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# PREPARATION OF THE ABAYA PROJECT FOR GEOTHERMAL SUSTAINABILITY ASSESSMENT PROTOCOL (GSAP) IN ETHIOPIA

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## ABSTRACT

The aim of this project is to assess the Abaya Geothermal Development project, developed by Reykjavik Geothermal using the Draft Geothermal Sustainability Assessment Protocol (GSAP). This assessment is a partial test of the Draft GSAP as time and data availability does not allow for a full assessment. The primary objective is to learn about the applicability of the protocol which was adapted from the Hydropower Sustainability Assessment Protocol to geothermal power projects. A secondary objective was to gain insights into the performance of the geothermal project under assessment and to identify opportunities for improvement of this and other geothermal projects in Ethiopia.

The study site is located in Abaya region, Southern Nations Nationality People Regional State, Southern Ethiopia. Part of the Abaya Geothermal Development is the installation of a 300 MW power plant with potential for future expansion. The assessment was carried out in collaboration with the Reykjavik Geothermal management staff.

The results illustrate that the GSAP is comprehensive and applicable in an Ethiopian context and as such, it has the potential to support the legal frameworks applicable to geothermal energy development projects. The geothermal development was assessed with regard to 6 different issues and scored at level 3 (basic good practice) for 5 of them, and at level 2 for one. In general, the Geothermal Sustainability Assessment Protocol is an important management tool to secure that future potential projects will be developed in accordance with international standards and best practices. Furthermore, it can help secure social acceptance as it fosters community development and stakeholder engagement.

## 1. INTRODUCTION

Energy plays a key role in the attainment of the Ethiopian Sustainable Development Goals (SDGs) as energy is linked to all sectors of the economy. As a result, sustainable energy development and the attainment of goal 7 of the SDGs is a prerequisite for poverty alleviation and improvement of quality of

life. However, sustainable energy development has many challenges, including energy poverty, high dependence and unsustainable use of biomass, wasteful and inefficient energy production, transportation and utilization, low institutional, human and technological capacity, low private sector participation, high dependence on imported petroleum fuels and energy sector program financing (Ethiopia National Energy Policy, 2015).

The population is growing in Ethiopia and two of the main challenges faced by the Ethiopian Government is to ensure access to affordable, reliable, sustainable and modern energy for all and to take urgent action to combat climate change and its impacts. Energy consumption in Ethiopia is expected to increase due to expansion of industry, agriculture and transport. To reach the objectives of sustainable energy development the Government of Ethiopia must increasingly rely on renewable energy. The Ethiopian Energy Policy and the Climate Resilient Green Economy (CRGE) strategy advocate sustainable continuous economic growth and clean, sustainable and adequate affordable energy supply (Ethiopia Energy Authority, 2017). Energy and environmental regulations and Public Private Partnership (PPP) laws are being developed to create a favourable framework for promoting and facilitating the implementation of privately financed projects to support Ethiopian economic growth, to enhance transparency, fairness, value for money, efficiency and long-term sustainability.

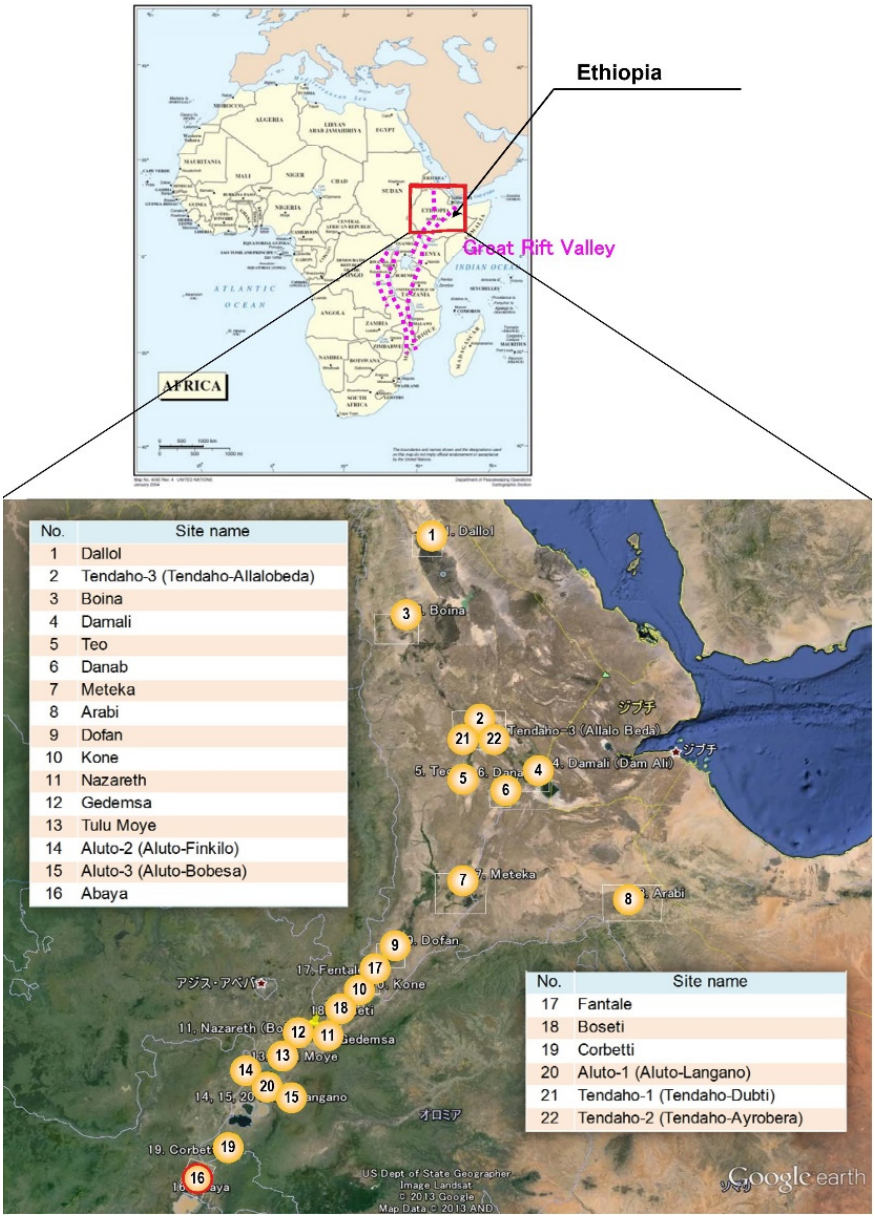


FIGURE 1: Map of the study area (16) and other potential geothermal development projects (JICA, 2015)

Geothermal energy is one of the renewable energy resources available in Ethiopia. The Government of Ethiopia with the Geological Survey of Ethiopia in the lead has identified 22 geothermal prospects based on the results of various geological surveys and has collected data from past surveys (Figure 1). All 22 sites are located in the Great East African Rift Valley and are characterized by a number of major lineaments/faults running parallel to the direction of the rift valley (JICA, 2015). Despite the vast potential, geothermal development can result in significant sustainability challenges and to manage those while developing the

geothermal resource a sustainability assessment tool is needed.

A sustainability assessment tool for hydropower projects, the Hydropower Sustaina-bility Assessment Protocol (HSAP) already exists and was officially launched in 2011 after many years of preparation and testing. The HSAP is a product of a considerable effort by multi-stakeholder parties representing the hydropower industry, several developing and developed countries, the finance sector and international environmental and social NGOs. The aim of the protocol is to provide a tool to measure, guide and improve the performance in the industry based on 23 key sustainability topics to enable sustainable hydropower. Separate protocol documents were provided for the different project stages; early stage, preparation, implementation and operation (Hydropower Sustainability, 2019a). The experience with the HSAP has shown that several advantages are linked with the use of the protocol, including improved sustainability practices, enhanced access to finance and improved public acceptance due to extensive stakeholder engagement as required by the protocol.

