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Review of Geothermal Development in Indonesia Toward 2025 and Beyond

Sanusi Satar, Abadi Poernomo, Prijandaru Effendi

api.inaga@yahoo.co.id

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ABSTRACT

The postponement of WGC 2020 to the year 2021 has given an opportunity to revise the paper. During the year 2019 - 2020, there were some progress in the geothermal development in Indonesia with some additional COD of geothermal power plants in a few geothermal working area (GWA).. Therefore, the paper needs to be revised accordingly. By the end of 2020, the total installed capacity of Geothermal Power Plants in Indonesia reached 2130.7 MW which made Indonesia the 2nd largest geothermal producer in the world after the USA (3695 MW). This milestone was reached after more than 35 years of geothermal development which was started with the assistance of the New Zealand Government for the first geothermal power plant project back in 1981, in Kamojang Geothermal working Area of West Java. The geothermal developments were then continued with other geothermal working areas under the Presidential Decree no. 22 in the year 1981, which was then replaced with the Presidential Decree No. 45 & 49 in the year 1991. In 2003, the Goverment of Indonesia issued its first Geothermal Law no. 27 in the year 2003 which regulated all the Geothermal Business from the establishment of the Geothermal Working Area up to the tendering process. In this law, the authority to carry out the tender of the Geothermal Working Areas was fully transferred to the Local Government to handle. It has created some problems later on and also problem with usage of forestry areas. In order to harmonize with the forestry law and also to speed up the progress of the geothermal development, the Law no. 27 Year 2003 was revoked and replaced with the new geothermal Law No. 21 in the year 2014. This paper will discuss the journey of the geothermal development in Indonesia, the latest status of its potential and targets of geothermal development through 2025 and beyond. It will also discuss the regulations including forestry regulations, the tariffs, Non-Tax income, its fiscal policy, Power Purchase Agreements up to the investment required in order to achieve its ambitious target of 7242 MW by 2025.

1. INTRODUCTION

Indonesia is a country which is known as the country which approximately consists of 17,000 islands and is located in the ring of fire. It has created an abundance of geothermal resources. Up to the end of 2020, when the paper is revised, 351 locations have been surveyed by Badan Geology (Geological Agency) of Ministry Energy and Mineral Resources of the Republic of Indonesia and with the total geothermal resources of approximately 23.965,5 MWe. (Table 1)

Table 1 - Geothermal Resources by Island

No	Island	No of locations	Resources (MWe)					Total	Installedd capacity (MW)
			Speculative	Hypothetical	Reserve				
					Probaaable	Estimated	Proven		
1	Sumatera	101	2.276	1.557	3.735	1.040,7	1.070,3	9.679	744,4
2	Jawa	73	1.265	1.19	3.414	418	1.82	8.107	1.253,8
3	Bali	6	70	21	104	110	30	335	0
4	Nusa Tenggara	31	190	148	892	121	12.5	1.363,5	12,5
5	Kalimantan	14	151	18	13	0	0	182	0
6	Sulawesi	90	1.365	362	1.041	180	120	3.068	120
7	Maluku	33	560	91	497	6	2	1.156	0
8	Papua	3	75	0	0	0	0	75	0
	Total	**351**	**5.952**	**3.387**	**9.696**	**1.875,7**	**3.054,8**	**23.965,5**	**2.130,7**
					14.626,5				
			23.965,5						

(Source : Badan Geologi Kementrian ESDM – 2019)
***Current status (EBTKE – ESDM)**

Historically, In Indonesia, the first proposal on energy from volcanoes came in 1918 during the Dutch colonial era. In 1926, five test borings were drilled in Kawah Kamojang with the result the well KMJ – 3 successfully flowed the steam and is still flowing until now. (Figure 1). The Kamojang exploration result in 1926 then became the pioneer of geothermal development in Indonesia. Through bilateral cooperation between the Government of Indonesia and the Government of New Zealand which was known as the Colombo Plan Grant in 1972, a prefeasibility study for electricity generation in Kamojang was carried out by Geothermal Energy New Zealand.

The first geothermal power plant with the capacity of 30 MW was inaugurated in 1983 as the first geothermal power plant in Indonesia. Since the mid-1980s, Chevron has operated two geothermal fields in West Java at Salak and Darajat (initially Unocal Geothermal Indonesia developed GWA Salak and Amoseas Indonesia developed GWA Drajat) with a combined capacity of around 365 MW. The Wayang Windu Geothermal Power Station in West Java, owned by Star Energy, has been in operation since 2000. It currently comprises two units with a total capacity of 227 MW.

Figure 1 - KMJ-3 Drilled in 1926
(Source: Courtesy of Pertamina Geothermal Energy.)

Pertamina continued developing the second phase of Kamojang area by installing Unit# 2 and Unit#3 with a capacity of 55 MW each inaugurated in 1988. The current total installed capacity has now reached 235 MW, with unit # 4 installed in 2008 for 60 MW and the last unit # 5 for 35 MW was successfully COD in 2015.

The development of geothermal by Pertamina in Indonesia was mandated by the government of Indonesia through the Presidential Decree No. 16 year 1974, to carry out the geothermal exploration in a whole Jawa island. In order to accelerate the geothermal development, the government of Indonesia issued the Presidential decree No. 22 in 1981 to appoint Pertamina as the only company to own the 15 Geothermal Working Areas (GWA) and fully authorized to develop the geothermal energy. However, the decree also allowed Pertamina to build a Joint Operating Contract (JOC) with private sectors which resulted a JOC/ESC signed between Pertamina and Unocal Geothermal Indonesia in 1982 for the development of Salak Geothermal Working Area and with Amoseas Indonesia in 1984 for the development of Darajat Geothermal Working Area. In 2006, PT. Pertamina Geothermal Energy (PGE) was established. Since then all the geothermal business in Indonesia which was given and authorized to PT. Pertamina was diverted to PGE.

The first unit of Salak Geothermal Power Plant, rated at 55 MW, was commissioned in 1994. The total unit installed in Salak were 6 (six) units with the current total installed capacity of 377 MW. The Darajat geothermal working area was developed by Amoseas Indonesia with the first unit for 55 MW, installed in 1994. Now, the current total installed capacity in Darajat is 270 MW. The Darajat and Salak geothermal power plants were operated by Chevron Geothermal Indonesia in 2005. In April 2017, those two fields were acquired by Star Energy. The Wayang Windu geothermal working area was first developed by Magma Nusantara Limited (MNL) in 1994 with its first unit COD for 110 MW in 2000.

The Wayang Windu Geothermal Power Plant was later acquired by Star Energy in 2003. Star Energy then developed the 2nd unit with a capacity of 117 MW in 2007 and commissioning was in 2009. It made the current total installed capacity in Wayang Windu 227 MW. The aforementioned geothermal working areas are located in West Java Province.

During the period of 1990 through 2017, the geothermal development in Indonesia continued to progress particularly for the existing geothermal working area owned by PT. Pertamina Geothermal Energy. Those GWA's are the Lahendong geothermal working area, located in North Sulawesi developed by PGE started in 1994. The commissioning of its first unit, rated at 20 MW, was in 2001. The current total installed capacity of Lahendong is 120 MW. During 2012 – 2017, Pertamina Geothermal Energy also developed the geothermal working area of Ulubelu in Lampung Province with a total current installed capacity of 220 MW. The development of Lumut Balai is located in South Sumatera province. It is planned to be commissioned in Mid-2019 and also to be followed by Hululais located in Bengkulu Province and planned to be developed for 110 MW (2x55 MW) starting in 2019. The long outstanding development Geothermal Working Area (GWA) of Karaha Bodas that was cancelled back in 1998 due to financial crisis was finally able to deliver 30 MW capacities with commissioning in April 2018.

Beside PGE, the other company which also actively developed the geothermal energy is PT. Geo Dipa Energi, the state-owned company. Geo Dipa Energi has successfully decommissioned 60 MW of the Dieng geothermal project located in Central Java in 2002. It is now planned to be further developed for another 60 MW starting in 2019. The other GWA under PT Geo Dipa Energi development is the GWA of Patuha located in West Jawa province, where the commissioning for 55 MW was successfully inaugurated in 2014.

The GWA of Sibual Buali, located in North Sumatera province which is known and operated by Sarulla Operations Limited (SOL) was finally able to make its first COD for 110 MW in 2016 after the field development was started in 1990 and now through 2019. The current installed capacity of Sarulla field is 330 MW.

Please note that all of those above GWA's were known as the existing GWA and were developed under the Presidential Decree no. 22 in the year 1981 which assigned and authorized PERTAMINA to develop geothermal energy and to sale the energy to the state own electricity company PT. PLN (Persero). In 1991, the Presidential Decree no. 45 & 49 were issued to replace the Presidential decree no. 22 in the year 1981 which mainly allowed Pertamina to sell the steam and electricity to PT. PLN (Persero) and also to regulate the tax for Geothermal Business.

The government issued the Presidential Decree no. 76 in the year 2000 on the exploitation of geothermal resources for electricity. The decree covered the whole aspect of geothermal development from upstream to downstream, including permits and tariff mechanisms on the electricity tariff. The Government of Indonesia issued its first Geothermal Law no. 27 in the year 2003, which regulated all matters regarding the geothermal business including tendering process. In this law, the local government is fully given the authority to manage the geothermal business and development as they may issue the regulation and permits to carry out the geothermal exploitation.

