job training (OJT) and trainings given overseas. While such efforts need continue in the future too, there is still a need to further strengthen GSE technical level. After the project was completed, in order to solve the capacity problem at GSE, JICA has sent GSE’s staff to Japanese universities and institutes for long term training since 2015.

<Financial Aspect>

Some budget has been secured for geothermal development (mainly for drilling). However, it is not enough to conduct all the planned development mentioned above..

<Evaluation Result>

<sup>2</sup> Priority S projects are committed projects, Priority A projects are classified as “very high economy”, and Priority B projects are classified as “high economy”.

There have been some problems observed in the institutional, technical and financial aspects. Therefore, the sustainability of the effects through the project is fair.

#### 5 Summary of the Evaluation

At the project completion, all the outputs were achieved as (i) Geothermal database was constructed using G\*BASE software to systematically store various geothermal data, and (ii) A Master Plan for geothermal energy was formulated. After the project was completed, most of the recommendations and prioritization of the project have not been materialized yet. However, contents of the final report of the project have been utilized for geothermal development to some extent. As for the sustainability, some problems have been observed in terms of the institutional, technical and financial aspects. As for the efficiency, both the project cost and project period slightly exceeded the plan.

Considering all of the above points, this project is evaluated to be partially satisfactory.

### III. Recommendations & Lessons Learned

#### Recommendations for Implementing Agency:

There is no clear demarcation of duties and responsibilities among concerned organizations regarding geothermal development. This creates overlap of duties and responsibilities that result in duplication of effort, unnecessary expense and accountability problem. During the ongoing restructuring of the organizations, all stakeholders who are involved in geothermal development (Geological Survey of Ethiopia, Ethiopian Energy Agency and Ethiopian Electric Power) are recommended to set clear demarcation of duties and responsibilities among all actors according to their professional and financial capacity to increase efficiency and save resources.

#### Lessons Learned for JICA:

After the project was completed, in order to solve the capacity problem at GSE, JICA has sent GSE's staff to Japanese universities and institutes for long term training since 2015. However, the students are still under study and GSE still have a capacity problem in performing all the necessary activities. An arrangement should have been made to have such trained manpower been assigned to proper positions before the project finished.



Aluto-langano Geothermal Site