CDM Financing for Geothermal Project in Indonesia: Current Status and Post 2012 Prospect

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Abstract

Geothermal potential in Indonesia reaches 29,038 MW, but only about 4% has been utilized. The obstacles faced is the high investment costs and limited funding mechanism. CDM is one of the incentive mechanisms that can be used to help overcome these obstacles. CDM for development of geothermal projects in Indonesia was the first utilized in the development of Darajat geothermal power plant unit III with the installed capacity of 110 MW which is operated by Chevron Geothermal Indonesia. This project has been registered at the CDM Executive Board in 11 December 2006 and received the CERs for the first time in 11 June 2009. After this success, a lot of construction of geothermal power plants using CDM funding scheme. The cost of generating geothermal power plants in Indonesia about 9.5 cents $/ kWh and with the CDM scheme can reduce the generating cost about 0.85 cents $/ kWh.

CDM is the only mechanism in the Kyoto Protocol that involves developing countries. The first phase of the Kyoto protocol will expire in 2012 and until now there is no legally binding to continue the second phase of the Kyoto protocol. Various proposals need to be studied regarding post-2012 climate change regime, including the CDM scheme. Agreement schemes need to be discussed and analyzed the advantages and disadvantages for Indonesia, especially in the development of geothermal power plants. Agreement is expected to come to involve the countries that did not ratify the Kyoto Protocol, especially the United States and Australia.

Keywords: geothermal, CDM, post 2012

1. Introduction

Indonesia has passed by volcano belt which stretches from the island of Sumatra, Java, Nusa Tenggara, Maluku and Sulawesi. The volcanic belt contained about 117 active volcanoes center that form a volcano line along approximately 7000 km, that lead Indonesia has 40% of the world's geothermal potential. According the data from Geology Agency of Ministry for Energy and Mineral Resources, Indonesia's geothermal potential reach 29.038 MW, which include proven reserves of 2.288 MW, probable reserves of 823 MW and possible reserves of 12.756 MW as well as hypothetical resources of 4.391 MW and speculative resources of 8.780 MW respectively.

Geothermal potential that has been used up to 2010 is 4.1% or 1,189 MW. Utilization of geothermal is still very small when compared to conditions in the Philippines which have utilized 44.5% of geothermal potential. Recently the development of geothermal power plant still has high investment cost and high interest rate. Therefore many constraints encountered in geothermal development in Indonesia that derived from the government regulation and financial obstacles for investors. Financial constraints faced by many obstacles, including the limited of funding mechanism. Clean Development Mechanism (CDM) is one of the incentive mechanisms that can be used to help overcome this obstacle.

The successful of Chevron Geothermal Indonesia to implement the CDM funding for Darajat geothermal power plant unit III has been promoting the development of the next geothermal projects. In addition, there are currently several government policies that helped in the development of

geothermal power plant. The paper will further described the condition of geothermal development and its relation to CDM funding and prospects post 2012.

2. Geothermal Development in Indonesia

In order to reduce dependence on petroleum product, the government has committed to increase the utilization of renewable energy, i.e. geothermal. The government issued Presidential Regulation No. 5 of 2006 on National Energy Policy (NEP) to target the utilization of renewable energy in the energy mix by 17% in 2025 with geothermal is targeted to reach portions of 5%. Under the regulation, the government issued a Blueprint of National Energy Management as a guide for stakeholders in the development of energy sector. The blueprint contained a roadmap for geothermal power plant that the installed capacity reached 9,500 MW by 2025.

The state electricity company (PLN) as the largest electricity supply enterprise also issued a General Development Plan of Electricity 2010-2019 (RUPTL). Based on the RUPTL, electricity generation from geothermal estimate increase about 17% per year from 10.32 TWh (2010) to 49.84 TWh (2019). The contribution of geothermal power plant to the national electricity fuel mix will increase from 6% (2010) to 13% (2019). According to the RUPTL, capacity addition of geothermal power plants of 5,990 MW in the year 2019. The total addition of generation capacity reached 55,484 MW with a capacity addition of geothermal power plants accounted of 10.8% share by the year 2019.

