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The CDM and Geothermal Projects, Indonesia

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ABSTRACT

Developing a geothermal power plant project is a financial challenge, and is harder than developing more traditional forms of renewable energy. One aim of the Kyoto protocol is to speed up the development of renewable energy power and indeed the evolution of such sources over the last decade has increased.

A Geothermal power plant project is considered a major long term investment due to the resources required and the length of payback period. Fortunately, there is an alternative additional funding source to contribute to the long term financial performance of geothermal projects. The UNFCCC (United Nations Framework Convention on Climate Change) has developed, as part of the Kyoto protocol, three flexibility mechanisms to help finance renewable projects and to reduce greenhouse gas (GHG) emissions worldwide. The Clean Development Mechanism (CDM) is one of these, which allows developing countries to participate and benefit from mankind's effort to save the earth.

For a geothermal project to receive carbon credits there are a set of certification stages to fulfill. The process requires careful attention and aid from CDM project partners.

1. INTRODUCTION

Geothermal is one of the potential sources to produce electricity with stable power plant performance. According to the International Geothermal Association, as of 2005, there are geothermal projects in 25 countries worldwide totaling more than 9.06 GW. The capacity is sufficient to fulfill the electricity needs of 60 million people. The utilized capacity should increase as a result of current research on geothermal wells and improved technology to increase the efficiency of geothermal power plant (such as Enhanced Geothermal System).

Compared to other fossil-fueled power plants, geothermal power plants produce minimal GHG emissions. The table below compares the emission in carbon dioxide equivalent and lists the green house gases (GHG) emissions in geothermal power plant.

	Geothermal	Coal	Petroleum	Natural Gas
Emissions in (tCO_2/MWh)	0.0816	0.9662	0.7076	0.4672

Figure 1: Emissions in Geothermal and Fossil Fuel Power Plants

Despite the potential, numerous challenges face the development of geothermal power plants. The technological complexity, large investment and supplier scarcity has made progress slow. Currently, there are several power cycle alternatives for various types of geothermal site. From single flash power cycle which is suitable for lower temperature lower entropy; to hybrid power cycle designed for higher temperature and higher entropy. An increase in the number of technology suppliers, both overseas and local has however made project development less difficult.

In terms of finance, there is a potential additional finance source which arises from the United Nations Framework Convention on Climate Change (UNFCCC). This UN agency is responsible for administration of the Kyoto protocol with the aim of reducing emissions of GHGs. The GHGs covered by the Kyoto protocol are Carbon dioxide (CO_2), Sulphur hexafluoride (SF_6), Hydrofluorocarbons (HFCs), Methane (CH_4), Nitrous oxide (N_2O), and Perfluorocarbons (PFCs). Carbon dioxide contributes the most to global warming, and therefore the other GHGs are accounted for in terms of CO_2e, with the "e" representing the equivalence of global warming potential. Emission commitments and emission reduction credits are therefore denominated in tonnes of CO_2e. The key goal of the Kyoto protocol is to reduce GHG emissions from industrialized countries over the period 2008-2012 by an overall 5.2% below the 1990 levels.

2. CDM (CLEAN DEVELOPMENT MECHANISM)

The CDM is one of the three flexibility mechanisms outlined in the Kyoto protocol. These mechanisms are Emissions Trading, Joint Implementation, and the Clean Development Mechanism.

The first flexibility mechanism is Emissions Trading (ET). A cap-and-trade transaction system has been institutionalised where developed countries that have ratified the Kyoto Protocol are allocated emissions allowances based on the negotiated targets. These countries can purchase carbon credits from each other in order to meet their Kyoto commitments.

Joint Implementation (JI) is the second mechanism of three flexibility mechanisms. Under the JI mechanism companies in industrialised countries can purchase carbon credits from GHG reduction projects implemented in another developed country or in a country with an economy in transition (mainly from countries of the formerly communist Eastern Europe). Emission Reductions from JI projects are called Emission Reduction Units (ERUs).

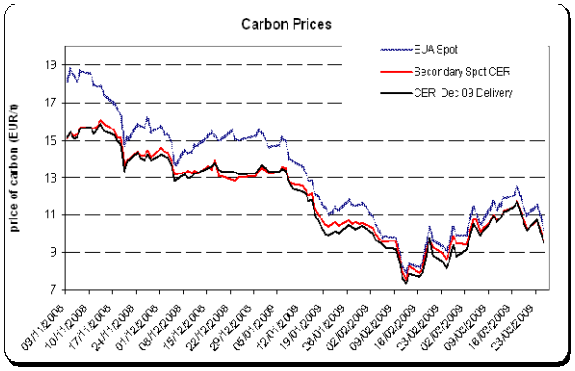
A CDM project is an investment or activity in a developing country that reduces emissions of the six Greenhouse gases - CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 - through energy efficiency, the generation of renewable energy or other measures. The emission reductions (carbon credits) resulting from CDM projects are called CERs (Certified Emission Reductions) and may be sold to a government or company in the industrialised world to help meet their Kyoto compliance targets.

