CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

A. General description of project activity

B. Application of a baseline methodology

C. Duration of the project activity / Crediting period

D. Application of a monitoring methodology and plan

E. Estimation of GHG emissions by sources

F. Environmental impacts

G. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

Darajat Unit III Geothermal Project.

Document version number 5.

23 July 2010.

A.2. Description of the project activity:

Purpose of Project Activity:
The purpose of this project is to increase the share of renewable energy resources utilization in Indonesia by installing additional capacity of geothermal power generation. Chevron Geothermal Indonesia, Ltd (CGI – filling the roles formerly undertaken by ChevronTexaco Energy Indonesia Limited which itself filled the roles formerly undertaken by Amoseas Indonesia Inc. and Texaco Darajat Ltd.), under a Joint Operating Contract (JOC) with PT. Pertamina (Persero) [the Indonesian state-owned oil and gas company] and an Energy Sales Contract (ESC) with PT. PLN (Persero) [PLN – the state owned electricity grid operator, retailer and majority generator (through 100% ownership of the two major generating companies in Indonesia)], is planning to expand operations at Darajat, in West Java, by installing Unit III, a 121MW geothermal power plant. The project is expected to provide electrical energy to meet growing national and regional demand and is consistent with the Indonesian Government's energy diversification and sustainable development goals. The electricity produced from this power plant will be supplied to the Java-Madura-Bali (JAMALI) interconnected grid system. Darajat Unit III will reduce emissions of greenhouse gases by avoiding fossil fuel-based electricity generation by other generators on the grid.

Currently, CGI is involved with two geothermal power plants in operation at Darajat:

- Unit I (55 MW - built, owned and operated since 1994 by Indonesia Power, a wholly owned company of PLN, the state electricity company; the steam is supplied by CGI);
- and Unit II (90[1] MW – built and operated since 2000 by CGI).

In Darajat Unit III, steam produced from the field will be used to generate electricity, which will then be sold to PLN (as is the case for Unit II). The electricity feeds into the JAMALI grid and is distributed through PLN's transmission system. Agreement to supply electricity to the JAMALI grid, through partnership with PLN and Pertamina, is critical for developing the Darajat geothermal field.

The Darajat Unit III Project will meet the following objectives:

- Contribute to the supply of electricity to the JAMALI interconnected grid system to meet the critical shortage of energy;
- Avoid greenhouse gas emissions that would otherwise occur from the electricity generation by predominantly fossil fuel based sources;
- Assist in achieving the Indonesian government's energy diversification goal of minimizing oil consumption by maintaining the use of renewable resources; and
- Contribute to sustainable development in the West Java region of Indonesia.

The Ministry of the Environment, serving as Indonesia's National CDM Focal Point, has formulated four sustainable development criteria which are the minimum which must be fulfilled by CDM projects being hosted in Indonesia. These national criteria are posted at:

[1] The turbine nameplate rating of Unit II is 81.3MW. It is currently operated above this due to favourable power factor conditions on the Jamali grid. The nameplate rating of Unit I is 55 MW.

http://dna-cdm.menlh.go.id/en/susdev/

A summary of the four national criteria is given below:

1) Environmental Sustainability	The scope of evaluation is the area directly impacted by the project. Criteria: Sustainable environment i.e. implementing the conservation or diversification of natural resource utilization; Safety and Health of the local community
2) Economic Sustainability	The scope of evaluation is within the administrative border of the regency. If the impacts are cross boundary, the scope of evaluation includes all impacted regencies. Criteria: local community welfare.
3) Social Sustainability	The scope of evaluation is within the administrative border of the regency. If the impacts are cross boundary, the scope of evaluation includes all impacted regencies. Criteria: community participation; the project does not reduce the social integrity of the community.
4) Technological Sustainability	The scope of evaluation is the national border. Criteria: Technology transfer.

The Ministry of Energy and Mineral Resources has elaborated on the national sustainable development criteria by outlining seven specific criteria for energy-related projects which are complementary to, and aligned with the four national criteria. The work to develop these seven criteria was carried out by the Ministry's Research and Development Center for Energy and Electricity Technology (Pusat Penelitian dan Pengembangan Teknologi Energi dan Ketenagalistrikan) which has defined the sector's sustainable development criteria for energy related CDM projects (Ministerial Decree No. 953.K/50/2003).

1. To promote implementation of programs on energy diversification or conservation
2. To promote development of clean energy and/or technology on clean energy
3. To enhance protection of environmental functions
4. To promote growth of local economies
5. To increase employment opportunities
6. To promote transfer of technology, and
7. To implement community development.

By reference to these seven criteria, the proposed Darajat Unit III Project fulfils both the energy-related and the national sustainable development criteria, as follows:

- Compliance to Criterion 1: Implementing Darajat Unit III will assist in achieving the Indonesian government's energy diversification goal of minimizing oil consumption by increasing the use of renewable resources. Further detail on the Government of Indonesia's energy strategy is provided in Section B. Currently, the share of geothermal capacity on the JAMALI grid is exceptionally small (only about 4%). Implementing the Darajat Unit III Project will assist in maintaining the overall percentage of renewable electricity generation that feeds the JAMALI grid and serves the region. Furthermore, the project will adhere to all federal, regional and local rules and regulations. CGI and the Darajat Unit III Project will be held to the highest environmental standards by both internal and external experts to minimize potential impacts from the project.
- Compliance to Criterion 2: Geothermal energy is a renewable resource that can be sustained for decades. The exploitation of geothermal energy as opposed to fossil fuel consumption can substantially decrease GHG and air pollutant emissions.
- Compliance to Criterion 3: Compared to other types of power plants, geothermal plants have relatively little effect on the environment. Only a very small area (less than 4 hectares) of the 5,000 hectare geothermal resources concession will be directly impacted by the construction and

operation of the Unit III Project; geothermal development using the latest in high angle drilling and land use efficiency requires minimal land utilization. CGI and the Darajat Unit III Project will be held to the highest environmental standards by both internal and external experts to minimize potential impacts from the project. The project will adhere to all local, regional, and federal rules and regulations. Installation of Unit III will result in minimal environmental disturbance because it will rely on much of the infrastructure installed during construction of Darajat Unit II.

- Compliance to Criteria 4 & 5: Construction and operation of Darajat Unit III will result in significant (over $128MM) foreign direct investment in Indonesia. Over ninety percent of the employees at CGI are Indonesian and this investment will increase the number of local jobs during both the construction and operation phases of the unit. The use of local labour and sub-contracts with local businesses is a mandatory corporate requirement for Chevron business units and the parties constructing the project. CGI is also implementing world class safety standards in the construction and operation of the project. These requirements will bring direct and tangible benefits to the indigenous community. Non-skilled workers from the local communities constitute 20% of the total workforce, and this equates to more than 100 personnel. Included in this local community involvement program is post job training to allow workers to enhance their potential for future job opportunities. Additionally, apprenticeship programs are being provided for local high school students.
- Compliance to Criterion 6: The project will therefore build capacity in a range of areas from systems management and operation to manual skills.
- Compliance to Criterion 7: CGI is actively involved in community support activities under the four pillars of education, health, socio-economics and infrastructure. CGI has contributed extensively to community driven projects and will continue supporting local community development; examples include promoting educational opportunities through the provision of scholarships, improvements to the infrastructure in surrounding communities such as water supplies and roads. CGI's goals in the local communities are driven by its desire for the activities and operations to create benefits for society, the environment and the communities in which CGI works.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
The Government of Indonesia (host)	▪ Chevron Geothermal Indonesia, Ltd (CGI is registered in Indonesia) ▪ PT. Darajat Geothermal Indonesia (CGI's 5% partner in Darajat Unit III)	No
The Government of the United Kingdom of Great Britain & Northern Ireland	▪ Chevron Limited (registered in the United Kingdom)	No

Under its JOC with Pertamina and its ESC with PLN, CGI supplies geothermal steam to a 55 MW power plant (Unit I, owned by PLN) and owns and operates a 90 MW power plant (Unit II) in Darajat, West Java. CGI also operates a steam and electricity co-generation facility (300 MW) in North Duri, Central Sumatra on behalf of PT Mandau Cipta Tenaga Nusanatara. Pertamina, PLN and CGI amended the ESC in 2004 and CGI expects to begin commercial operation of the new 121 MW Darajat Unit III in the 4th Quarter of 2006.

Through its acquisition of Unocal in 2005, Chevron Corporation has acquired the Unocal geothermal assets in Indonesia (Gunung Salak) and in the Philippines (Tiwi and Mak Ban). The Gunung Salak operation covers steam supply to six power plant units totalling 375 MW. Of this total, 195 MW (3 units) is owned and operated by Chevron and sells electricity to PLN, and 180 MW (3 units) is owned by PLN. In the Philippines Chevron supplies steam to power plants totalling 630 MW (Tiwi 230 MW, Mak Ban 400 MW) owned by the National Power Corporation.