Recently, Directorate General of the Renewable Energy and Energy Conservation issued a vision to achieve higher share of renewable energy in the national energy mix, i.e. 25% by the year 2025 that known as Energy Vision 25/25. In accordance with the NEP, Energy Vision 25/25 also concerns the supply side of energy diversification efforts with emphasis on the provision of renewable energy. In the vision, installed capacity of geothermal power plants targeted reached 12,000 MW by 2025.

BPPT (2010) has published a forecast of national electricity generation in long-term. Electricity generation capacity will grow in the rate of 6% per year from 40.44 MW by 2010 to 128.95 MW by 2030 using the base case. By 2030 coal power plant has the largest share which amount of 61%. The share of geothermal electricity production is expected to rise from 3% by 2010 to 12.5% by 2030. Meanwhile, the installed capacity of geothermal power plant in the period 2010 - 2030 will grow by 13.6% from 1:26 GW to 16:16 GW. Install capacity forecast for national electricity generation is shown in Figure 1.

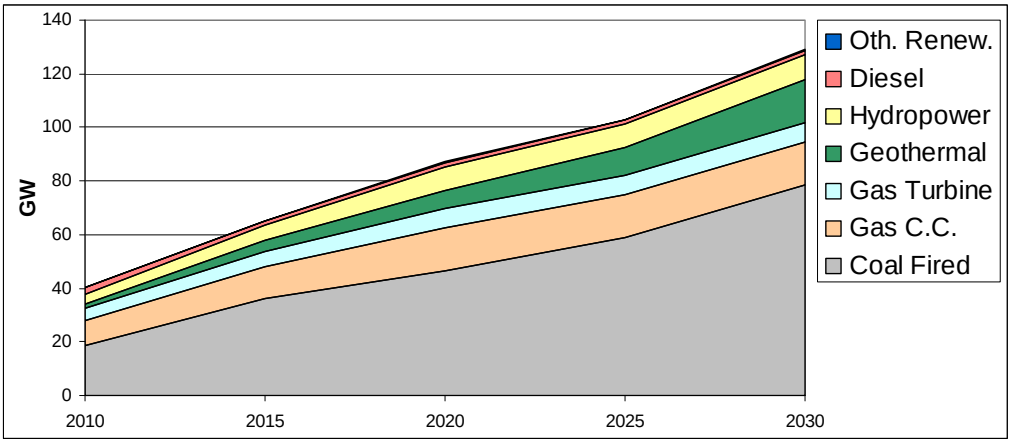


Figure 1 - Installed capacity forecast for national electricity generation (Base case; BPPT, 2010)

Comparison of installed capacity forecasts in 2025 from various sources are shown in Figure 2. Energy Vision 25/25 has the most optimistic forecasts in the development of geothermal power plant. The development is in line with the acceleration of power plant development, known as Fast Tract

Program (FTP) phase II with a total generating capacity of 10,000 MW and the majority use of renewable energy. The FTP phase II is stipulated in Presidential Regulation No. 04 of 2010 and Minister of Energy and Natural Resources Regulation No. 15 of 2010. To achieve these targets, the government issued Minister of Energy and Natural Resources Regulation No. 02 of 2011 which assign PLN to perform the Purchasing Power Agreement (PPA) or the Energy Sales Contract (ESC) with Independent Power Producer (IPP) to the development of geothermal power plants with the following conditions:

- The ceiling price is 9.7 cents $/kWh
- If the price of bid results above the ceiling price 9.7 cents $/kWh, PPA/ESC will be negotiated.
- If the price of bid results under the ceiling price 9.7 cents $/kWh, the price is final in PPA/ESC without negotiation
- The risk of exploration is a developer responsibility.