The detail of the geothermal business process and regulations were further described in the Government Regulation No. 59 in the year 2007. Since then, the tendering of the GWA were in progress in places such as Tangkuban Perahu, Cisolok Cisukarame located in West Java Province, Jaboi - Sabang in Aceh Province, Jailolo in Halmahera etc.

During the period of 2007 - 2008, the tariff of electricity to be applied in the bidding submission was the Minister of Energy and Mineral Resources (MEMR) Regulation no 14 in the year 2008, on the Ceiling Tariff of Electricity from Geothermal Power Plants.

The ceiling tariff of the electricity from geothermal power plants at the time of the tendering process of the GWA is calculated based on the percentage of the production cost as follows

a. 85 % of Production cost for power plant with capacity of 10 MW up to 55 MW

b. 80 % of Production cost for power plant above 55 MW

The MEMR issued the new regulation No. 32 in the year 2009 on the electricity tariff, to replace the MEMR Regulation No. 14 in the year 2008, using a Ceiling Tariff which was US$ 9.7 Cent/ KWh for 110 MW Capacity. In this period the GWA tendering process continued in places like Liki Pinawangan Muara Laboh located in West Sumatera Province, Rantau Dedap in South Sumatera, Gn. Rajabasa in Lampung Province, Suoh Sekincau in Bengkulu, Seulawah in Aceh, and Lawu in Central Jawa.

Only the GWA of Liki Pinawangan Muara Laboh in West Sumatera Province, Rantau Dedap in South Sumatera Province, Gn. Rajabasa in Lampung Province, developed by Supreme Energy and Sorik Marapi, located in North Sumatera, developed by Origin Tata Power (OTP) were able to make the progress. OTP was then acquired by ORKA in 2016. During 2019, the Liki Pinawangan Muara Laboh for 85 MW (Supreme Energy), the Sorik Merapi for 42.3 MW (ORKA) and the Lumut Balai for 55 MW (PGE) were finally able to be put on COD successfully.

The GWA of Jaboi – Sabang of Aceh Province was able to carry out its first exploratory drilling in 2018. The other GWA such as the one in Blawan Ijen in East Java province was just up to the exploration phase with a slim hole drilling by end of 2018 with a promising result and continued with its exploration drilling during 2019 – 2020.

Other GWA's which were failing to fulfill their commitment, were returned to the Government for retendering process or assigned to the State-Owned Companies such as PT PLN (Persero) and Geo Dipa Energi.

During 2003 up to 2014, the geothermal development faced some problems among others in the forestry area. This was due to language in the law calling geothermal a mining activity, as stated in the general provision - Geothermal Law No. 27 in the year 2003. The Geothermal Law No. 27 in the year 2003 was then revoked and replaced by the new Geothermal Law no. 21 in the year 2014.

In 2017, the new minister of EMR issued a new decree No. 10 Year 2017 which described the principal of PPA and the MEMR decree No. 12 in the year 2017, regulating the electricity Tariff from renewable energy. The MEMR No. 12 in the year 2017 was then replaced by MEMR No. 50 in the year 2017. These new regulations will be discussed on other pages.

During 2018, 54 MEMR regulations were revoked and some of the regulations were related to the geothermal business and development.

2. THE GEOTHERMAL DEVELOPMENT PROGRESS IN INDONESIA

As previously mentioned, the geothermal development in Indonesia was divided into two parts. These parts were between the existing GWA as authorized by government to Pertamina and the GWA after the Law No. 27 in the year 2003 was issued.

Before discussing further progress of geothermal development, below is the map of the number of GWA locations either those already on streams, already assigned to developers, and on tendering progress or new GWA for next and future tender. (Figure 2)

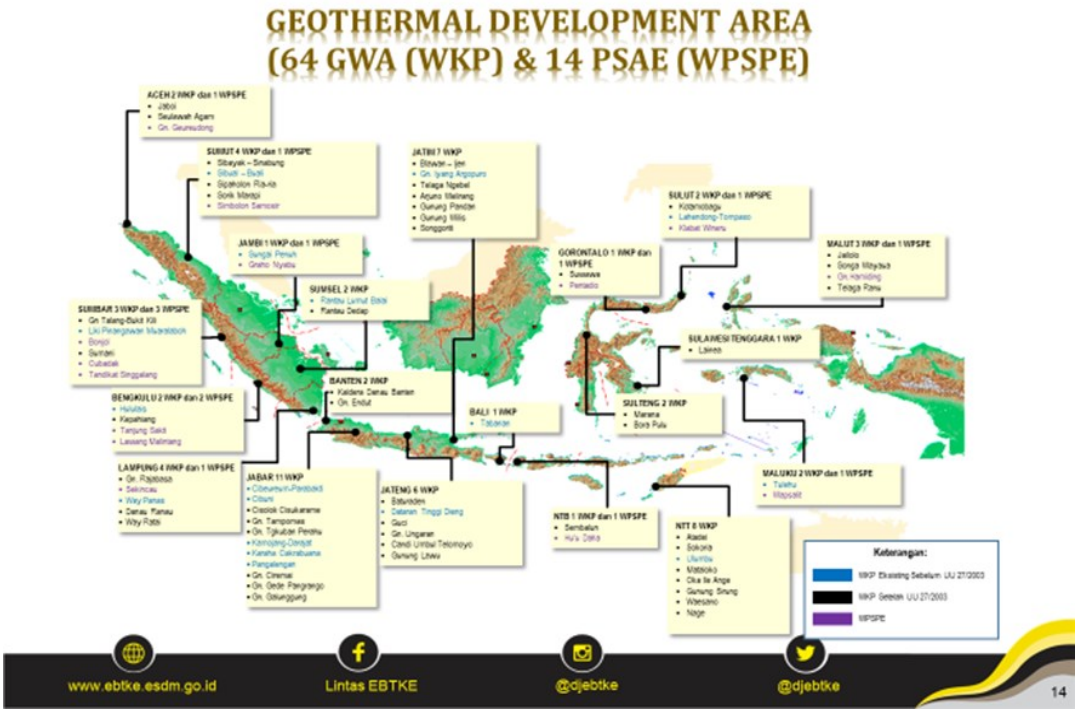


Figure 2 - The Geothermal Development Map Plan
(Source: DitJen EBTKE – MEMR)

The existing GWA's, were those before the Geothermal law No. 27 in the year 2003 was issued and the GWA's which were after the Law No. 27 in the year 2003 are all as listed below: (Table 2)

Table 2 - Geothermal Working Area

No	Geothermal Working Area	Province	Established Year	Resources (MWe)	Remark
1	Sibayak - Sinabung	Sumatera Utara	2012	114	WKP Existing (Before issuance of Law No.27 Year 2003)
2	Cibeureum - Parabakti	Jawa Barat	2012	927	
3	Pangalengan	Jawa Barat	2012	1706	
4	Kamojang - Darajat	Jawa Barat	2012	958	
5	Dataran Tinggi Dieng	Jawa Tengah	2012	947	
6	Lahendong - Tompaso	Sulawesi Utara	2012	350	
7	Sibual-buali	Sumatera Utara	2012	1146	
8	Ulubelu	Lampung	2012	536	
9	Kotamobagu	Sulawesi Utara	2012	410	
10	Lumut Balai	Sumatera Selatan	2012	1405	
11	Karaha - Cakrabuana	Jawa Barat	2012	530	
12	Hululais	Bengkulu	2012	1048	
13	Sungai Penuh	Jambi	2012	513	
14	Tulehu	Maluku	1997	100	
15	Tangkuban Perahu	Jawa Barat	2007	375	
16	Cibuni	Jawa Barat	2008	140	
17	Ulumbu	NTT	2016	112.5	
18	Iyang Argopuro	Jawa Timur	2012	285	
19	Tabanan	Bali	2012	276	
20	Liki Pinangawan Muaralaboh	Sumatera Barat	2009	133	WKP After Law No. 27 Year 2003
21	Gn. Rajabasa	Lampung	2009	283	
22	Jaboi	NAD	2008	125	
23	Sorik Marapi-Roburan-Sampuraga	Sumatera Utara	2008	200	
24	Cisolok Cisukarame	Jawa Barat	2007	45	
25	Gn. Tampomas	Jawa Barat	2007	100	
26	Gn. Ungaran	Jawa Tengah	2007	150	
27	Sokoria	NTT	2012	196	
28	Atadei	NTT	2008	40	
29	Jailolo	Maluku Utara	2007	75	
30	Rantau Dedap	Sumatera Selatan	2010	298	
31	Baturaden	Jawa Tengah	2010	200	
32	Guci	Jawa Tengah	2010	100	
33	Kaldera Danau Banten	Banten	2009	215	