Chevron Ltd. is the UK-based trading affiliate of Chevron Corporation. Chevron Ltd. will provide the GHG trading capability for this project.

PT. Darajat Geothermal Indonesia is CGI's 5% partner in Darajat Unit II and Unit III and is part of PT. Austindo Nusantara Jaya, an Indonesian conglomerate with interests in agribusiness, electric power generation, mining and financial services.

As host country, the Government of Indonesia (GOI) has a key role in the development of this CDM project activity. As noted in Section A2, the GOI has already set the sustainable development criteria for such CDM project activities. In an announcement concerning the ratification of the Kyoto Protocol the Ministry of the Environment noted that investment in the proposed Darajat Unit III was one of the benefits brought by ratification. The Designated National Authority, which was established by the GOI in July 2005, will have a critical role in the review process and approval decision concerning the project activity.

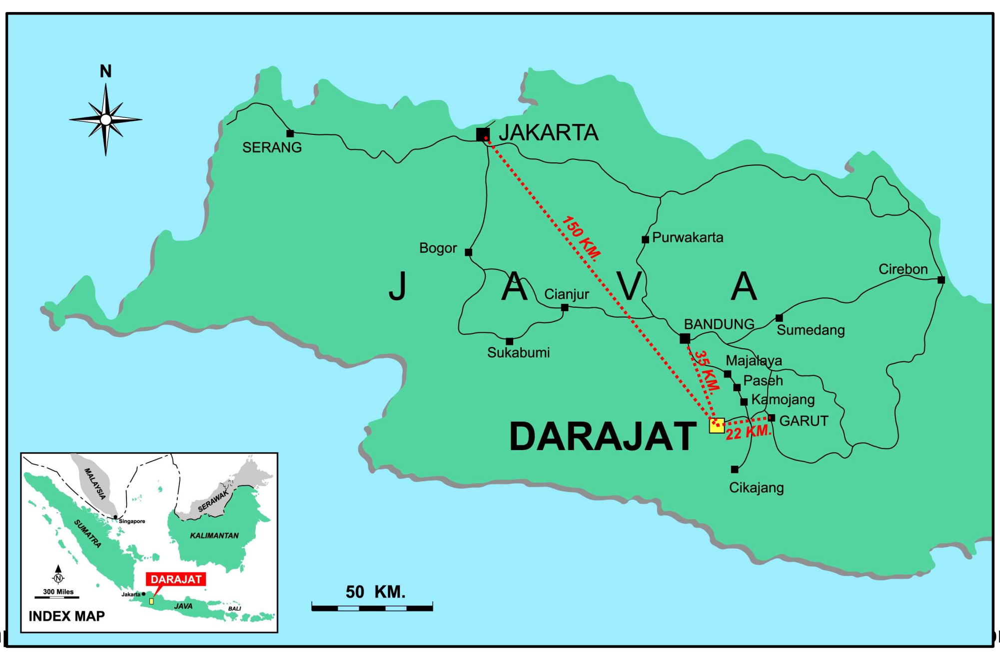
The Government of the United Kingdom of Great Britain & Northern Ireland is the Annex I Party which is expected to authorize the voluntary participation of Chevron Ltd. in this project.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

7°11’9” - 7°15’40” South Latitude, 107°41’54” - 107°45’40” East Longitude. See Figures 1 & 2.

Figure 1: Location of the Darajat Unit III Project



A.4.1.1. Host Party(ies):

Indonesia.

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

West Java.

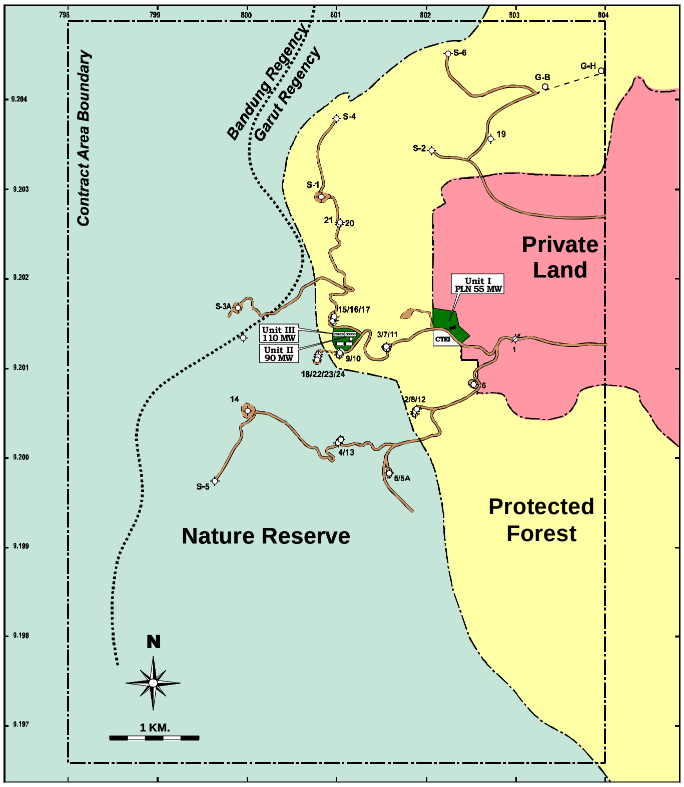
A.4.1.3. City/Town/Community etc:

Garut.

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

Situated 150km from Jakarta, the Darajat area is characterized by medium to high topographic relief. The concession area ranges in height from approximately 1500m to 2200m above sea level with an average height of more than 1600m. The major peaks within the concession area are Mt. Cawene, Mt. Gagak and Mt. Kiamis. The area is characterized by a mountain range that is formed by the activities of relatively young volcanoes. Volcanic activities in the area are indicated by the formation of hot springs, fumaroles and craters. The area surrounding Darajat is partly a mixture of nature reserve, production forest and farmed land (in a progression from highest to lowest elevation). Being cool and fertile, hundreds of hectares in the area are used for cultivation.

Figure 2: Location of the Project Activity



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

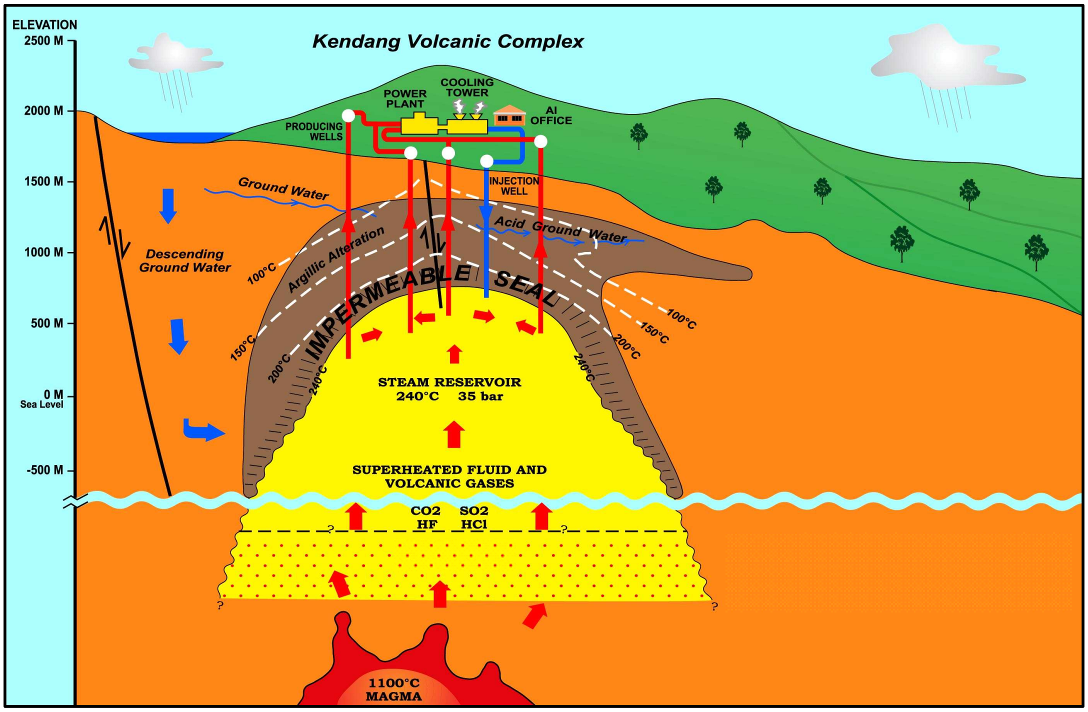
"Renewable electricity generation for a grid (geothermal)".

