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DEVELOPMENT PLAN OF THE LAHENDONG GEOTHERMAL EDUCATION PARK, NORTH SULAWESI

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ABSTRACT

Starting from the observation of the lack of skilled human resources in the management and development of geothermal in Indonesia, particularly in North Sulawesi, we feel the need to discuss this issue with all relevant stakeholders either directly or indirectly. We notice that there are only a few North Sulawesi youth take up career in geothermal. From various discussions, seminars and workshops on geothermal development in North Sulawesi in particular, and Indonesia in general, it was concluded that geothermal knowledge should be disseminated to all levels of communities both formally and informally. One of the ways to disseminate the geothermal knowledge is by setting up a geothermal education park as a part of community-based edu-tourism program. It is expected that the park can enhance the significance of the geothermal site as a natural laboratory for studying the earth sciences and geothermal. The target is the growth of communities' knowledge, interest, and support for geothermal resource development.

Lahendong geothermal fields is located in Tomohon City, about 30 km south of Manado. The field is situated in a beautiful, steep volcanic terrain at about 750 km above sea level, with vigorous thermal manifestation including fumaroles, gas discharges, steaming ground, hot springs, hot mud pools with mud volcanoes, and altered ground. Lahendong is the first developed geothermal system in the eastern part of the country. With its uniqueness and convenient access, Lahendong becomes a potential candidate of the site of the geothermal education park. According to the ideas proposed by Utami, *et al* (2011) the development of this public education facility will use the concept of "growing park", meaning that the park elements can be made available step by step depending on the stage of the development of the field itself, and the availability funding and other resources.

Keywords: *Lahendong, Geothermal Education Park, natural laboratory, public education facility, program planning and implementation of activities.*

1. INTRODUCTION

The Government of Indonesia has issued Presidential Regulation No. 5 of 2006 on National Energy Policy which establishes the use of geothermal energy in 2025 by 5%, or about 9000 MWe. However, until now only equal to 1052 MWe installed. Therefore is still be made to speed up the development geothermal energy in Indonesia because Indonesia's electricity needs from year to year increasing. In connection with it then to support the development of geothermal skilled workers need to be prepared people to understand about geothermal is, so it needs to be disseminated to the public about the benefits and role to help overcome energy crisis in Indonesia, as well as conducted training to middle-skilled workers for support the geothermal industry.

To overcome this, the Government and the people of North Sulawesi feel the need to build a Park on the Geothermal Education at Lahendong as a story telling that can build the interest and enthusiasm the children and the younger generation to know and love the earth sciences as a populist science so that later on emerged that the children and or young generation who are professional and skillfully to manage the geothermal so that the ideals in 2025 Indonesia electrical energy supplied by geothermal resources on at least 5 per cent can be achieved.

2. FIELD OVERVIEW

2.1. General

It is known that the geothermal potential spread almost throughout the Indonesian teritory except the islands of Kalimantan (Borneo), Papua and some other islands. In fact, data show that 40 percent of the world geothermal potential located in Indonesia. So why the Lahendong geothermal Education Park

wanted built in Tomohon ? Wise expression that although it has been a long time but always keep striking to say: one million steps must be preceded by a single step, we have to start somewhere (R. Korompis p: 104). Then why in Tomohon Lahendong we will build a park Geothermal Education and Tourism ?

As Geographically, the City of Tomohon position at 1° 15' North latitude and 124° 50' East Longitude, is plain cool and lush as it is situated at an altitude of approximately 700-800 meters above sea level (asl) and is surrounded by three active volcanoes namely Gunung Lokon (1,689 m), Mount Mahawu (1,311 m) and Mount Masarang. The data indicate that the geothermal potential in Tomohon city and surrounding areas are abundantly, so the Government and the community working together to make Tomohon city as a tourist destination by relying on the the potential available resources such as geothermal besides used to meet the energy needs are also utilized for tourism purposes. To date in 2013, the eastern part of parts of Indonesia there is no place that produces electrical energy from geothermal apart from Lahendong in Tomohon with installed capacity of 4 x 20 MW.

The data shows that the field of human resource management needs Geothermal in Indonesia has not been balanced by the availability of experts and medium-skilled workers there, while the energy needs from renewable sources such as geothermal increased. Various attempts have been made either by opening formal education programs at various universities such as ITB, UI, UGM, and other study centers, but it is still a hope due to interest young people in learning earth sciences is still not significant compared to the ease of studying others.

Resolves the problem, then one to stimulate the children's interest, young peoples or the general public is about curiosity to geothermal, can be reached through informal education as early as possible that can be accessed easily, professionally managed as a nature-based public education or comunity based edu and ecotourism.

