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Updates on the Geothermal Energy Development in the Philippines

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ABSTRACT

Located in the Circum-Pacific Rim of Fire, the Philippines is endowed with both mineral and energy resources. Philippines ranks second in the world (next to the United States of America) in using geothermal energy for electricity generation. From seven (7) production fields, a total of 1848MWe of electricity is produced which constitutes nearly 12% of the electricity requirements in the country. The success of the Philippines in exploiting geothermal energy may be attributed on good governance and commendable government-industry collaboration.

Future plans for development of more fields for electricity production as well as direct uses of the geothermal waters are in the pipeline. The Department of Energy is currently planning to increase the countries capacity by installing another 1.445 MW by the year 2030. Expansion to increase or at least maintain the performance of current production fields within its vicinities are being done. Before the end of 2014, the Maibarara Geothermal Field with a power generation capacity of 20 MW is expected to operate commercially along with the transfer completion of the Northern Negros Geothermal plant to the 20 MW Nasulo geothermal facility within the Palinpinon geothermal complex. Projects in the pre-development stage located in the island of Luzon include the 27 MW Mabini Project (Batangas), Negron Cuadrado Geothermal prospect (Zambales-Pampanga), 100 MW Kalinga project, 60-100 MW Bontoc-Sadanga geothermal project (Mt. Province), 60-100 MW Buguias-Tinoc Geothermal project (Benguet-Ifugao), 40 MW West Bulusan project, Iriga Geothermal prospect (Camarines Sur),Mariveles geothermal prospect (Bataan), East Mankayan Geothermal project (Benguet-Ifugao) and 70 MW Montelago Geothermal project (Mindoro) where hot springs, spa and aquaculture is planned to be established. Projects in the islands of Visayas and Mindanao include the 49 MW Biliran (Caibiran) Geothermal project and the North Cotabato prospects.

1. INTRODUCTION

For the longest time, the Philippines has been dependent on imported energy sources such as crude oil and coal, imported coal having the largest share for electricity generation. It was only during the recent time when the country started producing small volumes of oil (Palawan), natural gas (Malampaya) and coal (Semirara). Aside from these fossil fuels, renewable energy sources like hydropower and geothermal also play a significant role in meeting the electric energy needs of the country.

Located in the Circum-Pacific Rim of Fire, the Philippines is endowed with both mineral and energy resources. This paper will present a review of the updates on geothermal energy development in the Philippines as well as plans for increasing its role in the energy sector.

2. TIMELINE OF GEOTHERMAL ENERGY IN THE PHILIPPINES

2.1 History of geothermal energy: discovery to development

As early as 1962, early project on harnessing geothermal energy for electricity was initiated by the then Commission on Volcanology by conducting an inventory of hot spring areas in the country. Republic Act No. 5092 was enacted in 1967 to promote and regulate the exploration, development, exploitation and utilization of geothermal energy, natural gas and methane gas; to encourage its conservation; and for other purposes. A pilot geothermal power plant capable of generating 2Kwe was built in Tiwi (Albay). In anticipation of the oil embargo in the 1970's, four geothermal power plants were commissioned between 1973-1983, namely Tiwi (Albay), Makiling-Banahaw (Laguna-Batangas), Palinpinon (Southern Negros) and Tongonan (Leyte). The 1980s was a period of addition of power plants and expansion of generating capacities in these four fields as well as exploration on more prospects areas. Expansions continued as the demand for oil-based generators (including oil thermal, diesel and gas turbines) slowly decreased in the 1990s. This resulted to increase in the use of geothermal energy in electricity generation. By the 2000s, the demand for crude oil decreased side by side with increase in using natural gas. Coal also became a major source of electricity energy source (Buhay, 2013). On the other hand, there was a plateau in the production of geothermal electricity. Figure 1 shows the growth in the development of geothermal energy from 1977-2011.