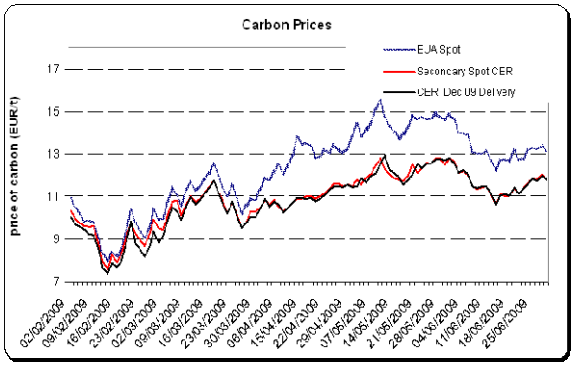
The Kyoto protocol has created a carbon market driven by demand and the supply of GHG emission reductions. Currently, there are several factors that affect the demand for emissions reductions: The Kyoto protocol expires in 2012 which has resulted in uncertainty. This issue will hopefully

be at least partially addressed at the Copenhagen climate summit in December 2009. The Waxman-Markey Bill passed by the USA House of Representative in September 2009 potentially increases demand for emissions reductions. On the other hand, carbon market supply is still highly dependent on a post-2012 agreement and bottle necks in the CDM registration and certification process.

The graphs below show the historical carbon price dated from November 2008 to September 2009. The carbon price is affected by several factors:

- The number of emission projects registered and credits issued
- Emissions policies in Annex I countries
- The global economic situation
- The price of other commodities; such as coal price, oil price, etc.





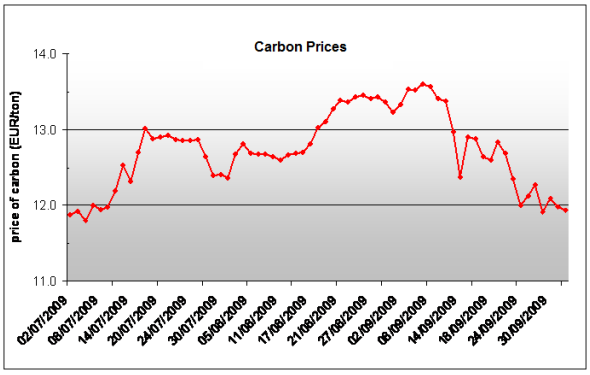


Figure 2: Carbon price in EUR from November 2008 to September 2009

The CDM has great potential to be implemented in developing countries such as Indonesia.

CDM projects must be approved by all countries involved, lead to sustainable development in the host countries, and result in real, measurable and long-term benefits in terms of climate change mitigation. The reductions must also be additional to any that would have occurred without the project

In order to fulfill those criteria, the CDM has three key concepts which are: 1) baseline, 2) additionality, and 3) leakage. The baseline outlines what would have occurred in the absence of the project and permits the calculation of emissions reduction due to the project. A key condition for the issuance of CERs is "additionality", meaning that the emissions reductions generated by a project would not have occurred in the absence of the project and are therefore not "business as usual". The project must also enhance sustainable development. The development of a CDM project is strictly regulated and monitored by the CDM Executive Board of the UN to ensure that the emissions reductions are of a high standard. Leakage is defined as the net change in anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and which are measurable and attributable to the CDM project activity.

In order to generate CERs, each project must follow a CDM project cycle as below:

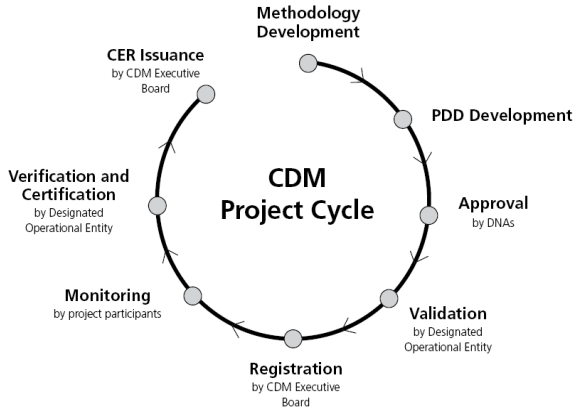


Figure 3: CDM Project Cycle

Methodology

All CDM projects must follow a methodology that has been approved by the CDM Executive Board (EB) of the UN.

Methodologies have already been approved for a number of project types and can be applied to all projects that fall under the applicability criteria. If a suitable methodology has not been approved, a new methodology must be developed and submitted to the EB by CDM experts.

Project Design Document (PDD)

The PDD forms the basis for approval of a CDM project. This document outlines the application of the methodology to the project, illustrating why and how the project reduces emissions and presenting a plan for annual monitoring of emissions reductions.

Host Country Approval

A precondition for registration of a CDM project is approval from the host country. This is provided by a Designated National Authority (DNA) and ensures that a project contributes to sustainable development in that country.

Validation and Verification

The completed PDD must be validated by an UN appointed auditor called a Designated Operational Entity (DOE). Validation ensures the methodology has been applied correctly and that the project results in a real reduction in emissions. Verification is the annual audit of a project by a DOE, and determines the quantity of carbon credits allocated to the project.