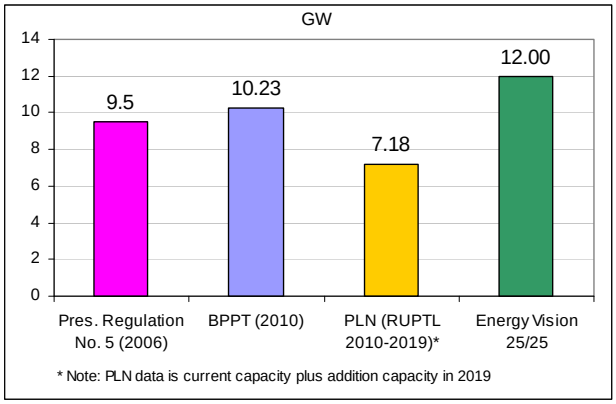


Figure 2 - Forecast of geothermal power plant capacity in 2025

3. CDM Funding

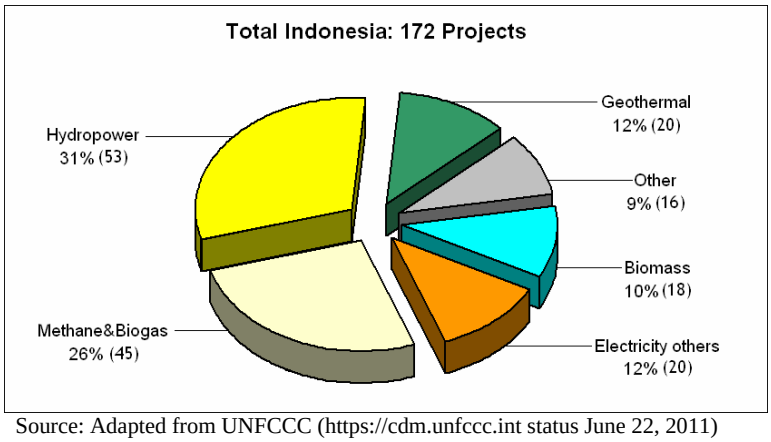
3.1. Review

Clean Development Mechanism (CDM) is a mechanism of the Kyoto Protocol in the multilateral framework that allows developed countries to invest in developing countries to reach emission reduction targets. The framework is designed to provide basic rules for project activities that can generate Certified Emission Reductions (CERs). This mechanism is the participation of developing countries to engage actively in this protocol. From the business side, the CDM will attract new investment with provides additional funding or incentives as compensation for reduction of CO_2 emission because the project is implemented in the sectors that are able to reduce emission or increase carbon sequestration.

The CDM project that submitted to the UNFCCC reached 7,004 projects around the world until mid-June of 2011. Indonesia have been submitted only 172 projects or 2.5% of the total project submitted. Investors of Indonesia may have big opportunities to develop CDM projects in the future because the current project is still very little compared with a neighboring countries. There are many projects that may include for the CDM projects in the future. The projects that have been submitted by Indonesia are largely the utilization of hydropower, methane and biogas. While the utilization of geothermal only listed 20 projects (See Fig 3).

In spite of 7,004 CDM projects that have been submitted, only 3,192 projects have already registered in the UNFCCC. The largest sector of the CDM project is energy industry, especially relating to the utilization of renewable energy (2,501 projects) followed by waste handling and disposal (553 projects). The largest investor is the United Kingdom of Great Britain and Northern Ireland (29.37%). Indonesia recently only has 69 registered projects, or about 2.16% of total registered projects. The

registered CDM projects from Indonesia is still very little compared to those of other developing countries like China (1,433 projects) and India (674 projects).