No.	Geothermal Working Area	Province	Established Year	Resources (MWe)	Remark
34	Blawan - Ijen	Jawa Timur		277	WKP After Law No. 27 Year 2003
35	Telaga Ngebel	Jawa Timur	2007	120	
36	Seulawah Agam	Aceh	2007	345	
37	Suwawa	Gorontalo	2009	160	
38	Songa Wayaua	Maluku Utara	2008	42	
39	Sipaholon Ria-Ria	Sumatera Utara	2018	60	
40	Marana	Sulawesi Tengah	2008	70	
41	Danau Ranau	Lampung dan Sumatera Selatan	2011	210	
42	Mataloko	NTT	2011	74.5	
43	Gn. Ciremai	Jawa Barat	2016	150	
44	Gn. Endut	Banten	2011	180	
45	Way ratai	Lampung	2012	330	
46	Umbul telomoyo	Jawa Tengah	2012	92	
47	Bora – pulu	Sulawesi Tengah	2012	123	
48	Gn.Lawu	Jawa Tengah-Jawa Timur	2012	332	
49	Sembalun	NTB	2012	100	
50	Oka ile ange	NTT	2012	50	
51	Kepahiang	Bengkulu	2012	254	
52	Gn. Arjuno-Welirang	Jawa Timur	2014	302	
53	Gn. Pandan	Jawa Timur	2014	60	
54	Gn. Gede Pangrango	Jawa Barat	2014	160	
55	Telaga Ranu	Maluku Utara	2014	85	
56	Songgoriti	Jawa Timur	2014	58	
57	Gn.Talang-Bukit Kili	Sumatera Barat	2014	90	
58	Gunung Wilis	Jawa Timur	2014	50	
59	Gunung Galunggung	Jawa Barat	2014	269	
60	Lainea	Sulawesi Tenggara	2016	66	
61	Gunung Sirung	NTT	2016	152	
62	Wapsalit	Maluku	2016	70	
63	Sumani	Sumatera Barat	2017	100	
64	Waesano	NTT	2017	151	
		Total		**18.651**	

(Source: DitJen EBTKE – MEMR)

By reviewing the above list, we can notice that the total current installed capacity of 2003.5 MW all comes from the existing GWA's and 127.2 MW come from the GWA's that were as a result of the mechanism tendering process of the Law No. 27 in the year 2003. The table below also showed the capacity of the turbines installed for each power plant up to the end of 2020. Additional installed

capacity came from PT Supreme Energy GWA Liki Pinawangan Muara Laboh for 85 MW, PGE GWA Lumut Balai for 55 MW, and ORKA GWA Sorik Marapi for a total of 42.3 MW were successfully put on COD during 2019 which made a total additional installed capacity of 182.3 MW contributed to the national electricity system and made the total installed capacity reached 2130. 7 MW through the end of 2020.

The progress of some GWA through 2020 are as follows :

1. GWA Jaboi located in Sabang Island of Aceh Province had completed the exploration activity and discovered proven reserved of 10 MW. The project was still awaiting the approval of PPA which has to follow the renewable tariff based on Government Regulation on Renewable Energy. At the time the paper is revised, the Draft of the Government Regulation on Renewable Energy is still being reviewed by the Goevrnment. However, it is expected the Jaboi Power Plant will make its COD for 5 MW in 2023 then followed by another 5 MW in 2024.
2. GWA Blawan Ijen located in East Java Province is still progressing with its development drilling in order to meet the target of COD as in the PPA for 55 MW of Ijen – 1 power plant in 2024 and another 55 MW of Ijen – 2 in 2025.
3. For the GWA of Hululais belongs to PGE, the drilling activity was completed by PGE and it is a steam selling contract between PGE and PLN, so the power plant will the the responsibility of PLN to develop and it is expected that COD of Hululais power plant will be made in 2025.

Table 3 - Geothermal Installed Capacity

No	GWA Location	Power Plant	Developeer / Operator	Turbine Capacity	Year of COD	Total Capacity (MW)
1	Sibayak - Sinabung, North	Sibayak	PT Pertamina Geothermal Energy	1 x 10 W 2 MW	2008 1998	**12**
2	Cibeureum - Parabakti, West	Salak	Star Energy Geothermal Salak, Ltd	2 x 60 MW 1 x 60 MW	1994 1997	**376.8**
3	Pangalengan, West Jawa	Wayang Windu	Star Energy Geothermal Wayang Windu	1 x 110 MW; 1 x 117 MW	2000 2009	**227**
		Patuha	PT Geo Dipa Energi	1 x 55 MW	2014	**55**
4	Kamojang - Darajat, West Jawa	Kamojang	PT. Pertamina Geothermal Energy	1 x30 MW; 2 x 55 MW; 1 x 60 MW; 1 x 35 MW	1983 1988, 1988 2008 2015	**235**
		Darajat	Star Energy Geothermal Darajat, Ltd	1 x 55 MW; 1 x 94 MW; 1 x 121 MW	1991 2000 2007	**270**
5	Dataran Tinggi Dieng, Central Jawa	Dieng	PT. Geo Dipa Energi	1 x 60 MW	2002	**60**
6	Lahendong – Tompaso, North Sulawesi	Lahendong	PT. Pertamina Geothermal Energy	6 x 20 MW	2001, 07, 09, 11, 16, 16	**120**
7	Waypanas – Lampung	Ulubelu	PT. Pertamina Geothermal Energy	4 x 55 MW	2012, 12, 16, 17	**220**
8	Ulumbu - NTT	Ulumbu	PT. PLN (Persero)	4 x 2,5 MW	2013, 13, 14, 14	**10**
9	Mataloko - NTT	Mataloko	PT. PLN (Persero)	1 x 2,5 MW	2013	**2,5**
10	Sibual-Buali - North Sumatera	Sarulla	Sarulla Operation Ltd.	3 x 110 MW	2017, 17, 18	**330**
11	Karaha Bodas - West Jawa	Karaha	PT. Pertamina Geothermal Energy	1 x 30 MW	2018	**30**
12	Lumut Balai – South Sumatera	Lumut Balai	PT. Pertamina Geothermal Energy	1 x 55 MW	2019	**55**
13	Sorik Marapi – North Sumatera	Sorik Marapi	PT Sorik Marapi Geothermal Power	1 x 42,3 MW	2019	**42,4**
14	Muara Laboh – West Sumatera	Muara Laboh	PT Supreme Energi Muara Laboh	1 x 85 MW	2019	**85**
TOTAL						**2.130,7**

(Source: DitJen EBTKE – MEMR)

From the table, it can be noted that during year 2000 through 2009 a number of power plants were successfully put on COD among others from Wayang Windu, Kamojang, Sibayak, Darajat, Dieng and Lahendong with a total installed capacity of 722 MW.

Prior to year the 2000, the total installed capacity of geothermal power plant just reached 574 MWe.

The Presidential Decree No. 4 in the year 2010 issued the Fast Track Program from which 10,000 MW of electricity development was issued. In the decree, 49 % was dedicated to be developed from geothermal which is equivalent to 4900 MW. It has created a trigger for the geothermal developer either to speed up their existing GWA or to participate in the new GWA tendering process. At this point, the issue of financing became a concern. The decree will also require an intensification of human resources development in order to support such expansion. Some universities took initiative and action on this capacity building requirement.

For the period of 2011 – 2020, the total installed capacity that could be reached was 834.7 MW

The total installed capacity from year 1983 up to year 2020 are,

1. Period 1980 – 1999	:	574	MW
2. Period 2000 – 2010	:	722	MW
3. Period 2011 – 2020	:	834.7	MW
4. Total	:	2130.7	MW

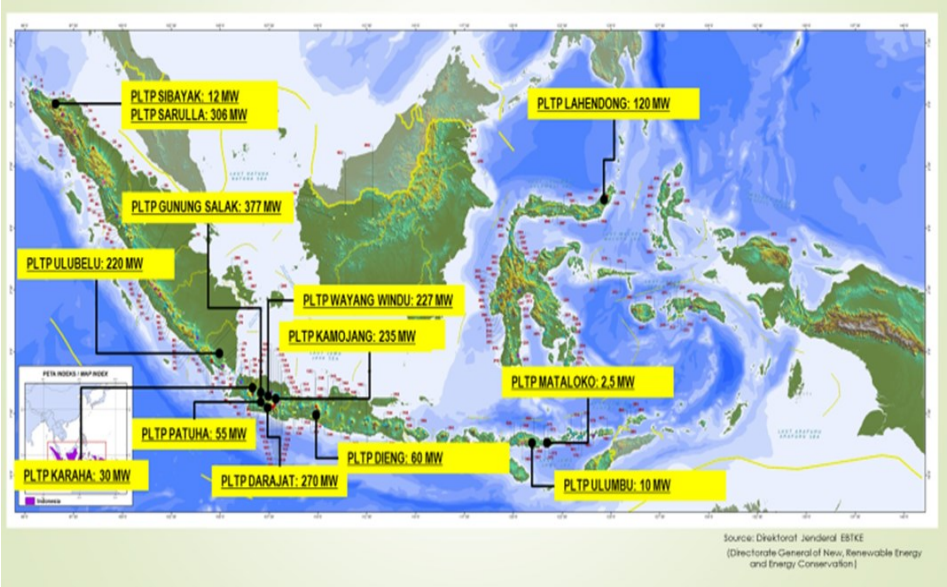
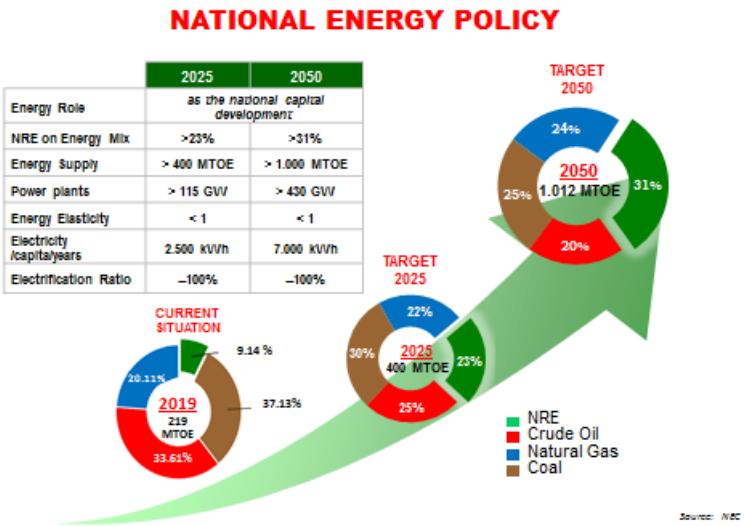


