THE GROWTH OF PHILIPPINE GEOTHERMAL ENERGY DEVELOPMENT

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ABSTRACT

Developments in the Philippine geothermal industry over the past ten years have been focused on policy reforms that encouraged the entry of new investors and promoted the privatization of government power generating assets. Activities over the last five years, however, suggest that the development momentum is once again picking up. After the decommissioning of some of the aging geothermal power plants, the total installed operating geothermal capacity in the country has increased with the commissioning of new plants. The fulfillment of two committed projects: Energy Development Corporation's (EDC) successful transfer of the Northern Negros Power Assets to Nasulo and the operation of the Maibarara Geothermal Inc.'s Maibarara Geothermal Plant contributed almost 70 MWe to the country's installed capacity. The return-to-service of EDC's BacMan Geothermal Power Plant in 2014 added another 130 MWe to the country's operating capacity.

Positive indicators of continuing growth within the country include the Department of Energy's (DOE) issuance of a Certificate of Commerciality to Biliran Geothermal Project whose power plant is slated to begin operation by 2016 and the completion of the DOE-led detailed investigation of low temperature resources in the country. The quick recovery of EDC's Leyte Geothermal Field's operations after being devastated by typhoon Haiyan in 2013 is a testament to the resilience of the Philippine geothermal industry. Along with other pre-development activities, the Philippines is on track to achieve its vision of increasing geothermal capacity by 75% in the year 2030.

In all of these frenzied geothermal efforts, EDC has been instrumental in the development of the country's geothermal resources as it continues to maintain the steam fields and power plants in their four major operating projects with an installed capacity of about 1194 MWe. EDC also has growth projects in their existing production fields and through DOE-awarded new frontier areas, as well as expansion overseas, with stakes and applications for geothermal concessions in Asia and Latin America, one of which is the Mariposa project where exploratory drilling will be undertaken this October 2015.

1. GEOTHERMAL DEVELOPMENT IN THE PHILIPPINES

1.1 Philippine Geothermal Power Assets in Brief

The Philippines is an archipelago located on the Circum-Pacific Ring of Fire with an estimated geothermal potential of around 3,000 MWe, 2,300 MWe of which had been identified as proven to probable resource (Pastor, Fronda, Lazaro, & Velasquez, 2010). Geologic environments that favor the formation of geothermal resources in the country are volcanic belts, major structures, and the vicinity of plutonic occurrences. Most operational geothermal production fields in the country are high temperature resources associated with volcanic belts. For example, the Bicol volcanic-Eastern Visayas Cordillera Belt that runs along the eastern margin of the country hosts Tiwi, BacMan, Tongonan, Mahanagdong, and the soon-to-operate Biliran (Malapitan & Reyes, 2000). The most exploitable of these systems are in volcanic environments, which are mature enough to have reacted out the acidic volcanic gases derived from the degassing of the magmatic intrusives and which are also the heat source. These geothermal systems are usually liquid-dominated with high temperatures reaching over 300°C (Vasquez & Javellana, 1997).

Figure 1: Map of Geothermal Service/Operating Contracts under Development Stage (producing fields) (Fronda, Marasigan, & Lazaro, 2015)

Driven by the need for energy security through tapping of indigenous power resources, geothermal utilization in the country is focused on electric power generation with direct uses being limited mostly to bathing and swimming and agricultural drying (Fronda, Marasigan, & Lazaro, 2015). The Philippines' total installed geothermal capacity reached a maximum of 2,027 MWe in 2007, with most of the power generated through conventional flash cycle plants receiving steam from high enthalpy resources (Fronda, Marasigan, & Lazaro, 2015). Since then, the total installed capacity in the Philippines has decreased with the retirement of aging plants in Tiwi, the decommissioning of the Botong Plant in BacMan Geothermal Field and the Northern Negros Geothermal Plant (Ogena, et al., 2010). By 2011, the total installed geothermal capacity of the Philippines from its five (5) then operating geothermal power plants was down to 1,848 MWe (Fronda, Marasigan, & Lazaro, 2015). The numbers began to increase again in 2014 with the successful rehabilitation of BacMan Geothermal Power Plant, which increased its power generation from 131.5 to 140 MWe and the commissioning of the 20-MWe Maibarara Geothermal Plant and 30-MWe Nasulo Geothermal Plant in Southern Negros Production Field. As of August 31, 2015, the total installed capacity in the

Philippines as reported by its Department of Energy is 1906 MWe (Table 1) (Department of Energy, 2015).

