CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

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Wayang Windu Phase 2 Geothermal Power Project
Version - 03
Dated 02/12/2010

Version History:

Version number	Date completed	
1	09 January 2009	PDD version to start validation
2	09 March 2009	Revision reflecting validation findings
2.1	31 March 2009	Revision reflecting validation findings
2.2	10 July 2009	Revision reflecting changed addresses of project participants and improvements in monitoring section
2.3	22 July 2009	Revision reflecting improvements in the timeline section
2.4	11 Sept 2009	Revision reflecting improvements in the common practice section
2.5	27 Oct 2009	Revision reflecting Methodology changes from ACM0002 ver 8 to ACM0002 ver 9
2.6	24 Nov 2009	Revision reflecting further improvements in the timeline section
2.7	26 Apr 2010	Revision reflecting amendments in the investment analysis section and some typo errors
3	02 Dec 2010	Changes according to EB58 decision to register the project with corrections

A.2. Description of the project activity:

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The proposed project activity, Wayang Windu Phase 2 Geothermal Power Project, is the construction and operation of a 117MW geothermal power station, which is an additional power unit to an existing grid-connected renewable power plant.

The Wayang Windu Phase 2 geothermal power generation project, located at the Wayang Windu allotment at 40km south Bandung in West Java, Indonesia, will be constructed and operated by the same

operator as Wayang Windu Phase 1, Star Energy Geothermal (Wayang Windu) Limited ("MNL"), a wholly owned subsidiary of Star Energy Holdings.

The project is developed under an Energy Sales Agreement between MNL, PT Pertamina Geothermal Energy (Persero), the Indonesian state geothermal exploration company, and PT Pembangkit Listrik Negara ("PLN"), the state owned utility company, that gives MNL the exclusive right to develop up to 400MW of electricity generating capacity on the Wayang Windu allotment.

Wayang Windu Phase 1 has been producing power since June 2000, delivering 110 MW of electricity into the national grid through a single buyer, PLN.

The project activity involves the installation of the additional main 117MW steam turbine and peripheral equipment to enable the turbine to be driven by the steam produced by the Wayang Windu geothermal fields. The turbine is connected to a generator which would produce the electricity to the JAMALI grid, and hence adding the electricity capacity of the existing Wayang Windu Phase 1.

The baseline scenario for this project is the generation of electricity by the operation of grid-connected power plants and by the addition of new generation sources. In the absence of the project activity electricity will continue to be generated by the existing generation units in the JAMALI grid.

The purpose of the Project activity is the generation of power using a reliable and renewable resource in place of power generation by a more greenhouse gas intensive fuel/source. The project will reduce greenhouse gas emissions through the displacement of fossil fuel electricity generation with a clean, renewable energy source.

The project is currently under construction and the expected commercial operation date is March 2009. There are no equipment and system in operation at the project site prior to the commencement of the project activity.

Project's contribution to sustainable development

A brief description of the contribution of the project activity towards sustainable development of the local community and the host country is discussed hereunder.

Host country DNA requires Sustainable Development Criteria[1] to accomplish by every CDM project. The criteria is described as follows:

1. Environmental Sustainability – Practising natural resource conservation or diversification. Assuring and maintaining levels of local community health and safety.
2. Economic Sustainability – Assuring and maintaining local community welfare.
3. Social Sustainability – Assuring and maintaining local community participation in the project and local community social integrity.
4. Technological Sustainability – Technology transfer and enhancing the capacity and utilisation of local technology.

[1] Source: http://dna-cdm.menlh.go.id/. Accessed on Jan 9th 2009.

In addition to the above criteria and indicators for sustainable development, the Ministry of Energy and Mineral Resources (MEMR), through its Research and Development Centre for Energy and Electrical Technology has established sustainable development criteria specifically for energy-related CDM projects (Ministerial Decree No.953.K/50 2003)[2].

The energy sector's sustainable development program has established the following seven criteria with which CDM energy-related projects need to comply:

1. Provide support to implement energy diversification and conservation programs – increase utilization of non-oil resources or reduce energy utilization per production unit.
   - Implementing Wayang Windu Phase 2 will provide support to implement energy diversification and conservation programs by using geothermal energy, a non-oil resource, to produce electricity.
2. Provide support for the development of clean energy alternatives and technologies – lower concentrations of NO_x, SO_x and GHG emissions.
   - Geothermal energy is a renewable resource. The exploitation of geothermal energy does not produce NO_x or SO_x, and will produce substantially less GHG emissions compared to fossil fuel generated electricity.
3. Provide support for environmental conservation – compliance with environmental regulations.
   - Indonesian law requires that environmental impact studies are undertaken for the Project and permits issued for the construction and operation of the Project. The Project will adhere to all local, regional and federal rules and regulations.
4. Provide support for local economic growth – increase income of the local community and/or local economic activities in the vicinity of the project.
   - The vast majority of the employees at Wayang Windu Phase 2 will be Indonesian and this will provide support for local economic growth by increasing income for the local community in the form of increased business activities. Also, most procurement for the ongoing operation of the plant will be sourced locally.
5. Maintain current employment rates without cessation of employees – no lay offs as result of project.
   - The Project will result in the creation of jobs as well as maintaining current employment rates without cessation of employees.
6. Provide support for technology transfer – increase utilization of local human resources in quality and quantity, provide new roles for local workforce, provide career development plans for employees.
   - The Contractor will train the local staff for the Project, providing them with new skill sets and enabling them to choose a career in their chosen field.
7. Provide 'community development' programs – projects should provide clear and certain community development plans.
   - The Project will support community development by providing improvements to the infrastructure in surrounding communities such as water supplies and roads, and support basic and advanced education for the local school children.

[2] Source: CDM Country Guide for Indonesia, edited by the Institute for Global Environmental Strategies 2nd edition, 2006.

A.3. Project participants:

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Name of Party Involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Indonesia (host)	Private: Star Energy Geothermal (Wayang Windu) Limited (MNL)	No
United Kingdom of Great Britain and Northern Ireland	Private: Sindicatum Carbon Capital Ltd	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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Republic of Indonesia

A.4.1.2. Region/State/Province etc.:

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West Java

A.4.1.3. City/Town/Community etc.:

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Kecamatan Pangalengan, 40km south of Bandung

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

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40km south of Bandung
7° 12′ 26.79″ S, 107° 37′ 44.12″ E

Figure 1 Location of Bandung

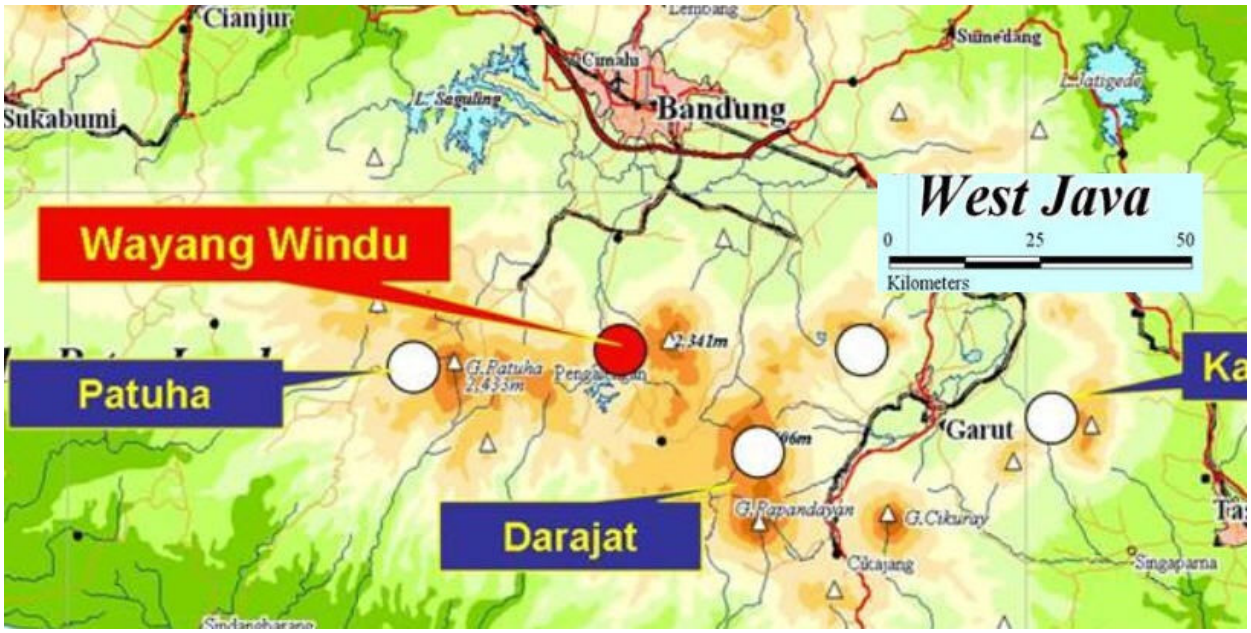

Figure 2 Location of Wayang Windu

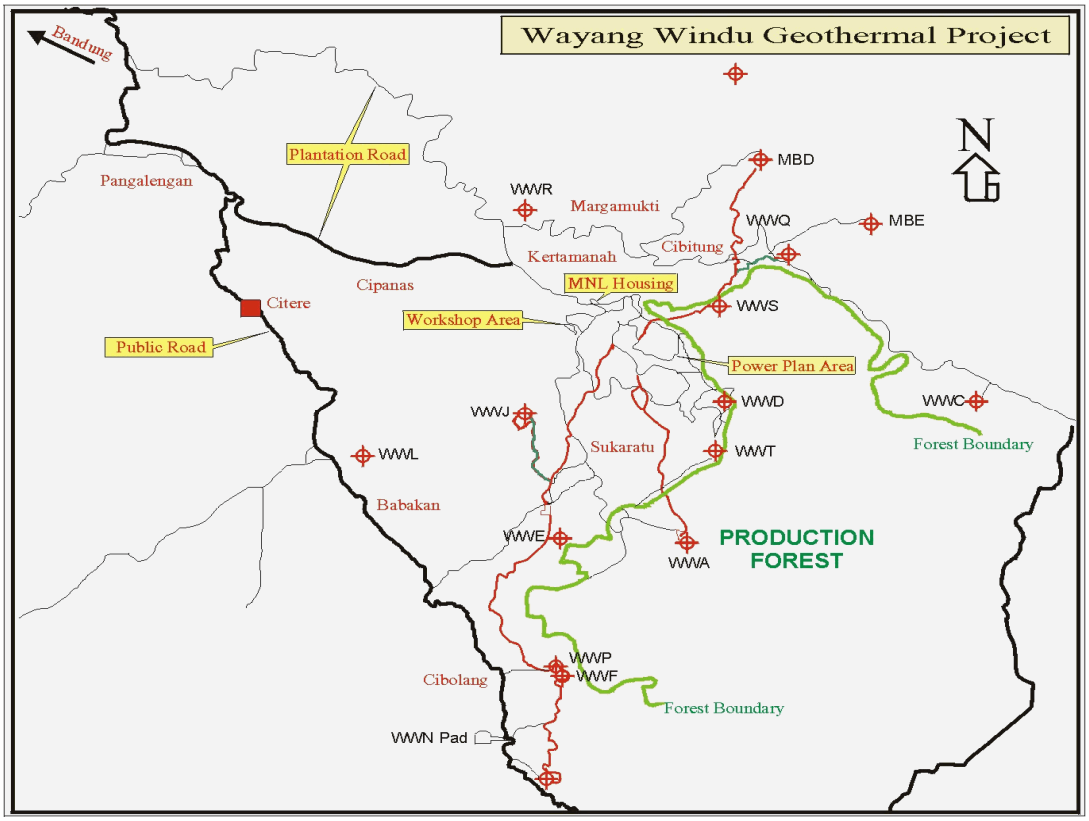

Figure 3 Location of the Wayang Windu Wells and Plant

Figure 4 Wayang Windu Geothermal Plant (unit1)

Figure 5 Airplane Image of Wayang Windu Plant (unit 1 + unit 2 at construction)

A.4.2. Category(ies) of project activity:

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The project activity falls under Category I: Energy Industries (Renewable/ Non-renewable Sources).

A.4.3. Technology to be employed by the project activity:

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Geothermal energy in Wayang Windu is stored in a steam reservoir within the earth's crust. Dry saturated steam at high pressure is produced at the surface from wells drilled into this reservoir. The steam is delivered to the power generation facilities through a steam gathering system, to move the turbine blades and drive a generator hence generating electricity. Exhaust steam from the turbine is condensed in a direct contact condenser and part of the condensed exhaust steam is re-injected into the geothermal reservoir, with the remaining being evaporated in the cooling towers. The electricity produced is transferred by the load dispatcher at the adjacent power switchyard to the transmission lines located outside the power plant.

The power plant will consist of a conventional geothermal condensing steam turbine generator with a capacity of 117 MW. Energy of condensation will be transferred to the circulating cooling water system in the steam exhaust condenser and will subsequently be rejected to atmosphere in a conventional mechanical draught cooling tower.

List of Main Equipment and Systems:

- 117 MW steam turbine
- 17,900 m^3/hour condenser
- Cooling tower
- 137.5 MVA Main Generator
- 150kV/13.8kV Generator Transformer
- Scrubbers
- Separator
- Plant DCS (Distributed Control System)
- SAGS (Steamfield Above Ground System)

This technology is technically sound and environmentally safe as is demonstrated by hundreds of similar installations around the world, including Indonesia[3]. Sumitomo Corporation, a Japanese corporation, that was selected to provide technical equipment, and to perform all engineering, procurement and construction services of the Project. Knowledge transfer is ensured through a comprehensive training for Star Energy Geothermal (Wayang Windu) Limited , the Owner's operation and maintenance personnel. The training shall cover the configuration and maintenance of all Equipment and systems of the Project designed and supplied by the Contractor.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

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Years[4]	Annual estimation of emission reductions in tonnes of CO2 e
1	794,832
2	794,832
3	794,832

[3] Please see step 2 under section B.5. of this PDD for list of geothermal plants in Indonesia.

[4] Based on 12-month period

4	794,832
5	794,832
6	794,832
7	794,832
Total estimated reductions (tonnes of CO2e)	5,563,824
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	794,832

A.4.5. Public funding of the project activity:

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There is no public funding for the Wayang Windu Phase 2 Geothermal Power Project.
The project financing portion comes from Standard Chartered Bank Singapore and the equity portion comes from the project owner's shareholders. Therefore the project activity is not using any public fund.

Funding of the project will be disclosed to the DOE during validation.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Title: Consolidated methodology for grid-connected electricity generation from renewable sources – Version 9 (ACM0002)
Reference: This methodology also uses the build margin (BM) and operating margin (OM) approach as specified in "Tool to calculate the emission factor for an electricity system" (Version 01.1) and also references the
"Tool for the demonstration of additionality" (Version 5.2)
"Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02)

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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ACM0002 (Version 9) – "Consolidated methodology for grid-connected electricity generation from renewable sources" is applicable to the Project as all conditions were satisfied by the Project. Detailed analysis as follows:

Applicability Condition	Applicability to the project activity
The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with run-	The project activity is the installation of an additional power unit at an existing grid-connected geothermal power plant.

of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	
The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.	The geographic and system boundary for the JAMALI grid is clearly identified and information on the characteristics of the grid is publicly available.
Project activities that do not involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be continued use of fossil fuel at the site.	The project does not involve switching from fossil fuels to renewable energy sources at the site of the project activity since the project activity is the installation of an additional power unit at an existing grid-connected geothermal power plant.

On the basis of the above all applicability criteria are met.

B.3. Description of the sources and gases included in the project boundary:

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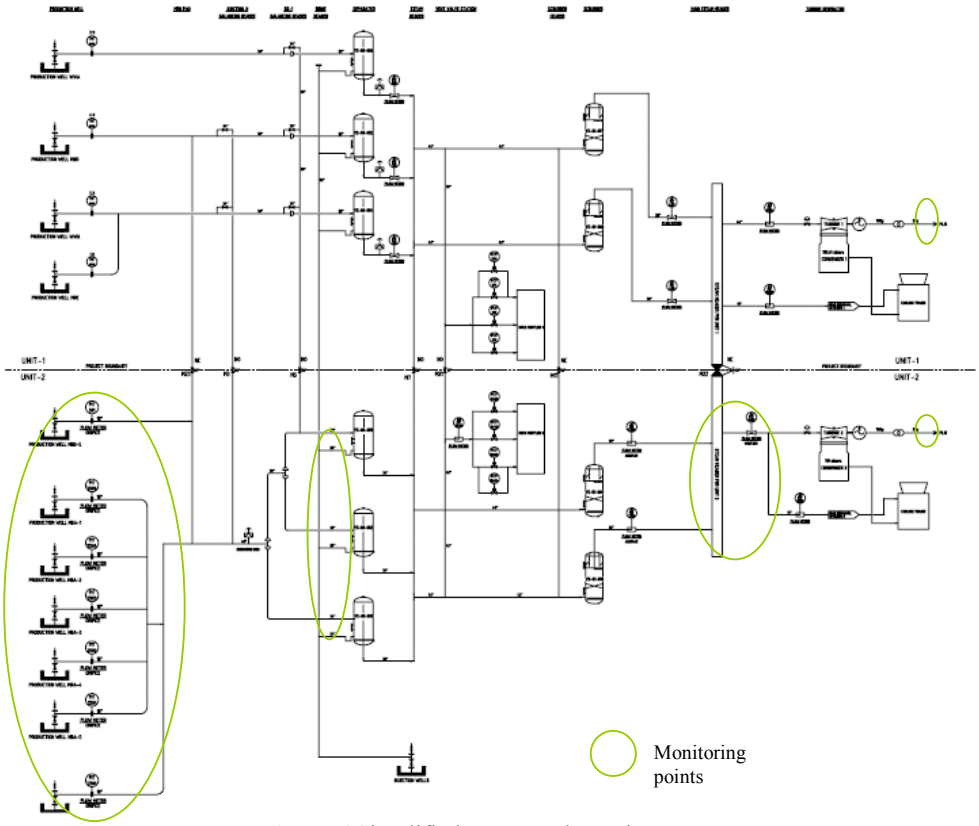

Figure 6 Simplified Process Flow Diagram

CH_4 and CO_2 will be emitted from the non-condensable gases contained in the geothermal steam. CO_2 will also be emitted from combustion of fossil fuels in the emergency diesel power generation set and diesel fire pump. Monitoring points and monitoring variables are described in Section B.7.1.