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

Geothermal energy in Darajat 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 approximately 25% of the condensed exhaust steam is reinjected into the geothermal reservoir, with the remaining 75% being evaporated in the cooling tower. See Figure 3 below depicting the proposed geothermal plant and reservoir at Darajat.

The power plant will consist of a conventional geothermal condensing steam turbine generator with a capacity of 121 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. This technology is technically sound and environmentally safe as is demonstrated by hundreds of similar installations around the world, including Indonesia. The same technology is being utilized by Darajat Units I and II Geothermal Projects.

Figure 3: Schematic diagram of proposed Darajat Unit III Project geothermal power plant and steam reservoir



A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

Darajat Unit III will reduce emissions of greenhouse gases in Indonesia by substituting renewable energy for fossil fuel-fired generation. In the absence of the project, fossil-based generation (predominantly coal) is anticipated to satisfy electricity demand due to its favourable economics. As discussed in Section B, the Government's most recent energy statistics for 2004 and plans for 2005-2025 show that coal and other fossil fuels dominate both capacity and electricity generation on the JAMALI grid[2]. Significantly, expansions of the grid are expected to further maintain the dominance of fossil fuel-fired power plant capacity and generation.

To calculate the baseline emissions, this project uses ACM0002 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources". This provides the "combined margin" which is an average of the build margin and operating margin on the JAMALI grid. The combined margin on the JAMALI grid is 0.754 tCO_2equ/MWh.

By contrast, the actual greenhouse gas emissions that will result from operation of the proposed Darajat Unit III Project are estimated to be just 0.03014 tCO_2equ/MWh or 27,155 tonnes CO_2equ per year (given

[2] Refer to Footnotes 12 and 13.

an expected output of 900,966 MWh/year). Emissions from the proposed Darajat Unit III Project are limited to those from the co-existing non-condensable gases in the steam evaporated in the cooling tower plus some additional emissions from combustion of fuel for operational purposes (vehicles and engines).

The baseline methodology ACM0002 requires the use of a tool for the demonstration and assessment of additionality. The application of this tool to the Darajat Unit III Project is briefly summarized below. A detailed description of additionality is provided in Section B.

Step 0 – Project start date

The project is expected to commence operation in Q4 2006. The crediting period is expected to start after the registration of the project activity.

Step 1 – Identify Alternatives & Regulatory Analysis

The following alternatives are identified:

a) The proposed project activity is not undertaken as a CDM project activity
b) No further investment in the project activity (equal to continuation of the current situation)
c) The project participant sells the proposed project
d) Build a gas-fired power plant of similar or larger capacity
e) Build an oil-fired steam power plant of similar capacity, and
f) Build a coal-fired steam power plant of similar or larger capacity.

The project activity and the alternatives to the project, such as natural gas-fired or coal-fired power generation, are consistent with current laws and regulations in Indonesia. Furthermore, there is no legal requirement to build Darajat Unit III.

Step 2 – Investment Analysis

Given the option in the additionality tool to choose either Step 2 or Step 3, we have chosen to apply the barrier analysis (Step 3) instead of the investment analysis (Step 2) in Section B. The barrier analysis is selected as it provides a better reflection of the complexity of the project investment decision and the investment barrier is included in the barrier analysis.

Step 3 – Barrier Analysis

There are greater barriers to foreign direct investment in geothermal power on the JAMALI grid than in other forms of investment in power generation – particularly coal-based electricity generation. These barriers to investment in geothermal energy supply to the JAMALI grid include:

i) Investment barriers due to political and economic circumstances in Indonesia, which impede the flow of any foreign direct investment into Indonesia (this applies to thermal and geothermal capacity expansion);
ii) Tariff barriers to independent power producers in the electricity market due to the absence of open market competition for selling electricity, with the state power monopoly under political and commercial pressure to keep power purchase prices low (this applies to thermal and geothermal capacity expansion);
iii) Technological barriers to geothermal generation due to subsurface / reservoir risk and other technical aspects; and
iv) Barriers to alternative sources of electricity generation due to the abundance of fossil fuel reserves (particularly certain types of coal which are not suitable for export) in Indonesia.

By registering Darajat Unit III as a CDM activity, the additional revenue from the sale of CER's helps to alleviate the barriers or the investment risks faced by the project developer. The best indicators of the numerous barriers to investment in geothermal energy in Indonesia are the level of new investment and the current capacity relative to the total geothermal resource. The estimated potential geothermal resource in Indonesia is 20,000 MW[3], whereas only 800 MW has been developed commercially to date. Furthermore, apart from the decision to invest in Darajat Unit III (in October 2004) and Kamojang Unit IV (in February 2006) there have been no new investment funding decisions which have led to increases in geothermal capacity on the JAMALI grid since 1997. Further detail on these indicators and the level of geothermal generation in Indonesia is given in Step Four – Common Practice.

Step 4 – Common Practice

Historically, geothermal projects have made a relatively small contribution to Indonesia's generation mix. In 2004, the most recent year for which comprehensive data is available, geothermal energy represented just 7% of the total MWh dispatched to the JAMALI grid and just 4% of the grid capacity. As much as 87% of the total MWh dispatched to the grid is from fossil-fuel based power generation, 47% of which is from coal-based electricity generation.

As noted above, Indonesia has an estimated potential geothermal resource of 20,000 MW and only 800 MW have been developed commercially to date; furthermore, current levels of investment (zero new investment decisions since 1997 apart from the 60 MW Kamojang Unit IV plant which was confirmed in February 2006) by independent power producers in new geothermal capacity indicate that this is not common practice.

Step 5 – Impact of CDM Registration

Returns must be sufficient to overcome the investment barriers (i.e., risks) inherent in the development of the Darajat Unit III Project. Analysis in Section B shows that the value of CERs obtained through the CDM process has a strong influence on the project's economics and helps to overcome some of the barriers outlined above. If approved by the CDM Executive Board the CERs could increase the annual revenue of the project by up to 11%, the IRR of the project by up to 240 basis points, and the NPV by up to 20% (values as at investment funding decision in October 2004). This additional value and the benefit of participating in the CDM process were significant factors in the decision to proceed with the project. Indeed one of the conditions for reaching agreement on 10 August 2004 with PLN on the value negotiated for the selling price of electricity from Unit III was that *"All rights to and revenue from any and all emissions credits and trading as a result of the UNFCCC and Kyoto Protocol for CDM or other Gas Emission Credit market mechanism related to the Darajat Contract Area are the property of and owned by CGI"*. Given the risks that exist now and which will continue to exist in the future for the proposed Darajat Unit III Project, the returns must be sufficient to offset them and potential CER credits will help to overcome the barriers to investment by improving the project's economics.

The potential value of the emissions reduction credits were considered in the very early stages of the project's planning. In 2002 the emissions reductions were calculated as part of a baseline study undertaken by URS.

As discussed in Section B, during the internal recommendation to proceed with the project, members of Chevron's Decision Review Board noted [1st October 2004] that the CDM component of the project was an important aspect in their decision. In the announcement of the decision to invest in the project, Wahyudin Yudiana, president director of Chevron's Indonesia Business Unit, stated that: "*Tradable United Nations Clean Development Mechanism credits, ("CDM") credits generated by the project for CO_2 emissions reduction, are to be pursued for approvals by appropriate Indonesian and international*

[3] National Energy Policy 2003-2020: Integrated Policy to Support a Sustainable National Development. Ministry of Energy & Mineral Resources, Jakarta (2004).

authorities and contribute significantly to the Project economics, which is a significant factor in the approval of the Project".

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Using an "average" approach for the operating margin as per the methodology ACM0002 the JAMALI grid has a combined margin emissions baseline rate of 0.754 tCO_2equ/MWh. Darajat Unit III is expected to generate 991,063 MWh/year, and have emissions of 0.03014 tCO_2equ/MWh, yielding annual emissions reductions of 717,391 tCO_2equ over the first crediting period. Start up of Unit III is expected on 1st December 2006.

Years	Annual estimation of emission reductions in tonnes of CO_2equ
2006	59,783
2007	717,391
2008	717,391
2009	717,391
2010	717,391
2011	717,391
2012	717,391
2013	657,608
Total estimated reductions (tonnes CO_2equ)	5,021,734
Total number of crediting years	7 years (first crediting period)
Annual average estimated reductions (tonnes CO_2equ) over the crediting period	717,391

A.4.5. Public funding of the project activity:

There is no public funding for the Darajat Unit III Project.