In this context, members of the Icelandic power sector proposed to adapt the internationally recognised and fully tested HSAP to geothermal projects. As a first step, a draft geothermal sustainability assessment protocol (GSAP) preparation stage was prepared in 2016 and a subsequent test assessment was performed for the Theistareykir 90 MWe geothermal project in North Iceland which was under construction by Landsvirkjun at the time (Landsvirkjun, 2017). Later a GSAP draft for the operation stage was prepared in 2017 and a test assessment was performed for the Hellisheidi 300 MWe / 130 MWth geothermal plant in Southwest Iceland, owned and operated by ON power, a subsidiary of Orkuveita Reykjavikur – OR (Reykjavik Energy) (ON, 2018).

As the protocol has been already tested in Iceland, the aim of this UNU-study project is to evaluate the appropriateness of the Geothermal Sustainability Assessment Protocol for a geothermal development in the global South, Ethiopia to be exact, with a case study of the Abaya project. More specifically the objective of the assessment is to:

- Identify how appropriate the protocol is for the developer and for the government in Ethiopia and to test the draft GSAP based on the Ethiopian relevant legal frameworks;
- Identify improvement opportunities in the project and its preparation;
- Identify data needs with respect to ensuring proper sustainability management;
- Identify areas of good practice and best practices of the existing projects and future projects in Ethiopia; and
- Facilitate a discussion with the developers, stakeholders and other working group members about the sustainability of geothermal projects.

## 2. HYDROPOWER SUSTAINABILITY ASSESSMENT PROTOCOL AND GEOTHERMAL SUSTAINABILITY ASSESSMENT PROTOCOL

### 2.1 Hydropower Sustainability Assessment Protocol (HSAP)

The HSAP is the culmination of a long process of debates and dialogue initiated by the International Hydropower Association (IHA) in response to the World Commission on Dams' final report in 2000 (World Commission on Dams, 2000). IHA saw a need for a practical tool to assess and demonstrate the sustainability of hydropower projects. In 2004, this led to the IHA developing sustainable guidelines for the sector with the intension that they provide practical and realistically implementable guidance.

By 2006, IHA had developed an initial sustainability assessment protocol, intended to provide a uniform method assessing sustainability of hydro projects worldwide. Recognising the value of this first version, WWF and The Nature Conservancy (Environmental NGOs) approached IHA with the request to further refining the tool. IHA agreed that the protocol would benefit from a more inclusive process that would

capture sustainability perspectives from all hydropower stakeholders. Eventually, the Hydropower Sustainability Assessment Forum was formed. The forum was made up of representatives from social and environmental NGOs, governments of developed and developing countries, financial institutions, development banks, and the hydropower industry. Each member of the forum consulted with a reference group made up of organisations with similar interest and objectives. This structure increased the scope and reach of the forum to incorporate the perspectives of as broad a range of stakeholders as possible (Hydropower Sustainability, 2019b).

Within the forum, developing countries were represented by the China Institute of Water Resources and Hydropower Research and by the Zambian Ministry of Energy and Water Development. This was particularly important for discussions about working with affected communities. Developed countries were represented by the Norwegian Department of Energy, the National Energy Authority of Iceland and GTZ of Germany. The hydropower sector was represented by the International Hydropower Association (IHA). NGOs such as Oxfam and Transparency International focused on the social aspects of hydropower projects, encouraging the direct participation of dam-affected people in the development process. WWF and the Nature Conservancy emphasized issues of interest to environmental NGOs. The finance sector was represented by the World Bank (observer status) and Societe Generale and Citigroup, who in turn represented the Equator Principles Financial Institutions (Hydropower Sustainability, 2019b).

The current HSAP is the result of an intensive period of debate and iterative drafting over a period of 30 months between 2008 and 2010. The forum operated by negotiation and consensus, embedding stakeholder dialogue as the foundation of the protocol. The forum members drew on existing key guidelines and policies, particularly the World Bank safeguard policies, the IFC performance standards and the World Commission on Dams‘ criteria and guidelines (Hydropower Sustainability, 2019b).

Stakeholder engagement during this process occurred in 24 countries with over 1,300 participants, 3,800 interested observers, and several thousand visits to the draft HSAP website. Draft versions of the HSAP were trialled in 20 countries, involving 18 hydropower companies on six continents and projects of all types, sizes, and life cycle stages. Project affected communities were engaged in the trials (Hydropower Sustainability, 2019b).

### 2.2 Geothermal Sustainability Assessment Protocol

The Geothermal Sustainability Assessment Protocol (GSAP) is modelled on the Hydropower Sustainability Assessment Protocol and is a framework to assess the performance of geothermal power projects according to a defined set of sustainability topics, encompassing environmental, social, technical and financial issues (GSAP 2018). A working group of Icelandic power companies and government agencies developed the protocol. The required adaption changes from HSAP to GSAP were kept to a minimum with the aim to maintain as much as possible the international recognition and multi-stakeholder consensus obtained for the HSAP.

A GSAP preparation stage assessment was performed for Theistareykir 90 MW-e power plant which is owned by Landsvirkjun (National Power Company) with the help of one experienced HSAP assessor in late 2016 to early 2017. The final report was published in June 2017 (Landsvirkjun, 2017).

An operation stage assessment applying the GSAP was carried out at Hellisheidi 330 MWe /130 MWth geothermal power plant in Southwest Iceland. The plant is owned by Orkuveita Reykjavikur (OR) and operated by its subsidiary ON power. Two experienced HSAP assessors let the assessment which was done in late 2017 to early 2018 with a final report being published on the company webpage in June 2018 (ON, 2018).

In short, the two test assessments illustrated the applicability of the GSAP, and no obstacles were found related to the fact that the plants were geothermal and not hydropower plants. It was shown that the draft GSAP works well in Iceland but to date it has not been tested in other countries. Further modifications and streamlining remains to be addressed, preferably in cooperation with test sites in other countries.

### 2.3 Structure of the geothermal sustainability assessment protocol (draft GSAP preparation stage April 2018)

The Geothermal Sustainability Assessment Protocol should be globally applicable and used on all types and sizes of geothermal projects, anywhere in the world, and be quality controlled to ensure reliability of the assessment findings. The protocol includes 20 topics (P-1 to P-20) as presented below. A new topic P-21 is in progress in 2019, that is Climate Change Mitigation and Resilience (Sigurdur St. Arnalds, pers. comm., Sept. 2019).

**P-1 Communications and consultation**
This topic addresses the identification and engagement with project stakeholders, both within the company as well as with external stakeholders (e.g. affected communities, governments, key institutions, partners, contractors, geothermal areas residents, etc.).

The intent is that stakeholders are identified and engaged in the issues of interest to them, and that communication and consultation processes establish a foundation for good stakeholder relations throughout the project life.

**P-2 Governance**
This topic addresses corporate and external considerations. The intent is that the developer has sound corporate business structures, policies and practices, addresses transparency, integrity and accountability issues, can manage external governance issues (e.g. institutional capacity shortfalls, political risks including transboundary issues, public sector corruption risks), and can ensure compliance.

**P-3 Demonstrated need and strategic fit**
This topic addresses the contribution of the project in meeting demonstrated needs for electrical power and, if applicable, direct use, as identified through broadly agreed local, national and regional development objectives and in national and regional policies and plans. The intent is that the project can demonstrate its strategic fit with development objectives and relevant policies and plans can be demonstrated, and that the project is a priority option to meet identified needs for electrical power and, if applicable, direct use.

**P-4 Siting and Design**
This topic addresses the evaluation and determination of project siting and design options, including the power station with associated structures and wells connected to the geothermal supply system and other infrastructures. The intent is that siting and design are optimized as a result of an iterative and consultative process that has taken into account technical, economic, financial, environmental and social considerations.