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam.	CO_2	Yes	Main emission source.
		CH_4	Yes	Minor emission source.
		N_2O	No	Minor emission source.
	For geothermal power plants, CO_2 emissions from combustion of fossil fuels required to operate the geothermal power plant	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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Based on ACM0002 version 09, as the project activity is the installation of an additional power unit at an existing grid-connected renewable power plant/unit, the baseline scenario is the following:

In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid at historical average levels, until the time at which the generation facility would likely be replaced or retrofitted. From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production is assumed to equal project electricity production, and no emission reductions are assumed to occur.

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by addition of new generation sources, as reflected in the combined margin (CM) calculations in section B.6.1. based upon the "Tool to calculate the emission factor for an electricity system." (Version 01.1)

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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The following steps are used to demonstrate the additionality of the project according to the latest version of the "Tool for the demonstration and assessment of additionality" (version 05.2).

Timeline of Events and Actions for CDM Consideration and Project Implementation

Date	CDM Activities	Project Implementation
2-Dec-1994		WW JOC between Perusahaan Pertambangan Minyak dan Gas Bumi Negara (called "Pertamina") and Mandala Magma Nusantara, B.V (MNL)
2-Dec-1994		WW Geothermal ESC among PT PLN (Persero) and Pertambangan Minyak dan Gas Bumi Negara (called "Pertamina") and Mandala Magma Nusantara, B.V (MNL).
May-1997		EPC contract with Sumitomo for Wayang Windu Unit 1 and 2. The contract was structured in "phases" to allow financial commitment to the project to be confirmed in steps, as the geothermal steam was proven. First Plant (or Combined) Phase of the EPC contract included basic infrastructure for both Units 1 and 2; Second Plant (or Combined) Phase of the EPC contract included the Unit 1 turbine generator facilities; Third Plant (or Combined) Phase of the EPC contract included the Unit 2 turbine generator facilities.
June-1997		Issue of Notice to Proceed for First Combined Phase of the EPC Contract. First Phase is the basic infrastructure incl roads, office, power station building.
Aug-1997		Issue of Notice to Proceed for Second Combined Phase of the EPC Contract. Second Combined Phase includes

		Unit 1 equipment. Sufficient steam was obtained to confirm to proceed with Unit 1.
Sept-1997		Decree from Indonesian Government formally advised all IPP developers to cease the development of new facilities due to the Asian Economic Crisis with the exception of Wayang Windu Unit 1 and Darajat Unit 2. The Asian Economic Crisis leads to the Crash of Rupiah currency against US Dollar. Since PLN's main contracts were in US Dollars but income was in Rupiah, the currency crash caused severe trauma for PLN and the Government of Indonesia.
Mar-1998		Formal Deletion of the Third Combined Phase of the EPC Contract. Third Combined Phase includes Unit 2 equipment[5].
Nov-1999		Deemed Performance Test Completion of Unit 1. Transmission line had not been completed by PLN, hence contract required the Owner to issue a "deemed completion".[6]
Mar-2000		Formal Settlement Agreement to close the Unit 1 EPC Contract
May-2000		Completion of Transmission lines by PLN.
June-2000		Commercial Operation of Unit 1
2000		Government of Indonesia insisted on the re-negotiation downwards of the electricity tariffs[7]
2001		Credit Suisse First Boston (CSFB) and Deutsche Bank (DB) took over MNL as debt settlement
31-Jan-02	Evidence that Wayang Windu Unit 2 participated in the CERUPT tender and subsequent correspondence showing the substantial amount of time and effort put to meet the requirements of the CERUPT	

[5] Refer to Settlement Agreement, page 3, item 2(a).

[6] Refer to Settlement Agreement, page 1, second paragraph.

[7] 3.5c/kWh of the interim tariff based on the "Interim Agreement" between PLN & MNL

	program.	
24-Jun-02	Signed Consulting Services Agreement between Unocal Geothermal of Indonesia and ICF Resources to carry out the baseline study in order to meet the criteria for CDM project validation set forth by the UNFCCC.	
12-Jul-02	Signed Consulting Services Agreement between Unocal Geothermal of Indonesia and PT Dames & Moore Indonesia to provide Unocal with services as a UNFCCC accredited validator in order to meet the criteria for CDM project validation set forth by the UNFCCC.	
22-Aug-02 and subsequent correspondence	Correspondence with Indonesian Ministry of Environment and Indonesian Ministry of Energy and Mineral resources: - Requesting the approval from Government of Indonesia for the approval of Wayang Windu Unit 2 Project Proposal - Mentioning that the CDM baseline study for Wayang Windu 2 is being audited by a validator (that is seeking accreditation by the CDM Executive Board) - Subsequent correspondence to PLN, Pertamina, CDM National Team Energy Sector about the validated baseline report for Wayang Windu Unit 2 - Reply from Indonesian Ministry of Environment that GOI approval could not be issued yet as Indonesia has not yet ratified the Kyoto Protocol	
09-Sep-02	Preliminary Validation / independent assessment of Wayang Windu 2 as a CDM project from URS (Environmental and Engineering Professional Services Provider) mentioned that the baseline study for the Wayang Windu 2 project meets the CDM requirements as set forth by the UNFCCC and CERUPT guidelines	
14-Sep-02	Letter from Indonesian Energy & Mineral Resources R&D Centre to Energy and Mineral Resources Research and Development Agency (Indonesian Department of Energy and Mineral Resources) concluding that WW2 is eligible to be processed as CDM-CERUPT Project	
23-Sep-02	Submission of CER offer to Tender Authority of Senter, Dutch Government Agency.	

	Contractual and financing uncertainties were mentioned, and CER value is viewed as the key to overcome the barriers.	
01-Oct-02	Signed CDM Agreement between MNL and YBUL (CDM Developer)	
16-Dec-03	Withdrawal of CERUPT offer as agreement on the contents of the contract can not be reached	
Nov-04		Star Energy acquired 100% of the ownership of MNL from CSFB, DB, and Unocal
17-Jun-05	Draft Proposed Terms of Reference from PT Pranata Energy Nusantara (PEN Consulting)	
04-July-05	Offer to develop CDM project for Wayang Windu Unit 2 Project under the Consortium of PT Pranata Energy Nusantara (PEN Consulting), Yayasan Pelangi Indonesia and EcoSecurities and the subsequent correspondence	
04-Jul-05	Senter Reaplication Letter from Magma Nusantara Ltd after the company has been purchased by Star Energy.	
11-Jul-05		Purchase contract for Tubular components for geothermal drilling
21-Nov-06		Amendment to the Wayang Windu Energy Sales Contract (ESC) and Amendment to the Wayang Windu Joint Operation Contract (JOC)
Until Dec 06	Consolidation of operations of Wayang Windu by the new owner (Star Energy) and discussion of further development potential according to existing utilisation rights for geothermal energy	
Dec-06	Environmental due diligence report from ERM	
30-Jan-07		EPC Contract for power plant and steam pipeline **(considered as the starting date of the project activity)**
04-Apr-07		Wayang Windu 2 Equity and Carbon Credit Discussion with Standard Chartered Bank
03-May-07		Accounts Agreement between the project owner and Standard Chartered Bank. Carbon credit is mentioned as parts of the receipts of the money to be received by the project owner
31-May-07 and	Letter from Ecosecurities about the possibility	

subsequent correspondence	of offer adjustment towards MNL's carbon assets from Wayang Windu 2 & subsequent correspondence / meetings	
13-Jun-07		Financial closure with Standard Chartered Bank
14-Jun-07		Final notice to proceed to the EPC Contractor
18-July-07	Internal document regarding Position paper on Carbon Credits, mentioning that over the past 12 months MNL has formally and informally been approached by up to 10 companies related to the trading of future carbon credits. Serious considerations have been given to Ecosecurities and Climate Change Capital/Standard Chartered Bank, and the paper recommending to sign an agreement with Climate Change Capital/Standard Chartered Bank	
7-Aug-07		Utilization Request Credit Facility Arrangement
8-Aug-07 and subsequent follow-up	Draft Letter of Exclusivity from Climate Change Capital	
Oct 07	Presentation regarding Carbon Finance Support for Geothermal Development by World Bank	
Until Sept 08	Project owner was in discussion with a few CDM Consultants before finally working with Sindicatum Carbon Capital for the PDD preparation and validation.	
9 Jan 09	Start of validation process	
Mar-09		Commercial Operation Date

Evidence for the above events and actions will be available during validation.

Based on the latest Glossary of CDM terms (Version 05), starting date of a CDM Project activity is the earliest date at which either the implementation or construction or real action of a project activity begins.

The development of Wayang Windu Unit 1 was undertaken on the basis of the development of Units 1 and 2 as an integrated Engineer, Procure, Construct (EPC) Contract with Sumitomo Corporation of Japan in 1997. The contract was structured in "phases" to allow financial commitment to the project to be confirmed in steps, as the geothermal steam was proven.

First Plant (or Combined) Phase of the EPC contract included basic infrastructure for both Units 1 and 2; Second Plant (or Combined) Phase of the EPC contract included the Unit 1 turbine generator facilities; Third Plant (or Combined) Phase of the EPC contract included the Unit 2 turbine generator facilities.

In practice Phases 1 and 2 were completed but Phase 3 was never awarded due to the impact of the Asian economic crisis of 1997/98/99.[8]

The basic infrastructure conducted for Unit 2 in the period of 2000 Unit includes the Unit 2 turbine-generator foundation work (14 meter depth), foundations for the Unit 2 Cooling Tower steel materials for the Unit 2 rotor and Condenser. These foundations were integral with the power house which was needed for the Unit 1 project, and did not imply any commitment to the development of a second Unit. Unit 1 started operation as stand-alone power plant with an overdimensioned power-house and some few unused materials, a fact that increased costs without any return for the original owners.

To reinforce this, in 1997 the Government of Indonesia formally advised all IPP developers to cease the development of new facilities due to the Asian Economic Crisis with the exception of Wayang Windu Unit 1 and Darajat Unit 2[9]. This also resulted in the Government insisting on the re-negotiation downwards of the electricity tariffs. Hence, when Star Energy took over the ownership of MNL in November 2004, the first activity which had to be undertaken was the formal renegotiation of the electricity tariff. Once completed, in November 2006, MNL was then in a position to make a decision about the economics of the development of Unit 2. It is shown within the financial analysis below that - although basic infrastructure was already in place – the remaining costs for completion of unit 2 would not have enabled a profitable operation of the project activity without the consideration of CDM. All costs for joint infrastructure and preparatory works have been excluded from this analysis therefore ensuring its conservativeness. Hence the project activity is considered as capacity addition to an existing power plant.

The earliest date at which the implementation, construction, and real action of the programme activity began was on 30 January 2007, when the contract for the Engineering, Procurement, and Construction of the project was signed. This is taken as the starting date of the project activity. Financial closure of the project activity was even achieved in June 2007 only, after convincing Standard Chartered Bank of the suitability of a concept including carbon revenues, and final notice to proceed to the EPC contractor was issued after the financial closure in June 2007.

Step 1: Identification of Alternatives to the Project Activity Consistent with Current Laws and Regulations

Define realistic and credible alternatives to the project activity(s) through the following Sub-steps:

Sub-step 1a: Define Alternatives to the Project Activity:

In this step, all realistic and credible alternative scenarios to the project activity will be identified. The alternatives available to the project participants

Below are the descriptions of all realistic and credible alternatives that are available to the project participants.

[8] Refer to Settlement Agreement dated 8 March 2000, page 3, item 2(a).
[9] Presidential Decree / KEPPRES No 39/1997 about cessation/reevaluation of projects by the government, state-owned companies, and related private companies

Alternative	Plausibility
The proposed project activity implemented without CDM financing, i.e. the construction of an additional geothermal power unit with an installed capacity of 117MW connected to the local grid, implemented without CDM revenues.	Not plausible due to the uneconomic returns.
Construction of a thermal power plant with the same installed capacity or the same annual power output.	Not plausible. Project owner has no competencies in construction and operation of thermal power plants. Hence, this is not a plausible alternative to the project owner.
Continuation of the current situation, i.e. electricity will continue to be generated by existing generation mix operating in the JAMALI grid, with capacity additions as planned.	Plausible, considered as the baseline scenario for the project.

From the above analysis, the only realistic and credible alternative to the project activity is the continuation of the current situation, i.e. electricity will continue to be generated by existing generation mix operating in the JAMALI grid, with capacity additions as planned.

Sub-step 1b: Consistency with Mandatory Laws and Regulations

The alternatives, i.e. construction of an additional geothermal power unit connected to the local grid, construction of a thermal power plant and continuation of the current situation (electricity will continue to be generated by existing generation mix operating in the JAMALI grid, with capacity additions as planned) are in compliance with all mandatory applicable legal and regulatory requirements.

Step 2: Investment Analysis

This step will demonstrate that the proposed CDM project activity is unlikely to be financially attractive by applying sub-step 2b (Option III: Apply Benchmark Analysis), sub-step 2c (Calculation and Comparison of Financial Indicators), and sub-step 2d (Sensitivity Analysis) of the *Tool for the Demonstration and Assessment of Additionality (Version 05.2)* approved by the CDM Executive Board.

Sub-step 2a: Determine Appropriate Analysis Method

Benchmark analysis (Option III) is chosen.

Sub-step 2b: Option III. Apply Benchmark Analysis

To estimate a Required Rate of Return ("RRR"), as specified in Sub-step 2b, in the CDM Methodological Tool (Version *05.2*), a relevant weighted average cost of capital ("WACC") was selected as an appropriate benchmark. WACC is a calculation of the firm's cost of capital by proportionally weighing each source of capital (debt and equity in this case), as per starting date of the project activity, i.e. when signing the EPC contract. The cost of capital (ke) was calculated using the Capital Asset Pricing Model ("CAPM"), which is in line with the method explained in the "Investment Valuation" book by A. Damodaran ("Damodaran"). The CAPM describes the cost of equity for a company's stock as equal to the risk-free rate plus a premium that investors expect for bearing the systematic risk inherent in the stock. Systematic risk emanates from external, macroeconomic factors, which affect all assets in a

particular way albeit with different magnitudes. The size of the premium is proportionate to the degree of volatility of the company's stock versus the market portfolio.

Although the project activity is a capacity addition, and therefore can only be implemented by Star Energy Geothermal (Wayang Windu) Limited (or Magma Nusantara Limited), the company internal benchmark (WACC of the project company) is not used in this project. This is because there were no project activities under similar conditions developed by the project owner by the investment decision period. Thus, no company-specific benchmark can be applied.

WACC and CAPM are expressed arithmetically by the following equation:

	Value	***Description***
r_f	4.84%[10]	Risk-free rate of return
β levered	3.36	$\beta = \beta u * (1 + (1-t)*(d/e))$
β unlevered	1.69[11]	Beta; investment or sector-specific risk for correlation to the market
R_P-λ	4.79%	Equity Risk premium
Λ	4.50%[12]	Country Risk Premium
Total Risk Premium	9.29%[13]	Equity Risk Premium + Country Risk Premium
Cost of Equity	36.02%	$K_e = r_f + \beta_L$ x (Risk Premium)
Cost of debt	7.59%	Unit 1 Bond Interest – Tax Rate
Debt	60%	
Equity	40%	
D/E ratio	1.50	Debt : Equity
T	34%[14]	Agreed Tax Rate
WACC	**18.96%**	(Cost of Debt * Debt) + (Cost of Equity * Equity)

The application of the above assumptions to the WACC resulting in a sufficient investment decision for a power business in Indonesia of **18.96%.** The detail calculation of the WACC will be available during validation.

Explanation to the assumptions used in the calculations above:

Cost of debt:
Calculated based on the pre-tax cost of debt of 11.5% which has been derived from the Bank Indonesia (BI) rate in January 2007 of 9.5% (http://www.bi.go.id/web/id/Moneter/BI+Rate/Data+BI+Rate/) increased by 2% (200 basis points) corresponding to the margin charged by the commercial banks.