2.2. Geothermal Potential in Lahendong and Surrounding

Lahendong field is situated at about 750 m above sea level, within the beautiful volcanic landscape of Minahasa. It is located between two active volcanoes, namely Lokon (9 km to the North) and Soputan (20 km to the South). Lake Tondano, the remnant of one of the world's largest calderas (Newhall and Dzurisin, 1988) is situated 10 km to the East of field (Figure 1).

The geothermal resource at Lahendong has been developed by PT. Pertamina Geothermal Energy (PGE), and the electricity generation has been made by the State Electricity Enterprise (PLN). The field currently produces 80 MWe. Now is being prepared to increasing the electricity production up to 100 MWe.

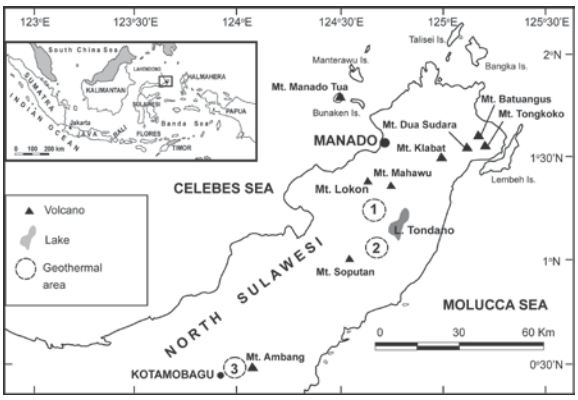

Figure 1: Location of the Lahendong geothermal system (1); and the Tompaso (2); and Kotamobagu (3) prospects with respect to major Quaternary volcanoes in North Sulawesi (Minahasa). (Utami, et all. 2011).

The situation map of the field is given in Figure 2. The field hosts patches of thermal manifestation, including a large mud pool in Lahendong valley, fumaroles and steam-heated features around the Lake Linow, and hot springs and altered ground in Leilem, Pangolombian and Kasuratan villages. Several neutral-pH, alkali chloride hot springs emerge at Tempang village (12 km south of Lahendong). The thermal manifestations at Lahendong and Linow have been more popular tourist destinations in comparison to those in other villages.

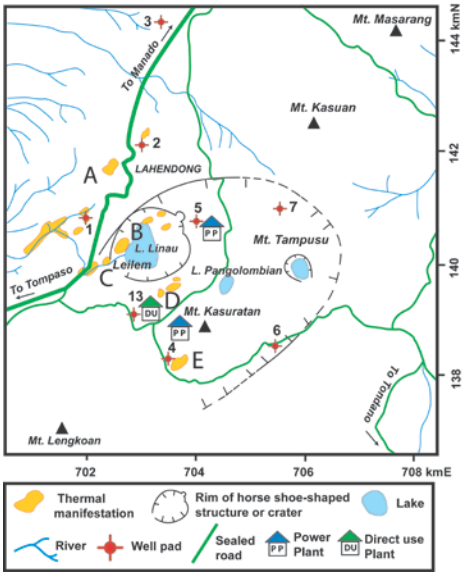

Figure 2: Situation map of the Lahendong geothermal field (Utami et al, 2011).

The first known published description of the thermal manifestation in North Sulawesi was made by a British naturalist, Alfred Rusel Wallace who visited Sulawesi in 1859 (Wallace, 1890), the year Charles Darwin published " On the Origin of species". These include mud pools, steaming grounds, and hor spring emerged in the several spots between Tompaso and Langowan villages. At Leilem village near Tomohon, the locals set up wooden sauna rooms above a cluster of small hot springs on the bank of Leilem River. Each room is equipped with a shower of cool water pipe from a neutral pH cold spring from nearby hill.

2.3. Cultural and Educative Significance of the Park

Indonesian culture is rich in story-telling tradition, so it is not a surprise that those living near thermal areas lovingly pass on the legends behind these thermal wonders to new generations and visitors. In North Sulawesi there is a legend of Toar (The Sun) and Lumimu'ut (The Sweating Rock). The ancestors of Minahasan people believed that they began their life in a thermal area in Tompaso. The story of their life is depicted in Bukit Kasih recreational park in the Tompaso thermal area. It was belived that the occurrence of twin mud volcanoes at Lahendong thermal valley (10 km North of Tompaso) was proof of the couple's everlasting love. Mud volcano is a hydrothermal mud buildup around an ejecting vent. Mud volcanoes commonly develop in the relatively drier parts of the large mud pool at the Lahendong valley. When two vents are located side by side, the "twin" mud volcano is formed.