**P-5 Environmental and social impact assessment and management**
This topic addresses the assessment and planning processes for environmental and social impacts associated with project implementation and operation throughout the area of impact of the project. The intent is that environmental and social impacts are identified and assessed, and avoidance, minimisation, mitigation, compensation and enhancement measures designed and implemented.

**P-6 Integrated project management**
This topic addresses the developer's capacity to coordinate and manage all project components, considering project construction and future operation activities at the project-affected area. The intent is

that the project meets milestones across all components, delays in any component can be managed, and one component does not progress at the expense of another.

**P-7 Geothermal resource**
This topic addresses the level of understanding of geothermal resources and the assessment of the geothermal production capacity. It also addresses the predicted response to the planned production and the planned generation efficiency based on the assessed geothermal conditions and utilization strategy.

The intent is that the project´s planned power generation takes into account a good understanding of the geothermal resource availability, renewability and reliability in the short- and long-term, as well as efficient utilization of the energy resource.

**P-8 Public health and safety**
This topic addresses health and safety planning for geothermal drilling, the supply system and power station and other health and safety issues for the public and neighbouring communities during project preparation, implementation and operation. The intent is that life, property and the environment are protected from the consequences of the geothermal energy harnessing and facility operation and other associated health and safety risks.

**P-9 Financial viability**
This topic addresses both access to finance and the ability of a project to generate the required financial returns to meet project funding requirements, including funding of measures aimed at ensuring project sustainability. The intent is that projects proceed with a sound financial basis that covers all project funding requirements including social and environmental measures, financing for resettlement and livelihood enhancement, delivery of project benefits, and commitments to shareholders/investors.

**P-10 Project benefits**
This topic addresses the additional benefits that can arise from a geothermal project and the sharing of benefits beyond one-time compensation payments or resettlement support for project affected communities. The intent is that opportunities for additional benefits and benefit sharing are evaluated and implemented in dialogue with affected communities, so that benefits are delivered to communities affected by the project.

**P-11 Economic viability**
This topic addresses the net economic viability of the project. The intent is that there is a net benefit from the project once all economic, social and environmental costs and benefits are factored in.

**P-12 Procurement**
This topic addresses all project-related procurement including works, goods and services. The intent is that procurement processes are equitable, transparent and accountable, support achievement of project timeline, quality and budgetary milestones, support developer and contractor environmental, social and ethical performance, and promote opportunities for local industries.

**P-13 Project affected communities and livelihoods**
This topic addresses impacts of the project on local communities, including economic displacement, impacts on livelihoods and living standards, and impacts to rights, risks and opportunities of those affected by the project. The intent is that livelihoods and living standards impacted by the project are improved relative to pre-project conditions with the aim of self-sufficiency in the long-term, and that commitments to project affected communities are fully delivered over an appropriate period of time.

Topics P-14 'Resettlement' and P-15 'Indigenous Peoples' that follow specifically address two subsets of project affected communities.

**P-14 Resettlement**
This topic addresses physical displacement arising from the geothermal project development. The intent is that the dignity and human rights of those physically displaced are respected, that these matters are dealt with in a fair and equitable manner, and that livelihoods and standards of living for resettlees and host communities are improved.

**P-15 Indigenous peoples**
This topic addresses the rights, risks and opportunities of indigenous peoples with respect to the project, recognising that as social groups with identities distinct from dominant groups in national societies, they are often the most marginalized and vulnerable segments of the population. The intent is that the project respects the dignity, human rights, aspirations, culture, lands, knowledge, practices and natural resource-based livelihoods of indigenous peoples throughout the project life.

**P-16 Labour and working conditions**
This topic addresses labour and working conditions, including employee and contractor opportunity, equity, diversity, health and safety. The intent is that workers are treated fairly and protected.

**P-17 Cultural heritage**
This topic addresses cultural heritage with specific reference to physical cultural resources at risk of damage or loss by the geothermal project and associated infrastructure impacts (e.g. new roads, transmission lines). The intent is that physical cultural resources are identified, their importance is understood, and measures are in place to address those identified to be of high importance.

**P-18 Biodiversity and invasive species**
This topic addresses ecosystem values, habitats, and species in the project areas, as well as potential impacts arising from pest and invasive species associated with the planned project. The intent is that there are healthy, functional and viable terrestrial and aquatic ecosystems in the project-affected area that are sustainable over the long-term, and that biodiversity impacts arising from project activities are managed responsibly.

**P-19 Induced seismicity and subsidence**
This topic addresses the management of induced seismicity and subsidence issues associated with the project. The intent is that physical impacts such as induced seismicity and subsidence caused by the project are recognised and managed responsibly and do not present problems with respect to other social, environmental and economic objectives and that these impacts are recognised and managed.

**P-20 Air and water quality**
This topic addresses the management of air and water quality issues associated with the project. The intent is that air and water quality in the vicinity of the project is not adversely impacted by project activities.

Applying the protocol delivers an evidence-based assessment of performance in each topic with a set of scores providing an indication of performance in relation to basic good practice and proven best practice. Each topic is scored based on the following six criteria, that is assessment, management, stakeholder engagement, stakeholder support, conformation/compliance, and outcomes, see Figure 2. However, all elements of the criteria may be or may not be necessarily fulfilled for each of the topics. Figure 2 illustrates the protocol´s gradational approach and the scoring statements for each of the criteria. As shown in Figure 2, the scoring system is as follows:

5 points: meets basic good practice and proven best practice;
4 points: meets basic good practice with one significant gap compared to proven best practice;
3 points: meets basic good practice with more than one significant gap compared to proven best practice;
2 points: one significant gap compared to basic good practice; and
1 point: more than one significant gap compared to basic good practice.