Debt to equity ratio:

[10] Source: Bloomberg US 30-year treasury bond for January 2007
[11] Source: Damodaran 2007
[12] Source: Damodaran Country Risk Premium Values for 2007 http://pages.stern.nyu.edu/~adamodar/
[13] Source: Damodaran Datasets- Risk Premiums for Other Markets for 2007 http://pages.stern.nyu.edu/~adamodar/
[14] Source: Wayang Windu Joint Operation Contract between Perusahaan Pertambangan Minyak dan Gas Bumi Negara and Mandala Magma Nusantara, B.V, article 9.1 and the Indonesian Government Decree No. 49/1991

In accordance with the additionality tool, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer. Thus, the debt to equity ratio considered as 60:40 which is also standard debt to equity ratio in developing countries is used

Cost of equity:
The cost of equity has been determined using the Capital Asset Pricing Model (CAPM). The CAPM approach to risk analysis calculates the risk premium associated with the specific risk involved in a particular project. The riskiness is calculated by means of the beta and this beta measures the relative riskiness of the proposed project activity. The CAPM assesses risks at a market level and not by looking at an individual's risk preferences and therefore is sufficient to analyze the appropriate rate of return necessary to compensate investors for the risk faced in the proposed project activity.

Risk free rate:
The risk free rate has been taken as the average of the 30 years US Treasury bond rates for January 2007 corresponding to the start date of the project activity and the expected lifetime of the proposed project activity. While the proposed project activity is based in Indonesia, the US risk free rate is appropriate because the project activity is almost exclusively exposed to US Dollar ("USD") transactions; both for its costs and revenues, and the forecasted cash flows used in the computation are also in nominal USD terms. The approach of using a USD denominated risk free rate is consistent with the citation in Damodaran page 156 that states *"The risk-free rate used to come up with expected returns should be measured consistently with how the cash flows are measured. Thus, if cash flows are estimated in nominal US dollar terms, the risk-free rate will be the US Treasury bond rate. This also implies that it is not where a firm is domiciled that determines the choice of a risk-free rate, but the currency in which the cash flows on the firm are estimated."*
The quoted source in this matter is the most relevant, considering that several other components of the calculations used are derived from Damodaran's books and research.
Furthermore, when calculating the cost of equity in the proposed project activity, the country risk premium is already included in the applicable equity risk premium and therefore US Treasury Bond rate would be the most appropriate figure to be applied in this context. Using the Indonesian government bond rate, which also includes the country risk, would lead to double counting of the country risk. This concept is further explained in Damodaran on Page 167.

Beta:
The beta value for the power sector referring to the values provided by Damodaran Online (http://www.stern.nyu.edu/~adamodar/pc/archives/betas07.xls) reference Index for year 2007. The quoted source in this matter is the most relevant, considering that formula derived was quoted from his books and research.To be conservative, the beta value is referenced from the year 2007 (instead of the published 2006 data in Jan 2007); as the value selected is lower than the beta value in year 2006 of 2.05 (http://www.stern.nyu.edu/~adamodar/pc/archives/betas06.xls).
The appropriateness of using the US beta rather than using any emerging market specific beta based on following reasoning (explained in Damodaran page 189):

1. Indonesia is considered to be an emerging market, where the equity markets represent a small proportion of the overall economy and the historical returns in the market are available only for a short period.
2. The annual stock returns from the Indonesian Stock Exchange have very large standard deviations;

3. The composition of the indices for the Indonesian Stock Exchange that measure market returns are dominated by a few large companies.

Furthermore, the US power sector beta has been taken as the most appropriate reference for the power sector beta in the cost of equity calculation as the US market offers the most robust data set available. It should also be noted that betas from the comparable companies in Indonesia are not available. Jakarta Composite Index (JCI) and LQ45 (a stock market index for the Indonesian Stock Exchange) have only a single energy company namely Perusahaan Gas Negara in their composition.
As cited on page 201 of Damodaran, it is appropriate to use US power sector beta for the power sector in small or emerging markets, such as Indonesia. This is because the country risk premium has been included in the applicable equity risk premium in the calculation, and therefore has been taken into account in the calculation of the cost of equity in Indonesia.
The usage of US beta instead of using local accounting betas by practitioners has also been cited in other financial books (page 129 of "Valuation of Companies in Emerging Markets: a Practical Approach" by Luis E. Pereiro).
Further, it could be noted that the unlevered beta has been levered applying the tax rate and debt:equity ratio.
It is also to be noted that the approach and input parameters are consistent with another CDM project in Indonesia ref. no 2346 (Kabil II 11.4 MW Gas Fired Project) which was registered following a request for review which included questions on the suitability of the WACC calculation

Equity Risk premium and Country Risk premium:
The equity risk premium and the country risk premium for Indonesia have been sourced from A. Damodaran, New York University (http://www.stern.nyu.edu/~adamodar/pc/archives/ctryprem07.xls) reference Index subtitle - Discount Rate Estimation, Risk Premiums for Other markets for year 2007. The quoted source in this matter is the most relevant, considering that formula derived was quoted from A. Damodaran's books and research. These have been used to form the basis of the total risk premium (9.29%). The risk premium value is referenced from the year 2007 (instead of the published 2006 data in Jan 2007) as it has a lower value than the risk premium in year 2006 of 10.16% (http://www.stern.nyu.edu/~adamodar/pc/archives/ctryprem06.xls). Therefore the used data is more conservative. The risk premium value can be disaggregated into 2 separate elements:

1. Global Equity Risk Premium of 4.79% which is conservative to the 5% that is commonly used by financial practitioners
2. Specific Country Risk Premium of 4.5% which is appropriate to Indonesia.

This total Equity Risk Premium is considered reasonable as it measures the rate of return investors seek to compensate them for investing in higher risk equity based assets rather than risk free securities.

Sub-step 2c: Calculation and comparison of financial indicators

The table below exhibits the financial analysis for the project activity without CDM related income. Calculation of the IRR is established on the annual cash flow (annual revenue) of produced electricity, annual operational expenditure, and capital expenditure (initial investment cost). Following the EB Guidance the financial analysis excludes costs (drilling of 4 wells) which occurred prior to the starting date of the project activity. This approach is conservative as a lower CAPEX has to be considered.

Item	Project Activity
Installed capacity (MW)	117
Annual Production	953 GWh/yr
Capacity Factor	93%
Capital Expenditure (CAPEX) (US$ / MW)	US$ 1,550,000/MW
Operational Expenditure (OPEX) (USCent/kWh)	USCent 2.04/kWh
Operational Expenditure (OPEX) (US$ /year)	US$ 18,506,000/year-avg
Project Lifetime (yr)	30
Operating Hours (h/yr) (24 hours a day, 365 days a year, 93% capacity factor)	8,147
Income Tax-based on the JOC	34%
Tariff for PLN (USCent/kWh) – Levelized for 30 years including inflation	8.20
Terminal Value after 30 years	40% of CAPEX
CER price (US$ / CER)	12.00 – 1.18 Exchange Rate in '05
Resulting Project IRR	**17.62%**
Resulting project activity IRR with CERs	**20.48%**

Table 1 Data Used to Calculate IRR

Further details and explanation of the assumptions used in the investment analysis:

Total Investment Cost:
The estimated Total Investment Cost of USD 181.38 million consists of the EPC Cost, the Drilling, Total Infrastructure, and Other Costs estimated to occur after the starting date of the project activity. It is also to be noted that total investment cost is revised reflecting the change in the start date. In accordance with the "Guidance on the Assessment of Investment Analysis", all the expenses that have been incurred prior to the start date have not been used in the investment analysis. The drilling and other costs incurred during the year 2006 i.e., before the start date of the project activity have been considered as sunk costs and therefore excluded in the IRR calculation.
The total investment cost is consistent with the Information Memorandum for Refinancing of Wayang Windu Geothermal Project (unit 1) and Financing of the Wayang Windu Geothermal Expansion Project. The financing which has been agreed and approved by the Lenders is in accordance with the Unit 2 Credit Facility Agreement dated 3 May 2007.

Make up wells:
Make-up wells are required to compensate for the natural decline in output from the wells. It is also to be noted that from accounting point of view, make-up wells are additional wells being drilled for the project, and therefore are taken along with the total investment cost in the IRR calculation spreadsheets.

Number of wells needed to replace depleted well:
2 wells are needed to replace the depleted wells every 3 years - were calculated based on the estimation of the steam needed for the power plant, electricity generation potential from each well, and the steam depletion rate. The average 2 make-up wells required every 3 years is based on the following assumptions and calculations:

Assumption		
Parameter	**Value**	**Source**
Amount of steam needed for the power plant	120% of the generation capacity, i.e. 120% * 113.5[15] = 136.2 MW	Based on the Common Terms in the Loan Agreeement for the project activity.
Electricity generation per well	15 MW / well	Calculated based on the historical data of the steam of the Wayang Windu 1 and the guaranteed steam rate design of the turbine.
Steam depletion rate	5%	Conservative value based on Wayang Windu well and resource performance analysis study conducted by Mauro Parini, advisor reservoir engineer for Unocal Geothermal and "Review of Wayang Windu Field Steam Decline - Wayang Windu Production Data Review" prepared by Sinclair Knight Merz ("SKM")

Calculation	
Depletion per year	136.2 MW*5% = 6.81 MW
Depletion for 3 year	6.81*3 = 20.43 MW
No of wells needed to replace depleted well (every 3 years)	20.43/15 = 1.362 (Rounded to 2.00)

With no other factors being taken into account, the number of wells to be replaced annually would equal 0.45 or 1 well to be replaced every two years. However, a replacement rate of 2 wells every 3 years has been assumed for the following reasons:

- As mentioned in the Wayang Windu well and resource performance analysis study conducted by Mauro Parini, the average decline rates of Wayang Windu 1 wells in 2004 were reported to be at 5.2%. The report however also mentioned that the decline rate is somewhat uncertain, with one of the wells in Wayang Windu 1 reported with a decline rate of 45%.
- Based on the report "Review of Wayang Windu Field Steam Decline - Wayang Windu Production Data Review" prepared by Sinclair Knight Merz dated 24 Nov 2009 ("SKM"); Page 1 of the report indicates that the overall depletion rate of all Unit 1 wells has increased to 8.1% and the average decline rate for Wayang Windu 2 wells are forecasted to be in the range of 5.2 to 7.8%. Also is to be considered is that the analysis of the report has been conducted with some uncertainty in the actual steam count and some assumption in the behavior of the wells due to the very short flow history of the Wayang Windu 2 wells (SKM page 21). Also has to be noted is that the reported average decline rate has been analyzed by excluding the wells with "abnormal" well behavior, i.e. well MBA-4 with wellbore problems in Wayang Windu 2 with a decline rate of 546.3% (SKM page 21). In reality, wells are bound to have problems during their lifetime which would increase the decline rate. Therefore the actual decline rate should be higher than reported when actual conditions are being taken into the analysis.
- The decline rate of both Wayang Windu 1 and 2 wells will be higher when Wayang Windu 3 is built. This is because of the additional mass extraction and the reinjection rate due to an additional power plant (SKM page 1).

[15]Net capacity calculated from the turbine generator capacity (117 MW) minus the house load (3.5 MW)

- Furthermore make-up wells would be required when the required well repair is not successful which was evidenced by abandonment of one of the wells[16] which had already been repaired but the repair had been insufficient to resolve the issue.

Therefore the assumption of 2 new make-up wells every 3 years calculated with the above approach (a lower average decline rate of 5% and rounding up the figure in the final step of the calculation) is considered appropriate and conservative.

Also to be noted are the following points:

- Drilling of make-up wells requires mobilization and usage of a drilling rig, with the estimated cost of USD 1,500,000 to USD 2,000,000 on the rig mobilization, excluding the usage of the rig and the drilling cost. Therefore it is more reasonable to drill 2 wells in 3 years instead of 1 well every 2 years, and the drilling costs estimated in the investment analysis is derived based on this assumption.
- Regardless of resource studies, it can take several years of production from a field before the reservoir performance can be gauged and there is always a risk of an unexpected decline in the capacity of the respective geothermal wells[17].
- Often after wells are drilled, geothermal steam production is not guaranteed. For example, for the Kamojang Geothermal project, 16 wells have been drilled, yet only 11 wells are useable in the production stage[18] for Lahendong-I only 7 out of 9 wells drilled were productive[19]

Make-up well cost:
The value of drilling a make-up well was determined from the make-up well costs conducted in 2006 for Wayang Windu 1 of USD 3.7 million as also reported in the audited financial statement in 2007. Thereby, leading to an estimation of USD 4.2 million in 2010 with escalation of 3% based on the historical average of the US CPI index.

Well repair:
Well repair of existing wells is required due to corrosion or other damage. Geothermal fluids are corrosive, with the H2S forming sulfuric acid, plus inflow of potentially acidic aquifers at depth (http://www.repp.org/geothermal/geothermal_brief_geothermal_resources.html). Hence, checks are made for corrosion in each well each year and repairs are conducted as required to avoid risk of a well blow-out which can be catastrophic. It is also to be noted that from accounting point of view, well repair costs are taken as the operating expenditure in the IRR calculation spreadsheets. The total repair well cost is based on the 'schedule repair wells' and the 'repairwell cost per well'.

Schedule repair wells:
This is based on the previous experience from Wayang Windu unit 1. The investment analysis estimated that 3 wells are repaired every 3 years based on the estimation that each well will be repaired once every 10 years.

[16] MBE-2 plug and abandon report dated 24 Aug 2009
[17] Refer to registered CDM geothermal project no. 2022: http://cdm.unfccc.int/Projects/DB/DNV-CUK1218173149.57/view
[18] Refer to CDM geothermal project no. 3028: http://cdm.unfccc.int/Projects/DB/RWTUV1255101629.04/view
[19] Refer to registered CDM geothermal project no. 2876: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1249404911.81/view

Repair well cost per well:
The value for well repair cost was derived from the work over program to fix wells in 2003 for Wayang Windu unit 1 of USD 1.5 million. Thereby, leading to an estimation of USD 1.7 million in 2009 with escalation of 3% based on the historical average of the US CPI index.

It is to be noted that the equipment used to repair a well will depend on the repair solution selected. If casing is to be replaced, it is essential to use a medium to large drilling rig. If the well is to be treated with acid injection, it may be possible to use a simple "coiled tubing unit" which is much less expensive than mobilizing a rig. Hence the cost of well repair will vary according to the solution selected. Typically, an operating company will not repair each well immediately as a problem occurs unless it results in the well being unsafe. Normally, a rig will be mobilized only when there are several jobs to be performed since the mobilization cost is a major component of the charges[20]
Since the cost of the drilling rig is directly related to the size of the rig, it is important to select the correct rig for the job. If a repair job is commenced with a small rig or coiled tubing unit, and it is found that the job actually requires a casing replacement, it will incur additional cost to mobilize a larger rig capable of handling the casing material.

With this background, the well repair cost based on 2003 costs of repairing wells of Wayang Windu unit 1 taking into account escalation was used instead of taking the average well repair costs of Wayang Windu 1 from 2003 to 2010 of USD 1 million for the reasons of:

- Well repairs in 2003 involved major work, setting new casing into several wells. Hence a relatively large drilling rig was used for this (approximately $50,000 per day costs for the rig). These repairs were successful and allowed operation to continue until the makeup wells were drilled during the 2006/07 drilling program which also drilled wells for the Unit 2 development.
- Well repairs in 2008 were relatively simple, requiring only injection of water and inspection of the wells, and a simple Coiled Tubing Unit (CTU) was mobilized (approximately $5000 per day costs for the CTU). These repairs were unsuccessful and resulted in the decision to abandon a well in the next program.
- Well repairs in 2010 required more capability than a coiled tubing unit but less than a full rig, so a Snubbing Unit was mobilized (approximately $10,000 per day costs for the Snubbing Unit), and this allowed the successful abandonment of one well (MBE2) and some other minor routine workovers to increase steam supply.
- Star Energy Geothermal (Wayang Windu) Ltd ("SEG") as a prudent operator, budgets to undertake well repair on a regular basis as reflected in the investment analysis. The estimated cost which is used in the investment analysis is based on the cost to mobilize a small to medium drilling rig.

Further to be noted that budgeting in the investment analysis is expected for long term repair of wells and takes account of several factors:

- The number and complexity of well repairs will increase with the age of the wells.
- The basis of the estimate should allow for well abandonment of the deepest well since this is the safest solution, hence as a minimum a medium/large sized rig is required. Similar to that used in 2003.

[20] Refer to "Geothermal Well Design, Construction and Failures" paper by James N. A. Southon, SKM for Proceedings World Geothermal Congress 2005 and "Geothermal Well Operation and Maintenance" paper by Sverrir Thorhallsson for Geothermal Training Programme of the United Nations University, Sept 2003

- 1 million USD was found to be the average well repair cost for the Wayang Windu unit 1 from 2003-2010. This value is lower than that estimated for the proposed project activity because of the relative simplicity of the well repairs conducted in some of them, which led to some unsuccessful repairs and abandonment of a well. Therefore, the average well repair cost of WW1 during the period 2003-2010 are not a good reflection of the long term well repair costs for Wayang Windu 2.