2.2 Updates on geothermal energy.

The Philippines ranks second in the world (next to the United States of America) in using geothermal energy for electricity generation. Aside from Makiling-Banahaw, Tiwi, Palimpinon and Tongonan during the 1990s. Mt. Apo, Northern Leyte and most recently Maibarara field were added (Figure 2). From eight (8) production fields, a total of 1868 MWe of electricity (as of 2013) is produced which constitutes nearly 11% of the electricity requirements in the country.

Maibarara Geothermal Field in Sto. Tomas, Batangas was the most recent to be commissioned and went on line in the last quarter of 2013 with an installed generating capacity of 20 MWe. This field was initially explored with well drilling and testing by the Philippine Geothermal Inc. from 1974-2003. After which service contract was awarded to PetroEnergy resources and transferred to Maibarara Geothermal Inc. in 2010. From 2010 to present, drilling and construction of the fluid collecting and reinjection system as well as power plan started in 2012. Studies showed proven resources can support 20Mwe with a life span of 25 years.

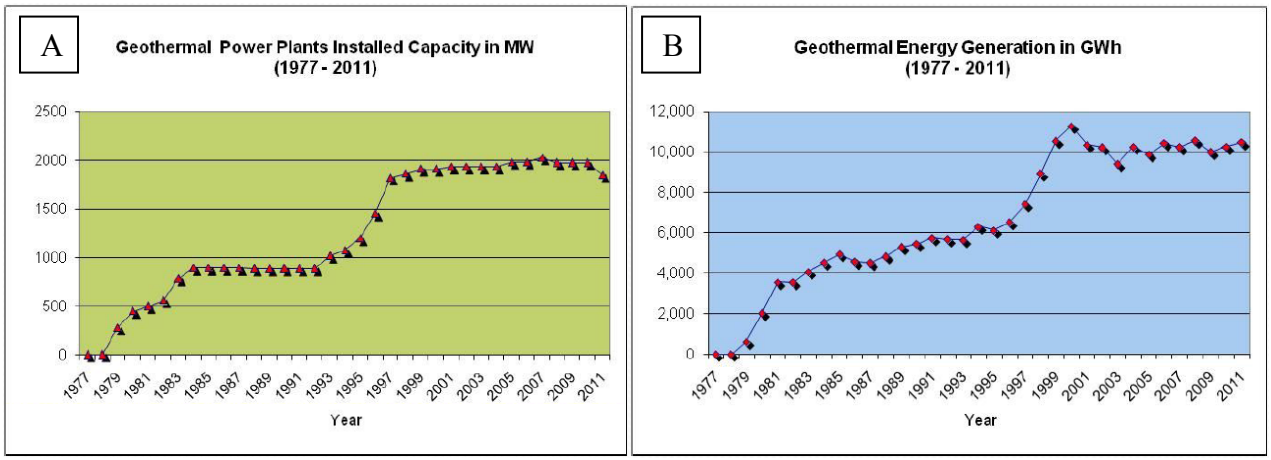

Figure 1 A. Combined installed capacity of geothermal power plants in the Philippines from 1977 to 2011. B. Combined geothermal energy generation from 1977-2011. (Fronda, no date)