SECTION B. Application of a baseline methodology

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

ACM0002[4]: Consolidated baseline methodology for grid-connected electricity generation from renewable sources

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

Consistent with the Applicability described in Annex 2 of ACM0002:

- This methodology is applicable to capacity additions to grid-connected renewable power generation project activities from geothermal sources such as Darajat Unit III.
- The project does not involve switching from fossil fuels to renewable energy at the site of the project activity.
- The geographic and system boundaries for the JAMALI electricity grid can be clearly identified in the case of Darajat Unit III, and information on the characteristics of the grid is available.

B.2. Description of how the methodology is applied in the context of the project activity:

The Darajat Unit III geothermal power plant will be a 121MW capacity addition to the JAMALI grid. The project activity mainly reduces carbon dioxide emissions by substituting fossil fuel-based electricity generation on the grid with renewable electricity based on geothermal energy. ACM0002, the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", and the "Tool for the demonstration and assessment of additionality[5]" are applied to this project. Given that new projects compete with existing plant on the JAMALI grid, operating and build margins are used to derive the emissions factor for the connected grid – or the Combined Margin. The selected approach under ACM0002 is "Existing actual or historical emissions, as applicable".

The additionality tool is used to demonstrate that the GHG emissions are reduced below those that would have occurred in the absence of the CDM project activity. See Section B.3.

The emissions sources from Darajat Unit III includes very small emissions of carbon dioxide and methane from non-condensable gases contained in the geothermal steam and extremely small carbon dioxide emissions from combustion of fossil fuels required to operate the geothermal power plant. The spatial extent of the project boundary includes the project site (Darajat Unit III) and all power plants connected to the JAMALI grid (which can be dispatched without significant transmission constraints). There are no imports or exports of electricity to or from the JAMALI grid.

The baseline scenario is the electricity that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. For the Darajat Unit III baseline, option (d) – average operating margin – is used to calculate the operating margin, and option 1 – calculate the build margin emissions factor *ex ante* – is used to calculate the build margin. The most recent capacity additions to the grid that comprise 20% of the system gives a larger annual generation

[4] Version 6 dated 19 May 2006. Downloaded from: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html
[5] Refer Footnote 3.

than the five most recently built power stations. The reasons for selecting the average operating margin are as follows:

1. Data is not gathered and made publicly available from an official source to calculate a dispatch data analysis operating margin;
2. Data is not gathered and made publicly available from an official source to calculate a simple adjusted operating margin; and
3. "Low-Cost/Must-Run" resources constitute more than 50% of total grid generation in each of the years 2000-2004, precluding the use of the simple operating margin (refer to D.2.1.4).

As per ACM0002, leakage emissions – in particular from construction of the power plant, and from geothermal wells on bleed or on test – are not considered as part of the baseline scenario or project emissions. Reductions in output from Unit I or Unit II that are attributable to the project activity are considered leakage; this is addressed in Section E.

Calculations for the baseline emissions for the JAMALI Grid based on the Average Operating Margin method and the Build Margin are presented in Annex 3.

B.3. 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:

As defined in ACM0002, the baseline scenario is the following: electricity which would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. The project scenario is the development of the Darajat Unit III plant.

The additionality of the Darajat Unit III Project scenario shown in Steps 0-5 is established using the "Tool for the demonstration and assessment of additionality".

Step 0 – Preliminary screening based on the starting date of the project activity

The project is expected to commence operation in Q4 2006. The crediting period is expected to start after the implementation of the project activity.

Step 1 – Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity

1. The following alternatives available to the project participants are identified.

   a) The proposed project activity is not undertaken as a CDM project activity
   b) No further investment in the project activity (or continuation of the current situation)
   c) The project participant sells the proposed project (CGI owns the rights to build Unit III which it could sell to another project developer)
   d) Build a gas-fired power plant of similar or larger capacity
   e) Build an oil-fired steam power plant of similar capacity, and
   f) Build a coal-fired steam power plant of similar or larger capacity.

Sub-step 1b. Enforcement of applicable laws and regulations

2. Both the project scenario and the other alternatives are in compliance with all applicable legal and regulatory requirements. Items 3-4 are therefore not applicable.
3. Not applicable.
4. Not applicable.

Step 2 – Investment Analysis
Not Applied.

Step 3 – Barrier Analysis

Sub-step 3a. Identify barriers that would prevent the implementation of this type of the proposed project activity:

There are a number of significant barriers that impede the implementation of geothermal projects in Indonesia, particularly by Independent Power Producers. In general, the barriers result from the investment climate, electricity market, and other technology risks arising from the choice of geothermal energy. These include the following:

i) Investment Barriers due to political and economic circumstances in Indonesia, which impede the flow of any foreign direct investment into Indonesia (whether coal or geothermal capacity expansion);
ii) Tariff Barriers to independent power producers in the electricity market due to the absence of open market competition for selling electricity, with the state power monopoly under political and commercial pressure to keep power purchase prices low;
iii) Technological barriers to geothermal generation due to subsurface / reservoir risk and other technical aspects; and
iv) Barriers to alternative sources of electricity generation due to the abundance of fossil fuel reserves (particularly certain types of coal which are not suitable for export) in Indonesia.

By registering Darajat Unit III as a CDM activity, the additional revenue from the sale of CERs helps to alleviate the barriers or the investment risks faced by the project developer.

i) Investment Barriers

Chevron's experience with the Darajat Unit II project, the predecessor to the proposed project outlined in this PDD, provides a first-hand example of the financial risks – and associated costs – inherent in an uncertain investment climate. These financial risks create significant barriers to new investment in geothermal generation in Indonesia.

The high economic growth of Indonesia throughout the early 1990s encouraged a large inflow of private foreign capital into Indonesia. Medium and long-term electricity supply expansion and indigenous energy resource development plans were drawn up in anticipation of continued growth in energy demand[6]. When the Asian financial crisis began in mid-1997, many energy projects were either ongoing or scheduled for implementation in the next two to three years. Others were planned for implementation after 2000 and through 2005, and several projects were planned to come on-stream through 2010. The Asian financial crisis caused the delay or cancellation of several of these projects, and threatened many others. Many, if not most, of these projects were undertaken by the private sector and financed through private investment.

As a result of the Asian financial crisis in 1997, the GOI suspended the development of Darajat and put the ESC on hold. At that time the development of Darajat Unit II was already eighty percent complete, and CGI (then Amoseas) made the decision to complete construction and attempt to

[6] Seventeenth ASEAN Ministers on Energy Meeting (1999). "Impacts of Economic Crisis on energy sector: Indonesia's case," Bangkok, July 3www.eppo.go.th/inter/asean/AMEM17-Bangkok/AMEM-CR-Indonesia.html

renegotiate the ESC to avoid greater financial loss. By November 1998, the construction of Unit II was completed but the plant was not commissioned until February 2000 after an amendment to the ESC was negotiated, with significant GOI overview and direction, at a reduced selling price (40% lower). Unit II began commercial operation in June 2000.

In 2002, reflecting on the investment climate, the US Embassy[7] in Jakarta described the investment climate for geothermal development in the following manner: *"The early 1990s saw the awarding of eleven contracts for development of geothermal power plants, with a total committed capacity of 3,417 MW and original completion dates between 1998 and 2002. As a result of the 1997-1998 financial crisis, the Government suspended nine conventionally powered Independent Power Projects (IPPs) and seven geothermal projects. The government is now attempting to resuscitate the seven contracts but with little progress".*

In a *County Commercial Guide*[8] published the following year, the US Embassy highlighted the ongoing risks and barriers to all foreign investment in Indonesia: *"Analysts cite a number of factors contributing to Indonesia's prolonged business investment slump. These include slowing structural reforms, rapidly rising labor costs, the lack of an efficient and transparent legal system, widespread official corruption, signs of impending infrastructure shortages, uncertainties stemming from Indonesia's decentralization program, and competition from other labor-intensive economies in Asia, especially China and Vietnam. Although the Government of Indonesia has held dialogues on doing business issues with domestic and international business groups, through the end of 2002 it made little progress in formulating and implementing a meaningful reform program that would encourage potential investors. Focusing on improving Indonesia's investment climate has emerged as the GOI's top short-term policy challenge".*

More recently, Pointcarbon[9] has provided a brief analysis of the investment climate in Indonesia from a CDM perspective: *"Indonesia has a relatively vibrant project development sector, particularly within the energy production industry. Despite persistent rumours that the DNA notification is around the corner, it has not taken place[10]. Moreover, investment climate is weak and corruption rampant. Nevertheless, the Netherlands have signed an umbrella ERPA with the Indonesian government on 2 million CERs.*

Indonesia excels in potential for geothermal power, small hydro and waste biomass from palm oil and forestry operations, and the oil and gas sector could substantially reduce gas flaring. Moreover, Java's large agglomerations could sustain many landfill gas projects. The Active Geothermal Association was the first to recognise the benefits of CDM and has developed several interesting projects, whose additionality is not in doubt. This is due to the high levels of fossil fuel and electricity subsidisation, which is only slowly being reduced. However, two projects prepared for the Dutch CERUPT tender have been cancelled due to changes in ownership. The Indocement project got its methodology for fuel switch accepted by the EB. The Dutch Bilateral Carbon Purchase Agreement (BCPA) of 2 million CERs should spur project development."