Development of a geothermal field brings high technology into the area. The view of the operating facilities in the steam field, the power plant, and other plant utilities is indeed captivating. However, lay people (locals and visitor alike) may wonder: What is going on? How can the hot fluid from a great depth turn into electricity? Will the exploitation of geothermal resource harm our environment? Can we utilize the hot steam and hot water for other purpose? A public learning facility such as geothermal education park is necessary in order to satisfy such curiosity.

3.THE INTENT AND PURPOSE OF THE DEVELOPMENT OF THE PARK

3.1. The aims and Objectives of the Park.

We propose a geothermal education park concept that allows visitors to enjoy the atmosphere of a geothermal area, but at the same time:

a) Learn about the science of geothermal phenomena and appreciate the indigenous folklores and wisdom behind them. In this way the park encourages people, especially the young, to learn the science of the natural thermal heritage without ignoring its cultural significance.
b) Learn and appreciate the role of geothermal energy in fulfilling humanity's need of clean, renewable and sustainable energy. The park will show that the development of indigenous energy can help increase the prosperity of the community, and hence help eliminate resistance to the process of geothermal resource development.

The above concept of park development is readily applicable for Lahendong since several park elements are already available, and the existing roads connecting the trails from the thermal areas to the area of steam production and utilization are in a relatively good condition. As well, there is already public participation in the management and maintenance of the eco-tourism objects. These include the thermal wonders.

3.2. Current Situation

Since 2007, a building intended as a tourism information center was erected by the Government of Tomohon City overlooking the Lake Linow (Figure 3(b)). Unfortunately the building remains unused until now. With minor repair it would be a perfect gallery and geothermal information center. Items and collections as in paragraph 3, number 2 can be displayed here.

Lake Linow with its fumaroles, altered ground, mud pots, and gas discharge on its banks would be an ideal first site for public educational interest. The development of Lake Linow as an eco-tourism spot by a local private company since 2009 is beneficial for the proposed geothermal education park as it provides well maintained public facilities including a café, parking ground, rest rooms, and walking tracks (currently limited on the Eastern bank of the lake).

The Lahendong thermal valley (about 2 km North of Linow thermal area), although less developed compared to the Linow thermal area, is regularly maintained by a family who live nearby. The proposed public learning facility will undoubtedly give added value to the eco-tourism in the area.

(a)

(b)

Figure 3: Linow lakes view (a); and Geothermal Information Center Building (b), that has not been functioning.

4. DEVELOPMENT PLANNING

To learning from experience since 2007 until today then the government's commitment to develop the geothermal potential of the area as a superior competitiveness, it will realize the function of the park. The provincial, district and or city government with the stakeholders collectively, have managing programs, activities and budgets through planning documents in a variety of areas such as long and medium -term regional development plans (RPJMD & RPJPD) to 2025 so that the growing park of geothermal education can be realized and functionate. Besides that, the Government is preparing all the rules of structuring and the utilization of space in Tomohon and seeking investors who want to manage the the park according to its function without ignoring the existing regulations.

5. ACTIONS AND PRELIMINARY RESULTS

Things that have been performed and preliminary results have been achieved in realizing this park :

1. Tomohon City Government in cooperation with the BPPT and Geology Board / Centre for Volcanology and Disaster Mitigation for land use.
2. Building built by the government of Tomohon for a museum and or aphitherater but not yet functioning
3. The Ministry of Culture and Tourism to build facilities for resting area.
4. In collaboration with the colleges in this regard UGM and ITB and UNIMA and UNSRAT in designing technical academic material.
5. Is coordinated by Provincial Government in cooperation with KAPET BAPPEDA and BIMP EAGA and related stakeholder such as PT. Pertamina Geothermal Lahendong; PT.PLN Geothermal, Geoscience Training Center in Cikarang, and the others for functioning of the as much as possible the use of this park.