Source: Adapted from UNFCCC (https://cdm.unfccc.int status June 22, 2011)

Figure 3 - The CDM projects submitted by Indonesia

3.2. CDM Financing for Geothermal Power Plant Project

There are currently two methodology approved by the UNFCCC for the utilization of geothermal with the CDM scheme, i.e. ACM0002 for the utilization of geothermal to electricity generation and AM0072 for utilization of geothermal to space heating (Matthiasdottir et al, 2010). Indonesia up to now already obtaining CERs only use geothermal for electricity generation. The CDM funding to develop geothermal projects in Indonesia was first used by Darajatd geothermal power plant unit III with an installed capacity of 110 MW that operated by PT Chevron Geothermal Indonesia. This project has been registered at the CDM Executive Board in December 2006 and has received the CERs for the first time in June 2009. Darajat geothermal power plant has expected to reduce emission by 652,173 tons of CO_2 per year or approximately 4,565,211 tons of CO_2 for 7-years of credit period. After this success, a lot of geothermal power plants development begins using the CDM funding schemes.

The Indonesia geothermal projects which have been registered in the CDM Executive Board is only 4 projects, i.e. Darajat geothermal unit III project, Lahendong geothermal II-20 MW project, Kamojang geothermal unit IV-60 MW project, and Wayang Windu geothermal unit II project, while Sibayak geothermal project is in the validation stage. The CERs from the geothermal sector are expected only reached 13% through 2012 of all expected CERs obtained by Indonesia. Lahendong geothermal unit II project, Kamojang geothermal unit IV project, and Wayang Windu geothermal unit II and Sibayak geothermal project is expected each reduce CO_2 emission of about 66,713; 402,780; 794,832; and 50,243 tons per year respectively.

CO_2 emission from geothermal power plants is very small compared to the emission from fossil power fuel plants. Regarding the Project Design Document (PDD) of Darajat geothermal power plant unit III, the plant has its CO_2 emission of 30 kg/MWh, while coal-fired and oil power plant have CO_2 emission amount of 994 kg/MWh and 758 kg/MWh respectively. Even for geothermal binary cycle power plants, there are no CO_2 emission released (DiPippo, 2008). The full comparison of CO_2 emission from various types of power plants is shown in Figure 4.

There are several sources of studies to determine the CO_2 emission coefficient of geothermal power plant. Based on the UNDP (2008) study, CO_2 emission from geothermal power plant in Indonesia is amount of 200 kg/MWh, while the average of CO_2 emission from power plants in Indonesia is 756 kg/MWh. Based on Khoirunissa et.al. (2010) study, CO_2 emission from geothermal power plants amount of 27.5 kg/MWh. The calculation of the last study is closer to the calculation of DiPippo

(2008). Meanwhile for the calculation of baseline emission, the National Committee for Clean Development Mechanism (Komnas MPB) officially release news in 2009 explain that CO_2 emission from Jawa power system is 891 kg/MWh, while from Sumatera power system is 743 kg/MWh.