In total, geothermal power contributed 13% of the country's total electricity requirements in 2014 (Department of Energy, 2015). Despite the decrease in installed capacity, the Philippines remains the second largest geothermal power producer in the world (Bertani, 2015).

Table 1: List of Operating Geothermal Power Plants

Area	Operator	Installed Capacity (MWe)	
		2011	2015
Makiling-Banahaw (Mak-Ban)	PGPC/APRI	458.5	458.5
Tiwi	PGPC/APRI	234.0	234.0
Bacon-Manito (BacMan)	EDC	131.5	140.0
Palinpinon	EDC	192.5	192.5
Tongonan	EDC	112.5	112.5
Unified Leyte	EDC	610.2	610.2
Mt. Apo	EDC	108.5	108.5
Maibarara	MGI	-	20.0
Southern Negros (Nasulo)	EDC	-	30.0
COUNTRY TOTAL:		1847.7	1906.2

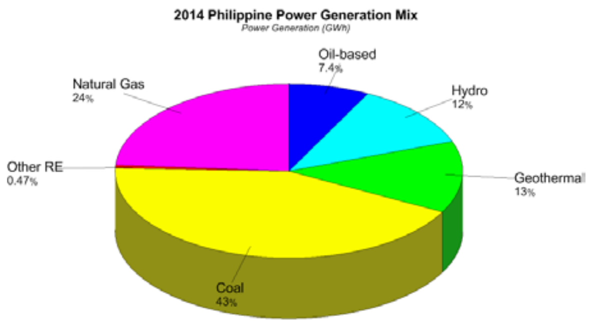

Figure 2: 2014 Philippine Power Generation Mix by source

1.2 Favorable Factors that Spurred Growth

The growth of installed geothermal capacity in the Philippines can be divided into a series of phases (Vasquez & Javellana, 1997) which comprise a cyclical trend of rapid growths in terms of installed generating capacity, stagnations, and government policy reforms (Penarroyo, 2015). While government policy and initiatives encouraged growth, financial and technical assistance from private and foreign institutions in various incarnations have driven most of the growth.

Pre-geothermal development phase *(prior to 1977)*: Geothermal investigations and studies have been supported by the Philippine government since as early as 1964 (Alcaraz, 1974). This was right after the United Nations-sponsored feasibility study on nuclear development in Luzon, which involved an evaluation of the country's energy resource potential for hydro, coal, geothermal, and natural gas (Gazo, 1997). The Philippine Commission on Volcanology (COMVOL) studied and inventoried geothermal activities in Mak-Ban, Tiwi, Tongonan, and Southern Negros, laying the foundation for geothermal development in the country. Tie-ups with foreign entities helped move forward the initial stages of geothermal development in the country. In 1971, Union Oil of California (UNOCAL) entered into a service contract with the Philippine National Power Corporation (NPC) to develop Mak-Ban and Tiwi while a 1972 bi-lateral energy cooperation program between the New Zealand and Philippine governments led to the development of Tongonan and Southern Negros (Vasquez & Javellana, 1997).

First major phase of geothermal development *(1977-1983)*: By 1976, the Philippine government created the Philippine National Oil Company – Energy Development Corporation (PNOC-EDC) with a mandate to develop indigenous energy resources. This was a response to the energy crises stemming from the oil crisis of the 1970s. PNOC-EDC took over the interests of NPC at Tongonan and Southern Negros and with technical assistance from the New Zealand government, performed exploratory drilling in the two sites. Eventually, a 3-MWe power plant was put up in Tongonan in July 1977. UNOCAL, under its local subsidiary Philippine Geothermal, Inc. (PGI), commissioned 6x55 MWe units in Tiwi in 1978 and in Mak-Ban in 1983. A 2.5 kWe turbine generator set was also put up in Tiwi for salt-making and grain drying as part of a National Science Development Board-sponsored project. PNOC-EDC, put up 3x37.5 MWe units in Tongonan and 3x37.5 MWe and 3x1.5 MWe units in Palinpinon in Southern Negros in 1983. During this period of rapid growth, the installed capacity in the country went from 3 MWe to 896 MWe in less than six years (Vasquez & Javellana, 1997).