Figure 3 - Geothermal Power Plants Location
(Source : DitJen EBTKE – MEMR)

Further, the government issued the Government Regulation No. 79 in the year 2014 which regulated the Government Policy on the National Energy Policy (KEN) regarding Energy Mix Policy toward 2025. (See Figure 4)



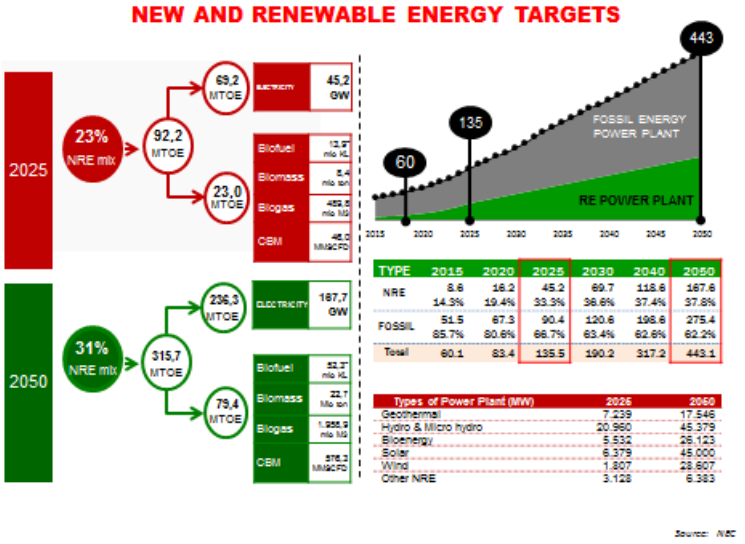


Figure 4 National Energy Policy

The policy required that 23 % of the Energy Mix should come from Renewable Energy by 2025. Out of 23 %, about 7 % is dedicated for geothermal which is approximately equal to 7242 MW. In other words, from the year 2020, it will require an additional 5133.3 MW by 2025.

The Policy of Geothermal development in Indonesia 2015-2050 can be reviewed on table 4 below. In the year 2019 the total installed capacity must reach 2134 MW, but in reality, Indonesia was just able to reach 1984.5 MW. This did, however, make Indonesia the 2nd largest geothermal producer in the world.

Table 4 Renewable energy mix

	2015	2016	2017	2018	2019	2020	2025	2030	2040	2050
Geothermal	1.439	1.654	1.909	2.134	2.494	3.110	7.242	9.300	13.423	17.546
Microhydro	5.024	5.119	5.236	5.491	7.008	7.889	20.960	25.844	35.611	45.379
Bioenergy	1.740	1.886	2.093	2.359	2.674	3.024	5.532	9.651	17.887	26.123
Solar	79	229	429	679	979	1.379	6.379	14.103	29.551	45.000
Wind	7	57	107	207	307	507	1.807	7.167	17.887	28.607
Other Renewable	372	1.860	1.860	1.860	1.861	1.863	3.128	3.779	5.081	6.383
Total	8.660	10.804	11.728	12.939	15.807	18.475	45.044	69.843	119.440	169.038

(Source: DitJen EBTKE – MEMR)

In 2019 the target was not able to be reached due to some power plants which were in progress since 2016 and targeted for completion by 2019. Unfortunately, these plant completions needed to be delayed for a variety of reasons until 2020, including Lumut Balai for 55 MW, Liki Pinawangan for 80 MW and Sorik Marapi for 45 MW. These power plants are ready to be on stream and COD in 2019 which will add another 180 MW to the geothermal development target.

On July 12, 2019 another milestone was reached by Geo Dipa Energi by breaking ground on a small scale 10 MW plant at GWA Dieng.

The government of Indonesia continues to progress in order to fullfil the target of 7242 MW by 2025. In table 5 are the geothermal resources, divided by provinces.

Table 5 - Geothermal Resources by Province

No.	Province	No of locations of the resources	Resources (MWe)						Installed Capacity (MW)
			Speculative	Hipothetical	Reserve			Total (MW - %)	
					Probable	Possible	Proven		
	Sumatera								
1	Aceh	19	585	186	521	0	0	1.292 (4.53%)	-
2	Sumatera Utara	16	250	134	1.002	180	330	1.896 (6.65%)	342
3	Sumatera Barat	18	526	280	544	0	60	1.410 (4.94%)	-
4	Riau	4	45	0	0	0	0	45 (0.15%)	-
5	Jambi	9	352	87	508	145	60	1.152 (4.04%)	-
6	Bengkulu	5	359	223	530	180	70	1.362 (4.77%)	-
7	Bangka Belitung	7	100	5	0	0	0	105 (0.36%)	-
8	Sumatera Selatan	7	225	643	750	130	212	1.960 (6.87%)	-
9	Lampung	13	375	359	1210	295	185	2.424 (8.50%)	220
	Jawa								
10	Banten	6	100	161	365	0	0	626 (2.19%)	-
11	Jawa Barat	40	1.075	884	1.583	1.283	1.555	6.380 (22.37%)	1.194
12	Jawa Tengah	14	130	387	984	90	310	1.901 (6.66%)	60
13	D.I. Yogyakarta	1	0	0	10	0	0	10 (0.03%)	-
14	Jawa Timur	12	105	257	1.007	0	0	1.369 (4.80%)	-
	Bali - Nusa Tenggara								
15	Bali	6	70	22	122	110	30	354 (1.24%)	-
16	Nusa Tenggara Barat	3	0	6	169	0	0	175 (0.61%)	0
17	Nusa Tenggara Timur	25	225	389	732	0	15	1.361 (4.77%)	12.5
	Kalimantan								
18	Kalimantan Barat	5	85	0	0	0	0	85 (0.22%)	-
19	Kalimantan Timur	2	50	0	0	0	0	50 (0.17%)	-
20	Kalimantan Utara	4	20	17	13	0	0	50 (0.17%)	-
21	Kalimantan Selatan	3	17	0	0	0	0	17 (0.05%)	-
	Sulawesi								
22	Sulawesi Utara	9	55	73	540	80	140	888 (3.11%)	120
23	Gorontalo	5	129	11	20	0	0	160 (0.56%)	-
24	Sulawesi Tengah	29	409	58	368	0	0	835 (2.92%)	-
25	Sulawesi Barat	12	316	53	32	0	0	401 (1.40%)	-
26	Selawesi Selatan	19	199	105	195	0	0	499 (1.75%)	-
27	Sulawesi Tenggara	13	200	25	93	0	0	318 (1.11%)	-
	Maluku – Papua								
28	Maluku Utara	15	190	7	482	0	0	679 (2.38%)	-
29	Maluku	18	370	84	195	0	0	649 (2.27%)	-
30	Papua Barat	3	75	0	0	0	0	75 (0.26%)	-
	TOTAL	342	6.617	4.456	11.975	2.493	2.967	28.508 (100%)	1.948,5

(Source: DitJen EBTKE – MEMR)

The followings are the discussion on the activity and the plan on the geothermal development in Indonesia toward 2025. Below table showed the GWA assignment to the State Owned Company PLN and Geo Dipa Energi for the period of 2015 – 2018. (Table 6)

Table 6 - GWA Assignment to SOE

NO	WORKING AREA / PROVINCE	SOE DEVELOPER	RESOURCES (MWE)	DEVELOPMENT PLAN
1	Mataloko - NTT	PLN	74,5	Unit 2: 10 MW (2022) Unit 3: 10 MW (2023)
2	Ulumbu - NTT	PLN	112,5	Unit 5: 20 MW (2021) Unit 6: 20 MW (2026)
3	Songa Wayaua – Maluku Utara	PLN	42	Unit 1: 5 MW (2023) Unit 2: 5 MW (2023)
4	Gn. Tangkuban Perahu – Jawa Barat	PLN	375	Unit 1: 20 MW (2023) Unit 2: 20 MW (2024) Unit 3: 20 MW (2024)
5	Atadei - NTT	PLN	40	Unit 1: 5 MW (2025) Unit 2: 5 MW (2027)
6	Gn. Ungaran – Jawa Tengah	PLN	150	55 MW (2025)
7	Kepahiang - Bengkulu	PLN	254	55 MW (2024)
8	Oka Ile Ange, NTT	PLN	50	10 MW (2025)
9	Gn. Sirung, NTT	PLN	152	5 MW (2025)
10	Danau Ranau, Lampung	PLN	210	40 MW (2025)
11	Gn. Arjuno Welirang	Geo Dipa Energi	302	Binary: 5 (2023) Unit 1: 55 (2025) Unit 2: 60 (2030) Unit 3: 60 (2034)
12	Candi Umbul Telomoyo	Geo Dipa Energi	92	Binary: 5 (2021) Unit 1: 40 (2023) Unit 2: 45 (2026)
TOTAL			1.460	595 MW

(Source: DitJen EBTKE – MEMR)

By assuming that the development cost per MW is US$ 5 million, so the above project will require approximately US$ 3 Billion. From the above table in the bracket shows the plan of the target year for each GWA and Power Plant, including its capacity.