The National Energy Policy[11] itself states that an investment climate that is not conducive will hamper the development of the energy industry. The lack of government funding for the energy sector means that private investments will be needed more than ever. As mentioned earlier, in an announcement concerning the ratification of the Kyoto Protocol, the Ministry of the Environment noted that investment in the proposed Darajat Unit III was one of the benefits brought by ratification.

---

[7] US Embassy Jakarta. 15 February 2002. (http://www.usembassyjakarta.org/econ/geothermal.html)

[8] US Embassy Jakarta (2003). "Country Commercial Guide – Indonesia". (http://www.usembassyjakarta.org/). Also: Indonesia: Investment Climate Statement 2003 (http://www.usembassyjakarta.org/econ/investment2. html); See also the 2004 Investment Climate Statement Appendix (http://www.usembassyjakarta.org/download/2004%20Investment %20Climate.pdf).

[9] Pointcarbon Country Analysis – Indonesia. 27th May 2005. (http://www.pointcarbon.com)

[10] This occurred on 17 July 2005. The Indonesian DNA has been registered with the UNFCCC.

[11] Refer Footnote 2.

ii) Tariff Barriers in the electricity market due to no open market competition for selling electricity

Investors are placing a premium on country risk in Indonesia due to uncertainty in law, international arbitration and surety of payment from state companies. Generators are required to sell to the state company PLN. With no open market competition, investors are worried that fair market prices may not be achieved, and that once projects are completed signed contracts may be suspended as has happened before. This barrier is particularly significant for private sector investment in electricity capacity expansion projects involving renewable energy. As stated in the National Energy Policy (2003-2020) "*the utilization of new energy and renewable energy is not progressing because the price of energy cannot compete with the price of fossil energy*".

iii) Technological barriers specific to investment in geothermal power

There are several specific barriers to investment in geothermal power including the small size and remote location of geothermal plants, the complicated government / operator management of the geothermal resource and power generation, plus the significant subsurface risks.

Size & location

The small size of geothermal power projects compared with gas or coal fired power plants and (as noted in the national energy policy) the remote location of the geothermal resource, often in hard-to-access mountainous areas, are both barriers to investment in geothermal power plants. Small 50-150MW geothermal power plants do not provide the economies of scale compared with larger 600-2400MW coal or gas plants and therefore are not as attractive to Independent Power Producers.

Management of the geothermal resource

In the past in Indonesia, separated upstream and downstream regulatory management of the geothermal resource required complex tri-party negotiations between PLN, Pertamina and the project developer and added complexity and bureaucracy to geothermal power development. A Joint Operating Contract (JOC) governed the contractor's relationship with Pertamina. PLN bought electricity on the basis of an Energy Sales Contract (ESC) which was agreed with the private sector party and Pertamina. Upstream regulatory oversight responsibilities were split between the Ministry of Energy and Mineral Resources (Directorate General of Oil and Gas) and Pertamina.

In mid-2002, and following legislation to restructure Pertamina into a state-owned limited liability company, Pertamina's regulatory responsibilities were transferred to the government. At the same time, the government upstream regulatory role was transferred within the Ministry of Energy and Mineral Resources from the Directorate General of Oil and Gas to the Directorate General of Geology and Mineral Resources (recently (late 2005/early 2006) restructured as the Directorate General of Minerals, Coal and Geothermal Energy).

In 2003, a new Geothermal Energy Act (No. 27/2003) came into effect. This act retrospectively protected the ongoing validity of existing JOCs and ESCs and other existing contracts, but changed the situation for new entrants. The separated upstream and downstream regulatory management of the geothermal resource remains, but Pertamina is no longer required as a partner in the development and new geothermal projects which are outside existing JOCs and ESCs will not receive the favourable tax treatment enjoyed by the existing JOCs and ESCs. They are therefore likely to find it much harder to negotiate an acceptable electricity sales contract with PLN. At the time of writing (September 2006), no new geothermal projects coming under this new act have been promoted. The first project to do so will need to negotiate an uncharted and uncertain path with an undefined time frame – a significant barrier to investment. Kamojang Unit IV was mentioned previously as a new geothermal development. However, that project was under development as an IPP contract prior to 2003 so is not expected to be affected by the new law.

Even though the 2003 Geothermal Energy Act provided for the ongoing validity of the existing JOCs and ESCs, the change in status of Pertamina and the change in the government regulator have given rise to additional difficulties for existing JOCs and ESCs. There are difficulties in respect of the existing JOCs continuing to enjoy the exemption from import taxes and duties on capital and operational goods which was previously ratified by the GOI and which is specified in the JOCs and ESCs (and on which the original, and renegotiated, selling prices for steam and electricity under the ESCs were based). A temporary, legal, work-around of these difficulties on a consignment-by-consignment basis has, in some cases, taken several months and has consequently resulted in unplanned project delays and additional costs for Darajat Unit III.

Subsurface / reservoir risk
In comparison with conventional power projects, geothermal projects have the additional significant risk of the uncertainty of the availability and production cost of the fuel source, i.e. steam. Whereas conventional projects can enter into long term fuel contracts for coal, oil and gas, a geothermal project is totally reliant on the steam produced from the reservoir deep below the earth. Often with limited information, the geothermal project must determine the extent of the steam resource available then produce a plan and budget to develop this as efficiently as possible. Significant capital expenditure and risks are associated with drilling wells to both confirm and then ensure this steam fuel delivery. Major uncertainty remains during the operation phase that the forecast remaining steam is actually in place and can be accessed economically. The number, location and timing of wells required to maintain the steam fuel supply is critical.

iv) Barriers due to prevailing practices and abundance of fossil fuel reserves in Indonesia

Fossil fuel reserves, particularly coal, are available in Indonesia in significant amounts; geological studies confirm abundant availability of low-rank coal resources in Indonesia. As noted in the GOI's National Energy Policy the low-rank coal is not in high demand in international markets (i.e. it cannot be economically exported) and the development of mine-mouth power plants that use this fuel will be able to increase the added value of low-rank coal. These coal resources and associated mine mouth power plants pose a competitive barrier to alternative sources of electricity generation, including geothermal.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity).

This section shows how the four main barriers identified above affect the six alternatives to the project activity defined in Step 1. The identified barriers would not prevent implementation of two of the alternatives – (1) no further investment in the geothermal unit, and (2) investment in small- or medium-sized gas-fired power generation.

a) The proposed project activity is not undertaken as a CDM project activity.
   i) *Investment Barriers*: CGI wishes to achieve a fair return on its investment. Darajat Unit III has to compete for capital with other projects in Chevron's capital project portfolio. About 80% of Chevron's annual capital budget is invested in oil and gas projects. High oil prices put this geothermal power project at a further disadvantage within Chevron because of the internal competition for capital. The CDM is cited as a critical aspect of the Darajat Unit III Project by senior Chevron executives because it gives the project strategic fit within Chevron's global operations (further detail is given in the Step 5 of the additionality tool). Even with a conservative CER price, the CDM raises the expected income stream by up to 11%, the IRR by up to 240 basis points and increases the NPV of the project by up to 20% (values as at investment funding decision in October 2004). This was a significant factor in the decision to approve the project.
   ii) *Tariff Barriers*: The current selling price for electricity with a single sole customer does not make this a particularly attractive investment alternative. Any further development at Darajat faces the risk of default or revision of the ESC – and given that this has happened in the past, it is clearly a significant barrier to investment in the project.

iii) *Technological Barriers*: technological issues are the same whether the project is undertaken as a CDM project or not.
iv) *Prevailing Practice*: All current developers of future geothermal projects under existing JOCs and ESCs have indicated that they anticipate revenue from CDM or similar, and that has been factored into revisions to their purchase agreements with the sole customer for such future capacity. Developers of future geothermal projects under the new Geothermal Law are expected to have the same expectation, even though no such projects have yet come to an agreement with a purchaser.

b) No further investment in the project activity (or continuation of the current situation).
There are no barriers that affect this alternative. However this is not the preferred alternative of the Government of Indonesia.

c) The project participant sells the proposed project.
i) *Investment Barriers*: CGI would wish to recover all investment costs plus a fair return on these, and the current selling price for electricity to PLN, the sole customer, is unlikely to be attractive enough to another purchaser without the additional value of the CDM.
ii) *Tariff Barriers*: The current selling price for electricity with a single sole customer does not make this a particularly attractive investment alternative. Any further development at Darajat faces the risk of default or revision of the ESC – and given that this has happened in the past, it is clearly a significant barrier to investment in the project.
iii) *Technological Barriers*: Not all potential customers have the capability or desire to operate and maintain a geothermal reservoir with its associated subsurface risks
iv) *Prevailing Practice*: All potential developers of geothermal capacity have indicated that the CDM is a critical aspect of new projects.