First development slowdown *(1984-1991)*: Institutional and funding issues due to the change in administration and the drop in oil prices led to the decreased rate of growth in the Philippine geothermal sector (Penarroyo, 2015). During this period, however, PNOC-EDC continued on exploration activities, performing exploratory drilling and confirming resources in BacMan, Mt. Apo, and other areas in Leyte (Vasquez & Javellana, 1997). As a response to the socio-political climate of the time, PNOC-EDC pioneered improving its relationship with its stakeholders through public consultation and monitoring of social concerns of its stakeholders (de Jesus, 2005).

Revived Institutional Interest *(1992-1993):* With the Luzon energy crisis threatening the capital Metro Manila, the government was forced to take on measures to increase power generation. This led to NPC relinquishing its sole control over power generation (Vasquez & Javellana, 1997) and the opening up of the power sector to independent power producer participation through Executive Order No. 215 (*"National Policy on Private Financing, Construction, and Operation of Power Plants"*) and Republic Act 6957 (*"Build, Operate, and Transfer Law"*) (Penarroyo, 2015). The resurrection of the Philippine Department of Energy brought about the country-wide Master Energy Plan, which included a roadmap for Philippine Geothermal development (Vasquez & Javellana, 1997).

Second major phase of geothermal development *(1994-2000):* The most recent major increase in installed capacity began in the early 1990's and slowed at around 1999. Through the efforts of PNOC-EDC and BOT partnership contracts with California Energy (CalEn), Ormat, and Marubeni, power plants in BacMan (150.0 MWe), Mt. Apo (106.0 MWe), additional units in Palinpinon (80 MWe.) and expansion and optimization in Leyte (588.0 MWe) were commissioned. Along with additional capacity from an 80-MWe in-field expansion and 16-MWe binary unit using waste brine in Mak-Ban, over 1000 MWe additional installed capacity was established during this phase (Vasquez & Javellana, 1997). Despite a general slowdown of growth in international geothermal development, the Philippines clocked 682 MWe of additional capacity, the highest increase in the world for that period (Huttrer, 2000).

Second development slowdown *(2001-2005):* No new plants were set-up during this period as developers focused more on improvements in resource management strategy such as plant optimization, steam line interconnection, and strategies to deal with corrosion/erosion and scaling (Bertani, World Geothermal Generation 2001-2005: State of the Art, 2005). Republic Act 9136 (*"Electric Power Industry Reform Act (EPIRA) of 2001"*) was ratified catalyzing change in the geothermal industry. The NPC began to divest its interests in its geothermal assets and privatization of the different geothermal contracts began (Penarroyo, 2015). It also became necessary to de-rate or rehabilitate aging plants, particularly in Tiwi and Mak-Ban, in preparation for their sale to Aboitiz Power Renewables, Inc. (APRI) (Ogena, et al., 2010).

Policy reforms and changing corporate landscape *(2006-2015)*: The years 2006 and 2007 saw the sale of Tiwi and Mak-Ban to Chevron Geothermal Philippines Holdings, Inc. (CGPHI) and APRI and the transition of PNOC-EDC to a fully privatized EDC, respectively. However, new players were scarce despite the deregulation of the power sector since 2001. The Renewable Energy Act of 2008, which was fully implemented in July 2009, attempted to incentivize the development of indigenous renewable energy sources and led to the influx of new players in the Philippine geothermal industry. As of August 31, 2015, DOE has awarded 43 projects with two pending applications. Of this lot, nine (9) already have power plant installations, not including the Northern Negros Plant that went online in 2007 and was decommissioned in 2011 due to reservoir problems. As opposed to the near-monopoly in previous years, the geothermal concessions are now distributed to almost 20 separate entities (Department of Energy, 2015). To illustrate this, the Maibarara power plant commissioned in 2014 and another one of the newest projects and geothermal power plants expected to come online in 2016 are not from the big players EDC and CGPHI/APRI.