| Level | Assessment | Management | Stakeholder Engagement | Stakeholder Support | Outcomes | Conformance/ Compliance |
|---|---|---|---|---|---|---|
| 5 | Suitable, adequate and effective assessment with no significant opportunities for improvement.<br>In addition to basic good practice (Level 3), the assessment is likely to take a relatively broad, external or regional view or perspective; emphasise opportunities; and show a high level examination of interrelationships amongst relevant sustainability issues. | Suitable, adequate and effective management processes with no significant opportunities for improvement.<br>In addition to basic good practice (Level 3), management plans and processes are likely to show excellent anticipation of, and response to, emerging issues or opportunities; senior management and/or executive decisions are likely to be timely, efficient and effective in response to monitoring data, investigations and issues arising; and, in cases, commitments in plans are public, formal and legally enforceable. | Suitable, adequate and effective stakeholder engagement processes with no significant opportunities for improvement.<br>In addition to basic good practice (Level 3), the engagement is likely to be inclusive and participatory with the directly affected stakeholders; thorough feedback is likely to be available on how directly affected stakeholder issues are taken in to consideration; in cases, there is likely to be directly affected stakeholder involvement in decision-making; and information identified through engagement processes to be of high interest to stakeholders is released publicly in a timely and easily accessible manner. | There is support of nearly all directly affected stakeholder groups for the assessment, planning or implementation measures for that topic, or no opposition by these stakeholders.<br>In cases formal agreements or consent with the directly affected stakeholder groups have been reached for management measures for that topic. | In addition to basic good practice (Level 3), there may be exhibited enhancements to pre-project conditions; contributions to addressing issues beyond those impacts caused by the project; leveraging of opportunities; or significant contribution to capacity building. | No non-compliances or non-conformances. |
| 4 | Suitable, adequate and effective assessment with only a few minor gaps.<br>In addition to basic good practice (Level 3), the assessment is likely to exhibit some recognition of broader, external or regional issues; opportunities; and interrelationships amongst relevant sustainability issues. | Suitable, adequate and effective management processes with only a few minor gaps.<br>In addition to basic good practice (Level 3), management plans and processes are likely to exhibit good anticipation of, and response to, emerging issues or opportunities; and, in cases, commitments in plans are public and formal. | Suitable, adequate and effective stakeholder engagement processes with only a few minor gaps.<br>In addition to basic good practice (Level 3), there is likely to be good feedback on how directly affected stakeholder issues have taken into consideration; and information on sustainability topics understood to be of high interest to stakeholders is voluntarily released publicly. | There is support of a large majority of directly affected stakeholder groups for the assessment, planning or implementation measures for that topic, or only very low level opposition by these stakeholders. | In addition to basic good practice (Level 3), there may be exhibited full compensation of negative impacts; some positive enhancements; or evidence of capacity building associated with the project. | Very few minor non-compliances and non-conformances that can be readily remedied. |
| 3 | Suitable adequate and effective assessment with no significant gaps.<br>This would typically encompass (as appropriate to the topic and life cycle stage) identification of the baseline condition including relevant issues, appropriate geographic coverage, and appropriate data collection and analytical methodologies; identification of relevant organisational roles and responsibilities, and legal, policy and other requirements; appropriate utilisation of expertise and local knowledge; and appropriate budget and time span.<br>At level 3 the assessment encompasses the considerations most relevant to that topic, but tends to have a predominantly project-focussed view or perspective and to give stronger emphasis to impacts and risks than it does to opportunities. | Suitable, adequate and effective management processes with no significant gaps.<br>These would typically encompass (as appropriate to the topic and life cycle stage) development and implementation of plans that: integrate relevant assessment or monitoring findings; are underpinned by policies; describe measures that will be taken to address the considerations most relevant to that topic; establish objectives and targets; assign roles, responsibilities and accountabilities; utilise expertise appropriate to that topic; allocate finances to cover implementation requirements with some contingency; outline processes for monitoring, review and reporting; and are periodically reviewed and improved as required. | Suitable, adequate and effective stakeholder engagement processes with no significant gaps.<br>These would typically encompass (as appropriate to the topic and life cycle stage): Identification of directly affected stakeholders; Appropriate forms, timing, frequency and locations of stakeholder engagement, often two-way; Freedom for affected stakeholders to participate; Attention to special stakeholder engagement considerations relating to gender, minorities, cultural sensitivities, level of literacy, and those who might require particular assistance; Mechanisms by which stakeholders can see that their issues are recognised and acknowledged, and how they have been or are being responded to; and disclosure of information on significant sustainability topics (in cases, this may be on request). | There is general support amongst directly affected stakeholder groups for the assessment, planning or implementation measures for that topic, or no significant ongoing opposition by these stakeholders. | As appropriate to the topic and the life cycle stage, there may be exhibited avoidance of harm, minimisation and mitigation of negative impacts; fair and just compensation; fulfilment of obligations; or effectiveness of implementation plans. | No significant non-compliances and non-conformances. |
| 2 | A significant gap in assessment processes relative to basic good practice (Level 3). | A significant gap in management processes relative to basic good practice (Level 3). | A significant gap in stakeholder engagement processes relative to basic good practice (Level 3). | There is support amongst some directly affected stakeholder groups for the assessment, planning or implementation measures for that topic, with some opposition. | A significant gap relative to basic good practice (Level 3), for example, some deterioration in baseline condition. | A significant non-compliance or non-conformance |
| 1 | Significant gaps in assessment processes relative to basic good practice (Level 3) | There are significant gaps in management processes relative to basic good practice (Level 3) | There are significant gaps in stakeholder engagement processes relative to basic good practice (Level 3). | There is low support amongst directly affected stakeholder groups for the assessment, planning or implementation measures for that topic, or a majority oppose. | Significant gaps relative to basic good practice (Level 3), for example deterioration in baseline conditions with delay or difficulties in addressing negative impacts. | Significant non-compliances and non-conformances. |

FIGURE 2: Protocol criteria and scoring statements (Hydropower Sustainability, 2019a)

Assessments rely on objective evidence and in this study the written evidence was derived from:

- RG internal reports such as the Abaya Geothermal Development Environment and Socioeconomic Baseline Study;
- Draft ESIA Geothermal Utilization Scoping Report July 2019 (ESIA, 2019);
- RG Stakeholder Engagement Plan version 01 July 2019, RG Stakeholder Engagement Assessment Report 2018; and
- Abaya Geothermal Development project transcription and transcripts of stakeholder engagement meetings.

## 2.4 Earlier protocol assessments

The Theistareykir project assessment was the first to test the draft Geothermal Sustainability Assessment Protocol. The primary objective was to learn about the applicability of the protocol. A second objective was to gain insights into the performance of the project and to identify opportunities for improvement of this and other geothermal projects in Iceland. The assessment focussed on the preparation stage of the project before key decisions such as the granting of licenses and the final investment decision were taken.

The Theistareykir sustainability profile results shows that 18 topics were assessed, topics P-14 and P-15 were shown to be irrelevant and P-18 was not scored separately and later moved to P-8 (public health & safety). The results confirmed that the protocol was applicable to geothermal projects and the Theistareykir project received high scores throughout the assessment. The results are shown in Figure 3. The scores for each subject have a scale from 1-5 as described earlier.

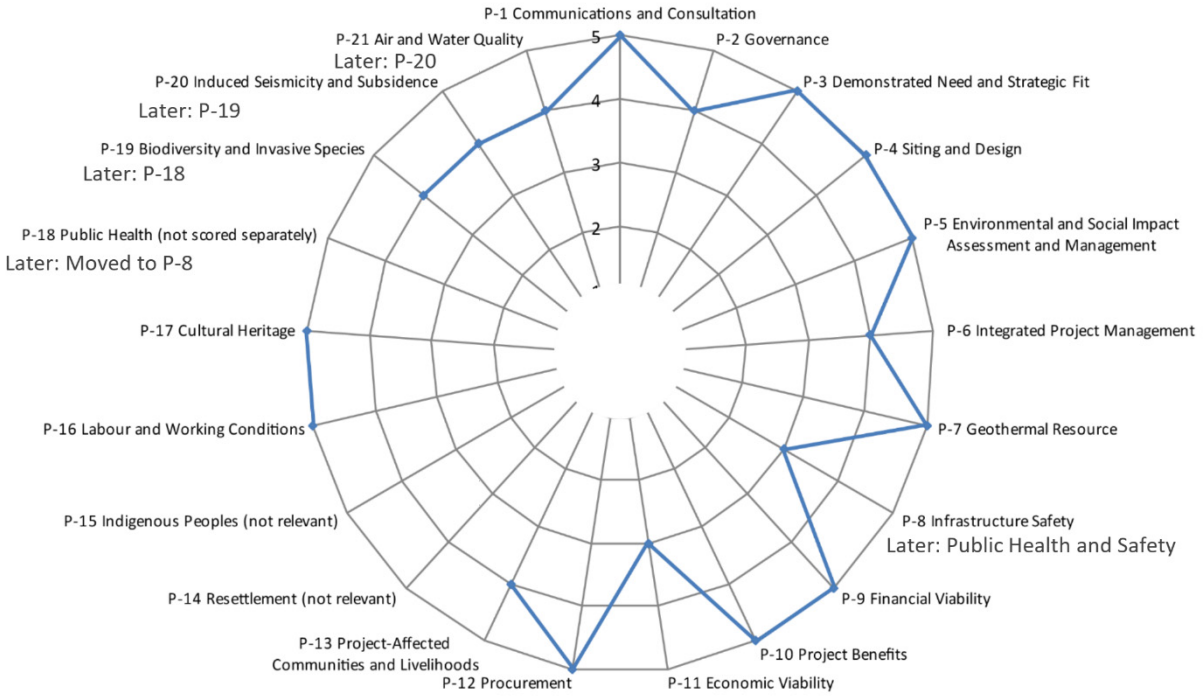


FIGURE 3: Theistareykir sustainability profile

## 3. CASE STUDY AND METHODODLOGY BASED ON SUSTAINABILITY CONCEPT

### 3.1 Objectives

The assessment described in this study was carried out for the UNU-GTP specialized training course in collaboration with Reykjavik Geothermal. The Abaya geothermal project was selected because it is at the early exploration stage and the environmental and social impact assessment are undergone at this stage. The objective of the assessment is to:

- Identify how appropriate the protocol is for the developer and for the government in Ethiopia and to test the draft GSAP based on the Ethiopian relevant legal frameworks;
- Find improvement opportunities in the project and its preparation;
- Identify data needs with respect to ensuring proper sustainability management;
- Identify areas of good practice and best practices of the existing projects and future projects in Ethiopia; and
- Facilitate a discussion with the developers, stakeholders and other working group members about the sustainability of geothermal projects.