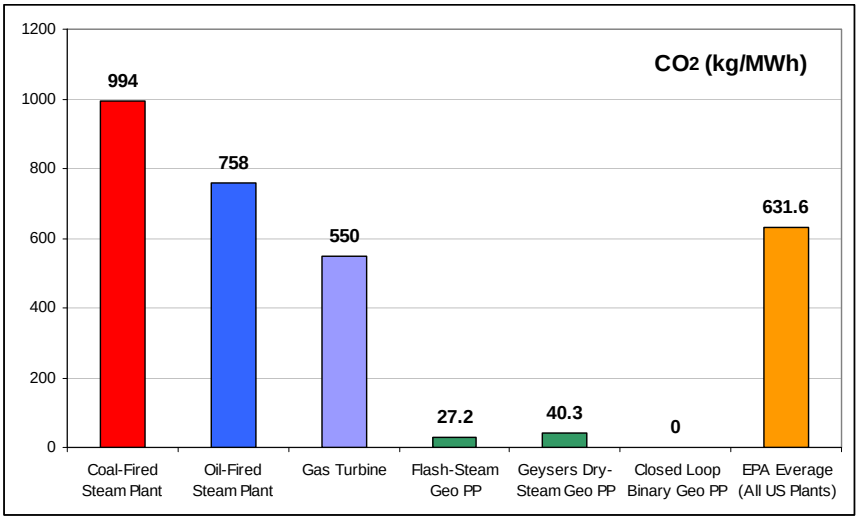
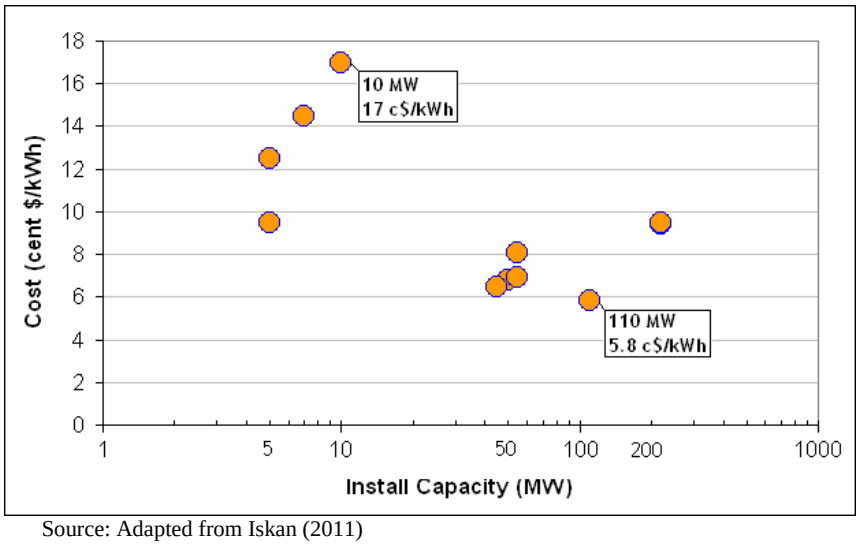


Figure 4 - CO_2 emission from various types of power plant (DiPippo, 2008)

The cost of electricity generation from geothermal in Indonesia is about 5.8 to 17 cents $/kWh or an average of about 9.5 cents $/kWh as shown in Figure 5. Taking the assumption of 90% capacity factor, CO_2 emission baseline for power system of 891 kg/MWh, geothermal power plant emission of 17.7 kg/MWh and the CERs price of 10 $/ton then using the CDM scheme may reduce the cost of electricity generation approximately 0.85 cents $/kWh. Combination of the CDM funding and the Minister Regulation No. 02 of 2011 may expected the development target of geothermal power plants on the FTP phase II can be achieved. Some of the development of geothermal power plants in Indonesia has already submitted to the UNFCCC to receive funding through the CDM scheme. List of projects that have been submitted are shown in Table 1.



Source: Adapted from Iskan (2011)

Figure 5 – Cost of geothermal electricity generation in Indonesia

Table 1 – List of geothermal project in Indonesia that has been submitted to the UNFCCC

No.	Project	Capacity	Owner
1	Atadei	2x2.5 MW	PT West Indo Utama Karya
2	Rantau Dedap	2x110 MW	PT Supreme Energy Rantau Dedap
3	Rehabilitation of Kamojang	-	PT Indonesia Power
4	Sungai Penuh Unit I and II	2x55 MW	PT PLN (Persero)
5	Kotamobagu Unit I, II, III, IV	4x20 MW	PT PLN (Persero)
6	Hululais Unit I and II	2x55 MW	PT PLN (Persero)
7	Patuha	3x60 MW	PT Geo Dipa Energi
8	Lumut Balai Unit 1,2,3,4	4x55 MW	PT Pertamina Geothermal Energy
9	Ulubelu Unit 3&4	2x55 MW	PT Pertamina Geothermal Energy
10	Karaha Unit 1	30 MW	PT Pertamina Geothermal Energy
11	Lahendong Unit 5&6	2x20 MW	PT Pertamina Geothermal Energy
12	Kamojang Unit 5&6	40 & 60 MW	PT Pertamina Geothermal Energy
13	Tulehu	2x10 MW	PT PLN (Persero)
14	Liki Pinangawan Muaralaboh	2x110 MW	PT Supreme Energy Muara Laboh
15	Gunung Rajabasa	2x110 MW	PT Supreme Energy Rajabasa
16	Cibuni	10 MW	Biosphere Capital Pte Ltd
17	Mataloko	10 MW	Biosphere Capital Pte Ltd
18	Ulumbu	6 MW	Biosphere Capital Pte Ltd
19	Ulubelu Unit I and II	2x55 MW	PT PLN (Persero)
20	Lahendong IV	20 MW	PT PLN (Persero)