2. CURRENT GEOTHERMAL OPERATIONS

2.1 Mak-Ban, Laguna

The Mak-Ban Geothermal Project in Laguna is the second largest geothermal steam field in the country with a combined installed plant capacity of 442 MWe. The total installed capacity is broken down into 10 units housed in five plants, which were turned over to APRI in May 2009. As of earlier this year, six (6) units are operational, two (2) are on standby and two (2) serve as base load plants. Four (4) units were rehabilitated and upgraded in 2003 as part of APRI's agreement with NPC and resulting in increased load capability of 63 MWe from 55 MWe. The binary plant, which utilized waste heat from separated brine downstream of the steam separators have been shut down since APRI's acquisition of the plants. Rehabilitation of the binary plant is underway and is expected to be completed by middle of next year (Aboitiz Power Renewable, Inc., 2015). The steam fields of Mak-Ban are now operated by Philippine Geothermal Production Company (PGPC), a joint venture between AllFirst Equity Holdings, Inc. and CGPHI. PGPC and DOE executed a Geothermal Service Contract in April 2013 allowing PGPC to operate MakBan. A total of 132 wells have been drilled in the field from which 72,861 GWh of cumulative total energy has been produced between commissioning in 1979 to 2013 (Fronda, Marasigan, & Lazaro, 2015).

2.2 Tiwi, Albay

The Tiwi field is the first exploited geothermal area in the Philippines, having a 2.5-kWh demonstration generator by the early 1970's (Gazo, 1997). It initially had an installed capacity of 330 MWe from three (3) power plants with 2x55MWe generators each; however, two units had to be decommissioned due to insufficient steam supply and typhoon damages. Similar to Mak-Ban, the plants were rehabilitated by NPC in 2003 in preparation for the turnover to APRI and units 1 and 2 increased their installed capacity form 55 MWe to 60 MWe, while Units 5 and 6 led to an increased load capability of 57 MWe. Units 5 and 6 are now undergoing extensive rehabilitation (Aboitiz Power Renewable, Inc., 2015). The total load capability of Tiwi, thus far, is 234.0 MWe. The steam field of Tiwi is also operated by PGPC. A total of 156 wells have been drilled in the field, 66 of which are operating. From its start of operation in 1979 to 2013, the field has generated 50,286 GWh of electricity (Fronda, Marasigan, & Lazaro, 2015).

2.3 BacMan, Albay/Sorsogon

The Bacon-Manito Geothermal Production Field (BGPF) located in the provinces of Sorsogon and Albay in the Bicol region started commercial operations in 1993 with the 2x55 MWe Bac-Man 1 Power Plant. In 1994, a second modular power plant, Bac-Man II, was commissioned at 20 MWe and then expanded by another 20 MWe in 1998. When PNOC-EDC was privatized, and the plants were turned over to BacMan Geothermal Inc. (BGI), all were in states of disrepair due to age and effects of calamities that naturally plagued the Bicol region. Rehabilitation of BacMan 1 started in 2010, with an ambitious timeline that ended in mid-2011. Weather delays, long delivery lead times, and mechanical problems prevented the rehabilitation team from meeting this deadline. This was capped off in 2013 by the shearing off of a turbine blade in Unit 2 of BacMan-1. The plant finally came online again in 2014. The cumulative gross generation of BacMan has been 7,617 GWh since commissioning to 2013.

2.4 Negros Island (Southern Negros, Northern Negros, and Nasulo Expansion)

The Negros Island hosts two developed geothermal fields that have been commercially exploited: the Southern Negros Geothermal Production Field (SNGPF) in Palinpinon town in Negros Oriental and the Northern Negros Geothermal Production Field (NNGPF) in Negros Occidental. SNGPF is one of the first developed in the country, having supplied steam to the 112.5-MWe Palinpinon-1 since 1983. On the other hand, the 49-MWe Northern Negros Geothermal Power Plant (NNGPP) was commissioned in 2007. Shortly after NNGPP's commissioning, it was determined that NNGPF could only sustainably support 16-18 kg/s of steam, which is not sufficient to fill the plant requirement (Fronda, Marasigan, & Lazaro, 2015). Extensive studies of various well interventions were conducted to find a sustainable field management strategy; but by 2011, EDC, who owned the Northern Negros facility, wrote off the power plant and deployed its assets to another EDC-run facility on the island, SNGPF. There, development of an expansion project, the Nasulo production sector, was ongoing and the equipment from the defunct plant would find better utilization. Sumitomo Corporation was tapped for the project which was dubbed "N2N". The N2N project was completed by December 2012 and 30-MWe Nasulo Expansion Project came online by 2013. Aside from Palinpinon-1 and Nasulo, SNGPF also has Palinpinon-II comprised of three (3) modular plants, Okoy (20 MWe), Nasuji (20 MWe), and Sogongon (40 MWe). Combined, the plants of SNGPF have supplied 30,203 GWh of electricity from the 1980s to 2013 (Fronda, Marasigan, & Lazaro, 2015).