The advantage of choosing a project in the preparation stage is that the assessment can have the largest influence on the sustainability of the project. As Abaya geothermal project is already under preparation, the assessment will help to evaluate the project from the start and then later the implementation and operation phases can be assessed.

### 3.2 Project description

The Main Ethiopian Rift constitutes the northernmost part of the East African Rift System, an area characterized by active extensional tectonics and associated volcanic activities. The Abaya geothermal

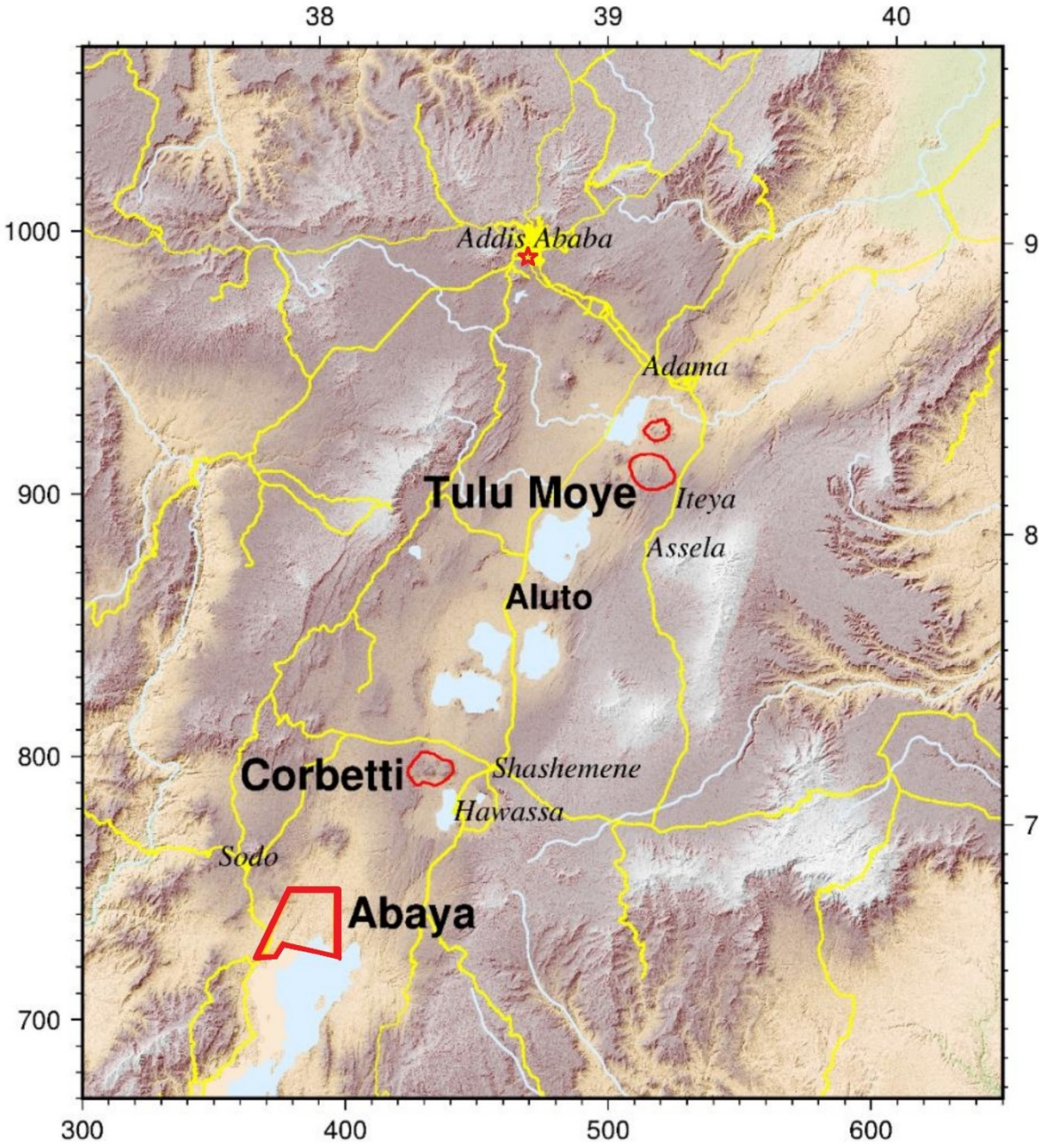


FIGURE 4: Location map of the study area (Abaya) and other potential projects nearby (RG, 2019)

prospect is located about 275 km south of Addis Ababa as shown in Figure 4. The greater Abaya geothermal area is about 2500 km$^2$ in size but the current Reykjavik Geothermal Abaya licence is about 520 km$^2$. Administratively, the Abaya area covers parts of the Wolayita and Sidama zones in Southern Nations, Nationalities and Peoples (SNNP) regional state. The Woredas (districts) are Humbo and Damot Weyde in Wolayita, and Dale in Sidama. The population, according to the National Population and Housing Census of Ethiopia projection in 2013 for 2014-2017 is 114,004 in Damot Weyde, 145,542 in Humbo, and 317,246 in Dale. The Abaya geothermal development project is the third geothermal power plant concession area in Ethiopia which is planned to be developed by Reykjavik Geothermal (RG, 2018).

Surface exploration studies have been carried out in Abaya. Geochemical work involved surface sampling of rocks, gases and fluids for chemical analysis to find evidence of geothermal activity. Geophysical work involved magnetotelluric (MT) and transient electromagnetic (TEM) resistivity measurement technologies. Once analysed together with the geochemical sampling and analysis, the

data yields parameters of the geothermal resource such as depth, size, temperature and other information. The geothermal target zones in the project/study area which are of geophysical and geochemical interest have been assessed. The conclusion of the exploration phase was to locate a drilling area in the study area. The drilling area will include the power plant, drill pads and flow lines linking the locations to the geothermal plant. The exact locations of these wells, flow lines and plant will be determined following the exploration drilling and detailed engineering design.

Major regulations, guidelines and proclamations applicable to the geothermal energy development projects are listed in Table 1 below (JICA, 2015).

TABLE 1: Legal frameworks

| No. | Title | No. | Date of issue |
|---|---|---|---|
| 1 | Geothermal Resource Development Regulation | 453 | July 22, 2019 |
| 2 | Geothermal Resource Development Proclamation | 981 | September 16, 2016 |
| 3 | Ethiopia Energy Regulation | 447 | January 28, 2019 |
| 4 | Energy (Amendment) Proclamation | 1085 | June 8, 2018 |
| 5 | Ethiopian Energy Authority Establishment Council of Minsters Regulation | 308 | May 22, 2014 |
| 6 | Public Private Partnership Proclamation | 1076 | February 22, 2018 |
| 7 | Environmental Impact Assessment Proclamation | 299 | December 31, 2002 |
| 8 | Environmental Pollution Control Proclamation | 300 | December 03, 2002 |
| 9 | Environmental Protection Organs Establishment Proclamation | 295 | October 31, 2002 |
| 10 | Expropriation of Landholdings for Public Purposes and Payment of Compensation Proclamation | 455 | July 15, 2005 |
| 11 | Rural Land Administration and Land Use Proclamation; Proclamation | 456 | July 15, 2005 |
| 12 | Ethiopian Water Resource Management Proclamation | 197 | March 9, 2000 |
| 13 | Ethiopian Water Resource Management Regulations | 115 | March 29, 2005 |
| 14 | Solid Waste Management Proclamation | 513 | February 12, 2007 |
| 15 | Environmental Impact Assessment Procedural Guideline Series I | | November, 2003 |
| 16 | Draft EMP for the Identified Sectoral Developments in the Ethiopian Sustainable Development & Poverty Reduction (ESDPRP) | | May 01, 2004 |
| 17 | Investment Proclamation | 280 | July 02, 2002 |
| 18 | Council of Ministers Regulation on Investment Incentives and Investment Areas Reserved for Domestic Investors | 84 | February 07, 2003 |
| 19 | The FDRE Proclamation, ‘’Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes’’ | 455 | Y2005 |
| 20 | Council of Ministers Regulation, ‘’Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes’’ | 135 | Y2007 |
| 21 | Oromia Regional Administration Council Directives, ‘’Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes’’ | 5 | Y2003 |
| 22 | Investment (Amendment) Proclamation | 373 | October 28, 2003 |