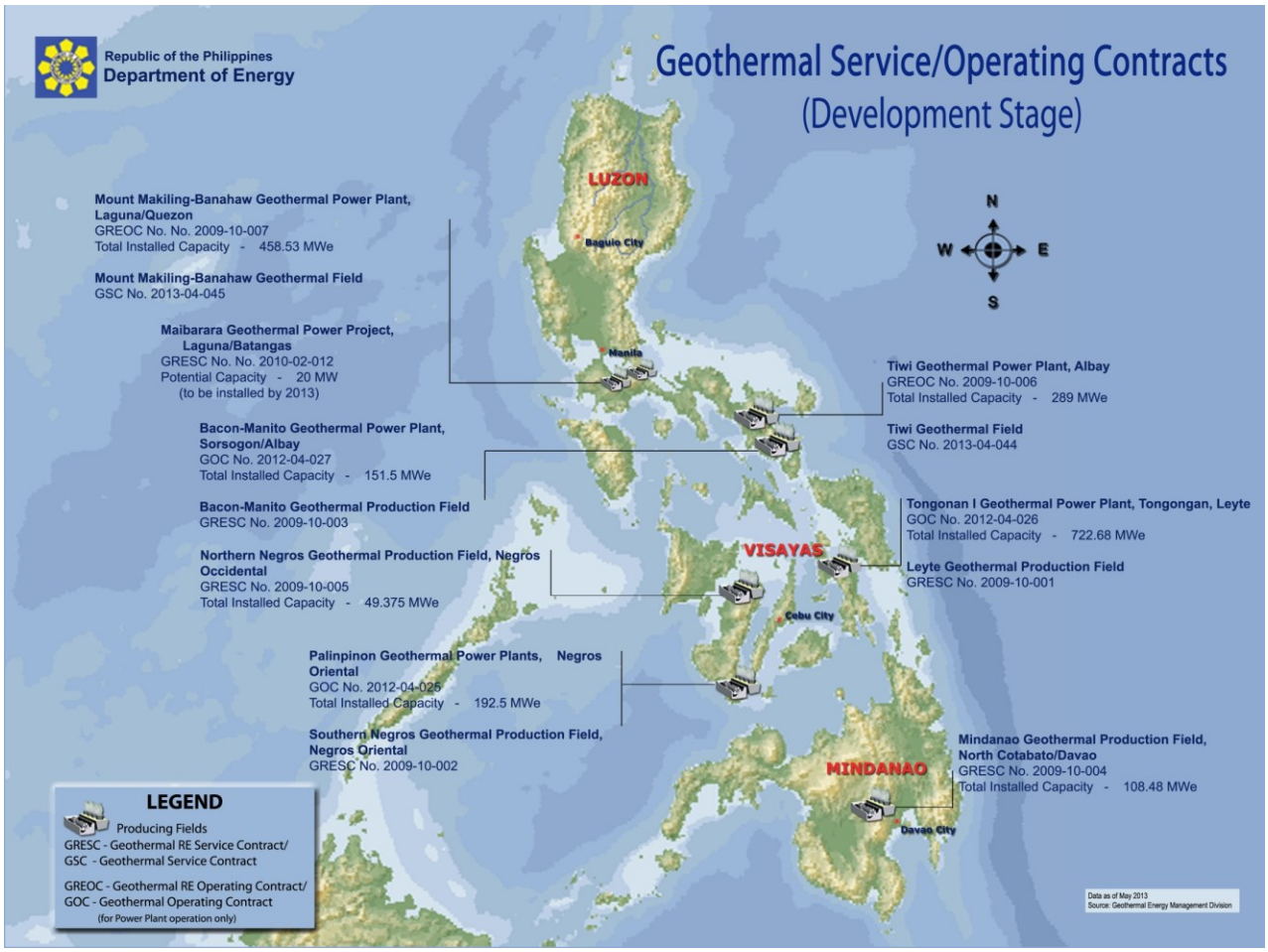

Figure 2 Geothermal power plants in the Philippines (retrieved from the Department of Energy)

The success of the Philippines in exploiting geothermal energy may be attributed on good governance and commendable government-industry collaboration. There was a strong pressure to reduce dependency on foreign oil and gas supply which led to concerted and consistent national effort to explore and eventually exploit geothermal energy resources in the Philippines.

Resulting from these attractive government incentives, the geothermal companies increased from 2 to 11 and geothermal projects rose from 10 to 33 by 2013 in varying stages of exploration/development (Table 1). Drilling activities in the developed fields are being conducted with the intentions of locating possible extensions of the fields for increase steam productions.

Table 1 List of geothermal projects and geothermal companies in the Philippines (modified De Jesus, 2013).