The sustainable operating capacity of Northern Negros, on the other hand, is continuously being evaluated by EDC and plans of putting up a smaller plant in the area have been floated.

2.5 Leyte (Tongonan and Unified Leyte), Ormoc

The Leyte Geothermal Production Field (LGPF) was the first commercially exploited geothermal production field in the country, having had its 3-MWe non-condensing steam turbine by 1977 and the largest production field in the country in terms of installed capacity. The LGPF reservoir is conceptualized to be made up of two hydrothermal systems separated by an impermeable block. The two systems are the Tongonan system, which hosts production from Tongonan-1, Upper Mahiao, and Malitbog Power Plants and the Mahanagdong system, which hosts Mahanagdong A and B Power Plants. Upper Mahiao, Malitbog, and the two Mahanagdong Power Plants make up what is known as the Unified Leyte (UL) geothermal power complex. The fields and UL power plants are managed and operated by EDC while Tongonan-1 is operated by EDC subsidiary Green Core Geothermal Inc. (GCGI).

Large-scale exploitation in the Tongonan system came in 1983 with the commissioning of the 112.5-MWe Tongonan-1. This was increased significantly in the mid-1990s with the addition of the 132-MWe Upper Mahiao and 231-MWe Malitbog Power Plants. Optimization plants in the form of the 18-MWe Tongonan-1 Topping Cycle Plant and the 15-MWe Malitbog Bottoming Cycle Plant brought the installed capacity attributed to the field to 508 MWe. Exploitation in the Mahanagdong hydrothermal system, on the other hand, began in 1993. Mahanagdong A houses 2x60 MWe Toshiba generators while Mahanagdong B has 1x60 MWe (Shibuya & Morikawa, 2000). The massive extraction in LGPF has led to a host of reservoir-related problems that brought about steam decline. These, in turn, brought about mitigation measures that were studied, tested, applied, and proven to aid in arresting the steam decline. Some successful measures include changing the reinjection scheme, the utilization of "sacrificial wells", and continuous drilling of M&R wells to replace damaged and aging wells (Uribe, Dacillo, Dacoag, Andrino, & Alcober, 2015). Studies on acid utilization and Paril inflows are also being undertaken to increase production in Mahanagdong. As of December 2013, the field has produced about 80,382 GWh of power cumulative from all its plants.

In late 2013, LGPF was badly hit by super typhoon Haiyan (locally dubbed "Yolanda"). The generation capacity of the field dropped to nothing when vulnerable cooling towers and other facilities suffered severe damage after being hit by the historically powerful winds carried by the storm. Restoration was not a simple feat and required both repairs to the plants and revival of wells which had been shut due to safety concerns before the storm. However, as an aftermath of the storm, EDC not only managed to quickly restore normal operations, but underwent rescue and relief efforts to help its Leyte stakeholders.

EDC did not stop at restoration as Yolanda taught the company that it needed to work on making its installations, particularly in Leyte and BacMan, resilient against natural hazards such as typhoons that are worsening in the face of climate change. SPX Marley was thus commissioned to redesign the cooling towers in such a way that they would be able to withstand 300 kph winds. The designs were completed in mid-2014 and should be installed by the end of 2015. Aside from addressing the vulnerability of the cooling towers, EDC also spent on new control rooms which have been modified to protect critical electronic instrumentation and control systems in the face of storms. The buildings on site have also been reinforced and wind screens are being considered to protect its facilities.