Table 7 - GWA to be Offered

NO	PLAN/PROPOSE GWA	PROVINCE	ESTABLISHMENT YEAR	RESOURCES (MWE)
1.	Cubadak	Sumatera Barat	2017	66
2.	Gunung Geureudong	Aceh	2018	160
3.	Huú Daha	NTB	2018	65
4.	Pentadio	Gorontalo	2018	25
5.	Tanjung Sakti	Bengkulu	2018	70
6.	Hamiding	Maluku Utara	2018	265
7.	Sekincau	Lampung	2018	378
8.	Simbolon Samosir	Sumatera Utara	2018	155
9.	Graho Nyabu	Jambi	2018	200
10.	Klabat Wineru	Sulawesi Utara	2018	20
11.	Bonjol	Sumatera Barat	2018	340
TOTAL				**1.744**

(Source: DitJen EBTKE – MEMR)

The above list is the prospect geothermal areas that are open and proposed or planned by the Ministry of Energy and Mineral Resources to be offered to the developers to peform a preliminary survey and continue with exploration. The developers who are interested may participate in the limited tender process after they passed the administration and technical requirements. In the bid tender, the developers are required to meet the minimum requirements such as the financial ability and the technical capability including the commitment to carry out the preliminary survey through the exploration. (Ref : MEMR Regulation no. 36 year 2017 on the procedure on the PSA – Preliminary Survey Assignment and PSAE – Preliminary Survey Assignment and Exploration).

Table 8 is the plan on offering the GWA during 2019 by the GoI through Directorate General New Renewable Energy and Energy Conservation – DitJen ETBKE of MEMR.

Table 8 - GWA Offering Plan 2019

NO	GWA	RESOURCES (MW)	DEVELOPMENT PLAN (MW)
1	Lainea, Southeast Sulawesi	66	20
2	Sembalun, West Nusa Tengara	100	20
3	Telaga Ranu, North Maluku	85	5
4	Kotamobagu, North Sulawesi	410	80
5	Gunung Wilis, East Jawa	50	20
Total		**711**	**145**

(Source: DitJen EBTKE – MEMR)

Table 9 is the Working Areas that are assigned for Preliminary Survey and explorations that will be offered to the developers. These areas are planned to be tendered in 2019. (WAPSEA – Working Area for Preliminary Survey and Exploration Assignment).

Table 9 - Working Area for Preliminary Survey and Exploration Assignment

NO	WAPSEA	RESOURCES (MW)
1	Pentadio, Gorontalo Sulawesi	25
2	Bonjol, West Sumatera	200
3	Sipaholon Ria-Ria, North Sumatera	35
4	Lokop, Aceh	50

(Source: DitJen EBTKE – MEMR)

Other government efforts in accelerating the geothermal development are to carry out an exploratory drilling program which is one of the breakthroughs implemented by the Government in geothermal development. The program is called "***Government Drilling with the Infrastructure Financing Geothermal Sector ".***

Table 10 - Location of Government Drilling Activity

NO.	WORKING AREA	LOCATION	PROBABLE RESERVE (MW)	STATUS OF THE AREA
1.	Wae Sano	Nusa Tenggara Timur	30	GWA
2.	Jailolo	Maluku Utara	75	GWA
3.	Bittuang	Sulawesi Selatan	28	Open Area
4.	Nage	Nusa Tenggara Timur	30	Open Area

(Source: DitJen EBTKE – MEMR)

Table 10 is the location of the government drilling activity. The first pilot project will be at Waesano in NTT, where the financing is led by PT SMI (Sarana Multi Infrastructure) as the project owner with a grant from World Bank

The purpose of the PSAE is to reduce the risk of geothermal exploitation which is expected will encourage the development of geothermal by the private sector/developer and also State Owned Enterprise .

The other breakthroughs beside government drilling are :
1. The geothermal development is shifted in the Eastern part of Indonesia.
2. Assignment to the State Owned Enterprise.
3. Preliminary Survey and Exploration Assignment.
4. Permit/Licensing Simplification.

To support the above item no. 1, Flores Island was appointed as the Geothermal Island based on the MEMR Decree 2268 K/30/MEM/2017 . There are 18 locations with reserves of 959.5 MW (Figure 5).

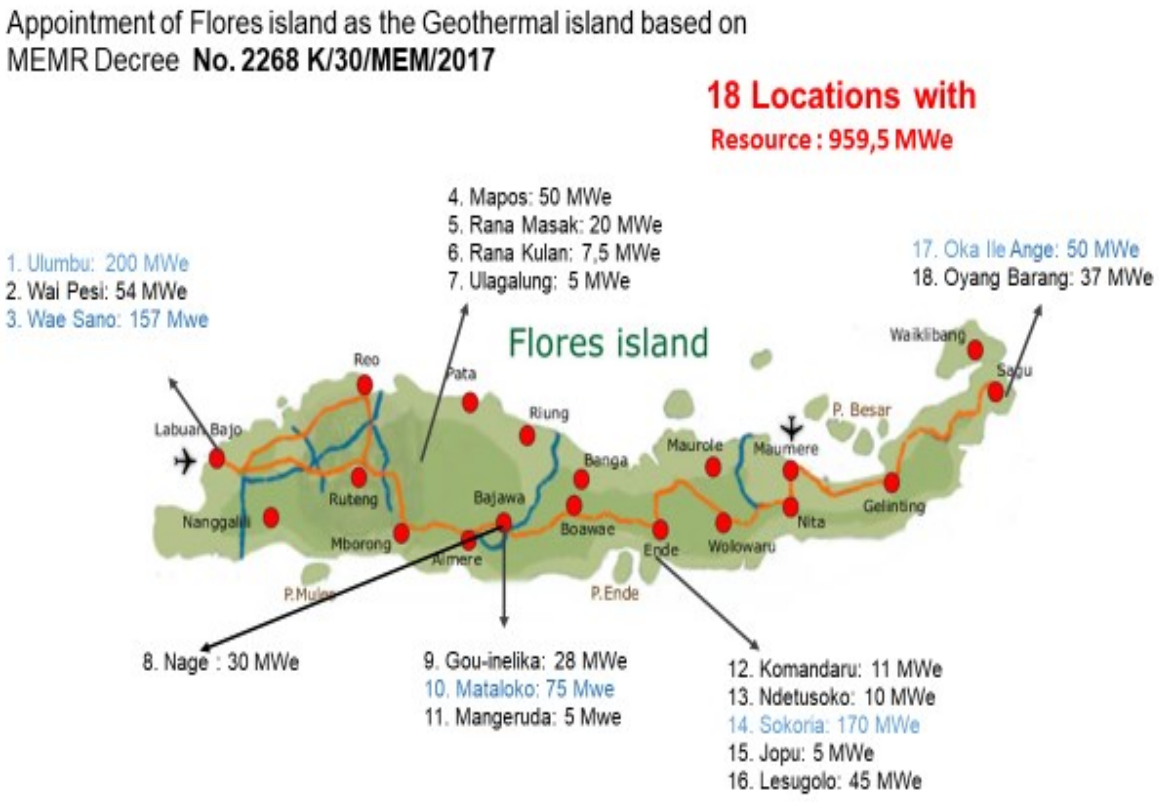


Figure : 5 – Flores Geothermal Island

The Government continues to pursue the target of renewable energy development of 23 % by 2025 in the energy mix and to give a best effort in assisting the geothermal development by re-establishing the geothermal development roadmap. The Directorate General of New, Renewable Energy and Energy Conservation , Directorate General of Electricity and Geology Agency of MEMR along with PT PLN (Persero) and Indonesian Geothermal Association (INAGA) have compiled the Roadmap of Indonesia Geothermal Development 2019 – 2030 with the target of development of 7,242 MW by 2025 and 10,002 MW by 2030. The Roadmap was compiled based on the proposal of the project planning from the Geothermal developers and the capacity of the geothermal resources in each location.

In accordance with the data from the Geological Agency of MEMR (December 2018), Indonesia has the geothermal resources of 25,386.5 MW in 349 locations across Indonesia. As noted the installed capacity reached 1948.5 MW which is equal to approximately 7.6 % of the total resources.