d) Build a gas-fired power plant of similar or larger capacity.
i) *Investment Barriers*: For independent power producers, the sole customer's (PLN) past history of not honouring its contracted obligations to purchase, and of agreeing to purchase but at a reduced selling price, is a common barrier. However, gas plant can be built quickly as a combustion turbine (open cycle), then converted to a combined cycle power plant. Fuel can be supplied by pipeline, and the plant can be located close to load centers. Such plants are being built in the JAMALI system.
ii) *Tariff Barriers*: The current selling price for electricity with a single sole customer does not make this a particularly attractive investment alternative. Any development faces the risk of default or revision of its ESC – and given that this has happened in the past, it is clearly a significant barrier to investment.
iii) *Technological Barriers*: None – these facilities are currently being installed in the JAMALI grid (such as Cilegon).
iv) *Prevailing Practice*: None – these facilities are currently being installed in the JAMALI grid (such as Cilegon).

e) Build an oil-fired power steam plant of similar capacity.
i) *Investment Barriers*: The high $ per MW installed capacity of an oil-fired steam development as small as 121 MW would be a barrier to this type of investment.
ii) *Tariff Barriers*: The current selling price for electricity with a single sole customer does not make this a particularly attractive investment alternative. Any development faces the risk of default or revision of its ESC – and given that this has happened in the past, it is clearly a significant barrier to investment.
iii) *Technological Barriers*: This alternative is not available to CGI which has a company policy to invest in clean power generation technology.

iv) *Prevailing Practice*: As Indonesia has moved from a position where crude oil was a significant foreign exchange earner, to being an oil importer, there will be increasing pressure to reduce the amount of oil used for power generation. Figure 4 confirms that the government goal is for oil to make up a smaller part of the power generation mix. The current high oil prices have placed a high burden on the GOI as PLN has not been permitted to increase its retail tariffs to cover these costs, with a resultant requirement on the GOI to provide fuel price support to PLN. This has come at a time when local natural gas supplies have been decreasing due to field depletion and the JAMALI load has been increasing.

f) Build a coal-fired steam power plant of similar or larger capacity.
   i) *Investment Barriers*: Such plants are being built in the JAMALI system (Cilacap 2 x 300MW), so if investment barriers exist, they have been overcome. Paiton Energy Company has stated their readiness to undertake an expansion of their coal fired power plant in East Java if an electricity sales contract can be negotiated with PLN at the price they have offered (less than 5US c/kWh).
   ii) *Tariff Barriers*: The current selling price for electricity with a single sole customer does not make this a particularly attractive investment alternative. Any development faces the risk of default or revision of its ESC – and given that this has happened in the past, it is clearly a significant barrier to investment.
   iii) *Technological Barriers*: A specific barrier to new coal fired power generation is the relatively strict environmental permitting for new coal plant, and the time it takes to acquire land required for the project. A further barrier for a small coal-fired facility as small as 121MW is the high cost per MW installed capacity by comparison with gas-fired open cycle or combined cycle gas turbine power plants. The option of building a new coal fired facility is not available to CGI which has a company policy to invest in clean power generation technology.
   iv) *Prevailing Practice*: Abundance of low-rank coal which cannot be economically exported, means that there is much less risk of fuel price fluctuations for new coal plant – particularly those located at the mine-mouth. None of the low-grade coal resources occur on the islands of Java, Madura or Bali. However, such resources do exist in South Sumatra and a connection to the JAMALI grid would not be technologically difficult.

As noted above, the main alternative to the project activity is to maintain the status quo which is low investment by Independent Power Producers and low (or zero) investment in geothermal power projects. The barriers identified above affect private sector investment in geothermal power projects and to a lesser extent investment in fossil fuel based power generation, given that there is some investment in gas fired power plant. Private investment will be required to expand power generation capacity as envisioned in the National Energy Policy[12]. The Energy Policy also states that utilization of renewable sources of energy, with the exception of hydro power, is relatively small because they are not competitive with conventional energy. The utilization of new energy and renewable energy is not progressing because the price of energy cannot compete with the price of fossil energy (liquid fuels excluded).

Given the barriers noted above the two most viable alternative scenarios are:

- The continuation of the current situation (or no further capital investment in geothermal capacity expansion at Darajat); or
- Investment in small or medium-sized gas fired power generation which has fewer risks and uncertainties, fewer issues with siting or environmental permitting (compared with geothermal or coal) and can overcome the various investment barriers outlined.

Step 4 – Common Practice

[12] Refer Footnote 2.

Sub-step 4a. Analyse other activities similar to the proposed project activity
Sub-step 4b. Discuss any similar options that are occurring.

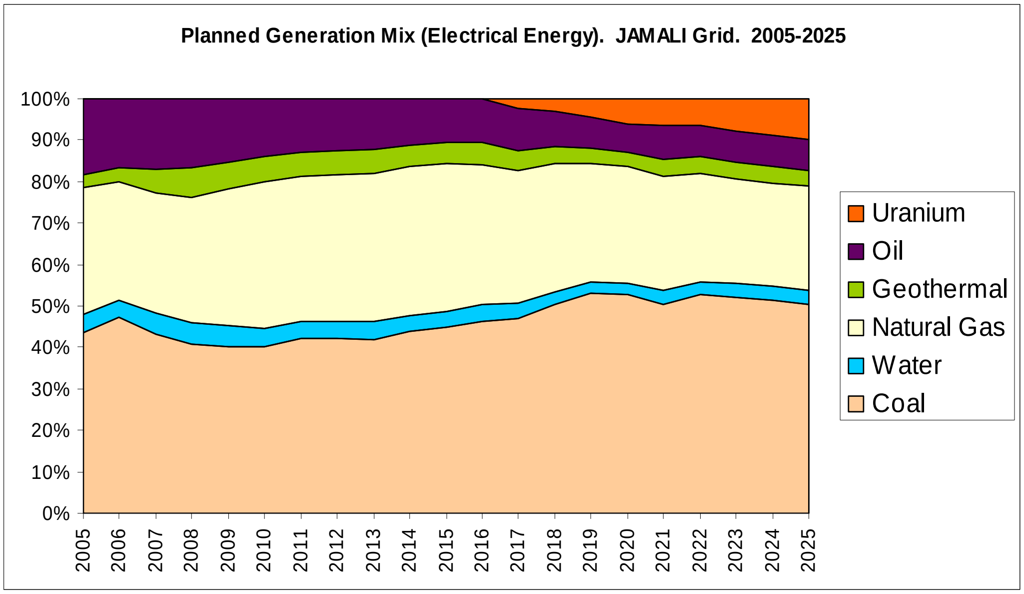
Although Indonesia has significant geothermal resources (the National Energy Policy notes there are 51 geothermal fields around the archipelago and *"17 locations are fields with high enthalpies that could generate 20,000MW over 30 years"*), this type of electricity generation is currently not common practice. In the 1990's there were expectations that total geothermal capacity on the JAMALI grid would rise to 3,417MW. By 2001 this projection was revised downwards to 1,987MW geothermal capacity by 2005. In reality, in 2004 geothermal energy represented just 7% of the total MWh dispatched to the JAMALI grid and just 800MW capacity or 4% of the grid capacity. The current projection for capacity expansion is only for another 660MW capacity by 2025. In contrast, as much as 87% of the total MWh dispatched is from fossil-fuel based power generation, of which 47% is coal-based electricity generation (see Table 1). In the longer term, fossil fuels, particularly coal, are expected to dominate electricity generation on the JAMALI grid (see Figure 4). As stated in the National Energy Policy: *"utilization of renewable sources of energy, with the exception of hydro power, is relatively small because they are not competitive with conventional energy"*. Apart from the decision to invest in Darajat Unit III (in October 2004) the only new investment funding decision associated with increasing geothermal capacity on the JAMALI grid since 1997 is the 60 MW Kamojang Unit IV plant which was confirmed in February 2006[13]. Chevron's success with this project would be an important stimulant to the geothermal industry in the country after nearly a decade of stagnation.