The IRR of the project without CDM revenues is **17.62%** which is below the market benchmark required rate of return of **18.96%.** The IRR of the project with CDM revenues is **20.48%.** The additional revenues from the sale of CERs increase the project's IRR to the required return for an average investor in this type of power project.

The perception of the carbon market was that the carbon price will increase over the time, and hence this was considered to balance the remaining risks. In addition to the improvement to the project's IRR, the additional CER revenue gives a secondary stream of revenues in EURO or USD.

Therefore the project activity only becomes financially viable if the project activity generated additional revenue from the CDM through the sale of the emission reductions.

The details of the calculation spreadsheet will be available to the DOE during validation.

Sub-step 2d: Sensitivity analysis:

Sensitivity analyses described below are performed using assumptions which are considered conservative. The 'best-case' conditions for the project IRR were assumed by altering the CAPEX, OPEX, electricity tariff, and electricity output parameters.

Deviations of ±10% have been taken into account in the above decisive assumptions. The summary table is shown below.

Sensitivity	w/o CER		
	-10%	**0%**	**10%**
Tariff	17.085%	17.620%	18.150%
Capacity Factor	17.191%	17.620%	18.046%
O&M and G&A	18.086%	17.620%	17.149%
CapEx (sensitized all)	19.081%	17.620%	16.356%
CapEx (sensitized w/out EPC)	18.144%	17.620%	17.130%
Terminal Value	17.615%	17.620%	17.624%

Table 2 Sensitivity Analysis

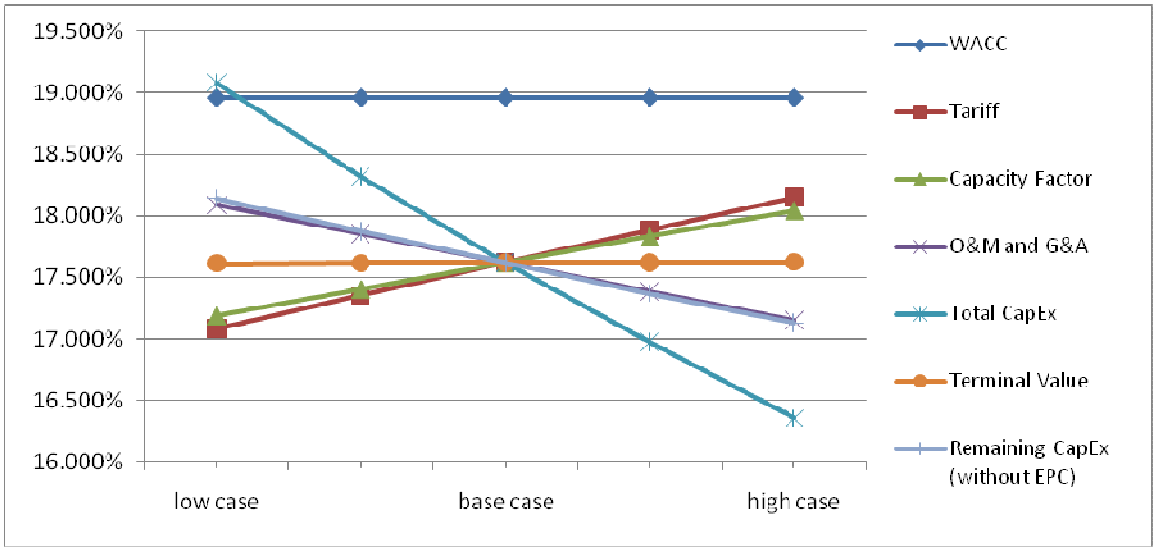

Figure 6 Diagram of the Sensitivity Analysis

As illustrated in the table above, the IRR ranges from 17.085% to 19.081% at when the economic parameters above are varied within the range of -10% to +10%. The best case scenario generated IRR (without CDM related income) of 19.081% and will only take place when the Total CAPEX is decreased by 10%. Total CAPEX consists of EPC cost and the Drilling, Total Infrastructure, and Other Cost. The variation in the EPC cost would not be possible as the EPC contract was agreed at the time of investment and is a result of a competitive bidding conducted by MNL. Hence this cost factor has been fixed and is not variable in the presented range. Therefore sensitivity analysis for the remaining of the construction cost (without the EPC cost) would be more relevant.
Other aspects to be considered:

- Lower OPEX is highly unlikely as the OPEX is based on the joint OPEX of unit 1 and unit 2, discounted the original OPEX of unit 1.

- For tariff, sensitivity is applied to the escalation index instead of the total escalated tariff to avoid double counting. A change in the base tariff would be highly unlikely considering that the project owner has already received an amendment of the Energy Sales Contract with the escalation factor included in the amendment. The escalation for each index is estimated based on the historical growth rate of each index from 1985 to 2005[21].

- Please note that the capacity factor changes are 91%, 93%, and 95% considering a change of 10% is not applicable), i.e. the capacity factor estimated for the project is already at 93%, and cannot go above 100% and also there will be required and scheduled maintenance requiring operation down-time.

It can be observed that the project activity is financially unattractive not only in the typical situation but also in the varying scenarios as described above and hence the project activity is additional.

[21]The data are taken up to 2005 as this is the latest annual data available during the investment date

All financial data used to arrive at the internal rate of return of the project activity with and without CDM revenues will be available to the DOE during validation.

Step 3: Barrier Analysis

This step is not being used.

Step 4: Common Practice Analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity:

Geothermal power development is not the first of its kind in Indonesia. However, according to the statistic, in early 2005, geothermal power generation in Indonesia provided annual energy of 6,085 GWh/year or about 2.2% of national power capacity[22].

Based on the statistic in 2006, the current utilization of the geothermal energy sources is only about 4.5% of the potential, with the installed capacity of 886.90 MW to the potential of 19,658 MW[23].

The operational geothermal power plants, not considered as CDM activity, were built between 1982 and 2000, and the planning of these plants therefore predates the Asian and Indonesian economic crisis of 1998 and the subsequent economic downturn.

The development in the 1990s was stimulated by electricity prices between USD 0.069 and USD 0.085, which made projects viable, and at that time there was no carbon finance or CDM available. PLN is now seeking to pay prices only under USD0.05/kWh[24]. Hence, it is hard for private developers to move forward with geothermal power project without confidence through the revenues from the CER.

[22] Source: Article "World Geothermal Power Generation 2001-2005" by International Geothermal Development http://www.geothermal.org/articles/worldpower05.pdf accessed on 28 November 2008

[23] Source: CDM Country Guide for Indonesia, edited by the Institute for Global Environmental Strategies 2nd edition, 2006.

[24] Source: Report produced for the United States Agency for International Development (USAID ASIA) Annex 3 Indonesia Country Report, From Ideas to Action: Clean Energy Solutions, For Asia to Address Climate Change, prepared by International Resources Group, dated June 2007

Indonesia geothermal proven reserves and power plants constructed status are as followed[25]:

Power Plant[26]	Location	Capacity (MW)	Development or Construction Date	Commencement Date	Policy Regime (Prior to/ Post the Financial Crisis)	Steam Field Operator	Power Plant Operator	With or Without CDM Activity	Similar to the Project Activity (yes/no)	Remarks
Kamojang Unit I, II, III[27,28]	Jawa	140 MW	1980s	Unit 1: 1982 Unit 2,3: 1987	Prior to the financial crisis	Pertamina (State-owned company)	PLN (State-owned company)	Without CDM Activity	No	This project was built during the higher electricity tariff regime, developed & operated by state-owned company with funding from World Bank (for unit 2 and 3)
Kamojang Unit IV[29]	Jawa	1 x 60 MW	Feb 2006	Dec 2007	Post the financial crisis	Pertamina (State-owned company)	Pertamina (State-owned company)	CDM Activity	No	This project was developed & operated by state-owned companies and is a CDM Activity
Salak Phase 1[30]	Jawa	3 x 55 MW		1994 (2 units) and 1997 (1 unit)	Prior to the financial crisis	Unocal / Chevron from 2005 (IPP)	PLN (State-owned company)	Without CDM Activity	No	This project was built during the higher electricity tariff regime, developed & operated by state-owned company

[25] Source: Article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008

[26] Source: Article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008.Cover story "IndoRenergy, Positioning Geothermal" from Petrominer magazine No.07/July 20,2009. Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018 page 53-54 (http://www.pln.co.id/InfoKorporat/ChangeofRUPTL20062015/tabid/175/Default.aspx), there are a few other non-PLN geothermal power plants to be built in the future, however those are not mentioned in this list as they are of different scale and/or of expected operation date of year 2011 onwards (i.e. currently at the planning stage/construction has not been started)

[27] Source: Article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008

[28] Source : Kamojang Geothermal PDD, version 01, dated 29 February 2008

[29] Source : Kamojang Geothermal PDD, version 01, dated 29 February 2008

[30] Source: Article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008

Salak Phase 2[31]	Jawa	3 x 55 MW	1994	1997	Prior to the financial crisis	Unocal / Chevron from 2005 (IPP)	Unocal built and operated for 15 years and transfer operatorship to PLN under BOT (IPP transferred to State-owned company)	Without CDM Activity	No	This project was built during the higher electricity tariff regime, and transferred to state-owned company under BOT
Darajat Phase 1[32]	Jawa	55 MW	1994	1994	Prior to the financial crisis	Indonesia Power – subsidiary of PLN (State-owned company)	Chevron (IPP)	Without CDM Activity	No	This project was built during the higher electricity tariff regime
Darajat Phase 2[33]	Jawa	90 MW	1997	2000	Prior to the financial crisis	Chevron (IPP)	Chevron (IPP)	Without CDM Activity	No	This project was built during the higher electricity tariff regime
Darajat Phase 3[34]	Jawa	117 MW		4th quarter of 2006	Post the financial crisis	Chevron (IPP)	Chevron (IPP)	CDM Activity	Yes	This project is an CDM Activity
Dieng Unit 1[35]	Jawa	1 x 60 MW	1994	July 1998	Prior to the financial crisis	California Energy developed the project and then transferred to PT Geo Dipa Energi, a joint venture of Pertamina and PLN, in 2001 (IPP transferred to State-owned company)	California Energy developed the project and then transferred to PT Geo Dipa Energi, a joint venture of Pertamina and PLN, in 2001 (IPP transferred to State-owned company)	Without CDM Activity	No	This project was built during the higher electricity tariff regime, and transferred to state-owned company

[31] Source: Article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008

[32] Source : Registered CDM Project: Darajat Unit III Geothermal Project PDD, version 3, dated 14 September 2006

[33] Source : Registered CDM Project: Darajat Unit III Geothermal Project PDD, version 3, dated 14 September 2006

[34] Source : Registered CDM Project: Darajat Unit III Geothermal Project PDD, version 3, dated 14 September 2006

[35] Source: Article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008

Dieng Unit 2[36]	Jawa	60 MW	Planning stage	Expected 2012-2014	Post the financial crisis	PT Geo Dipa Energi, a joint venture of Pertamina and PLN (State-owned company)	PT Geo Dipa Energi, a joint venture of Pertamina and PLN (State-owned company)		No	This project was developed & operated by state-owned company and is not operational yet
Wayang Windu Phase 1[37]	Jawa	1 x 110 MW	1997	2000	Prior to the financial crisis	Mandala Magma Nusantara BV (IPP)	Mandala Magma Nusantara BV (IPP)	Without CDM Activity	No	This project was built during the higher electricity tariff regime
Patuha[38]	Jawa	180 MW	Planning stage	Expected 2013	Post the financial crisis	PT Geo Dipa Energi, a joint venture of Pertamina and PLN (State-owned company)	PT Geo Dipa Energi, a joint venture of Pertamina and PLN (State-owned company)		No	This project was developed & operated by state-owned company and is not operational yet
Karaha Bodas[39]	Jawa	1x30 MW, 1x110 MW, 1x110 MW	Planning stage	Expected 2012, 2014, 2018	Post the financial crisis	Pertamina (State-owned company)	Pertamina (State-owned company)		No	This project was developed & operated by state-owned company and is not operational
Cibuni[40]	Jawa	1 x 10 MW	Planning stage	Expected 2013	Post the financial crisis	PT Yala Tekno Geothermal (IPP)	PT Yala Tekno Geothermal (IPP)		No	This project is of different scale and is not operational

[36] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018, Dieng 2 is expected to be operational in 2014 (page 53) and is currently at planning stage (page 116). Industrial experts confirm that at the current stage, the power plant has not been constructed.

[37] Source: Article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008

[38] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018, Patuha is expected to be operational in 2013 (page 53) and is currently at planning stage (page 116). Industrial experts confirm that at the current stage, the power plant has not been constructed.

[39] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018 page 53, the first unit of Karaha Bodas is expected to be operational in 2012. Based on consultation with industrial experts, Patuha is currently at the Financing Stage. The project will be funded by Pertamina, which is the government-owned company – in accordance to article http://www.thejakartapost.com/news/2009/04/03/govt-resume-karaha-bodas-power-project.html dated 04 March 2009

[40] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018, Cibuni is expected to be operational in 2013 (page 53) and is currently at planning stage (page 116). The project will be developed by PT Yala Tekno Geothermal – in accordance to article "Indonesia's Geothermal Development" http://jakarta.usembassy.gov/download/geo2002.pdf Accessed on 28 November 2008

Bedugul[41]	Bali	10 MW	Planning stage	Expected 2012	Post the financial crisis	Pertamina (State-owned company)	Bali Energy (IPP)		No	This project is of different scale and is not operational
Sibayak[42]	Sumatra	11.3 MW	Late 2005	July 2008	Post the financial crisis	Pertamina (State-owned company)	PT Dizamatara Powerindo (IPP)	CDM activity	No	This project is of different scale and is a CDM activity
Sarulla[43]	Sumatra	3 x 110 MW	Planning stage	Expected 2011	Post the financial crisis	Consortium of Medco, Ormat Technologies, Itochu Corp, Kyushu Electric (IPP)	Consortium of Medco, Ormat Technologies, Itochu Corp, Kyushu Electric (IPP)		No	This project has not reached financial closure and has not been built
Ulubelu[44]	Sumatra	1x55 MW, 1x55 MW	Planning stage	Expected 2011, 2012	Post the financial crisis	PLN (State-owned company)	PLN (State-owned company)		No	This project was developed & operated by state-owned company with Government-to-Government development funding (ODA)
Kerinci[45]	Sumatra	20 MW	Planning stage.	Expected 2011	Post the financial crisis	Pertamina (State-owned company)	Pertamina (State-owned company)		No	This project is of different scale
Lahendon Unit 1[46]	Sulawesi	20 MW		2000/2001	Prior to the financial crisis	Pertamina (State-owned company)	PLN (State-owned company)	Without CDM Activity	No	This project is of different scale and was developed & operated by state-owned company
Lahendon Unit 2[47]	Sulawesi	20 MW	Planning stage	2007	Post the financial crisis	Pertamin (State-	PLN (State-owned	CDM Activity	No	This project is of different

[41] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018 page 116, Bedugul is expected to be operational in 2012 (expected to be operational in 2010 based on page 53) and is currently at planning stage. Based on the consultation with the industrial experts, Bedugul has not started its construction. Based on Article "Bedugul Geothermal Project Still in Limbo" http://www.rasabali.com/bali-news/bedugul-geothermal-project-still-in-limbo-182.shtml accessed on 28 November 2008, the project is still waiting for permits and licenses.

[42] Source: Sibayak Geothermal Power Plant PDD, version 01, dated 26 August 2008

[43] Source: Medco investor update presentation slides mentioned that financing is still being negotiated during the 1st quarter of 2009 http://www.medcoenergi.com/userfiles%5Cfile/1H09_Investor_Update.pdf . Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018 page 53, Sarulla is expected to be operational in 2011.

[44] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018 page 311, Ulubelu is expected to be operational in 2011-2012. Government – government load is included in the project as per cited in http://www.id.emb-japan.go.jp/oda/en/projects/loan/odaprojects_loan_2004_5.htm accessed on 28 November 2008

[45] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018, Kerinci is expected to be operational in 2011 and is currently at planning stage (page 311) http://www.vsi.esdm.go.id/gunungapiIndonesia/kerinci/umum.html, http://www.jambiekspres.co.id/index.php/radar-jambi/radar-barat/294-panas-bumi-kerinci-akan-dijadikan-energi-listrik accessed on 28 November 2008

[46] Source: Lahendong II-20 MW Geothermal Project, version 11, dated 1 July 2007

						owned company)	company)			scale, developed & operated by state-owned company, and a CDM
Lahendon Unit 3[48]	Sulawesi	20 MW	Planning stage	2008	Post the financial crisis	Pertamina (State-owned company)	PLN (State-owned company)	Without CDM Activity	No	This project is of different scale, developed & operated by state-owned company
Ulumbu[49]	NTT / Flores	2 x 3 MW	Planning stage	Expected 2011, 2012	Post the financial crisis	PLN (State-owned company)	PLN (State-owned company)		No	This project is of different scale, developed & operated by state-owned company with loan from the Asian Development Bank (ADB)

Table 3 Indonesia Geothermal Proven Reserves and Power Plants

The above table shows that the only activity that is operational and is similar to the project activity (in the same defined region, rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework and investment climate) is Darajat Phase 3 Geothermal Project, which is a registered CDM project, and therefore is excluded from the analysis.