The Roadmap of Geothermal Development 2019 -2030 are summarized below :

Based on the Development Progress :
a. Existing (Project in progress, PPA) – 61 Projects at 29 GWA, Total of 2,547 MW
b. Pipeline (In the RUPTL, Not yet PPA) – 52 Projects at 34 GWA/WPSPE,
c. Total of 2,015 MW

Potential (Not yet in the RUPTL) – 107 Projects, Total of 3,491 MW which are divided as follows :
- 60 Projects – 32 GWA, Total of 1931 MW
- 23 Projects – 13 WPSPE, Total of 875 MW
- 22 Projects – 22 Open Area, Total of 685 MW

Based on target achedule of COD
a. Short term 2019 – 2024 planned for 48 projects, for a total of 1,522.5 MW
b. Mid term 2025 – 2028 planned for 126 projects, for a total of 5,131 MW
c. Long term 2029 – 2030 planned for 46 projects, for a total 1,400 MW

Based on Geothermal Resources
a. High Enthalpy > 225 Deg C : 168 projects for a total of 6,896.5 MW
b. Medium Enthalpy 125 – 225 Deg C : 52 projects for a total of 1,157 MW

From the above discussion on the roadmap geothermal development, it can be noted that during 2019 – 2025, additional capacity that is planned to be achieved is only 1,522 MW from 48 geothermal development projects, either from private sectors or from SOE. In addition, there are 220 geothermal projects planned through 2030 which will make a total installed capcity to reach 8053.5 MW.

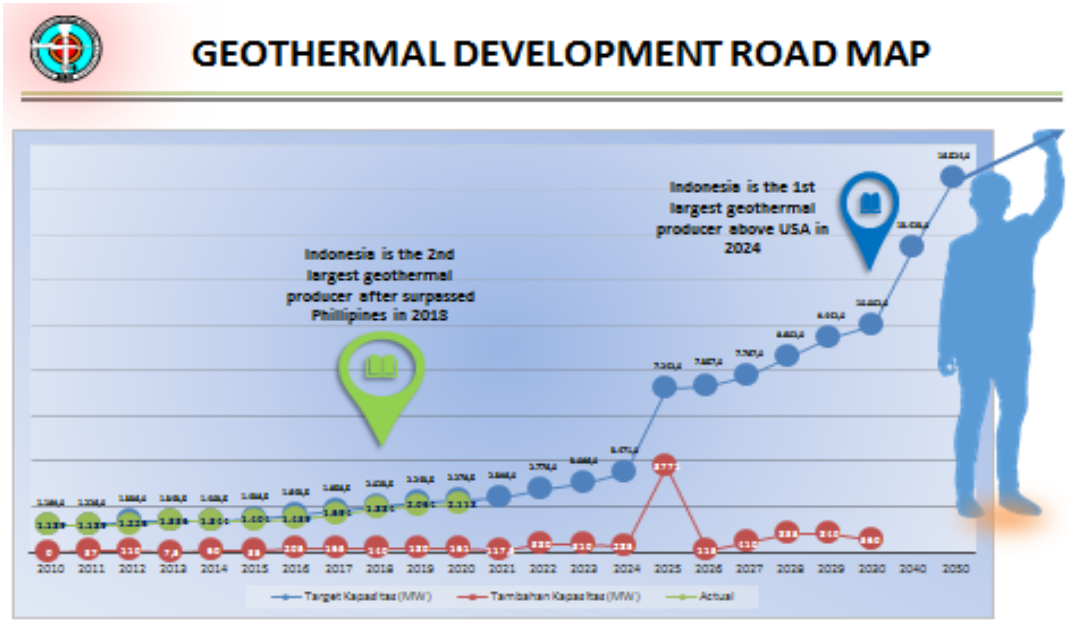


Figure 6 – Geothermal Development Roadmap through 2050
(Source : Inaga Presentation DIIGC 2020 / Dit.Jen. EBTKE MEMR)

From the above figure 6, it can be noted that by 2024, the expected installed capacity can reach 3841.5 MW and if it is the case, it will make Indonesia will be the largest geothermal producer in the world.

However, it can be noted that Covid 19 Pandemic had caused delayed for a few GWA such as Rantau Dedap, Sorik Merapi 2 and Sokoria which were supposed to be COD in 2020, had to be delayed to 2021**.** The total installed capacity frrom those 3 (three) GWA will be 140 MW that can be added to the system.Furthermoree, a demand on reduction of additional capacity had also caused PLN to delay 1 – 2 year in adding supply of electriciity.

3. REGULATIONS OVERVIEW

The geothermal development in Indonesia started in early 1972 when the Government of Indonesia received a Colombo Plan Grant to carry out exploration of geothermal resources in Indonesia and through a Presidential Decree No. 16 year 1974 the Government of Indonesia mandated Pertamina to carry out geothermal exploration in a whole Jawa Island, culminating in a Presidential Decree No. 22 in the year 1981. A regulatory summary is as follows:

1. To authorize PERTAMINA to carry out Exploration and Exploitation of the energy of Geothermal Resources.
2. PERTAMINA is obliged to sell the geothermal energy to PLN for electricity.
3. For the works or activity that are unable to be carried out by PERTAMINA, The Minister of Mining and Energy can appoint the third party as the contractor to cooperate with PERTAMINA in the form of a Joint Operating Contract.
4. The supervision is under the Department of Mining and Energy through the Directorate General of Oil & Gas

The Presidential Decree No. 22 in the year 1981 was then replaced by the Presidential Decree No. 45 & No. 49, in the year 1991.

In this Presidential Decree no. 45 in the year 1991, the main revision is as follows:
1. To give authorization to carry out exploitation and exploration of geothermal resources for energy generation/electricity.
2. If needed, Minister of Mining and Energy can give a permit to exploit the geothermal resource for a small scale to another agency, SOE and national business entity including cooperative agency for electricity and other business.
3. PERTAMINA can sell the energy in the form of steam or electricity to PLN, another agency, SOE, or a national business entity including a cooperative agency.
4. The supervision and technical consultation will be under the Directorate General Oil & Gas and the Directorate General Electricity and New Energy.

The presidential decree no. 49 in the year 1991 regulated treatment for Income tax, VAT, and other Levy on the implementation of the authorization and permits to exploit geothermal resources for energy generation / electricity. The tax will be applied to PERTAMINA, the JOC Contractor, and the permit holder to exploit geothermal. Those taxes are Income Tax, VAT for goods and services, and sales tax for luxury goods, Land & Building tax, and another Levy which will be regulated by the Minister of finance. The amount of tax and levy is determined at 34 % from net operating income except personal tax. The tariff of energy generation/electricity is regulated by the Minister of Mining and Energy. The decree will start to apply in the tax year 1992.

In the year 2000 the regulation of geothermal was renewed with the Presidential Decree no. 76 on the “Exploitation of Geothermal Resources for Electricity Power Generation”.
In this decree, the geothermal business and activity are regulated in more detail from exploration up to exploitation including time limitation for each activity.

Some important points in the decree are described below:
The geothermal exploitation is carried out by the developer from upstream to downstream activity including installation of the power plant.
The working area is a certain area that was appointed as a geothermal working area. The borderline is determined by the Head of Local Government including all terms & conditions.
The exploitation permit is issued by the Head of Local Government.
The exploration that will be done by the cooperative agency or private sector is given with a time limit of three years starting from the issuance of the permit until the discovery of proven reserve and if needed can be extended maximally twice, with each extension for 1 (one) year.
The exploitation of geothermal resources by the cooperative agency and private sector for their own use of the electricity is a non-binding agreement for the government or PT. PLN (Persero) to purchase its electricity power produced by them.
The selling Tariff of electricity from the business entity to the consumer is stated in Indonesian Rupiah.
The exploitation permit is given for 30 years and can be renewed with the consent of the Head of the local Government.

Other articles in the decree also regulated among others on the health, safety and environmental issues, sanction and also transition of the regulation which stated that the contract on the exploitation of the geothermal resource and or contract on JOC which have been signed prior to this presidential decree is established and are still valid and still applicable to the Presidential Decree no. 49 from the year 1991 on the Tax matter. In the decree, the working geothermal area that was given to PERTAMINA is still valid for a period of two years but PERTAMINA is obliged to adjust the activity based on this Presidential Decree.

To further improve the Geothermal Business and Development, the first Geothermal Law No. 27 Year 2003 on Geothermal was finally issued on October 22, 2003. But it took 4 (four) years to issue the Government Regulation (GR) No. 59 Year 2007 dated 5 November 2007 which will describe in detail the business and development of Geothermal Resources for indirect use.

In the general provision of the Law No. 27 in the year 2003, it was the first time the IUP (Izin Usaha Pertambangan Panas Bumi) – the Permit to Exploit the Geothermal Mining – was introduced.

The breakthrough in the law 27 of the year 2003 was that the authority to manage the geothermal business and exploitation including the permit was divided between central government and local government. If the GWA is across the province then the authority and management of the GWA is under the central government. If the GWA is across the regency then the authority and management is under the province administration which is headed by the Governor. If the GWA is located in the regency area, the authority and management is under the regency administration which is headed by Bupati (Mayor) if the geothermal resource is in the city administration. The authority also requires the local government to issue regulation related to the geothermal activity but must be in accordance with the valid law and regulation.