Table 1: JAMALI Grid Electricity Generation Capacity and Electricity Production 2004 [14]

	2004 Capacity		2004 Generation	
Power Plant Type	**MW**	**%**	**GWh**	**%**
■ Hydro	2,559	13.2%	6,122	6.4%
■ Geothermal	812	4.2%	6,493	6.8%
■ Diesel	104	0.5%	89	0.1%
■ Steam - Oil	1,080	5.6%	8,307	8.7%
■ Steam - Gas	800	4.1%	1,050	1.1%
■ Steam – Coal	6,660	34.4%	45,088	47.2%
■ Combustion Turbine - Oil	1,459	7.5%	2,044	2.1%
■ Combined Cycle - Oil	2,416	12.5%	12,509	13.1%
■ Combustion Turbine - Gas	40	0.2%	104	0.1%
■ Combined Cycle – Gas	3,417	17.7%	13,660	14.3%
Total	19,347		95,466	

Figure 4: Planned Generation Mix (Energy) 2005-2025[15] (refer Annex 3, Tables 9 and 9a)

[13] US Embassy Jakarta, Energy Highlights February 2006. http://www.usembassyjakarta.org/econ/energy_highlight_feb06.html
[14] Directorate General of Electricity and Energy Utilization "Statistics: Electricity and Energy. Year 2004. Report No.18-2005".
[15] Decision of the Minister of Energy and Mineral Resources. No. 1213 K/31/MEM/2005. National Electricity Plan. Department of Energy and Mineral Resources. Jakarta, 25 April 2005.



Step 5 – Impact of CDM Registration

Given the risks that exist in the proposed Darajat Unit III Project, the returns must be sufficient to offset them and potential CER credits will help to overcome the barriers to investment by improving the project's economics. If approved by the CDM Executive Board the CERs could increase the annual revenue of the project by up to 11%, the IRR of the project by up to 240 basis points, and the NPV of the project by up to 20% (values as at investment funding decision in October 2004). This additional value and the benefit of participating in the CDM process (and the experience gained) are significant factors in the decision to proceed with the project. Indeed one of the conditions for reaching agreement on 10 August 2004 with PLN on the value negotiated for the selling price of electricity from Unit III was that *"All rights to and revenue from any and all emissions credits and trading as a result of the UNFCCC and Kyoto Protocol for CDM or other Gas Emission Credit market mechanism related to the Darajat Contract Area are the property of, and owned by CGI"*. As has been shown above, the project is not business as usual for either Indonesia or Chevron.

The potential value of the emissions reduction credits was considered in the very early stages of the project's planning. In 2002, the emissions reductions were calculated as part of a baseline study undertaken by URS. In the internal recommendation to proceed with the project, members of Chevron's Decision Review Board noted in October 2004 that the CDM component of the project was an important aspect in their decision. The following statements from different members of the Decision Review Board were included (and documented) as part of their recommendation to proceed. The statements show the significance of the CDM aspect of Darajat Unit III in gaining the internal project approval.

> *"The use of Clean Development Mechanism credits was extremely important in my decision for approval. The strategic learning for future projects was important and very meaningful. Obtaining the value for the CDM credits, and understanding how they were calculated, were necessary for my approval to proceed."* Greg Vesey – President, Chevron Technology Ventures.

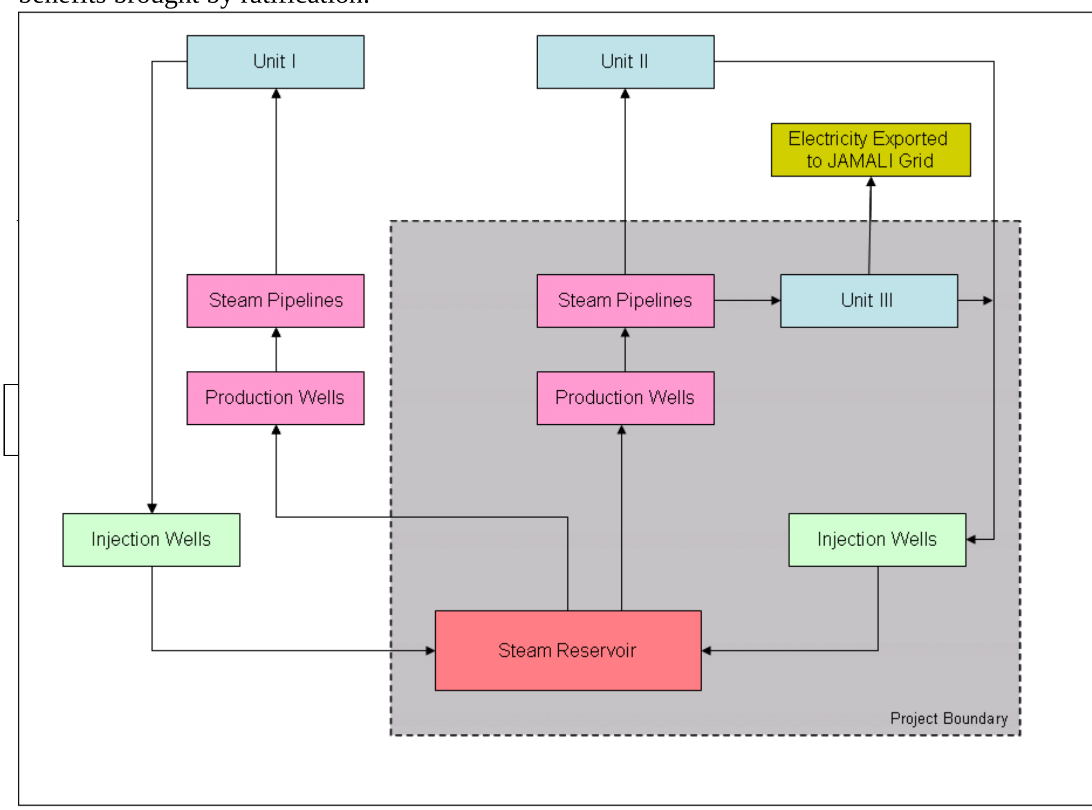
> *"The possibility of securing CDM credits certainly made the project more attractive and added to its positive recognition as environmentally friendly. The incorporation of the range of values also took into consideration the on-going validation efforts underway with the UN"*. Byron Wong – Vice President, Commercial Development Asia.

> *"Please continue to pursue CDM issue under UN standards. It is an issue that could have a positive impact on the project economics. It is also something that Chevron, as a corporation pursuing greenhouse gas reduction projects, should have detailed working knowledge"*. Charles McHugh – Regional General Counsel, Chevron International Exploration & Production.

> *"Conditional criteria for proceeding to next CPDEP Phase IV (implementation): Decision Review Board support to proceed to Phase IV and report this project to CTOP and Chevron OpCom is based on the assumption that the CDM credits will materialize through the UN process. The value created by the CDM credits significantly enhance the economic viability of this project considering other financial risk components associated with revenue receipt"*. Chris Prattini – Managing Director, Indonesia Strategic Business Unit.

In the announcement of the decision to invest in the project, Wahyudin Yudiana, President Director of Chevron's Indonesia Business Unit, noted that:
"*Tradable United Nations Clean Development Mechanism credits, ("CDM") credits generated by the project for* CO_2 *emissions reduction, are to be pursued for approvals by appropriate Indonesian and international authorities and contribute significantly to the Project economics, which is a significant factor in the approval of the Project*".

As mentioned previously, in an announcement concerning the ratification of the Kyoto Protocol, the Ministry of the Environment noted that investment in the proposed Darajat Unit III was one of the benefits brought by ratification.



n fields
closer to
icipated.
brought
val. The
stability
will be
Darajat
way for
sts.

5. The
lant and
project

[16] Huttrer, G.W. (2001). *The status of world geothermal power production 1995-2000*. Published in Geothermics, Vol. 30, No. 1.

The implementation of a geothermal power project involves four key stages. These stages and their corresponding GHG emissions are as follows:

Table 2: Geothermal Project Development Stages & their GHG Emission Sources

Stage		Source of GHG Emissions
1.	Surface Exploration by Exploratory Drilling	Gasoline and diesel combustion from machinery / diesel
2.	Steam Field Development (production well drilling and testing)	Gasoline and diesel combustion from machinery / diesel units
3.	Power Plant and Steam Field Construction	Gasoline and diesel combustion from machinery / diesel units
4.	Operation (including make-up well drilling and testing, if undertaken)	Fuel combustion (diesel, gasoline) by equipment and generation sets, non-condensable gases from cooling tower, potential fugitive emissions near steam reservoir well-heads for existing wells or future make-up wells on test or bleed.

Since the drilling and testing of wells for surface exploration and steam field development (Stage 1 & 2 above) were completed as part of the development and construction of Darajat Units I & II, Unit III will not incur these emissions.

In the future, when make-up well drilling is undertaken, there will be short term emissions similar to Stage 2. As per the methodology ACM0002, leakage emissions – in particular emissions arising from construction of the power plant (Stage 3 above), and from geothermal wells on bleed or on test (Stages 2 and 4 above) – are not considered as part of the baseline scenario or project emissions.