On this basis, there is no activity similar to the proposed project activity in the defined region.

Sub-step 4b: Discuss any similar Options that are occurring:

Based on the above step, there is no activity similar to the proposed project activity in the defined region.

This is reinforced with the movement to coal-based generation of power plants in Indonesia during the start date of the project activity[50]. The coal-based power plants were then supported by the Fast Track Program that mandates the building of 40 coal-fired power plants[51]. With the government support, coal-fired power plants become the more popular option in Indonesia together with the better economic consideration (low cost of generation and easy availability) in comparison to other potential energy sources, i.e. geothermal.

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[47] Source: Lahendong II-20 MW Geothermal Project, version 11, dated 1 July 2007

[48] Source: Cover story "IndoRenergy, Positioning Geothermal" from Petrominer magazine No.07/July 20,2009.

[49] Source: Based on PLN's RUPTL (PLN's Electricity Provision Plan) 2009 – 2018 page 54, Ulumbu is expected to be operational in 2011,2012. http://www.adb.org/Business/Opportunities/not/archive/jul-sep05/ino1982d.asp. Government received the loan from Asian Development bank http://www.adb.org/Business/Opportunities/not/archive/jul-sep05/ino1982d.asp

[50] Source: "Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) year 2006-2015" by PT PLN (Persero) http://www.pln.co.id/ruptl/070219_perubahan_ruptl_06_10_web_.pdf accessed on 28 November 2008

[51] In pursuant to Presidential regulation No. 71/2006

With the above arguments, it is concluded that geothermal power development is therefore not a common practice.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emission (BE_y)

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = (EG_y - EG_{baseline}) \cdot EF_{grid,CM,y}$$

Where:

BE_y = Baseline emission in year y (tCO_2/yr)
EG_y = Electricity supplied by the project activity to the grid (MWh)
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y (calculated by using "tool to calculate the emission factor for an electricity system version 01.1")

The methodology assumes that all project electricity generation above baseline levels ($EG_{baseline}$) would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in $EF_{,y}$

For calculation in this PDD, the electricity supplied by the project activity to the grid is determined by the conservative load factor of 93% of the power plant output capacity. During the crediting period, the electricity supplied to the grid by the project activity will be measured and cross-checked by the electricity sales record. Auxiliary use is assumed to be 3.5 MW for calculation in this PDD.

Calculation of $EG_{baseline}$

The project activity is the installation of additional power units at an existing grid-connected renewable power plant:

$EG_{baseline} = MAX (EG_{historical} , EG_{existing,y})$, until DATE $_{BaselineRetrofit}$

$EG_{baseline} = EG_{y}$, on/after DATE $_{BaselineRetrofit}$

Where:

$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh)
$EG_{historical}$ = Average of historical electricity delivered by the existing facility to the grid (MWh)

$EG_{existing,y}$ = Electricity supplied by the existing grid-connected power plant (MWh)
$DATE_{BaselineRetrofit}$ = Point in time when the existing equipment would need to be replaced in the absence of the project activity (date)

Calculation of $EG_{historical}$

$EG_{historical}$ is the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofit, or modified in a manner that significantly affected output (i.e. by 5% or more) expressed in MWh per year. A minimum of 3 years data is required. Data for periods affected by unusual circumstances such as natural disasters, conflicts, transmission constraints shall be excluded.

Historical electricity delivered by Wayang Windu Phase 1 from the start of its operation in June 2000 up to February 2009 will be used to calculate $EG_{historical.}$

Calculation of $DATE_{BaselineRetrofit}$

The technical lifetime of the existing facility, i.e. Wayang Windu Phase 1, in the absence of the project activity is taken to be 30 years. This is a conservative number, considering many of the power plants in Indonesia are operated even after its technical lifetime.

Wayang Windu 1 started operation in June 2000, hence the $DATE_{BaselineRetrofit}$ is 01 June 2030.

Calculation of $EF_{grid,CM,y}$

Step 1. Identify the relevant electric power system

Referring to ACM0002 version 09, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the grid. JAMALI (Jawa-Madura-Bali) grid applies for the project activity.

Electricity import emission factor

Electricity import emission factor is determined as 0 (zero) tCO_2/MWh because currently the JAMALI grid is not inter-connected with other provincial grids within Indonesia with no intermediate plan to do so.

Step 2. Select an Operating Margin (OM) Method

The low-cost/must-run resources constitute more than 50% of total grid generation (presented at table 4). Hence simple OM is not an available option and average OM method is used.

Table 4 Power Generation of JAMALI grid[52]

OWNER		*operation year*	2002	2003	2004	2005	2,006
IP		fuel	GWh				
	Hydro		3,482	2,938	3,223	3,834	2,720
	Diesel	Oil	87	60	66	128	101
	Gas Turbine	Gas	62	-	102	89	102
		Oil	960	1,581	1,812	1,855	1,655
	Geothermal		2,888	2,646	2,825	2,717	2,820
	Steam	Coal	20,205	22,220	21,482	23,248	23,875
		Oil	1,717	2,105	2,017	1,806	1,502
	Combined Cycle	Gas	6,672	7,133	6,677	6,830	5,622
		Oil	3,976	3,860	4,337	5,879	5,855
	TOTAL NET PRODUCTION		40,049	42,543	42,541	46,385	44,253

		year	2002	2003	2004	2005	2,006
PT PJB		fuel	GWh				
	Hydro		2,380	1,832	2,098	2,339	1,896
	Gas Turbine	Oil	53	41	32	91	47
	Muara Tawar		298	35	170	601	385
	Steam	Coal	4,112	4,722	5,101	4,567	4,929
		Oil	4,928	5,121	5,275	4,862	5,660
		Gas	1,324	1,177	1,030	646	669
		Oil/HSD	15	7	7	5	9
	Combined Cycle	GT/Gas	7,283	6,228	5,235	4,716	4,824
		Oil	481	1,359	2,229	3,101	2,589
		ST	3,944	3,456	2,714	2,112	2,422
	Muara Tawar	ST	1,117	1,281	2,860	2,901	2,614
	TOTAL NET PRODUCTION		25,935	25,259	26,751	25,941	26,044

		year	2002	2003	2004	2005	2,006
		fuel	GWh				
Muara Tawar							
	Gas Turbine	Gas	0	0	900	2,064	1,618
Tanjung Jati B							
	Steam	Coal	0	0	0	0	3,869
Cilegon							

[52] Source: data reported by Department of Energy and Mineral Resources of Indonesia - Directorate General of Electricity and Energy Utilization on 13 February 2009

	Combined Cycle	Gas	0	0	0	0	742
	TOTAL GROSS PRODUCTION		**0**	**0**	**900**	**2064**	**6229**
	TOTAL NET PRODUCTION		**-**	**-**	**862**	**1,981**	**5,966**

	2002	**2003**	**2004**	**2005**	**2,006**
			GWh		
TOTAL NET PRODUCTION IN JAVA BALI SYSTEM (including LCMR)	*82,976*	*86,815*	*91,497*	*96,805*	*100,015*
Low Cost/Must Run	*50,806*	*53,753*	*56,415*	*59,587*	*60,639*
ratio of LCMR	*61.2%*	*61.9%*	*61.7%*	*61.6%*	*60.6%*

The average OM can be calculated using either of the two following data vintages:

- Ex ante option: A 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. if the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1, or y-2) should be used throughout all crediting periods.

The data vintage chosen in this project is ex ante option.

Step 3. Calculate the operating margin emission factor ($EF_{grid\ OM,y}$) according to the selected method

Average OM is calculated as the average emission rate of all power plants serving the grid, including the low-cost/must-run power plants.

It may be calculated based on these 3 following options:

- Option A: fuel consumption and net electricity generation of each power plant
- Option B: net electricity generation, the average efficiency of each power plant and the fuel used in each power plant
- Option C: total net electricity generation of all power plants serving the system and the fuel type and total fuel consumption of the project electricity system.

Option A is chosen since the fuel consumption and net electricity generation of each power plant unit-not including low-cost/must-run- is available. Therefore, the formula applied for $(EF_{grid\ OM,y})$ is as follows:

$$EF_{grid,OM,y} = \frac{\sum_{i,m} FC_{i,m,y} \bullet NCV_{i,y} \bullet EF_{CO2,i,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OM,}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power plant / unit m in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power plant / unit m in year y (MWh)
m	=	All power plants / units serving the grid in year y except low-cost / must-run power plants / units
i	=	All fossil fuel types combusted in power plant / unit m in year y
y	=	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

$EF_{grid,OM,,2004-2006}$ = 0.844 tCO_2/MWh (Refer to Section 6.3, table 10)

Step 4. Identify the cohort of power units to be included in the Build Margin (BM)

The sample group identified of the cohort of power plant unit to be included in the build margin consists of either:

- The set of five power plants that have been built most recently
- The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently

The tool mandates the use of whichever option that comprises the larger annual generation. The identified five most recent power plants, however comprise of only 8.17% of total power generation and therefore sample group *m* was expanded to include power plants up to capacity additions that comprise 20% of system generations. These power plants and their corresponding generation and fuel consumptions are presented in the following Table 5[53].

[53] Data is composed based on interview and correspondence with PT PLN P3B (Persero). Source: PDD for Registered Project 1313: MEN-Tangerang 13.6MW Natural Gas Co-generation Project

Table 5 sample group *m* for Build Margin

Sample Group m power plant and its commissioning year		Fuel type	Operation year	Generated Power (GWh)	Cumulative generation per total generations of all power plants in the Jamali Grid (%)
Owner	**Power Plant**				
Cilegon	Cilegon	CCGT-Gas	2006	742.0	0.74
Tanjung Jati B	Tanjung Jati B	Steam-Coal	2006	3,869.0	4.61
PT Sumberenergi Sakti Prima	Cilacap	Steam-Coal	2006	1,937.0	6.55
Muara Tawar	Block 3	GT-Oil	2004	1,618.0	8.16
	Block 4	GT-Oil	2004		8.16
PT Krakatau Daya Listrik	Krakatau	Steam-Coal	2003	2.2	8.17
PT Cikarang Listrindo Power	Cikarang	GT-Gas	2003	403.0	8.57
PT Indonesia Power	Pemaron	GT-Oil	2003	201.3	8.77
PT Geo Dipa Energi	Dieng	Geothermal	2002	319.0	9.09
Chevron Texaco Energi Indonesia Ltd.	Darajad	Geothermal	2001	735.0	9.83
PT Magma Nusantara Listrindo	Wayangwindu	Geothermal	2001	922.0	10.75
PT Java Power	Paiton II	Steam-Coal	Nov, 2000	9,109.0	19.85
PT Paiton Energi	Paiton I	Steam-Coal	1999	9,116.0	28.97

The tool allows project participant to choose between one of the following options:

- Option 1: *ex–ante* for the first crediting period & updated for the second crediting period. For the third crediting period, build margin emission factor calculated for the second crediting period will be used.
- Option 2: *ex-post*. Calculated annually for the first crediting period. For the second crediting period, it will be calculated *ex-ante*. For the third crediting period, the calculated for the second crediting period will be used.

Option 1 ex-ante is chosen for the project.

Step 5. Calculate the build margin emission factor ($EF_{grid,BM,y}$)

The build margin is calculated using the following equation:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

The CO2 emissions from these power plants are calculated using data presented in table 6 and table 7.

$EF_{grid,BM,2006}$ = 0.937 tCO_2/MWh (Refer to Section 6.3, table 11)

Step 6. Calculate the combined margin emission factor ($EF_{grid,CM,y}$)

JAMALI grid baseline emissions factor (EFy) as the combined margin emissions factor ($EF_{grid\ CM,y}$) is calculated using the "tool to calculate the emission factor for an electricity system version 01.1". It consists of the combination of operating margin ($EF_{grid\ OM,y}$) and build margin ($EF_{grid\ BM,y}$) emission factors calculated *ex-ante* using following equation:

$$EF_{grid\ CM,y} = w_{OM} \cdot EF_{grid\ OM,y} + w_{BM} \cdot EF_{grid\ BM,y}$$

Where:

$EF_{grid\ CM,y}$ = Combined margin CO_2 emission factor for JAMALI grid connected power generation for in year y (tCO_2/MWh)

$EF_{grid\ OM,y}$ = Operating margin CO_2 emission factor for JAMALI grid connected power generation in year y (tCO_2/MWh)

$EF_{grid\ BM,y}$ = Build margin CO_2 emission factor for JAMALI grid connected power generation in year y (tCO_2/MWh)

w_{OM} = weighting for operating emission factor (50%)

w_{BM} = weighting for build margin emission factor (50%)

Leakage (L_y)

Since ACM0002 version 9 does not consider the emission due to power plant construction and fuel handlings, no leakage is considered ($L_y = 0$).

Project Emission (PE_y)

The project emissions that shall be accounted are:

- fugitive CH_4 and CO_2 in the non-condensable gases of the produced steam.
- CO_2 emission resulting from combustion of fossil fuel related to the operation of the power plant.

$$PE_y = PES_y + PEFF_y$$

Where:

PE_y = Project emission in year y (tCO_2/yr)

PES_y = Project emission of CH_4 and CO_2 due to the release of non-condensable gases from the stream produced in geothermal power plant in year y (tCO_2/yr)

$PEFF_y$ = Project emission from combustion of fossil fuels related to the operation of the geothermal power plant in year y (tCO_2/yr)

Project emission of CO_2 and CH_4 due to the release of non-condensable gases from the steam produced in the geothermal power plant is calculated as:

$$PES_y = (\omega_{main,CO2} + \omega_{main,CH4} \cdot GWP_{CH4}) \cdot M_{S,y}$$

Where:

PES_y = Project emission of CH_4 and CO_2 due to the release of non-condensable gases from the stream produced in geothermal power plant in year y (tCO_2/yr)

$\omega_{main,CO2}$ = average mass fraction of CO_2 in the produced steam (non-dimensional)

$\omega_{main,CH4}$ = average mass fraction of CH_4 in the produced steam (non-dimensional)

GWP_{CH4} = global warming potential of CH_4 valid for the relevant commitment period (tCO_2/tCH_4)

$M_{S,y}$ = Quantity of steam produced during the year y (tonnes)

For the calculation in this PDD, $\omega_{main,CO2}$ and $\omega_{main,CH4}$ are assumed to have the same figure from the previous Wayang Windu 1 project. These assumptions are taken due to the predicted same characteristic of geothermal steam. The steam reservoir for Wayang Windu 1 and 2 are located at the same geological formation/bed. Both parameters will be monitored during the crediting period.

$M_{s,y}$ for the emission reduction estimation in this PDD is available from the well test done for feasibility study. The parameter will be monitored during the crediting period.

Further project emissions from combustion of fossil fuel related to the operation of geothermal power plant is calculated as:

$$PEFF_y = PE_{FC,j,y}$$

Where:

$PEFF_y$ = project emissions from combustion of fossil fuels related to the operation of the geothermal power plant in year y (/yr)

$PE_{FC,j,y}$ = CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr). This parameter will be calculated by the "tool to calculate project or leakage CO_2 emissions from fossil fuel combustion version 02"

Fossil fuel consumption comes only from the emergency generator set and emergency fire pump. Regular maintenance that consumes diesel fuel will be performed. The consumption of diesel fuel and its characteristic will be recorded during the crediting period. To be conservative, for the calculation in this PDD, the amount of diesel fuel will be taken by doubling the volume of the diesel consumption in Wayang Windu 1.

Emission Reduction (ER_y)

The emission reduction $ER_y(tCO_2/yr)$ by the project activity during a given year y is the difference between the baseline emission (BE_y), project emission (PE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y - L_y$$

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2/tCH_4
Description:	Global warming potential of methane valid for the relevant commitment period
Source of data used:	IPCC
Value applied:	Default value for the first commitment period = 21 tCO_2/tCH_4
Justification of the choice of data or description of measurement methods and procedures actually applied :	--
Any comment:	--

Data / Parameter:	$EG_{historical}$
Data unit:	MWh
Description:	Average of historical electricity delivered by the existing facility to the grid
Source of data used:	Project activity site
Value applied:	912,476
Justification of the choice of data or description of measurement methods and procedures actually applied :	The average of historical electricity delivered by the existing facility (Wayang Windu Phase 1) to the grid, spanning all data from the most recent available month (February 2009) to the time at which the facility was operated (June 2000) expressed in MWh per year. Data is based on invoices from net electricity sales to the grid operator.
Any comment:	--

Data / Parameter:	$DATE_{BaselineRetrofit}$
Data unit:	Date
Description:	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data used:	Project activity site
Value applied:	01 June 2030
Justification of the choice of data or description of measurement methods and procedures	The technical lifetime of the existing facility, i.e. Wayang Windu Phase 1, in the absence of the project activity is taken to be 30 years. This is a conservative number, considering many of the power plants in Indonesia are operated even after its technical lifetime.

actually applied :	Wayang Windu 1 started operation in June 2000, hence the $DATE_{BaselineRetrofit}$ is 01 June 2030.
Any comment:	--

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Grid emission factor for JAMALI
Source of data used:	Grid calculation published by Department of Energy and Mineral Resources of Indonesia - Directorate General of Electricity and Energy Utilization and endorsed by Indonesia DNA on 19 January 2009.
Value applied:	0.891
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated with "tool to calculate the emission factor for an electricity system version 01.1".
Any comment:	Calculated once ex-ante at the start of the crediting period, using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

B.6.3. Ex-ante calculation of emission reductions:

Baseline emission (BE_y)

$BE_y = (EG_y - EG_{baseline}) \cdot EF_{grid,CM,y}$

Where:

BE_y = Baseline emission in year y (tCO_2/yr)
EG_y = Electricity supplied by the project activity to the grid (MWh)
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y (calculated by using "tool to calculate the emission factor for an electricity system version 01.1")

As described at section B.6.1, JAMALI grid baseline emissions factor (EFy) is calculated as the combined margin emissions factor using tool to calculate the emission factor for an electricity system version 01.1. The result applied is 0.891 tCO_2/MWh based on the ex-ante approach for both OM and BM.