The operational geothermal activity covers: Preliminary survey, Exploration, Feasibility study, Exploitation and Utilization of geothermal resource.
From preliminary survey up to exploration the time period given is for three years since the IUP is issued and can only be extended maximally two years, with each extension for 1 (one) year. The time period for Feasibility study is two years and for the exploitation is 2 years after this activity. If the developer failed to fulfill the commitment then the IUP holder is obliged to take over and utilization is valid for 30 (thirty) years after the exploration is completed and can be extended.

If the developer failed to follow the period of time as set in the IUP permit then it can be returned back or revoked or cancelled by the Government.

The stages in the geothermal business will cover:
a. Preliminary survey
b. Establishment of working area and tendering GWA
c. Exploration
d. Feasibility study
e. Exploitation
f. Utilization of the geothermal energy

In this regulation, in order to carry out the tender of the GWA, the minister can determine the tariff of the steam and electricity generated from geothermal energy. The tender will be done as an open /public tender which will be carried out by the central government if the GWA is across the province, by Governor if the GWA is in the province and across the regency, and by the Bupati or Mayor if the GWA is located in the regency or in the city. All the above activity is regulated in detail in the Government Regulation (GR) No. 59 of the year 2007.

After the GR 59 of the year 2007 was issued there were some minister decrees and regulations issued in order to accelerate the geothermal development, such as:

1. Minister Energy and Mineral Resources Regulation No. 14 of the year 2008 on the Ceiling Tariff of the electricity generated from geothermal power plants, issued on 09 May 2008. In this regulation, the tariff is divided into 2 (two) parts:
   For the unit above 10 MW up to 55 MW, the ceiling tariff will be 85 % either for high or medium voltage of the Production cost of the local electricity system.
   For a unit above 55 MW, the ceiling tariff will be 80% of the Production cost of the local electricity system at the high voltage connection plan.

2. Ministerial MEMR No. 32 of the year 2009 on the Ceiling Tariff of the electricity by PLN (Persero) form the geothermal power plant issued on 04 December 2009. This regulation replaced the above Ministerial MEMR regulation no. 14 Year 2008. The ceiling tariff for tendering purposes is kept at maximum 9.70 cent US$ /Kwh for the electricity purchased by PT PLN (Persero) at the high voltage system.

The GWA tender based on MEMR Regulation no. 14 Year 2008 resulted as follows among others Gn. Tampomas, Cisolok Cisukarame, Jailolo, Gn. Ungaran, Jaboi, Atadei, Sorik Marapi, Telaga Ngebel, Blawan Ijen.

After issuance of the MEMR Regulation no. 32 Year 2009, the following GWA were tendered among others Seulawah Agam, Suoh Sekincau, Liki Pinawangan Muara Laboh, Rantau Dedap, Rajabsa, Sokoria, Batu Raden, Guci, Gn. Ciremai, Gn. Lawu, Mataloko, Kepahiang, Gn. Arjuno Welirang, Gn. Talang – Bukit Kili, Wairatai.

In the year 2010, the GR No. 59 of the year 2007 was revised to become GR no. 70 Year 2010 on the geothermal business issued on 20 October 2010. The main revision was on article 86 that in terms of the authorized holder, permit and or contract are not yet able to perform the exploitation activity in their GWA until 31st December 2014, then the authorized holder, permit and or contract are obliged to return the GWA to the Government. This article was intended to target the developers which owned the existing GWA, before the Law No. 27 Year 2003 was issued.

The GR no. 59 of the year 2007 and GR. No. 70 of the year 2010 were then revised again to become GR no. 75 in the year 2014 issued on 14 October 2014. In this regulation some articles were revised particularly on the Bid Tender process which were described in more detail and sharpened the procedures either for the auctioneer and the developers including the obligation and the sanction. In this regulation the performance bond as the exploration commitment is introduced as per the article no. 23, GR No. 75 of the year 2014 and can be explained as follows:

“A statement letter on the ability to place the exploration commitment fund in SOE Banks or prime banks for the amount of minimum US$ 10,000,000 (ten million US dollar) for the development of 10 MW capacity or bigger and US$ 5,000,000 (Five million US dollar) for the capacity below 10 MW and then a letter from the bank which its domicile is in Jakarta to confirm that the developer has the ability to provide funding for the exploration activity”

As a note, the GR no. 59 from the year 2007 and GR no. 70 from the year 2010 are still valid and applicable for the geothermal business.

To accelerate the geothermal development in order to provide the need of electricity and also to implement the Presidential Decree No. 4 of the year 2010, regarding the 2nd 10,000 MW Fast Track Program which allocated 40 % must be from geothermal energy or around 4900 MW, the Ministerial MEMR regulation no. 22 from the year 2012 on "The assignment PT PLN (Persero) to purchase electricity from geothermal power plant and the ceiling tariff on purchasing of electricity energy by PT PLN (Persero) from geothermal power plant" was issued on 16 August 2012.

Below Table 11 shows the electricity tariff of Geothermal Power Plants as stipulated in the MEMR Regulation No. 22 of the year 2012.

It was noted that the ceiling tariff on MEMR Regulation No. 32 of the year 2009 was based on the capacity of 110 MW and then improved by MEMR regulation No. 22 in the year 2012, which is based on the Islands as per Table 11 below and did not specify the tariff for the capacity below 110 MW and low voltage. Some of the results from previous tender were unable to progress due to low tariffs that makes it uneconomical for the developer to proceed and therefore there is a need to regulate the new decree to assist those developers which already won the tender but need to be assisted to proceed and meet the target schedule up to COD. The MEMR Regulation no. 22 of the year 2012 was then revoked and replaced with Ministerial Regulation No. 17 of the year 2014 on "The purchasing of electricity from geothermal plant and geothermal steam for geothermal power plant by PT PLN (Persero)" which was issued on 3 June 2014. In the regulation the tariff was divided by regional and also by capacity and year of COD. The tariff can be viewed on table 12. But again, it was just for the development of 110 MW capacity geothermal power plants which later created a problem if the developer was only able to install the turbine at a rating below 110 MWs capacity.

Table 11 – Ceiling Tariff Base on MEMR Reg. No. 22/ 2012

No	Region	Geothermal Electricity Tariff (US $ Cent / KWH)	
		High Voltage	Medium Voltage
1	Sumatera	10	11.5
2	Jawa, Madura dan Bali	11	12.5
3	Sulawesi Selatan, Sulawesi Barat, dan Sulawesi Tenggara	12	13.5
4	Sulawesi Utara, Sulawesi Tengah, dan Gorontalo	13	14.5
5	Nusa Tenggara Barat, dan Nusa Tenggara Timur	15	16.5
6	Maluku dan Papua	17	18.5

(Source: DitJen EBTKE – MEMR)

Table 12 – Ceiling Tariff Base on MEMR Reg. No. 17/ 2014

Year of COD	Ceiling Tariff (sen USD/kWh)		
	Region I	Region II	Region III
2015	11.8	17.0	25.4
2016	12.2	17.6	25.8
2017	12.6	18.2	26.2
2018	13.0	18.8	26.6
2019	13.4	19.4	27.0
2020	13.8	20.0	27.4
2021	14.2	20.6	27.8
2022	14.6	21.3	28.3
2023	15.0	21.9	28.7
2024	15.5	22.6	29.2
2025	15.9	23.3	29.6

(Source: DitJen EBTKE – MEMR)

Region I will cover Sumatera, Jawa and Bali

Region II will cover Sulawesi, Nusa Tenggara Barat, Nusa Tenggara Timur, Halmahera, Maluku, Irian Jaya dan Kalimantan

Region III is the area within Region I and Region II which is in the remote area and the electricity is provided by fossil fuel.

The above table 12 is the base tariff at COD which is not including the escalation as per the PPA model and the construction of transmission line which is the responsibility of PT PLN (Persero).

Some articles in the MEMR Decree No. 17 Year 2014 that were important as a breakthrough in accelerating the developments can be summarized below:
The Director General (DG) EBTKE is to determine the Region and Year of COD including the Development Capacity when tendering is carried out.
The tariff will refer to the ceiling tariff as per the table (Figure 17) without negotiation to be stated in the PPA and valid for 30 years.
PT PLN is obliged to purchase either the electricity from the geothermal power plant or geothermal steam for the power plant.

In the case that the MEMR has not given assignment to PLN the developers are given an opportunity to adjust the tariff but with the condition that the PPA must be signed by 31st October 2014 at the latest.

In the case that the MEMR has given the assignment to PLN to purchase the electricity to the developers which already have the IUP, those developers are given an opportunity to adjust the tariff but must sign the PPA by August 31st, 2014 at the latest.

During the process of geothermal activity or development by the developers, it was learned that some of the geothermal resources are located in the conservation and protected forest. Geothermal was classified as the mining activity, and the Law on forestry No. 41 of the year 1999, at article 38 point 4, stated that any mining activity at the protected forest is prohibited.

It was also noted that in the Law 27 of the year 2003, the authority to carry out geothermal business was given to the local government but the geothermal business was a bit slow because officials of the local government required intensive training in order to increase the capacity building and also increase their competency in the geothermal energy business.