We recommend that, in a developed geothermal field such as Lahendong, that park coverage includes both thermal manifestation and the geothermal production and utilization areas. The following are the suggested park elements:

1. A starting point with a billboard map. There should also be a brief explanation of the existence of natural geothermal activities in the region and their significance to human's life.
2. A visitor information center which would include a geothermal museum or gallery to allow brief but comprehensive interest in the geothermal surroundings. It should be erected at the entrance to the park. Collections such as geologic specimens from the field, miniatures of the steam field facilities and power station, photographs, sketches, and/or video to explain the history of development of the resource, could well be displayed here. Health and safety procedures for visiting the thermal area could be introduced here as well.
3. Safe and clear trails in the field which allow the visitor to follow the flow of explanations from "upstream" (the science of geothermal) to "downstream" (the technology of its thermal energy extraction and utilization).
4. Stop sites at thermal interest points with billboards displaying educational diagram of both scientific and legendary interest.
5. Signs to warn visitors of geothermal hazard, with clear instructions, in order that they avoid unnecessary accidents and risk.
6. Stop sites near the selected fluid production facilities, power plant and/or other utilization facility with billboards showing simple explanations about them (components, function, operating condition, etc). These stop sites must be located in a safe distance from the facilities so that they do not obstruct the operation of the field.
7. Lookouts, which should be positioned in strategic places so that visitors are able to enjoy the picturesque views and take a brief rest.
8. Muster points that allow visitors to gather safely in the event of geo-hazard or other disaster.
9. Other necessary public facilities.

6. CLOSING REMARKS

Development of a geothermal education park in Indonesia is relevant to the campaign for the development of geothermal resources in the country. The presence of such a park would be of multi-beneficial significance:

a) The park would entice people, especially the young people, to learn about this clean,

renewable and sustainable type of energy resource.

b) The positive understanding of geothermal energy gained through enjoyable learning in the actual park, would strengthen public support for the promotion of geothermal resource development in the country.
c) Well planned geothermal education parks will help increase the quality of the existing eco-tourism as well as increase the popularity of many of our thermal areas previously perceived as less preferred destinations.

The well-developed Lahendong geothermal field with its quality infrastructures is a favorable site for the first geothermal education park in the eastern part of Indonesia. It will inspire and motivate the local young people to participate in the future development of geothermal energy, as part of their own future.

SUGGESTION

1. We suggest the concept of a "growing park" where the park elements would be made available step by step depending on the state of the development of the field itself, and the availability of funding, space, and other resources. More displays and facilities can be added as the field development progresses. Simple, cheap, and "easy to make" items such as explanation billboards, and also trails should be prioritized. As a starter, by simply implementing these two basic steps, the park would be in a position to readily function and progressively find its shape.
2. Expected outcomes of thought to build Lahendong Geothermal Education Park, will guide the present generation and the coming will understand the strength ties of the relation between the natural resources i.e geothermal with the local culture as manifested of popular legend of Minahasa Toar and Lumimuut figures, will be a modest contribution to understanding the broad and deeply about the role of the ancestors and elders in the village in preserving local uniqueness as a cultural attraction that can be boost the local economy around.

REFERENCES

Anonimous. 2011. Peraturan Daerah Provinsi Sulawesi Utara No. 3 Tahun 2011 tentang Rencana Pembangunan Jangka Panjang Daerah Provinsi Sulawesi Utara Tahun 2005-2025.

Anonimous. 2011. Peraturan Daerah Provinsi Sulawesi Utara No. 4 Tahun 2011 tentang Rencana Pembangunan Jangka Menengah Daerah Provinsi Sulawesi Utara Tahun 2005-2025.

Mulyana, R. 2013. Arah Pengembangan Kebijakan Geothermal Nasional Melalui Amandemen UU Nomor 27 Tahun 2003 Tentang Panas Bumi dan Regulasi Turunannya. Paper Bandung, 1 Mei 2013.

Newhall, C.G., and Dzurisin, D. 1988. Historical Unrest at Large Calderas of the World. U.S. Geological Survey Bulletin.1855. pp. 345-351.

Ratag, M., Korompis, R. 2009. Kurikulum Berbasis Kehidupan. Yayasan Pendidikan Lokon. Tomohon.

Roeroe, W. A. 2008. Peranan Para Tua-tua dalam Naskah-naskah Perjanjian Lama. Universitas Kristen Indonesia Tomohon Press dan Lembaga Telaah Agama dan Kebudayaan.

Sarundajang, S. H. Dr. 2011. Geostrategi; Sulawesi Utara Menuju Pintu Gerbang Indonesia di Asia Pasifik. Kata Hasta Pustaka. Jakarta

Usman, H. Prof. Dr. M.Pd., M.T., Akbar, P. S. M.Pd. 2009. Metodologi Penelitian Sosial. Bumi Aksara. Jakarta.

Utami, P., Khasani, Roeroe, J., Tuerah, N., Bachrun, Z.I., Rozaq, K. and Gumalag, M. 2011. Lahendong Geothermal Education Park: a Proposed Geothermal Public Education Facility in the Eastern Indonesia. Proc. 33th New Zealand Geothermal Workshop, Rotorua. 5 p.