Operating margin emission factor

The Operating Margin Emission Factor has been calculated by Department of Energy and Mineral Resources of Indonesia - Directorate General of Electricity and Energy Utilization and endorsed by Indonesian DNA using values as per following tables.

Table 6 NCV

Type of fuel	$NCV_{i,y}$	
	GJ/kt fuel	GJ/kltr fuel
IDO(Industrial Diesel Oil)	41,961.1	36.93
HSD(High Speed Diesel)	42,728.6	36.11
MFO(Marine Fuel Oil)	41,019.0	40.61
Natural Gas	48,000.0	
Coal	24,030.8	

Table 7 Density of Fuel

Type of fuel	Density kg/m3=(kt x 10^{-6}/kltr)
IDO(Industrial Diesel Oil)	880
HSD(High Speed Diesel)	845
MFO(Marine Fuel Oil)	990

Table 8 Effective CO_2 Emission Factor

Fuel type	Default Carbon Content	Default Carbon Oxidation factor	Effective CO2 emission factor
	A	B	C ($EF_{CO2,I,y}$)
	(tC/TJ)	-	(t- CO_2/GJ)
Residual Fuel Oil MFO(Marine Fuel Oil)	21.1	1	0.0774
Gas/Diesel Oil IDO(Industrial Diesel Oil) HSD(High Speed Diesel)	20.2	1	0.0741
Natural Gas	15.3	1	0.0561
Coal	26.2	1	0.0961

Table 9 Fuel Consumption

OWNER	year	2002	2003	2004	2005	2006

IP		unit					
	HSD	kilo litre	1,519,777	1,632,380	2,125,397	2,700,109	2,170,653
	MFO	kilo litre	553,762	624,350	702,330	546,934	461,319
	IDO	kilo litre	4,028	3,989	3,502	4,074	2,343
	Gas	MMBTU	51,652,593	59,063,442	46,531,163	43,019,888	48,298,358
	Coal	ton	9,711,476	10,856,426	10,636,155	12,508,407	13,164,773

Source :Indonesia Power Statistic's 2002,2003,2004,2005 and 2006

		year	2002	2003	2004	2005	2006
PT PJB		unit					
	HSD	kilo litre	535,778	698,757	1,303,071	1,706,774	1,450,468
	MFO	kilo litre	1,403,673	1,468,915	1,532,591	1,397,208	1,593,046
	Gas	MMBTU	112,139,072	95,849,384	82949203	71,106,206	71,160,078
	Coal	ton	2,121,797	2,370,264	2,767,434	2,506,026	2,752,759

Source :Statistik Perusahaan 2002-2006, PT PJB

		year	2002	2003	2004	2005	2006
		unit					
Muara Tawar							
	Gas	MMBTU	0	0	*9,063,717*	*20,786,124*	*16,294,549*
Tanjung Jati B							
	Coal	ton	0	0	0	0	*1,525,279*
Cilegon							
	Gas	MMBTU	0	0	0	0	*4,420,921*

calculation data

		year	2002	2003	2004	2005	2006
IPP		unit					
Gas	Cikarang	MMBTU		*5,130,800*	*6,130,700*	*5,585,300*	*4,070,300*
	TOTAL			**5,130,800**	**6,130,700**	**5,585,300**	**4,070,300**
Coal	Paiton I	ton	8,300,753	9,060,889	4,207,456	5,113,446	4,437,332
	Paiton II	ton			3,560,659	4,395,998	4,273,017
	Krakatau	ton	0	*5,995.7*	*5,620.9*	*374.7*	*835.6*
	Cilacap	ton	0	0	0	0	*764,054.0*
	TOTAL	ton	**8,300,753**	**9,066,885**	**7,773,736**	**9,509,819**	**9,475,239**

Source : Indonesia Mineral and Coal Statistics, 2004, 2006, 2007, Ministry of Energy and Mineral Resources

Table 10 OM

EMISSION REDUCTION (t-CO2)

	OWNER		2002	2003	2004	2005	2006
1	IP		t-CO2				
		HSD	4,064,232	4,365,358	5,683,799	7,220,710	5,804,824
		MFO	1,739,793	1,961,565	2,206,560	1,718,341	1,449,359
		IDO	11,016	10,910	9,578	11,142	6,408
		Gas	6,637,470	3,495,943	2,754,162	2,546,331	2,858,762
		Coal	22,419,514	25,062,698	24,554,190	28,876,394	30,391,653
		TOTAL GHG REDUCTION	34,872,026	34,896,474	35,208,288	40,372,919	40,511,005

			2002	2003	2004	2005	2006
2	PT PJB		t-CO2				
		HSD	1,432,793	1,868,636	3,484,710	4,564,305	3,878,884
		MFO	4,410,019	4,614,994	4,815,050	4,389,707	5,004,985
		Gas	6,637,470	5,673,289	4,909,733	4,208,750	4,211,939
		Coal	4,898,293	5,471,894	6,388,784	5,785,309	6,354,906
		TOTAL GHG REDUCTION	17,378,575	17,628,814	19,598,277	18,948,071	19,450,714

			2002	2003	2004	2005	2006
			t-CO2				
3	Muara Tawar						
		Gas	0	0	*536,478*	*1,230,323*	*964,468*
4	Tanjung Jati B						
		Coal	0	0	0	0	*3,521,197*
5	Cilegon						
		Gas	0	0	0	0	*261,673*
		TOTAL GHG REDUCTION	-	-	536,478	1,230,323	4,747,338

6	IPP		2002	2003	2004	2005	2006
			t-CO2				
	Jatiluhur	Hydro	0	0	0	0	0
	Dieng	Geothermal	0	0	0	0	0
	Salak 4,5,6	Geothermal	0	0	0	0	0
	Wayang Windu	Geothermal	0	0	0	0	0
	TOTAL GHG REDUCTION		***0***	**0**	***0***	***0***	***0***
	Drajat II	Geothermal	0	0	0	0	0
	Cikarang	gas	-	*303,690*	*362,874*	*330,592*	*240,920*
	TOTAL GHG REDUCTION		**-**	***303,690***	***362,874***	***330,592***	***240,920***
	Paiton I	Coal	19,162,777	20,917,596	9,713,160	11,804,691	10,243,842
	Paiton II	Coal			8,219,991	10,148,420	9,864,511
	Krakatau	Coal	0	*13,841*	*12,976*	*865*	*1,929*
	Cilacap	Coal	0	0	0	0	*1,763,864*
	TOTAL GHG REDUCTION		**19,162,777**	**20,931,437**	**17,946,127**	**21,953,976**	**21,874,146**

	2002	2003	2004	2005	2006
TOTAL GHG REDUCTION (t-CO2)	71,413,378	73,760,415	73,652,044	82,835,880	86,824,124
TOTAL NET PRODUCTION (MWh)	82,976,188	86,815,336	91,496,978	96,805,270	100,014,611
COEFFICIENT EMISSION REDUCTION (t-CO2/MWh)	**0.8606**	**0.8496**	**0.8050**	**0.8557**	**0.8681**

TOTAL GHG REDUCTION in 2004, 2005, 2006	243,312,048	t-CO2
TOTAL NET PRODUCTION in 2004, 2005, 2006	288,316,859	MWh
OPERATING MARGIN	**0.844**	**tCO2/MWh**

Electricity import emission factor

Electricity import emission factor is determined to 0 (zero) tCO_2/MWh because currently the JAMALI grid is not inter-connected with other provincial grids within Indonesia with no intermediate plan to do so.

Build margin emission factor

The Build Margin Emission Factor has been calculated by Department of Energy and Mineral Resources of Indonesia - Directorate General of Electricity and Energy Utilization and endorsed by Indonesian DNA. The CO_2 emissions from these power plants are calculated using the same data presented in table 5, table 6, table 7 and table 8. The result can be found in table 10 below.

Table 11 BM calculation

Power Plant	fuel type	Generated Power	Fuel Consumption			unit	Effective CO2 emission factor	convert value	Emission Reduction	
		Actual Data	Actual data	calculation data						
		GWh net					(t- CO2/GJ)	(GJ/MMBTU)	t-CO2	
Owner		C	F	G= CxD/I	G= 1000x CxD/E		H	I	G=(ExF)xH/1000	G=ExGxH
PT Paiton Energi	Steam-Coal	9,116.0	4,437,332			ton	0.0961		10,243,842	
PT Java Power	Steam-Coal	9,109.0	4,273,017			ton	0.0961		9,864,511	
PT Magma Nusantara Listrindo	Geothermal	922.0		0						0
Chevron Texaco Energi Indonesia Ltd.	Geothermal	735.0		0						0
PT Geo Dipa Energi	Geothermal	319.0		0						0
PT Indonesia Power	GT-Oil	201.3		61,422		kltr	0.0741			164,255.5
PT Cikarang Listrindo Power	GT-Gas	403.0		4,070,300.0		MMBTU	0.0561	1.0551		240,919.5
PT Krakatau Daya Listrik	Steam-Coal	2.2			835.6	ton	0.0961		1,929.1	
Muara Tawar	GT-Oil	1,618.0		16,294,548.7		MMBTU	0.0561	1.0551		964,468.3
	GT-Oil									
PT Sumberenergi Sakti Prima	Steam-Coal	1,937.0			764,054.0	ton	0.0961		1,763,863.7	
Tanjung Jati B	Steam-Coal	3,869.0			1,526,135.8	ton	0.0961		3,523,174.3	
Cilegon	CCGT-Gas	742.0		6,666,284.2		MMBTU	0.0561	1.0551		394,574.9
TOTAL										27,161,539.0

TOTAL GHG REDUCTION in 2006	27,161,539	t-CO2
TOTAL NET PRODUCTION in 2006	28,973,555	MWh
BUILD MARGIN	**0.937**	**tCO2/MWh**

Combined margin emission factor

$$EF_{grid\ CM,y} = w_{OM} \cdot EF_{grid\ OM,y} + w_{BM} \cdot EF_{grid\ BM,y}$$

Item	Unit	EF
$EF_{OM,average,y}$	(tCO_2 e/MWh)	0.844
$EF_{BM,y}$	(tCO_2 e /MWh)	0.937
EF_y	(tCO_2 e /MWh)	**0.891**

The combined margin emission factor of the JAMALI grid for 2004-2006 is 0.891 tCO_2/yr

Baseline emission

$BE_y = (EG_y - EG_{baseline}) . EF_{grid,CM,y}$

Taken into account the load factor of 93% and 8760 operational hours/yr, the electricity supplied to the JAMALI grid by the additional power unit (Wayang Windu Phase 2):

$EG_{capacity\ addition}$ = *load factor .(installed capacity-auxiliary use) . operational hours*
=0.93 . (117 – 3.5) MW . 8760 hours/yr
= 924,661.8 MWh/yr

Taken into account the average of historical electricity delivered by the existing facility (Wayang Windu Phase 1) to the grid, spanning all data from the most recent available month (February 2009) to the time at which the facility was operated (June 2000):

$EG_{baseline}$ = $EG_{historical}$ = 912,476 MWh

$EG_y - EG_{baseline}$ = (912,476 + 924,661.8) - 912,476
= 924,661.8 MWh

BE_y = $(EG_y - EG_{baseline}) . EF_{grid,CM,y}$
= 924,661.8 MWh/yr . 0.891 tCO_2/MWh
= 823,873.66 tCO_2/yr

Leakage (L_y)

Since ACM0002 version 9 does not consider the emission due to power plant construction and fuel handlings, no leakage is considered (Ly=0).

Project Emission (PE_y)

$PE_y = PES_y + PEFF_y$

Where:
PE_y = Project emission in year y (tCO_2/yr)
PES_y = Project emission of CH_4 and CO_2 due to the release of non-condensable gases from the stream produced in geothermal power plant in year y (tCO_2/yr)
$PEFF_y$ = Project emission from combustion of fossil fuels related to the operation of the geothermal power plant in year y (tCO_2/yr)

Project emission of CO_2 and CH_4 due to the release of non-condensable gases from the steam produced in the geothermal power plant is calculated as:

$$PES_y = (\omega_{main,CO2} + \omega_{main,CH4} \cdot GWP_{CH4}) \cdot M_{S,y}$$

Where:

PES_y = Project emission of CH_4 and CO_2 due to the release of non-condensable gases from the stream produced in geothermal power plant in year y (tCO_2/yr)

$\omega_{main,CO2}$ = average mass fraction of CO_2 in the produced steam (non-dimensional)

$\omega_{main,CH4}$ = average mass fraction of CH_4 in the produced steam (non-dimensional)

GWP_{CH4} = global warming potential of CH_4 valid for the relevant commitment period (tCO_2/tCH_4)

$M_{S,y}$ = Quantity of steam produced during the year y (tonnes)

$$PES_y = (\omega_{main,CO2} + \omega_{main,CH4} \cdot GWP_{CH4}) \cdot M_{S,y}$$
$$= (4.1 \cdot 10^{-3} + 1.96 \cdot 10^{-6} \cdot 21) \cdot 7{,}007{,}299.2$$
$$= 29{,}018.35\ tCO_2/yr$$

Project emission from combustion of fossil fuel related to the operation of geothermal power plant is calculated as:

$$PEFF_y = PE_{FC,j,y}$$

Where:

$PEFF_y$ = project emissions from combustion of fossil fuels related to the operation of the geothermal power plant in year y (/yr)

$PE_{FC,j,y}$ = CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr). This parameter will be calculated by the "tool to calculate project or leakage CO_2 emissions from fossil fuel combustion version 02"

$$PE_{FC,j,y} = \sum FC_{diesel,j,y} \cdot COEF_{i,y}$$

Where:

$FC_{diesel,j,y}$ = quantity of diesel combusted in emergency genset and fire pump during the historical year of Wayang Windu 1 operation (ton)

$COEF_{i,y}$ = CO_2 emission coefficient of diesel fuel (tCO2/ton)

$COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of diesel fuel, as follows:

$$COEF_{i,y} = NCV_{diesel,y} \cdot EF_{CO2,diesel,y}$$

Where:

$NCV_{diesel,y}$ = weighted average net calorific value of diesel fuel (IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories) (GJ/ton)

$EF_{CO2,diesel,y}$ = weighted average CO_2 emission factor of diesel fuel historical (IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (tCO_2/GJ)

$COEF_{i,y}$ = 43.3 . 0.0204 . 44/12
= 3.24 (tCO_2/ton)

$PE_{FC,j,y}$ = 7.06 . 3. 24
= 22.87 (tCO_2/yr)

$PE_y = PES_y + PEFF_y$
= 29,018.35 + 22.87
= 29,041.22 (tCO_2/yr)

Emission Reduction (ER_y)

$ER_y = BE_y – PE_y – L_y$
= 823,873.66 – 29,041.22 – 0
= 794,832.46 tCO_2/yr
= 794,832 tCO_2/yr

B.6.4 Summary of the ex-ante estimation of emission reductions:

Renewable crediting period (7 years x 3) is adopted by the Project. It is expected that the project activities will generate emission reductions of about 794,832 tCO_2e per year over the first 7-year crediting period.

year	Estimate of project activity emission (t CO_2)	Estimate of baseline emission (t CO_2)	Estimate of leakage (t CO_2)	Estimate of overall emission reduction (t CO_2)
1	29,041	823,874	0	794,832
2	29,041	823,874	0	794,832
3	29,041	823,874	0	794,832
4	29,041	823,874	0	794,832
5	29,041	823,874	0	794,832
6	29,041	823,874	0	794,832
7	29,041	823,874	0	794,832
Total (tCO_2)				5,563,824

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Wayang Windu Unit 1 delivers electricity through its 110 MW steam turbine and peripheral equipment driven by the steam produced by the existing production wells allocated for Wayang Windu Unit 1.

The project activity, Wayang Windu Unit 2 - an additional generation capacity, delivers electricity through its 117 MW steam turbine and peripheral equipment driven by the steam produced by the 7 production wells allocated for Wayang Windu Unit 2.