### 3.3 Assessment process and methodologies

Specific topics were selected with regard to the limited time available for the project, data availability, and the status of the project. Priority was given to the topics that are important for the study area and the country's need. The selection criteria of the topics also were based on the location of the project. For example, the "Indigenous Peoples" and "Resettlement" topics were not relevant for the Theistareykir project in Iceland. However, "Resettlement" is crucial for the highly populated project area of the Abaya Geothermal Development project.

The topics included in the assessment were:

Communications and Consultations (P-1), Demonstrated Need and Strategic Fit (P-3), Siting and Design (P-4), Environmental and Social Impact Assessment and Management (P-5), Integrated Project Management (P-6), and Geothermal Resource (P-7).

Each topic was evaluated with respect to up to six criteria, as shown in Table 2, and scores were assigned according to the following step-wise process.

Step 1: Evaluates if the scoring statements for each of the criteria specified at Level 3 are met by the project.
Step 2: If there is one significant gap compared to the Level 3 statements (all or part of a criterion is not fulfilled), then a score of 2 is assigned to the topic.
Step 3: If there is more than one significant gap compared to the Level 3 statements, then a score of 1 is assigned to the topic.
Step 4. If all of the Level 3 statements are met, then move to Level 5 to evaluate if the scoring statements for each of the criteria specified are met by the study project.
Step 5: If there is one significant gap compared to the Level 5 statements, then a score of 4 is assigned to the topic.
Step 6: If there is more than one significant gap compared to the Level 5 statements, then a score of 3 is assigned to the topic.
Step 7: If all of the Level 5 statements are met, then a score of 5 is assigned to the topic.

The table below shows what criteria are used for assessment for each selected topic. Note however that not all elements of the criteria are fulfilled for each topic. For example, stakeholder support is not relevant to any of the chosen topics.

TABLE 2: Criteria applied for each chosen topic

| Criteria | Topics | | | | | |
|---|---|---|---|---|---|---|
| | **P-1** | **P-3** | **P-4** | **P-5** | **P-6** | **P-7** |
| Assessment | x | x | x | x | | x |
| Management | x | | x | x | x | x |
| Stakeholder engagement | x | x | x | x | | |
| Stakeholder support conformance/compliance | x | | | | | |
| Outcomes | | x | x | x | x | |

## 4. RESULTS

Assessments rely on objective evidence including RG internal reports (RG, 2018) such as the Abaya geothermal development environment and socioeconomic baseline study (ESIA, 2019), the RG Stakeholder Engagement Plan version-01 (RG, 2018), the Abaya geothermal development project transcription and transcripts of stakeholder engagement meetings. It is difficult to construct a reliable

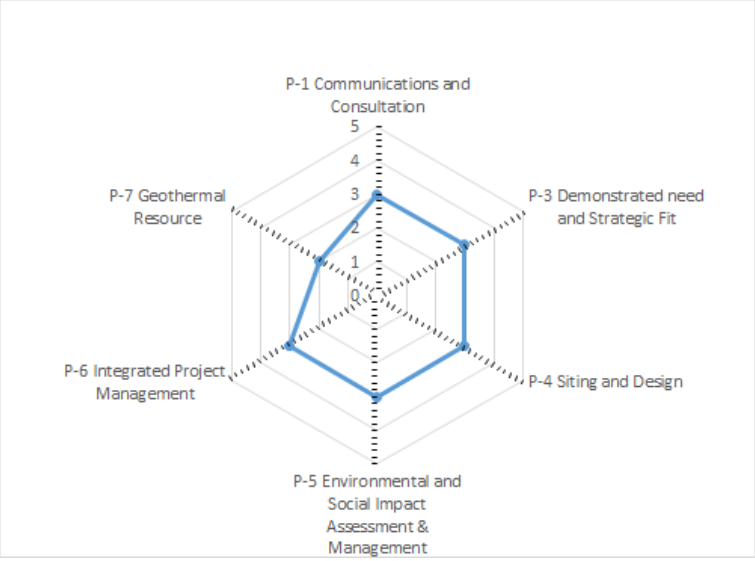


FIGURE 5: Abaya sustainability topic scores

protocol without good data and wideranging information about the project as the GSAP has to be implemented through field work on site and interviews with different stakeholders in addition to the analysis of all the written documents and each topic has to scored according to the findings. This, however, cannot be done for this UNU-study project due to shortage of time.

Table 3 below and Figure 5 show the overall score for each of the criteria relative to basic good practice (Level 3). The status of the project and availability of data did not warrant the evaluation of a higher score than level 3 in this UNU-study project so that none of the topics warranted a score higher than 3 according to the analysis.

TABLE 3: Overall score for each of the criteria assessed relative to basic good practice (Level 3)

| **Criteria** | **Topics** | | | | | |
|---|---|---|---|---|---|---|
| | **P-1** | **P-3** | **P-4** | **P-5** | **P-6** | **P-7** |
| Result | 3 | 3 | 3 | 3 | 3 | 2 |

Rationale of each score and the summary scoring statements are provided below for each topic.

### P-1 Communications and consultation

This topic addresses the identification and engagement with project stakeholders, both within the company as well as with external stakeholders (e.g. affected communities, governments, key institutions, partners, contractors, geothermal areas residents, etc.). The intent is that stakeholders are identified and engaged in the issues of interest to them, and that communication and consultation processes establish a foundation for good stakeholder relations throughout the project life (GSAP, 2018).

The objective of stakeholder identification is to establish which organizations and individuals might be directly or indirectly affected (both positively and negatively) or have interests in the project. Stakeholder identification is an ongoing process, requiring regular review and updates. Stakeholder engagement is therefore a basis for building strong, constructive and responsive relationships that are essential for successful management of a project. To date, a large number of potentially affected and interested parties have been identified through contacts that RG has already made with communities, government departments and other organisations as part of its consultation process, disclosure and government relations activities. Based on this definition, this assessment considers the following to be directly affected stakeholders:

Project affected communities and potential displaced persons and indigenous peoples (in the project locality), owners of land in the Abaya project license, residents using the area, local businesses including the offtaker EEP, tourism businesses, and employees during construction and operation. Project proponents (within the project-development group) are Reykjavik Geothermal, different departments involved in the Abaya project area, consultants (Green Sober Environmental Management Consultants, and VSO Consulting, 2019), contractors (e.g. the drilling company) and service providers.

There is also a range of important, secondary stakeholders but not directly affected stakeholders, including government agencies Federal and Regional government ministries and institutions Regional government representation at Zonal, Woreda and Kebele levels, and those who have an indirect interest in the proposed project. They include International financial institutions/donors, WB, IFC, AfDB, EU, EIB, financiers and regulators, NGO's and CBOs, and the media (radio, newspapers, TV stations, webpages) informing the local people about the planned activities during project implementation.