Sources: Adapted from UNFCCC (https://cdm.unfccc.int; status June 22, 2011)

4. CDM Post 2012

The first phase of the Kyoto Protocol will expired in 2012 and until now there is no legally binding to continue the second phase. Continuation of the Kyoto Protocol after 2012 is still being debated in the international forums regarding climate change. Developing countries proposed to continue into the second phase of the Kyoto Protocol. The second phase is expected to have progress in reducing CO_2 emission for developed countries that may reach 45% of the emission in 1990 by 2020. Meanwhile developed countries are more inclined to end the Kyoto Protocol and seek other mechanisms as alternatives. The efforts of developed countries to end the Kyoto Protocol is considered as an attempt to force developing countries with large emission, such as China, India, Brazil, and South Africa to be equal committed to reducing CO_2 emission and remove the differences between Annex I and non-Annex I countries. The European Union plays an important role because as supply for CERs recently and after 2012.

The CDM projects expansion recently is still constrained by many things, such as the procedure takes a long time and uncertainty about CDM post 2012. New scheme of CDM emerge but is still debated. The new scheme should not consider only to creating a low-carbon society, but also simultaneously reduce poverty, reduce poverty, and improve social welfare towards a global justice between developed and developing countries. Several approaches are considered such as sectoral approach. In this approach, CERs are not provided based on project by project, but based on the emission reductions can be achieved compared with the setting target for the sector.

There needs further study regarding various proposals of climate change regime post-2012, including the CDM scheme. Proposal agreement and analysis of advantages as well as disadvantages for Indonesia need to be discussed especially in the development of geothermal power plant. Future agreement may expected to involve countries that have not yet ratify the Kyoto Protocol, especially the United States and Australia.

5. Conclusion and Recommendation

Development of geothermal power plant faces several obstacles both in terms of regulation and financial constraint. Financial constraints rise because the selling price of electricity from geothermal power plants are still lower than the economic price of 9.5 cents $/kWh. This is a major problem that inhibits the development of geothermal power plant. Using the CDM financing scheme can reduce the cost of electricity generation approximately by 0.85 cents $/kWh using a CERd price assumption of 10 $/tons CO_2. But until now, the proposed of CDM project of Indonesia is still very little and may improved for the future.

The government through Minister of Energy and Natural Resources Regulation No. 02 of 2011 trying to overcome the financial obstacles by issuing a ceiling price of electricity generation from geothermal of 9.7 cents $/kWh. The regulation that applicable to the FTP phase II projects would be as a legal foundation of PLN to accelerating the implementation of geothermal power plant development. Meanwhile the price has not yet reached economical price for the areas of geothermal potential are small, especially in eastern part of Indonesia.

Some constraints need to be considered in the development of geothermal power plant in the future, such as:

- Beside the price issue, there is a risk of uncertainty associated with exploration of geothermal energy resource.
- In spite of the CDM scheme may boost eligibility of geothermal power plant, but there are obstacles in case of transaction costs for the CDM administration process. Process from PDD establishment to registration requires a very high cost. The complexity of the process, lack of resources for certification and uncertainty post 2012 became a problem that should be immediately resolved. In case of small scale geothermal power plant, the CDM scheme would be less interesting to consider.

The CDM funding for geothermal power plant development may be improved for the long term. Taking into account the large enough potency of CDM funding then the government and stakeholder should take an effort for the continuation of the Kyoto Protocol post 2012. Continuation of the protocol and the CDM scheme post-2012, Indonesia is expected take advantage of funding for development of geothermal power plant.

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