Registration and Issuance

Once a project has received a successful validation report and host country approval, it can be submitted to the CDM EB for registration. A registered CDM project is able to generate emissions reductions. Each year, the verification report from a DOE is submitted and subsequently the relevant quantity of certified emission reductions (CERs) or carbon credits are issued by the EB.

3. FINANCING OPPORTUNITY

A CDM project will obtain revenue from every CER which is sold to Annex I countries. The table below illustrates the potential revenue from a geothermal CDM project.

Capacity	100 MW
Load Factor	95%
Days of operation	340
Generation	775,200 MWh
Grid Emission Factor	0.891 tCO_2e/MWh
CERs	690,703 tCO_2e
Price	€ 12
Annual revenue	€ 8,288,436
Crediting period	3x7 years
Total undiscounted CDM revenue	€ 174,057,156

Figure 4: Potential revenue of a CDM project

The illustration shows the potential revenue obtained by a geothermal project with capacity 100 MW. It is assumed that with 95% load factor and 340 days of operation, it would yield CERs 690 kilo tonne of carbon dioxide equivalent. With a total crediting period of 21 years (7 years renewed three times), the project would receive € 174 million. Assuming an 18% discount rate, the Present Value of CDM revenue is € 44.6 million. The present value discounts the total CDM revenue by the discount factor reflecting opportunity cost of capital.

The potential of carbon finance has attracted several geothermal projects to be registered under the CDM. As of September 2009, 15 geothermal projects have been submitted to the CDM EB of which 7 have been registered and are therefore eligible to receive carbon credit revenue.

Title	MWel	Country	ktCO2e/yr
LaGeo, S. A. de C. V., Berlin Geothermal Project, Phase Two	44.0	El Salvador	177
Berlin Binary Cycle power plant	9.2	El Salvador	44
Amatitlan Geothermal Project	25.2	Guatemala	83
Darajat Unit III Geothermal Project	110.0	Indonesia	652
San Jacinto Tizate geothermal project	66.0	Nicaragua	281
Lihir geothermal power project (NM53)	55.0	Papua New Guinea	279
20 MW Nasulo Geothermal Project	20.0	Philippines	75

Figure 5: Registered CDM geothermal projects

The next figure shows project under validation and hence undergoing the CDM registration process. Interestingly, 4 of these are Indonesian geothermal projects (Lahendong II-20 MW Geothermal Project, Kamojang Geothermal 60 MW, Sibanyak Geothermal Power Plant 11 MW, and Wayang Windu Phase-2 Geothermal Power Project 117 MW).

Title	MWel	Country	ktCO2e/yr
Lahendong II-20 MW Geothermal Project	20.0	Indonesia	59
Kamojang Geothermal	60.0	Indonesia	408
Sibayak Geothermal Power Plant	11.3	Indonesia	50
Wayang Windu Phase 2 Geothermal Power Project	117.0	Indonesia	804
Olkaria II Geothermal Expansion Project	35.0	Kenya	171
Olkaria III Phase 2 Geothermal Expansion Project in Kenya	48.0	Kenya	171
40 MW Northern Negros Geothermal Project	40.0	Philippines	175
Korea Land Corporation Pyeongtaek Sosabul-district new and renewable energy model city	0.0	South Korea	3

Figure 6: Geothermal projects undergoing CDM validation

4. DEVELOPING GEOTHERMAL PROJECTS IN INDONESIA UNDER THE CDM

Achieving success in registering a CDM geothermal project in Indonesia involves several key factors. These factors include industry specific characteristics, government regulations, financing sources and project partners.

There are three typical ways of developing a CDM project (this applies to all project types): 1) unilateral, 2) identified buyer, and 3) technology provider. Unilateral means there is no identified buyer. The CDM project is developed without any knowledge of the prospective CER buyer. The second type is a project with an identified buyer who may consider the CDM part of a wider financing package. The third option is where a technology provider solutions for the development of a CDM geothermal project.

In order to secure the successful development and registration of a CDM project, the project owner should find a partner to create and monetizes the carbon asset. The partner for CDM development will have the following roles:

- Identify potential CDM projects
- Take projects through to registration with CDM EB
- Investment structuring
- Monitor the project performance every quarter
- Assist with annual audits to issue carbon credit

The CDM project developer should have a proven track record of registered projects and issued credits. Partnering with CDM experts intent on expanding the portfolio of CDM projects and exploring new potential CDM sectors is advised. It is also beneficial if the CDM project partner has a strong relationship with potential CER buyers to ensure demand for the CER credits.

Agrinergy is an example of an early player in the CDM market with strong presence in Asia and a successful track record in registering and transacting CDM projects. This company has experience of many CDM projects in Indonesia including hydropower, biomass, fuel switch, and co-composting.

CONCLUSION

Project participants should see the CDM as a potential additional funding source for the development of geothermal power plants. With the strong potential for geothermal in Indonesia, this country could be a leading CDM host country.

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