Reykjavik Geothermal (RG) Limited will be responsible for the entire project cycle, from inception to construction, operation and decommissioning. The project manager is responsible for the project newsletters, for responding to stakeholders' queries, organising public consultation meetings, publishing studies and updating websites. The project manager generally handles communications with authorities.

**Scoring statement: compares to basic good practice**
*Assessment:* Stakeholder mapping has been undertaken to identify and analyse stakeholders that are directly affected and to establish communication requirements and priorities with no significant gaps. *Criteria met: Yes*

*Management:* Communications and consultation plans and processes, including an appropriate grievance mechanism, have been developed at an early stage applicable to project preparation, implementation and operation that outline communication and consultation needs and approaches for various stakeholder groups and topics. *Criteria met: Yes*

*Stakeholder engagement:* The project preparation stage has involved appropriately timed communications and engagement, often two-way, with directly affected stakeholders on topics of interest and relevance to them. Engagement is undertaken in good faith and communication channels are in place for stakeholders to raise issues and get feedback. *Criteria met: Yes*

*Conformance/compliance:* Processes and objectives relating to communications and consultation have been and are on track to be met with no major non-compliances or non-conformances, and any communications related commitments have been or are on track to be met. *Criteria met: Yes*

All relevant stakeholder groups have opportunities to receive appropriate information, contribute their views and engage in dialogue. *There are no significant gaps relative to basic good practice, resulting in a score of 3.*

### P-3 Demonstrated need and strategic fit

This topic addresses the contribution of the project in meeting demonstrated needs for electrical power and, if applicable, direct use, as identified through broadly agreed local, national and regional development objectives and in national and regional policies and plans. The intent is that the project can demonstrate its strategic fit with development objectives and relevant policies and plans can be demonstrated, and that the project is a priority option to meet identified needs for electrical power and, if applicable, direct use (GSAP, 2018).

This section identifies relevant key administrative and institutional bodies in Ethiopia and national and international legislation, standards and guidelines that are relevant for Grade II geothermal resource development which is the direct use for the various sectors. To develop a Grade II geothermal resource whose temperature does not exceed 120°C and whose volume does not exceed 2,000,000 $m^3$ per year, the developer should request the license from the regional government (Geothermal Proclamation 981/2016, Regulation 453/2019). Furthermore, the developer needs to engage in discussions with stakeholder from the different industries, e.g. greenhouse operators and tourism office administrations. Also, the community needs to be sensitized for the objectives of the assignment and preliminary concerns, queries and feedback on the proposed geothermal activities need to be collected.

**Scoring statement: compares to basic good practice**
*Assessment:* An assessment has been undertaken of the needs for electrical power and of national and regional policies and plans relevant to those needs, with no significant gaps. *Criteria met: Yes*

*Stakeholder Engagement:* The results of the assessment of strategic fit are publicly disclosed, it is assumed that the power plant operators intend to provide this information at a later stage. *Criteria met: Yes*

*Outcomes:* The strategic fit of the project with needs for electrical power and, if applicable, direct use, and relevant policies and plans can be demonstrated. *Criteria met: Yes*

The main objective of regional stakeholders is the economic development shown by continued interest from industrial sectors, including tourism. The company intends to develop application for direct use of geothermal resources. There are no significant gaps relative to basic good practice, resulting in a score of 3.

**P-4 Siting and design**

This topic addresses the evaluation and determination of project siting and design options, including the power station with associated structures and wells connecting to the geothermal supply system and other infrastructures. The intent is that siting and design are optimized as a result of an iterative and consultative process that has taken in to account technical, economic, financial, environmental and social considerations (GSAP, 2018).

This section identifies relevant key administrative and institutional bodies in Ethiopia and national and international legislation, standards and guidelines that are relevant to the Environmental and Social Impact Assessment (ESIA) of the project. Several stakeholder engagements have taken place with national and local government officials by Reykjavik Geothermal since 2008.

**Scoring statement: compares to basic good practice**
*Assessment:* Technical information has been analysed at an early stage alongside social, environmental, economic, financial, and regulatory considerations in order to develop a preliminary project design and possible alternatives. *Criteria met: Yes*

*Management:* An optimization process has been undertaken to assess the project siting and design options. *Criteria met: Yes*

*Stakeholder engagement:* The siting and design optimization process involved appropriately timed, and often two-way, engagement with directly affected stakeholders, communications channels are in place for stakeholders to raise issues and get feedback. Criteria met: Yes

*Outcomes:* The final project siting and design responds to numerous sustainability considerations for siting and design. Criteria met: Yes

The EIA is under development, a more specific design could be developed for all project components. It is assumed that the site plans and the feasibility study are the basis for the site design works, there is no significant gap relative to basic good practice and scoring is 3.

**P-5 Environmental and social impact assessment and management**

This topic addresses the assessment and planning processes for environmental and social impacts associated with project implementation and operation throughout the area of impact of the project. The intent is that environmental and social impacts are identified and assessed, and avoidance, minimisation, mitigation, compensation and enhancement measures are designed and implemented (GSAP, 2018).

This section identifies relevant key administrative and institutional bodies in Ethiopia and national and international legislation, standards and guidelines that are relevant to the Environmental and Social Impact Assessment (ESIA) of the project.

RG hired Green Sober Environmental Management Consultants (GSEM) to undertake environmental and social baseline studies in accordance with Ethiopian laws and regulations, the World Bank standards and policies and the International Finance Corporation (IFC). The Abaya geothermal development project is the third geothermal power plant in Ethiopia (RG, 2018). Its baseline study was initiated by Reykjavík Geothermal (RG) and the study was undertaken by Green Sober Environmental Management consultants (GSEM) from February to April, 2019.

Public consultations and participation in a development project is anchored in the Laws of Ethiopia. This Stakeholder Engagement Plan is designed to meet laws of the Federal Democratic Republic of Ethiopia (FDRE) and IFC Performance Standards on Environment and Social Sustainability. Public consultation is a mandatory part of the project development as outlined in the constitution as well as the IFC standards. Stakeholder engagement must adhere to national requirements, as specified by the Environmental Protection Proclamation 295 /2002 and related regulations and ordinances. Ethiopia has signed and ratified several International conventions which relate to access to information, public participation in decision-making, and public access to justice in relation to the environment.

Several stakeholder engagements have taken place with national and local government officials by Reykjavik Geothermal since 2008. These have involved administrative and elected officials on various issues at different levels from federal, regional, elected, Woreda to Kebele (Woreda (district) is the third-level of regional administrative division and it is further subdivided into Kebele (neighbourhood associations) which is the smallest unit for local government administration in Ethiopia). Many meetings have been held with the off-taker, the Ethiopian Electric Power Office. Furthermore, a number of high-level stakeholder engagements have taken place with potential development partners (e.g. EIB), NGOs (USAID /Power Africa, Clinton Foundation, SOS Children's Villages), and also with local administrative officials and farmers when preparing and during geoscience field work. A number of these meetings are documented in minutes but not all by far. Others have resulted in agreements of various sorts, where parties agreed to:

- Disseminate information about the project at local, regional and national levels
- Introduce upcoming pre-feasibility and ESIA processes starting with baseline studies
- Sensitize the community for the objectives of the assignment
- Collect preliminary concerns, queries and feedback on the proposed geothermal activities.

**Scoring statement: compares to basic good practice**
*Assessment:* Assessments of project environmental and social impacts have been undertaken for project implementation and operation, including evaluation of associated facilities, scoping of cumulative impacts, role and capacity of third parties, and impacts associated with primary suppliers, using appropriate expertise with no significant gaps. A baseline has been established and is well documented describing the pre-project condition against which post-project changes can be compared. *Criteria met: Yes.*

*Management:* Environmental and social issues management plans and processes have been developed with appropriate expertise (internal and external) for project implementation and operation with no significant gaps; in addition to key social and environmental issues relating to the geothermal project, plans address construction related waste, noise, air quality, land disturbance and rehabilitation; the environmental and social impact assessment and key associated management plans are publicly disclosed. *Criteria met: Yes.*

*Stakeholder engagement:* The environmental and social impact assessment and management planning process has involved appropriately timed, and often two-way, engagement with directly affected

stakeholders; communication channels are in place for stakeholders to raise issues and get feedback. *Criteria met: Yes.*

*Outcomes:* Environmental and social plans avoid, minimize and mitigate negative impacts with no significant gaps. *Criteria met: Yes.*

Environmental and social plans to avoid, minimise and mitigate negative impacts are available as the project is ongoing with no significant gaps. *There are no significant gaps relative to basic good practice, resulting in a score of 3*.