The steam pipeline from Wayang Windu Unit 1 and Unit 2 are interconnected, allowing steam to flow from production wells of Wayang Windu Unit 1 to steam turbine of Wayang Windu Unit 2, and vice versa.

In regards to this, monitoring of the steam parameters for the project activity will be conducted in the conservative matter.

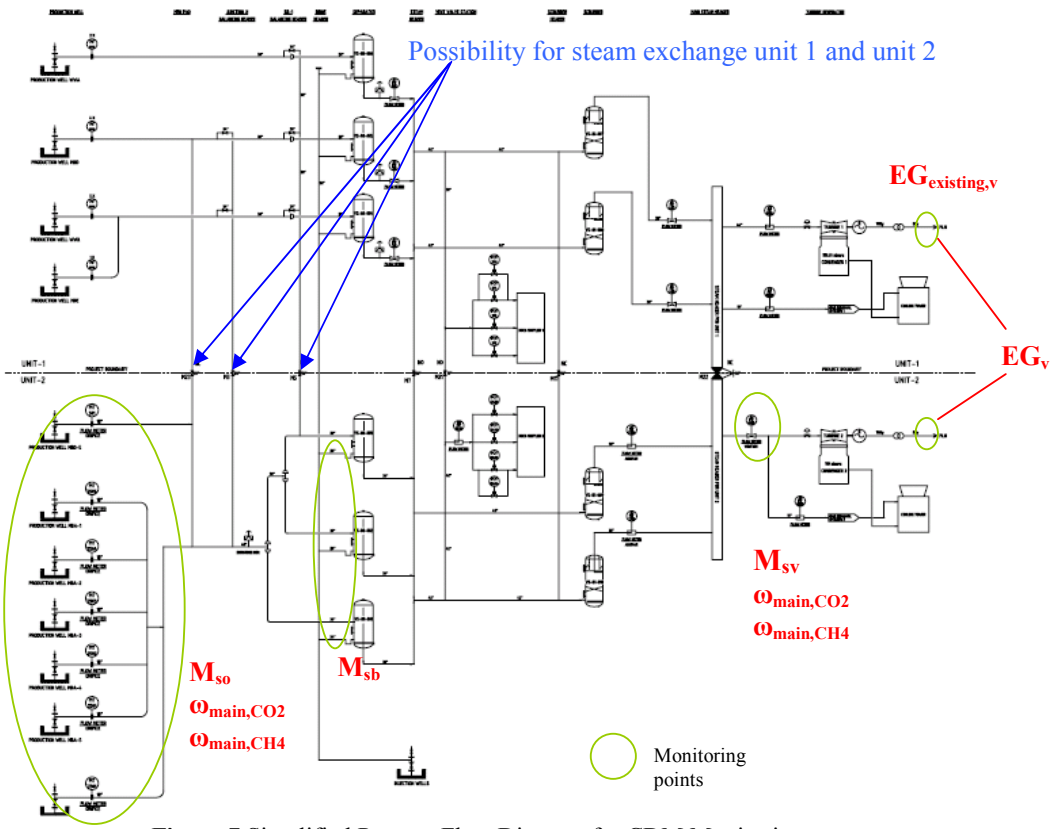


Figure 7 Simplified Process Flow Diagram for CDM Monitoring

Data / Parameter:	$M_{S,y}$
Data unit:	Tonnes
Description:	Quantity of steam produced during the year y
Source of data to be used:	Measurement at project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7,007,299.2
Measurement procedures:	The quantity of steam produced is recorded daily by means of a Venturi flow meter ($M_{sv,y}$) located at the upstream of the Wayang Windu Unit 2 turbine and which is adjusted for losses of brine at the steam separator ($M_{sb,y}$) as well as Orifice Plates ($M_{so,i,y}$) located at the Wayang Windu Unit 2 well heads. In order to be conservative, the primary data will be taken from the higher values from either from the upstream metering points or the downstream metering. In case steam is transferred from unit 1 steam fields for power generation at unit 2 the upstream figure will higher. In case steam from the new steamfields at unit 2 will be transferred to the power generator of unit 1 the downfield figure will be higher. Using the higher one of the two values ensures that project emissions which are attributable to the capacity addition by unit 2 are clearly identified and accounted. Thus, the quantity of steam ($M_{S,y}$) is given by: $M_{S,y} = \max((M_{sv,y} + M_{sb,y}), \sum_i M_{so,y})$
Monitoring frequency:	Data is monitored continuously (polling of at least every second) and condensed to half hour values. Daily figures will be built according to the methodology by accumulation of data.
QA/QC procedures to be applied:	Calibration: following the technical specification/requirement of the manufacturer but a least every three years
Any comment:	DCS records the data continuously at the resolution of 2 milliseconds.

Data / Parameter:	$\omega_{main,CO2}$
Data unit:	tCO_2/t steam
Description:	Average mass fraction of CO_2 in the produced steam
Source of data to be used:	Field sampling & measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$4.1 \cdot 10^{-3}$

Description of measurement methods and procedures to be applied:	Non-condensable gases sampling will be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H_2S) and carbon dioxide (CO_2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane. The non-condensable gases sampling and analysis should be performed at least every three months and more frequently, if necessary. The primary data will be taken from either the analysis from the gas sampling carried out in the production wells or at the steam field-power plant interface depending on the values used for the $M_{S,y}$ (Quantity of steam produced during the year y)
Monitoring frequency:	Samples will be taken every three months at the monitoring points of $M_{so,i,y}$ *and* $M_{sv,y}$
QA/QC procedures to be applied:	Following ASTM Standard Practice E1675
Any comment:	Sampling of gases in brine is not required as this path of gas flow is negligible.

Data / Parameter:	$\omega_{main,CH4}$
Data unit:	tCH_4/t steam
Description:	Average mass fraction of CH_4 in the produced steam
Source of data to be used:	Field sampling & measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$1.96 \cdot 10^{-6}$
Description of measurement methods and procedures to be applied:	Non-condensable gases sampling will be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H_2S) and carbon dioxide (CO_2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane. The non-condensable gases sampling and analysis should be performed at least every three months and more frequently, if necessary.

	The primary data will be taken from either the analysis from the gas sampling carried out in the production wells or at the steam field-power plant interface depending on the values used for the $M_{S,y}$ (Quantity of steam produced during the year y)
Monitoring frequency:	Samples will be taken every three months at the monitoring points of $M_{so,i,y}$ *and* $M_{sv,y}$
QA/QC procedures to be applied:	Following ASTM Standard Practice E1675
Any comment:	Sampling of gases in brine is not required as this path of gas flow is negligible.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Electricity supplied to the grid (sum of the electricity supplied by the existing power generation unit and the additional capacity generation)
Source of data to be used:	Measurement result at the metering system
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,837,138
Description of measurement methods and procedures to be applied:	Two redundant meters of accurancy as required according to national regulations for electricity sales (recently 0.2 class). ”Meter Utama” transaction kWh meter (main meter) ”Meter Pembanding” transaction kWh meter (check meter)
Monitoring frequency:	Data is monitored continuously within the DCS. The data from the “Meter Utama” and the “Meter Pembanding” are downloaded monthly and backed up regularly at the server. The data from the “Meter Pembanding” is collected weekly.
QA/QC procedures to be applied:	Calibration: following the technical specification/requirement of the meter and the grid operator (at least every three years). It will be double checked with the receipt of electricity sale.
Any comment:	-

Data / Parameter:	$EG_{existing,y}$
Data unit:	MWh
Description:	Electricity supplied by the existing power generation unit to the grid
Source of data to be used:	Measurement result at the metering system
Value of data applied for the purpose of calculating expected emission reductions in section B.5	912,476
Description of	Two redundant meters of accurancy as required according to national

measurement methods and procedures to be applied:	regulations for electricity sales (recently 0.2 class). "Meter Utama" transaction kWh meter (main meter) "Meter Pembanding" transaction kWh meter (check meter)
Monitoring frequency:	Data is monitored continuously within the DCS. The data from the "Meter Utama" and the "Meter Pembanding" are downloaded monthly and backed up regularly at the server. The data from the "Meter Pembanding" is collected weekly.
QA/QC procedures to be applied:	Calibration: following the technical specification/requirement of the meter and the grid operator (at least every three years). It will be double checked with the receipt of electricity sale.
Any comment:	-

Data / Parameter:	$PE_{,FC,i,y}$
Data unit:	tCO_2/yr
Description:	CO_2 emission from fossil fuel combustion in operation of power plant (emergency genset and diesel pump) in year y. This parameter is calculated as per the " tool to calculate project or leakage CO_2 emission from fossil fuel combustion version 02".
Source of data to be used:	As per the "tool to calculate project or leakage CO_2 emission from fossil fuel combustion version 02".
Value of data applied for the purpose of calculating expected emission reductions in section B.5	22.85
Description of measurement methods and procedures to be applied:	As per the "tool to calculate project or leakage CO_2 emission from fossil fuel combustion version 02".
Monitoring frequency:	Calculated
QA/QC procedures to be applied:	As per the "tool to calculate project or leakage CO_2 emission from fossil fuel combustion version 02".
Any comment:	As per the "tool to calculate project or leakage CO_2 emission from fossil fuel combustion version 02".

Data / Parameter:	$FC_{i,j,y}$
Data unit:	Ton/year or m^3/year
Description:	Quantity of diesel fuel combusted in power plant operation during the year y
Source of data to be used:	Onsite measurement & record of diesel fuel consumption for emergency genset and fire pump
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7.06 ton/yr
Description of	Flow meter will be used-, conversion to mass by using national standards for

measurement methods and procedures to be applied:	fuel density
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	The consistency of metered diesel fuel consumption quantities will be cross-checked by an annual energy balance that is based on engine specification fuel consumption and the working hour
Any comment:	-

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ per mass or volume unit (GJ/ton, GJ/m^3)
Description:	Weighted average net calorific value of diesel fuel in year y
Source of data to be used:	Regional or national average default values
Value of data applied for the purpose of calculating expected emission reductions in section B.5	43.3 GJ/ton (IPCC)
Measurement procedures:	n/a
Monitoring frequency:	Reviews on changes of standards will be done during preparation of monitoring reports.
QA/QC procedures to be applied:	It will be checked if the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines.
Any comment:	

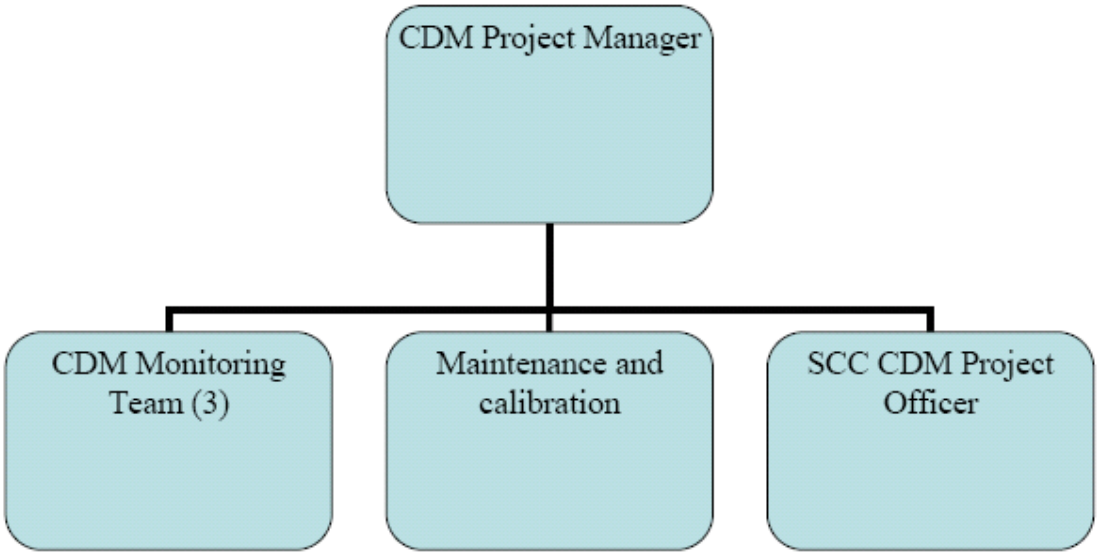
Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	Weighted average CO_2 emission factor of diesel fuel in year y
Source of data to be used:	Values provided by national average default values, or IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in the IPCC Guidelines
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0748
Measurement procedures:	n/a
Monitoring frequency:	Reviews on changes of standards will be done during preparation of monitoring reports.
QA/QC procedures to be applied:	It will be checked if national values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines.
Any comment:	

B.7.2. Description of the monitoring plan:

Purpose: To ensure that the approved monitoring methodology is correctly implemented in order to enable the accurate and transparent determination of avoided emissions.

Scope: This procedure covers the project activity described in the CDM project entitled Wayang Windu Phase 2 Geothermal Power Project.

Responsibility: The CDM Project Manager is responsible for overseeing the implementation of this procedure. Competency requirements for the position of Project Manager will be defined and applied to ensure that the Project Manager is able to implement this procedure. Additional competencies e.g. for the maintenance and calibration of the meters and online reporting system will be sourced externally where necessary. The organizational structure will be as follows:



Calculation of emissions reduction:
The data required to calculate baseline emissions and project emissions will be fed into a protected spreadsheet which will calculate the emission reductions according to the formulae described above, using the defined default values. Access to the spreadsheet will be controlled. The spreadsheet will be regularly audited to ensure it is operating correctly.

Quality control
Data will be compared from month to month using trend analysis to show where parameters have deviated significantly from preceding or following values. Any values identified as being unusual in this manner will be rechecked. Where preceding or following values are not available, references values may be taken from published data as appropriate such as 2006 IPCC guideline.

Accuracy and calibration of instruments
All meters will be purchased and maintained to ensure a high level of accuracy. The exact specifications of each meter will be determined during the detailed design of the project. Thereafter the meter accuracies will be included in this procedure and steps taken to maintain those levels of accuracy.

All key meters will be subject to a quality control regime that will include regular maintenance and calibration. A record will be maintained showing the location and unique identification number of each meter, the calibration status of that meter (when last calibrated, when next due for calibration) and who performs the calibration service. Calibration certificates will be retained for all meters until two years after the end of the crediting period.

Archiving of data
The monitoring team will periodically archive data to a secure and retrievable storage format on a periodic e.g. weekly basis. Calibration records may be archived by scanning and storage in an accessible electronic format. These data will be stored until 2 years after the end of the crediting period.

Document Control
The Project Manager will implement a document control system that ensures that the current versions of necessary documents are available at the point of use. All documents must be maintained in English with local translations because English is the formal language of the CDM.

Preparation of monitoring report
The archived / live data will be used to prepare a periodic monitoring report to be submitted to the CDM EB for verification and issuance of CERs. A standard format for the monitoring report will be prepared and prior to the submission of the first monitoring report. An internal technical review process will be conducted and documented before such a report will be submitted for verification.

Manual data recording system
The CDM Project Manager will implement a manual data recording system to act as a back-up for the online system. This will involve completion of a daily log sheet that records meter readings at the start of the day (which is also the end of the previous day). Spot readings of other values (temperature and pressure) will also be recorded periodically and at the times when meter readings are taken. At least one set of manual readings will be taken directly from the meters each day, and used to check the read-outs in the control room.
These log sheets will act as a back-up for total volume combusted and a means of estimating other essential data in the event of a prolonged failure of the on-line system (prolonged failure will constitute more than 24 hours (uninterrupted) without on-line monitoring).

Treatment of missing or corrupted data
Where data in the on-line system are corrupted or missing whilst the plant is operating, the missing data can be estimated by taking the lower of the average value for the parameter in question in the hour before the error arose or the hour immediately after the system came on-line again. If there is evidence to suggest that both of these values are un-representative, the average from the previous 24 hours will be used.

The error will be recorded in the daily log sheet and the occurrence of the error will be investigated and rectified as soon as possible. If the on-line system is compromised for more than 24 hours, data will be manually recorded.

Audit function and management review
The Project Manager will arrange for an audit of the management system periodically and at least once per year. The auditor will not be involved in the daily operation of the mine and if necessary, may be sourced from a third party. The auditor will assess the implementation of the monitoring procedure and the preparation of the monitoring report. Audit findings, and steps taken to address findings will be recorded and reviewed in a Management Review meeting (convened at least annually) at which time the effectiveness of these procedures will be reviewed and necessary changes implemented.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

>>
Baseline study is reported by the Department of Energy and Mineral Resources of Indonesia - Directorate General of Electricity and Energy Utilization on 13 February 2009 to the Indonesian DNA/Environmental Ministry, which were endorsed by Indonesia DNA/Environmental Ministry on 19 January 2009.

The calculation is based on the "Tool to calculate the emission factor for an electricity system" (Version 01.1)

Responsible persons have been Mr. Werner Betzenbichler, Senior Climate Change Officer, Sindicatum Carbon Capital: Werner.Betzenbichler@carbon-capital.com and Ms. Melanie Tantri, CDM Project Officer, Sindicatum Carbon Capital: Melanie.Tantri@carbon-capital.com

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>> 30 January 2007 (based on the date of the Engineer, Procure and Construct Agreement for the Steamfield Above Ground System and Power Plant Project)

C.1.2. Expected operational lifetime of the project activity:

>> 30 years

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

>>3th December 2010 or the date of registration whichever is latest.