There was a necessity to revise the Law no. 27 of the year 2003 on the Geothermal that will accelerate the geothermal development by private sector and also the SOE.

Below Figure 6 will show the geothermal resources located in the forestry that showed the percentage of the geothermal resources where 42 % is located in the conservation forest and 24 % is located in the protected forest which is equal to approximately 6000 MW of the total potential of the geothermal resources in Indonesia (28.000 MW).

The Law no. 27 year 2003 was then revoked and replaced with the Law no. 21 of the year 2014 on the Geothermal issued on 17 September 2014 and then followed with the Government Regulation No. 07 of the year 2017 on the geothermal for indirect use which described in detail the geothermal business process

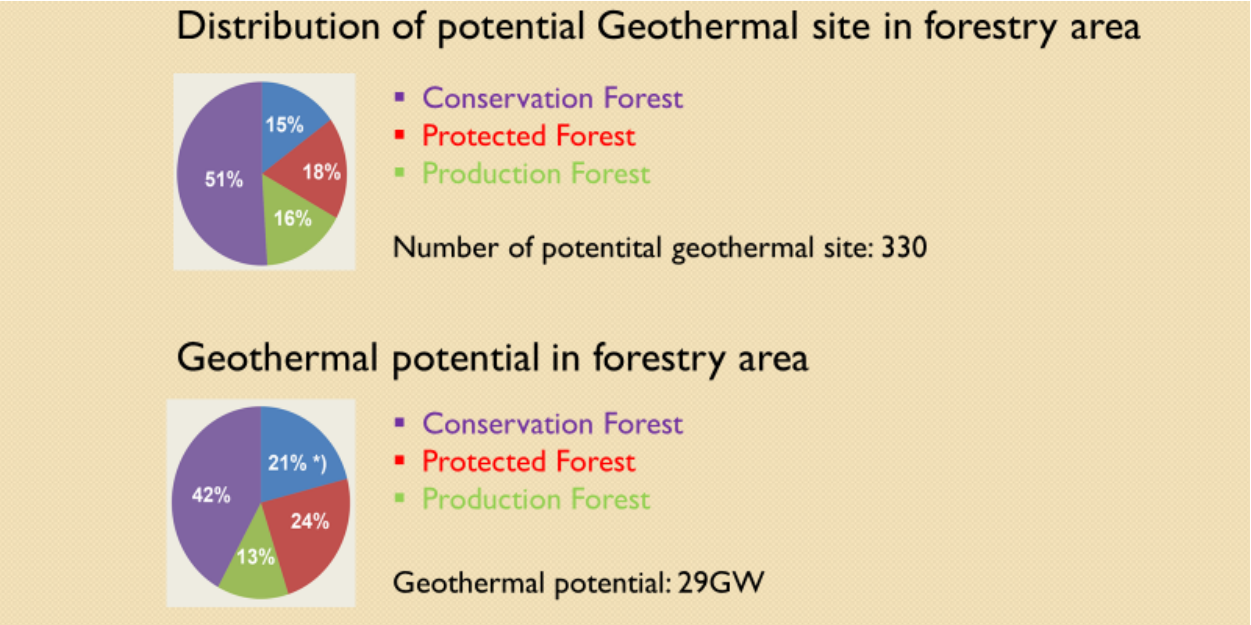


Figure 6 – Distribution of Potential Geothermal Site in Forestry Area

The substance of the Law no. 21 of the year 2014 on the Geothermal was:

Geothermal use is not a mining activity.
The geothermal energy for indirect use is fully managed by the central government and for direct use is managed either by central government or local government in accordance with the authority as per the regulation.
There is a Production Bonus which is based on the percentage of gross income to be given to the local government (Ref. GR no. 28 of the year 2016).
The government has the right to carry out the exploration, exploitation up to the utilization of the geothermal energy by giving assignment to the SOE and or Public Service Agency.
The geothermal development is regulated in more detail through the government regulation either for indirect or direct use.
The Permit, Tendering, Control and Supervision of the geothermal business and development are fully under the authorization of the central government.
Transfer of share of the private sectors or developers is regulated.
Other MEMR regulations were issued again in 2017. They are MEMR decree No. 10 year 2017 which regulated the principal of the PPA and the MEMR decree no. 12 year which regulated on the utilization of renewable energy for electricity power.
The MEMR No. 10 year 2017 can be summarized below:
Risk Equality between IPP & PLN
Contract period max. 30 Years
BOOT (Built, Own, Operate & Transfer)
Capital Depreciation minimum 20 years
Penalty & Take or Pay.
The Decree was revised in the same year to become Permen ESDM No. 49/2017

Which described:
Risk Allocation
Transfer Right
Force Majeure

The content of MEMR No. 12 of the year 2017 in general can be summarized as follows:
In the case that the local Production cost is below or the same as the National Production cost, the mechanism to determine the tariff is left to the B to B, whereas if the local Production cost is above the national production cost, the electricity price from geothermal will be 100 % of the local Production cost.
For the geothermal sector, the regulation can be found in the Article No. 11 of the MEMR No. 12 of the year 2017.
A PPA may proceed when the reserve is proven after exploration.
The tariff using a ceiling tariff is based on the Production cost.
The MEMR decree no. 12 of the year 2017 was then revoked and replaced by MEMR decree No. 50 in the year 2017, stating that the tariff must refer to the existing regulation where the ceiling tariff must refer to the 100 % of local electricity production cost.
Further on the MEMR 50-year 2017 are:
The new article, a BOOT system (Built, Own, Operate, and Transfer), is introduced after 30 years of the PPA is finished.
The purchasing of electricity power is obliged to obtain the MEMR approval.
Standard PPA is regulated where PT. PLN (PERSERO) is obliged to prepare and to publish the standard document of procurement, standard PPA and the typical of technical procedure for direct selection implementation.
The MEMR Decree No. 10 and 49-year 2017 were revised again to become the MEMR Decree No. 10 year 2018.

Revision mainly on article No. 28 – *Force Majeure*, by deleting paragraph 2.b which is in the case of changing the Government Law/Regulations, paragraph 5, in case of *force majeure* that will cause new investment or additional cost, the company has the right for tariff adjustment, however, the paragraph 6 (six) mentioned that in the case of *force majeure* due to changing of the regulation that will cause reduction on investment costs then the PLN has the right for tariff adjustment.

Paragraph 3, in case of *force majeure*, the COD can be extended and Paragraph 4, in case of *force majeure* and energy can be delivered, the PPA can be extended.

Minster of EMR issued Minister Decree No. 16 year 2020 regarding Strategy Plan of Ministry of EMR to develop geothermal for the year 2020 – 2024. It was said that the target up to 2025 will only be pushed for an additional capacity of 1037 MW. It is seen by the MEMR as the pipeline projects for GWA's in Aceh, North Sumatera, West Sumatera, Bengkulu, Jambi, South Sumatera, Lampung, Banten, Central Jawa, East Jawa and west Jawa.

The above target will be achieved by way :

- Funding of Exploration by the government
- Providing incentive for levelized cost of electricity
- Facilitate access to the project financial
- Provide regulation and advocacy for utilizing the conservatioan area.
- Social engineering in order to obtain the support from the community
- Improved governance

At the time this paper is revised, the Presidential Decree on New,Renewable Energy is still being reviewed by the Government. However, some efforts by the stake holders to propose a new regulation in the geothermal business, including a Feed in Tariff proposal, are still in progress.

4. CONCLUSION

From the above discussion it can be concluded that:

1. Indonesia is committed to develop geothermal energy in order to support their GHG emission reductions.
2. It is admitted that the target of 7242 MW of geothermal development by 2025 will be difficult to be achieved due to technical, financial, and legal uncertainty.
3. During the past 30 years, either the Laws, Government regulations, Presidential Decrees, or the Ministerial Decrees keep changing in order to accelerate the development but in certain cases the new regulations were difficult or unable to be applied and, in many cases, the new regulations made the project become uneconomical. This is also due to uncertainty of the legal sanction.
4. It has been addressed that the Fit in Tariff is preferable by the developers.
5. There is a need to revise the latest and current regulations which will be able to support the developers. This will accelerate geothermal development through projects that are economical, meeting the financial provider requirements.
6. Based on the above discussion and evaluation including the impact of Covid 19 pandemic and also the roadmap of geothermal development, the capacity of geothermal development through 2025 can only reach approximately 3600 MW, around 50% only from the target 7200 MW by 2025.

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ABBREVIATION:

COD	: Commercial Operating Date
Ditjen EBTKE	: Directorate General New, Renewable Energy and Energy Conservation
Ditjen DJK	: Directorate General of Electric Power
GWA	: Geothermal Working Area
IUP	: The Permit to Exploit Geothermal Mining
MEMR	: Ministry of Energy and Mineral Resources
Permen ESDM	: Minister EMR decree
PT PLN (Persero)	: State Owned Electricity Company
PGE	: PT.Pertamina Geothermal Energy
PSPE	: Preminilary Survey Assigment and Exploration
RUPTL	: Electricity Suply Business Plan by PT PLN (Persero)
WAPSPE	: Working Area for Preliminary Survey and Exploration Assignment