**P-6 Integrated project management**

This topic addresses the developer's capacity to coordinate and manage all project components, taking into account project construction and future operation activities in the project-affected area. The intent is that the project meets milestones across all components, delays in any component can be managed, and one component does not progress at the expense of another (GSAP, 2018).

Roads are required for construction and operational activities at the exploration drilling site. Various possibilities will be considered for alternative access roads. Exploration drilling may involve 1 to 4 exploration wells which can be 1,500 to 3,500 m deep. Duration for the drilling of an exploration well is 1-2 months. After the conclusion of drilling and blow testing during the exploration drilling phase, the wells are prepared for connection to the steam utility. If blow testing shows that a well is sufficiently productive to be used for generation, it will be utilized as a production well for the power station. The drilling area will include the power plant, drill pads and flowlines linking the wells to the geothermal plant. The exact locations of these wells, flowlines and the plant will be determined following the exploration drilling and detailed engineering design.

RG needs to ensure that geothermal drilling is done in the most environmentally and safe manner as is required by the New Zealand and AUC Code of Practice for Geothermal Drilling. Extensive well testing including interference/tracer testing to ensure that the equipment specifications are well within the bounds of the productivity of the reservoir is required. Environmental health and safety issues also need to be addressed.

**Scoring statement: compares basic good practice**
*Management:* An integrated project management plan and processes have been developed that takes into account all project components and activities with no significant gaps. A construction management plan has been developed that identifies resource related risks, construction risks and describes processes that contractors and others are required to follow to manage these risks. *Criteria met: Yes. See discussions below.*

*Outcomes:* The project is likely to meet overall budget and timing objectives and targets, and plans to avoid, minimize and mitigate risks are in place with no significant gaps. *Criteria met: Yes.*

It is assumed that the operators are developing a plan to avoid, minimise and mitigate risks with no significant gaps. Details have to be provided at a later stage and *there are no significant gaps relative to basic good practice, resulting in a score of 3*.

**P-7 Geothermal resource**

This topic addresses the level of understanding of the geothermal resources and the assessment of the geothermal production capacity. Also, it addresses the predicted response to the planned production and the planned generation efficiency based on the assessed geothermal conditions and utilization strategy. The intent is that the planned power generation takes into account the geothermal resource availability,

renewability and reliability in the short- and long-term, as well as efficient utilization of the energy resource (GSAP, 2018).

Geothermal power generation involves drilling deep exploration and production wells into the Earth's crust to harness the thermal energy contained in underground reservoirs in the form of geothermal water or steam. The Abaya geothermal development project is the third licensed geothermal power plant to be developed in Ethiopia (RG, 2018).

Geology is one of the major factors which play an important role in the distribution and occurrence of groundwater. The study area is generally formed by ingenious rocks (tertiary volcanic rocks). The Abaya geothermal project area is mainly composed of Teritiary volcanic rocks. These are the Pleistocene basalts, the Nazreth group and Dino formation, rhyolitic and ignimbrite lava flows, aphyric and porphyritic basalt with lesser vesicular basalt, minor alkali trachyte flows and tuffs, and lacustrine volcano clastic sediments and tuffs (RG, 2018).

Surface explorations have been carried out in Abaya. Geochemical work involved surface sampling of rocks, gases and fluids for chemical analysis for evidence of geothermal activity. Geophysical work involved magnetotelluric (MT) and transient electromagnetic (TEM) resistivity measurement technologies. Once analysed along with geochemical sampling and analysis, the data yields parameters of the geothermal resource such as depth, size, temperature and other information.

The geothermal target zones in the project/study area of geophysical and geochemical interest have been assessed. The conclusion of the exploration phase was to locate a drilling area in the project /study area. The drilling area will include the power plant, drill pads and flowlines linking the wells to the geothermal plant. The exact locations of these wells, flowlines and the plant will be determined following the exploration drilling and detailed engineering design.

**Scoring statement: compares basic good practice**
*Assessment:* An assessment of the geothermal resource production capacity has been undertaken utilising available data, field measurements, testing of wells, appropriate statistical indicators, and geothermal reservoir models. Issues which may impact the geothermal availability or reliability have been identified and factored into the modelling and scenarios, uncertainties and risks have been evaluated. *Criteria met: Yes. See discussion below.*

*Management:* A plan and processes for generation operations have been developed to ensure efficiency of geothermal energy utilization, based on analysis of the geothermal production capacity, a range of scientific and technical considerations, taking into account power system opportunities and constraints, as well as social, environmental and economic considerations. *Criteria met: Yes.*

Based on this information, the drilling area includes three possible water well plans and two tentatively located drilling well pads. Currently, this is only guess-work as the behaviour of the resource does not become apparent until several wells have been successfully drilled and tested over an extended time period. Hence, there is one significant gap which is test drilling compared to basic good practice, resulting in a score of 2.

## 5. DISCUSSION

The assessment is done for six topics compared to basic good practice (level 3). The results show that five topics meet basic good practice (level 3). However, one topic P-7 scores at level 2 with one significant gap in test hole drilling. None of the topics analysed met level 5 which is proven best practice. By using the protocol as a guideline and by forming a committed and experienced working group the

project could meet the criteria for level 5 in the future enhancing its sustainability. Challenges of the assessment include:

1. The experience of the assessor. A professional assessment requires an experienced assessor;
2. The time budget to go through all relevant criteria. Due to time limitations only a limited number of topics were analysed, and it was not possible to capture insights from the developer and stakeholders; and
3. Appropriateness and data limitations. Due to the early stage of the project, much of the data required is not yet available.

Due to those limitations, the results should only be taken as an indication of sustainability management of the Abaya geothermal project.

The results illustrate that the protocol is comprehensive in terms of capturing major sustainability impacts and is sensitive to the issues unique to each site and location. It is also clear that it can enhance social acceptance as it is an evaluation that seeks out the perspectives of all parties involved directly or indirectly, insuring equality at every level. It insists that those responsible for the project maintain open, effective and constant communication with the government institution as well as the local community and investors. It creates a strict framework for acceptable working methods and requires regular re-assessment and updating of project plans and schedules.

As stated before, due to the time limitation, it was not possible to facilitate a discussion with the developers, stakeholders and other working group members about the sustainability of the geothermal project. However, to get a better score a wide consultation is needed enabling the development to implement proven best practice both for this case study project and for other projects in the future.

It must, however, be kept in mind that the protocol assessment does not provide an overall ‘pass’ or ‘fail’ mark for a project, nor can it be used to certify a project as sustainable. In short, the protocol provides an effective mechanism to continuously improve sustainability performance because results identify gaps that can be addressed and the findings provide a consistent basis for dialogue with stakeholders.

## 6. CONCLUSION

The Geothermal Sustainable Assessment Protocol (GSAP) is a management tool which is applicable in an Ethiopian context. It supports and strengthens the Ethiopian legal frameworks for assessing the impact of geothermal development on the Ethiopian Sustainable Development Goals. The protocol captures the main sustainability themes applicable and illustrates areas where geothermal developers can improve their practices. In general, the Geothermal Sustainability Assessment Protocol is an important management tool to secure that future potential projects will be developed in accordance with international standards and best practices. Furthermore, it can help secure social acceptance as it fosters community development and stakeholder engagement.

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