C.2.1.2. Length of the first crediting period:

>> 7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>> NA

C.2.2.2. Length:

>>NA

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

The project owner has implemented an Environmental Impact Study, which consists of ANDAL (Environmental Impact Analysis), RKL (Environmental Management Plan), and RPL (Environmental Monitoring Plan) in March 2006 to ensure that the project activity complied with the environmental regulations, e.g. Indonesian Law No. 4 of 1982, Government Regulation no 51 of 1993, Decree of Environmental Minister No. 17 of 2001.

The complete copy of the Environmental Impact Study will be available to DOE upon request. The impact evaluation includes various phases of pre-construction, construction, operational, and post-operational phases. Pre-construction phase is mainly the land clearing activities while construction phases consist of the mobilization and construction of the power plant, equipment, work forces, and material mobilization. Operational phase consists of utilization of personnel mobilization and operation, power plant operation, and power plant maintenance. Post operational phase consists of dismantling, regeneration, and personnel demobilization.

The environmental key parameters are summarized as the following:

Higher Frequency of Traffic & Infrastructure Damage

During construction and operation, higher frequency of traffic was due to mobilization of equipment that may cause local traffic. Infrastructure damage might be done due to the traffic of heavy duty vehicles and its loads. In order to manage such issue, it will be needed to limit the size, amount, and frequency of vehicles passing as well as provide an alternate route.

Air Quality

During the construction phase, the air quality decreases due to pollutants. The parameters that are increased are as following:

- Particulates 0.03%
- SO2 7.25%
- NOx 10.13%
- CO 3.03%

Despite the decline of air quality that is inevitable, the impact from the abovementioned aspect is considered minor, based on the Government Regulation no 41 /1999. During the operational phase, gases from the cooling tower could reduce the air quality. Hence, the gases will be channeled back to the cooling tower.

Workers at the project site will be wearing masks to reduce the health impact.

Noise Intensity
During the construction phase, the noise quality of the area is reduced from 59dBA to 65-75 dBA due to the higher frequency of traffic. To manage this, a few programs will be put in place during the mobilization period, i.e. vehicle maintenance, speed limit, and truck scheduling.
During the operational phase, the noise will come from the steam vent valve, turbine, generator, cooling tower and transformer. Noise reduction measures will be placed surrounding the location and trees will be planted to reduce the noise.

Job Opportunities
The project activity will increase the job opportunities at the local area. The job opportunities during the drilling of the new wells and the construction of the power plant include the new business for accommodation for the foreign workers and catering for the staff.

Water Quality
During the construction period, it is estimated that 250 personnel will be employed. A good sanitation system will be required to manage the domestic waste water disposal to avoid the degradation of the quality of the surface water as well as to reduce the risks towards the community health. Trees will be planted at the open area to minimize the impact of the surface water quality. During the operational period, the salt water from the separator, condensate, and water separated from the mud will be put back into the injection well. In the case of the failure of the injection system, the liquid will be kept at the temporary reservoir. If the capacity is exceeding the reservoir, the power plant operation will be stopped.

In summary, no adverse environmental impacts occurred during construction and operational phase of the project activity. All related environmental impacts by implementing a robust environmental management and monitoring plan. The project activity is included as one of the clean renewable energy projects that can reduce the dependency on fossil fuel. The project activity would have long term environmental benefit for local villagers and the surroundings.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
There are no significant environmental impacts of the project

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>
According to the requirements for local stakeholders' involvement in the CDM Project, a stakeholder meeting was conducted on December 5th, 2008, at Arion Swiss - Belhotel, starting at 10am. The stakeholders participated in the event include local residents, local village representatives, interested non-governmental organizations, PT Pertamina Geothermal Energy, PT Perusahaan Listrik Negara. In addition, a public notice of the meeting was posted in the local newspaper.

The meeting started with an introduction to the project by project owner, followed by questions and comments from participants and ended at 3.30 pm.

E.2. Summary of the comments received:

>>

Presented below are the brief comments raised by the stakeholders regarding the project activity:

I. Ms. Bintari, Environmental Consultant from Bandung

Q. How sustainable are the activities that you are doing for the reforestation and the sustainability of the environment?

A. The activities for the sustainable environment are still going on. The fund available is even increasing year by year, although the electricity capacity is fixed yearly.

II. Mr. Deni Muhammad Abdullah, Presidium OKP Pengalengan

Q. 1. Do you have the estimation on the amount of emission that will be reduced from this project?
2. Once the CER is obtained by MNL, where will this fund be channeled to?

A. 1. Yes. The current estimation is about 700,000 CER. However, the actual emission reduction could be different from the current estimation. The actual emission reduction will be measured during the monitoring period of the project activity.
2. This project was not attractive financially. CER revenue helps to make this project becoming attractive. Hence the CER obtained will be used as one of the revenue sources to payback the project loan and to make sure the sustainability of the project.

III. Mr Ubadudin, Rekanan Lokal Pengalengan.

Q. Why a lot of the goods purchasing are ordered from outside the area? MNL is supposed to be committed to help in the sustainability of the local businesses.

A. Purchasing is done based on the tender regulation set by the Indonesian government. Hence the process is fair and just. The goods will be bought from the most suitable supplier best on the tender terms.

IV. Mr Oskar, NGO Gempita

Q. How safe is this project and are there any safety guarantee for the locals surrounding the area of the projects? Why since the starting of this project, there are some geographical changes, i.e. land cracks at Cibolang.

A. In general, geothermal projects are very safe. There are a few geothermal projects that have been running for years in Indonesia, and many around the world that have been running safely for years. MNL also applies the highest safety standard in our operation, in accordance to local and international applicable safety standards and regulations.

V. Mr Gunyan Maksus, Village Head Association, around Pangalengan, West Java

Q. What are the benefits that the CDM will bring to the low income community, the community that is affected by the project, and the community that support the project?

A. The benefits for the communities mentioned will be felt through the CSR program implemented by MNL.

VI. Mr. Muhammad Ihsan, member of DPRD Komisi C Bandung

Q. Where are you currently at the CDM process?

A. We are currently preparing the PDD. Stakeholder consultation is part of the requirement of the PDD.

VII. Mr. Rega Usmana, Pangalengan Outdoor Community

Q. 1. How do you invite the stakeholders that attend the meeting today?
2. The funds received by the Community Development are different from funds given to the Community Development. MNL should watch more on this issue.

A. 1. Some of the stakeholders were invited through invitation letter. This includes the local representatives, head of villages, local government bodies, and PLN. We have also invited the public through the Pikiran Rakyat, local newspaper.
2. Our accounting is audited regularly internally and by the third party. Hence there shall not be any funds missing in the system.

VIII. Mr. Isman Kosmantara, Gapura Community (Local Fellows Community)

Q. Going forward, will there be any job opportunities for the local fellows?

A. Yes. There will be job opportunities for the local community.

E.3. Report on how due account was taken of any comments received:

>>

The comments received were either questions concerning the project activity and/or general statements in support of the project activity. None of the comments required any specific actions from the project developer. The participants at the meeting were satisfied with the responses received and showed their support for the project. Minutes of the meeting are available to the DOE in Bahasa Indonesia, along with a list of attendees.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Star Energy Geothermal (Wayang Windu) Limited
Street/P.O.Box:	Jl. Let. Jend. S. Parman Kav 62-63, 8th - 11th floor
Building:	Wisma Barito Pacific, Star Energy Tower
City:	Jakarta
State/Region:	DKI - Jakarta
Postcode/ZIP:	12710
Country:	Indonesia
Telephone:	+62 21 532 5828
FAX:	+62 21 5366 0558
E-Mail:	hendra.tan@starenergy.co.id
URL:	www.starenergy.co.id
Represented by:	Hendra Tan
Title:	Director – Treasury & Financial Planning
Salutation:	Mr.
Last name:	Tan
Middle name:	
First name:	Hendra
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Street/P.O.Box:	

Organization:	Sindicatum Carbon Capital Limited
Street/P.O.Box:	Duke Street
Building:	33
City:	London
State/Region:	
Postfix/ZIP:	W1U 1JY
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FAX:	+44 20 3008 4752
E-Mail:	ccregistration@carbon-capital.com
URL:	
Represented by:	Gareth Phillips
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Salutation:	Mr
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Middle Name:	
First Name:	Gareth
Department:	
Mobile:	

Direct FAX:	
Direct tel:	
Personal E-Mail:	ccsecretariat@carbon-capital.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the Wayang Windu Phase 2 Geothermal Power Project.
The project financing portion comes from Standard Chartered Bank Singapore and the equity portion comes from the project owner's shareholders. Therefore the project activity is not using any public fund.

Funding of the project will be disclosed to the DOE during validation.

Annex 3

BASELINE INFORMATION

Based on data reported by the Department of Energy and Mineral Resources of Indonesia - Directorate General of Electricity and Energy Utilization on 13 February 2009 and 24 December 2008 to the Indonesian DNA/Environmental Ministry, which were endorsed by Indonesia DNA on 19 January 2009

DEPARTEMEN ENERGI DAN SUMBER DAYA MINERAL REPUBLIK INDONESIA
DIREKTORAT JENDERAL LISTRIK DAN PEMANFAATAN ENERGI
Jl. H.R. Rasuna Said Blok X 2, Kav. 07 dan 08 Kuningan Jakarta 12950

Tromol Pos 3043/Jkt 10002 Telepon : (021) - 5225180 (5 saluran) Faks : 5256044-5256066 Web: www.djlpe.esdm.go.id

Nomor : 494 /21 /650.1/2009 13 Februari 2009
Lampiran : -
Hal : Baseline Faktor Emisi Sistem Ketenagalistrikan Sumatera dan Updating Baseline Faktor Emisi Sistem Ketenagalistrikan JAMALI

Yang terhormat
Ketua Komisi Nasional Mekanisme Pembangunan Bersih
Kantor Kementerian Negara Lingkungan Hidup
Jl. DI Panjaitan, Kav. 24, Kebon Nanas
Jakarta Timur 13410 ☎ 8590 4923 (FAX, TEL)

Menindaklanjuti surat Dirjen Listrik dan Pemanfaatan Energi No. 3783/21/600.5/2008 tanggal 24 Desember 2008 perihal tersebut di atas dan adanya beberapa pertanyaan yang kami terima dari pengembang proyek CDM perihal cara penghitungan faktor emisi tersebut, dengan ini kami sampaikan tambahan penjelasan sebagai berikut:

1. Angka baseline faktor emisi Sistem Ketenagalistrikan Sumatera dan Jawa-Madura-Bali (JAMALI) tahun 2008 yang disampaikan melalui surat Dirjen Listrik dan Pemanfaatan Energi tersebut dihitung dengan menggunakan *tool to calculate the emission factor for an electricity system version* 01.1 yang dikeluarkan oleh *Executive Board* CDM pada tanggal 19 Oktober 2007.
2. *Baseline* faktor emisi Sistem Ketenagalistrikan Sumatera pada tahun 2008 sebesar 0,743 tCo_2e/MWh dihitung berdasarkan data tahun 2005 sampai dengan tahun 2007.
3. *Baseline* faktor emisi Sistem Ketenagalistrikan JAMALI yang besarnya 0,754 tCO2/MWh pada tahun 2006, di-*update* menjadi 0,891 tCO_2e/MWh pada tahun 2007. *Updating* tersebut dihitung dengan menggunakan data tahun 2004 sampai dengan tahun 2006.

Atas perhatiannya, kami ucapkan terima kasih.

Direktur Energi Baru Terbarukan dan Konservasi Energi

Ratna Ariati
NIP. 100002746

Tembusan:
Dirjen Listrik dan Pemanfaatan Energi

Translation of the previous page:

Department of Energy and Mineral Resources of Indonesia

Directorate General of Electricity and Energy Utilization

Jl. H.R. Rasuna Said Blok X 2, Kav. 07 and 08 Kuningan Jakarta 12950

Tromol Pos 3043/Jkt 10002 Phone: (021)-5225180 (hunting) Fax:5256044-5256066 Web:www.djlpe.esdm.go.id

No : 494/21/650.1/2009 13 February 2009
Attachment : -
Subject : Baseline Emission Factor for Sumatra Grid and Updating Baseline Emission Factor of JAMALI Grid

Attention to
Head of CDM Designated National Authority
Office of Environmental Ministry
Jl. DI Panjaitan, Kav 24, Kebon Nanas
East Jakarta 13410
Fax/Tel: 85904923

In continuation to the letter from Directorate General of Electricity and Energy Utilization No. 3783/21/600.5/2008 dated 24 December 2008 regarding the mentioned subject and questions that we have received from CDM project developers about the calculation of the emission factor, our further explanation is as following:

1. Baseline emission factor for Sumatra Grid and Java-Madura-Bali (JAMALI) grid in 2008 which was reported by Directorate General of Electricity and Energy was calculated based on *tool to calculate the emission factor for an electricity system version 01.1* which was issued by *CDM Executive Board* on 19 October 2007.
2. Baseline emission factor for Sumatra Grid in 2008 is 0.743 tCO_2e/MWh based on data in year 2005 until 2007.
3. Baseline emission factor of JAMALI grid was 0.754 tCO_2e/MWh in 2006, and has been updated to 0.891 tCO_2e/MWh in 2007. The updated figure was calculated using the 2004 to 2006 data.

Thank you for your kind attention.

Director of Renewable Energy and Energy Conservation

Ratna Ariati
NIP. 100002746

CC:
Directorate General Electricity and Energy Utilization

20-FEB-2009 13:46 FROM UP LKL TO 2515218 P.01/21

U.P. Yth. Ibu MELANIE SYNDICATUM.

KEMENTERIAN NEGARA LINGKUNGAN HIDUP
REPUBLIK INDONESIA

Jl. D.I. Panjaitan, Kebon Nanas
JAKARTA 13410
Kotak Pos/PO Box 7777 JAT 13000

Telepon : 021-8580067-69, 8517148
Faksimil : 021-8518135, 8517147
Website : Http://www.menlh.go.id

Jakarta, 19 Januari 2009

Nomor : B-277/Dep.III/LH/01/2009
Lamp. : -
Perihal : Informasi terbaru baseline faktor emisi untuk proyek CDM pada sistem ketenagalistrikan Sumatera dan J JAMALI

Kepada Yth. :
(Daftar tujuan surat terlampir)
di
Tempat

Menindaklanjuti surat dari Direktur Jenderal Listrik dan Pemanfaatan Energi, Departemen Energi dan Sumber Daya Mineral (No: 37833/21/600.5/2008) tanggal 24 Desember 2008 perihal Baseline Faktor Emisi Sistem ketenagalistrikan Sumatera dan Updating baseline Faktor Emisi Sistem ketenagalistrikan JAMALI, maka bersama ini disampaikan bahwa informasi terbaru untuk baseline faktor emisi pada sistem ketenagalistrikan Sumatera dan JAMALI adalah sebagai berikut:

a. Sistem ketenagalistrikan Sumatera : 0,743 tCO_2 eq/MWH;
b. Sistem ketenagalistrikan JAMALI : 0,891 tCO_2 eq/MWH

Sehubungan dengan hal tersebut di atas, maka secara resmi informasi tersebut dapat digunakan oleh para pemangku kepentingan dalam mengembangkan proyek CDM di Indonesia.

Demikian kami sampaikan atas perhatiannya diucapkan terima kasih.

Deputi MENLH Bidang Peningkatan Kapasitas Pengelolaan LH dan Pengendalian
Sekretaris Harian / Ketua KN-MPB,

Dra. Masnellyarti Hilman, MSc.

Tembusan Yth.:
- Menteri Negara LH (sebagai laporan)

TOTAL P.21

Translation of the previous page:

ENVIRONMENTAL MINISTRY OF INDONESIA

Jl. D.I. Panjaitan, Kebon Nanas
JAKARTA 13410
PO Box 7777 JAT 13000

Tel: 021-8580067-69, 8517148
Fax: 021-8518135, 8517147
Website: http://www.menlh.go.id

No : B-277/Dep.III/LJ/02/2009 Jakarta, 19 January 2009
Attachment : -
Subject : Latest information of baseline emission factor for CDM projects at Sumatra and JAMALI grid

Attention to
( )

In continuation to the letter from Directorate General of Electricity and Energy Utilization, Department of Energy and Mineral Resources (No. 37833/21/600.5/2008) dated 24 December 2008 regarding Baseline Emission Factor for Sumatra Grid and the updated figure for the Baseline Emission Factor for JAMALI Grid, hence we convey that the latest information for baseline emission factor for Sumatra grid and JAMALI grid are as following:

a. Sumatra Grid : 0.743 tCO_2eq/MWh
b. JAMALI Grid : 0.891 tCO_2eq/MWh

This information can be used as the official data for the stakeholders in developing the CDM projects in Indonesia.

Thank you for your kind attention.

Deputy Minister of Environment for Resource Conservation and Environmental Impact Management / the Head of Indonesian DNA

Dra. Masnellyarti Hilman, MSc.

CC:
Minister of Environment (as a report)

Annex 4

MONITORING INFORMATION

- - - - -