2.6 Mt. Apo, Kidapawan

The Mt. Apo Geothermal Project (MAGP) located in Kidapawan, has been commercially operating since 1997, starting with the commissioning of Mindanao-1 power plant. Capacity was expanded with Mindanao-2 power plant in 1999. Both steam field and power plants were operated pre-2007 by PNOC-EDC and afterwards by the privatized EDC. As of December 2013, the two plants have, in total, generated up to 12,761 GWh of electricity (Fronda, Marasigan, & Lazaro, 2015).

2.7 Maibarara, Batangas

The 20-MWe Maibarara Geothermal Power Plant began operations in February 8, 2014. The 1x20 MWe power plant broke ground in late April 2012 in Sto. Tomas, Batangas. The power plant was developed by the Maibarara Geothermal, Inc. (MGI), a joint venture between PetroEnergy Resources Corp., TransOil Asia Energy Development Corporation, and PNOC-Renewables Corporation. MGI has indicated that it is in the process of expanding the power plant to produce up to 10 MWe more. The expansion efforts are expected to come to fruition on 2017.

2.8 Biliran, Biliran

The Biliran Geothermal Project (BGI) is targeting the start of commercial operations in late 2016. Development will be in 10-MWe modules, building up to 100 MWe. An additional 170 MWe could be developed in the northern part of the field. So far, eight (8) geothermal wells have been drilled in the southern portion of the concession confirming 40 to 50 MWe resource potential. BGI, which has a 25-year geothermal renewable energy contract with DOE for the 260 km^2 Biliran concession, was a joint venture between Filtech Energy Drilling Corp. (FEDCO) and the Icelandic company Orka Energy Holding. A 60% stake was acquired by Emerging Power Inc. (EPI) in August 2015.

2.9 Projects in Exploration Phase

DOE reports 31 geothermal projects from all over the country in various phases of exploration and development that have been awarded to 17 separate entities. There are two more projects pending award (Department of Energy, 2015).

Table 2: List of Awarded Geothermal Projects in the Exploration Phase

Project Name	Company	Potential Capacity (MWe)
Sal-Iadapan-Boliney-Bucloc-Tubo	Pan Pacific Power Phils. Corp.	NA
Buguias-Tinoc	PRC-Magma Energy Resources, Inc.	60
Daklan	Clean Rock Renewable Energy Corp.	60
Kalinga	Aragorn Power and Energy Corporation	120
Mainit-Sadanga	PRC-Magma Energy Resources, Inc.	80
East Mankayan	Basic Energy Corp.	NA
Cervantes	Pan Pacific Power Phils. Corp.	NA
Cagua-Baua	PRC-Magma Energy Resources, Inc.	45
Mariveles	Basic Energy Corp.	NA
Mt. Natib	Clean Rock Renewable Energy Resources Corp.	40
Negron-Cuadrado	Negron Cuadrado Geothermal Inc.	NA
San Juan	San Juan Geothermal Power Inc.	20
Tiaong	Tiaong Geothermal Power Inc.	NA
Mt. Puting Lupa	Filtech Energy Drilling Corp.	NA
Tayabas-Lucban	Tayabas Geothermal Power Inc.	NA
Talim	Alco Steam Energy Corp.*	NA
Montelago	EPI	40
Mt. Labo	EDC**	65
Southern Bicol	SKI Construction Group Inc.	40
West Bulusan	Basic Energy Corp.	NA
Iriga	Basic Energy Corp.	NA
Northern Negros	EDC	NA
Mandalagan	EDC	20
Biliran	Biliran Geothermal Inc.	50
Lakewood	EDC	40
Ampiro	EDC	30
Balatukan-Balingasag	EDC	20
Mt. Sibulan-Kapatagan	APRI	NA
Mt. Talomo-Tico	APRI	NA
Mt. Zion	EDC	20
Mt. Zion 2	EDC*	NA

* Newly awarded
** With pending approval for the surrender/termination of GSC
NA Not Available

2.10 Low-Enthalpy Fields

Since 2011, in order to accelerate the development of low to medium enthalpy geothermal resources in the country (90-150°C maximum temperature), a detailed resource assessment of selected low-enthalpy fields was conducted (Fronda, Marasigan, & Lazaro, 2015). Three island resources which lacked impressive thermal manifestations—Balut Island in Romblon, Banton Island in Davao del Sur, and Maricaban Island in Batangas—were studied using the following activities: (1) review of available data, (2) remote sensing and aerial photo interpretation, (3) semi-detailed geological, geochemical, and geophysical surveys, (4) resource characterization and conceptual modeling, and (5) drilling 1-3 slim holes with an accumulated depth of 1,500 m. The project ended last December 2014.