Geothermal Project	Geothermal Company	Installed/Projected Resource (MW)	Phase
Bacon –Manito	Energy Development Corporation	150	Operating
Leyte	Energy Development Corporation	700	Operating
Maibarara	Petro Energy Resources	20	Operating
Makiling Banahaw	AP Renewables Inc.	458	Operating
Mt. Apo	Energy Development Corporation	106	Operating
Northern Negros	Energy Development Corporation	49	Dismantled 2013
Palinpinon	Energy Development Corporation	192.5	Operating
Tiwi	AP Renewables Inc.	289	Operating
Ampiro	Energy Development Corporation		Exploration/Frontier
Balingasag	Energy Development Corporation		Exploration/Frontier
Lakewood	Energy Development Corporation		Exploration/Frontier
Mandalagan	Energy Development Corporation		Exploration/Frontier
Montelago	Constellation Energy Corporation		Exploration/Frontier
Mt. Zion	Energy Development Corporation		Exploration/Frontier
Acupan-Itogon	Primary Energy Corporation		Exploration/Development
Biliran	Biliran Geothermal Inc.		Exploration/Development
Buguias-Tinoc	PRC-Magma Energy		Exploration/Development
Bulusan	Basic Energy Corporation		Exploration/Development
Daklan	Clean Rock Renewable		Exploration/Development
Iriga	Basic Energy Corporation		
Isarog	PNOC Renewables Corporation		Exploration/Development
Kalinga	Aragorn Power & Energy		Exploration/Development
Labo	Energy Development Corporation		Exploration/Development
Mabini	GeoEnergy and Basic Energy Corporation		Exploration/Development
Mainit	Energy Development Corporation		Exploration/Development
Mainit-Sadanga	PRC-Magma Energy		Exploration/Development
Mankayan	Basic Energy Corporation		
Mariveles	Basic Energy Corporation		
Natib	Clean Rock Renewable		Exploration/Development
Negron-Cuadrado Geothermal	AP Renewables Inc.		Exploration/Development
North Cotabato	AP Renewables Inc.		
Sta. Lourdes-Tagburos	Primary Energy Corporation		Exploration/Development

Installed capacities of geothermal power plants makes up at least 11% of the total installed generating capacities in the Philippine country mix. Other sources of electric energy include coal (32%), hydropower (20%), oil-based (19%) and natural gas (17%). In terms of gross power generation by plant type, geothermal power plants account for 14% (DOE, 2012). Development of geothermal energy in the Philippines has boosted expansion of the national grid and interconnection of the Visayan and Luzon islands.

On the other hand, there was a reduction in the installed generating capacity of 1972 MWe in May 2010 to 1848 as of June 2013 due to the dismantling of the 49 Northern Negros geothermal plant in Negros Occidental in late 2013. The closure of the power plant was due to the lower than expected output resulting from low permeability and calcification inside the wellbore. Moreover, there were a number of temporary reductions in the geothermal electricity generation due to damages from floods and landslides in Bacon Manito and Tongonan.

2.3 Future plans for geothermal energy

The Department of Energy in its Energy Plan 2012-2013 expressed the plans of increasing geothermal energy production from by 1.445 GW from its present installed capacity of 1848, an increase of almost 75% from the present production. This will involve overhauling of the national grid network, promotion of investments in the energy section and implementation of new low-carbon and energy efficiencies.

Partnership and private sector participation is planned for the some of the existing developed fields namely for Bacon-Manito and Southern Negros and Southern Leyte fields. Geothermal studies have been actively conducting research and development studies with the aim of finding solutions to problems encountered in the field as acidic and high gas wells.

Increase in steam production is also expected in 2016 once the initial 44 MWe plant along Naujan Lake, Montelago, and Mindoro is commissioned. Drilling programs are either on going or planned in the next years in search of increasing steam production. Energy Development Corporation is developing both expansion and frontier its projects in the Philippines namely in Bacon Manito, Northern Negros, Leyte and Mindanao (Mt. Apo) which may result to geothermal electricity generation of more than 200MWe (Ogena and Fronda, 2013).

3. CONCLUSIONS

The Philippines has still to explore and exploit its geothermal resources to increase its contribution in the electricity power need of the country. This will result to more self-reliance on indigenous energy source together with wind and solar energy. However due to its geography of having numerous islands and inherent vulnerability to typhoons and earthquakes, transmission cost of electricity from geothermal power plants may create obstacles in it being used as primary source of electricity.

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