Of the three resources studied, Balut Island was the only one determined to have an active geothermal system with some certainty. The resource size based on geophysical data is about 3-9 km^2. On Banton Island, thermal manifestations were determined to be of shallow origin and geochemical analysis do not point towards a hotter or deeper geothermal source. This was supported by geological evidence as the age of the volcano was considerably older than what is believed to host active geothermal systems in the country. The geophysical anomalies also showed disconnected resistivity anomalies. Seawater encroached Maricaban Island and had inconclusive results as the temperatures from geochemistry of springs and geophysical signatures were unreliable due to dilution with seawater. The uncertainty in Maricaban led to its being selected for the drilling of two (2) exploration holes (Halcon, et al., 2015).

3. THIRD MAJOR PHASE OF GEOTHERMAL DEVELOPMENT

3.1 Signs of future growth

The Philippine experience in geothermal development shows susceptibility to external factors. The long gestation period, high investment costs and high risks involved from exploration to production meant state initiative drove development forward. The RE law of 2008, like the BOT law in the early 1990s, is expected to open up paths towards rapid growth. Other external factors are on the technological end with increasing understanding of geothermal systems and their fluids. Improved exploration and drilling technology reduce risks inherent in geothermal development while advancing technologies in acid well utilization and scaling inhibition aid in taking development a step further.

New players bringing in more investments into the industry is a sign of growth and these investments have driven at least one project from advanced stages of exploration to production. Aside from increased investments, a shift in focus from high temperature fields and consideration of low temperature fields increases the exploitable potential.

3.2 The EDC Experience

The lifecycle of the geothermal industry in the Philippines has been synonymous with the lifecycle of EDC. The birth of the company coincides with the birth of geothermal in the country as do periods of growth and stagnation. EDC, with a total installed capacity of about 1194 MWe in four locations and which accounts for over 62% of the country's geothermal power capacity, there is no doubt that the company drives the Philippine geothermal industry. As a leader in geothermal power generation in the country, EDC does not sit complacently. It continuously innovates to improve resource management and operational efficiency. The engineering solutions being developed to protect from future Yolandas will undoubtedly set standards in geothermal development in climate-vulnerable countries. In 2014, EDC obtained ISO 9001:2008 certification from TUV Rheinland Cert GmbH validating the company's commitment to upholding performance standards across all its sites.

The impact of EDC's growth to the geothermal industry in the country is not limited to installed capacity and MWe generation. EDC has shaped practice and policy, promoting sustainable geothermal development. Even before national regulation was passed, PNOC-EDC began consulting and partnering with its stakeholders, building a so-called "umbilical cord" that enables its surrounding communities to grow with the company. Through projects like BINHI and its flagship CSR project, HELEn, EDC managed to showcase that geothermal development could be done sustainably, with minimal impact to the environment, and with great benefits to the community. The sincerity of the company in its aims was tested and proven during its Yolanda efforts to help its neighbors despite being severely hit itself.

It is this brand of geothermal development that EDC is beginning to bring outside of the Philippines, to projects in Asia and Latin America. EDC has established its presence in Indonesia and won concessions in Chile where it is set to begin drilling in late 2015. It has also begun introducing geothermal exploration in some promising Peru prospects. This is on top of continuing exploration and development of its other concessions in the country.

3.3 Outlook for the Philippine Geothermal Industry

Based on the recent trends in geothermal development, it appears that momentum is picking up on several fronts:

1. New players are coming in and bringing more investments into the geothermal industry.

2. New resources outside of the high temperature reservoirs conventionally developed in the country are being considered and explored.

3. New ventures outside of the country are being undertaken.

4. Technology and methods innovations are continuing, to improve resource management strategies, operational efficiency, and hazard resiliency.

All together, it can be said that the pace had been set for a third phase of rapid growth in the Philippine geothermal industry.

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