The boundary for the baseline scenario is the JAMALI interconnected electricity grid.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

The date of completion of the baseline study was 22 August 2006.

Mr. Maher Sungkar
Chevron Geothermal Indonesia, Ltd
Sentral Senayan I
Jl. Asia Afrika No. 8
Jakarta 10270
INDONESIA
OE/HES Manager
Ph.: +62 21 5798 4278
Fax.: +62 21 5798 4477
Email: mahersk@chevron.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:

1st December 2006

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

Thirty years.

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

C.2.1. Renewable crediting period

Renewable.

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

1st December 2006

C.2.1.2. Length of the first crediting period:

7 years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

Approved consolidated monitoring methodology ACM0002 "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources" (Version 6).

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

This monitoring methodology shall be used in conjunction with the approved baseline methodology ACM0002 ("Consolidated baseline methodology for grid-connected electricity generation from renewable sources") and applied to geothermal sources.

The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.

Consistent with the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002), the project boundary includes the following emissions sources:

– For geothermal project activities, fugitive emissions of methane and carbon dioxide from non-condensable gases (NCGs) contained in geothermal steam and carbon dioxide emissions from combustion of fossil fuels required to operate the geothermal power plant.

The monitoring methodology is applicable to the Darajat Unit III Geothermal Project as it provides a comprehensive monitoring of the emissions reductions associated with the project. The monitoring methodology consists of measurements of all the process and data streams needed in order to accurately quantify the emissions associated with the proposed Darajat Unit III Project. These include:

- Generated electricity and the fraction exported to the JAMALI grid, for Darajat Unit III and for the existing Unit I and Unit II, and a daily log of Unit I and Unit II
- Steam mass flow delivered to the power plant,
- NCG fraction in the main steam flow,
- Analysis of NCG samples to determine GHG content, and
- Measurement of fuel consumption in vehicles and other ancillary on-site equipment.

The collected data will be inventoried over the lifetime of the project.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
12. $M_{S,y}$	Mass quantity	Quantity of steam produced during the year	tonne (t)	m	daily	100%	electronic	During the crediting period and two years after	See note 1
13. w_{Main,CO_2}	Mass fraction	Fraction of CO_2 in produced steam	t_{CO_2}/t_{steam}	m	every 4 months	100%	electronic	During the crediting period and two years after	See note 2
14. w_{Main,CH_4}	Mass fraction	Fraction of CH_4 in produced steam	t_{CH_4}/t_{steam}	m	every 4 months	100%	electronic	During the crediting period and two years after	See note 2
[17] 15. $M_{t,y}$	Mass quantity	Quantity of steam generated during well testing	tonne (t)	m		100%	electronic	During the crediting period and two years after	See note 1
16. $w_{t,CO2}$ footnote 17	Mass fraction	Fraction of CO_2 in steam during well testing	t_{CO_2}/t_{steam}	m		100%	electronic	During the crediting period and two years after	See note 2
17. w_{t,CH_4} footnote 17	Mass fraction	Fraction of CH_4 in steam during well testing	t_{CH_4}/t_{steam}	m		100%	electronic	During the crediting period and two years after	See note 2
18. $F_{i,y}$	Fuel quantities	Amount of fossil fuels used for the operation of the geothermal plant	Mass or volume	M, c		100%	electronic	During the crediting period and two years after	See D.2.1.2 (b)
19. $COEF_i$	Emission factors coefficient	CO_2 emission coefficients of fossil fuels types i displaced by used in the operation of the geothermal plant	t_{CO_2}/mass or volume unit	m		100%	electronic		Plant or country-specific values to calculate COEF are preferred to IPCC default values.

[17] Emissions from well testing form part of the construction emissions which are now excluded from the project emissions, baseline and monitoring methodology

Note 1: Flow rates

1a. Steam flow rate, power plant

The steam quantity discharged from the geothermal wells will be measured with a venturi flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venturi meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports. As part of the QA/QC procedure a back-up check calculation, as described in D.3 and D.4, will be performed in addition to the primary venturi flow meter measurement.

Note 2: Non-condensable gases in geothermal steam

Non-condensable gases (NCGs) in geothermal reservoirs usually consist mainly of CO_2 and H_2S. They also contain a small quantity of hydrocarbons, including predominantly CH_4. In geothermal power projects, NCGs flow with the steam into the power plant. In conventional vacuum condensing steam cycle geothermal power plants, a small proportion of the CO_2 is converted to carbonate / bicarbonate in the cooling water circuit. In addition, parts of the NCGs are reinjected into the geothermal reservoir, if the facility practices reinjection of excess steam condensate. However, as a conservative approach, this methodology assumes that all NCGs entering the power plant are discharged to atmosphere via the cooling tower or (in the case of a geothermal power plant where the steam is condensed at a pressure above atmospheric, the NCGs are commonly vented to atmosphere from the condenser, unless they are collected and reinjected into the geothermal reservoir).

NCG sampling should be carried out ~~in production wells and~~ [18]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 NCG 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 NCG sampling and analysis should be performed at least once every four months.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The following emissions will be monitored:

- Fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam; and
- Carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant.

[18] This is not necessary since fugitive emissions from wells on test or bleed are excluded in this methodology, refer Footnote 7 in ACM0002, Version 6

a) Fugitive carbon dioxide and methane emissions due to release of non-condensable gases from the produced steam (PES_y):

$$PES_y = (w_{main,CO_2} + w_{Main,CH_4} \cdot GWP_{CH_4}) \cdot M_{S,y}$$

where PES_y are the project emissions due to release of carbon dioxide and methane from the produced steam during the year y, w_{Main,CO_2} and w_{Main,CH_4} are the average mass fractions of carbon dioxide and methane in the produced steam, GWP_{CH_4} is the global warming potential of methane and $M_{S,y}$ is the quantity of steam produced during the year *y*.

b) Carbon dioxide emissions from fossil fuel combustion ($PEFF_y$)

$$PEFF_y = \sum_i F_{i,y} \cdot COEF_i$$

where $PEFF_y$ are the project emissions from combustion of fossil fuels related to the operation of the geothermal power plant in tons of CO_2, $F_{i,y}$ is the fuel consumption of fuel type *i* during the year *y* and $COEF_i$ is the CO_2 emission factor coefficient of the fuel type *i*.

Fuel purchased for use at the Darajat asset is consumed both by existing geothermal operations and the geothermal power plant which is the subject of this PDD. Fuel is not purchased or consumed separately for Darajat Unit III. To obtain a value of Fi,y applicable for use in the calculation of PEFFy, the total consumption of fuel of type *i* at the Darajat asset will be pro-rated on the basis of the nominal gross output of Unit III (121 MW) versus the total nominal gross output of all geothermal generating units at the Darajat asset operated by CGI, currently 216 MW (Unit II: 95 MW gross – this is 5MW higher than the value noted in Section A.2 due to operation at a higher turbine inlet pressure). Refer to discussion in Section D.4.

Total project emissions, PE_y , are therefore equal to $PES_y + PEFF_y$.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :									
Based on the Average OM method									
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1. EG_y	Electricity quantity	Electricity supplied to the grid by the project	MWh	m	Hourly measurement and monthly recording	100%	electronic	During the crediting period and two years after.	Electricity supplied by the project activity to the grid. Double check by receipt of sales.
2. EF_y	Baseline emission factor	CO_2 emission factor of the grid	t_{CO_2}/MWh	c	Yearly, for three years most recent data prior to CDM registration	100%	electronic		Calculated as an ex-ante weighted sum of the OM and BM emission factors
3. $EF_{OM,y}$	Operating Margin emission factor	Operating Margin CO_2 emission factor of the grid	t_{CO_2}/MWh	c	Yearly, for three years most recent data prior to CDM registration	100%	electronic		Calculated ex-ante as per the Average Operating Margin Emission Factor method

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

Based on the Average OM method

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
4. $EF_{BM,y}$	Build Margin emission factor	Build Margin CO_2 emission factor of the grid	t_{CO_2}/MWh	c	Yearly, for three years most recent data prior to CDM registration	100%	electronic		Calculated ex-ante as per the Build Margin Emission Factor method
5. $F_{i,j,y\ \&\ i,k,y}$	Fuel quantity	Amount of fossil fuel consumed by each power source per plant, per fuel type when there is more than one fuel	Mass or volume	m, e	Yearly, for three years most recent data prior to CDM registration	100%	electronic		Either directly from the power plants (including IPPs), or from data supplied by DJLPE[19] or DJGSDM for PLN plants (either as actual fuel consumed per plant for coal, or lumped consumption by fuel type for oil and gas)
6 $CC_{i,j,y\ \&\ i,k,y}$	Fuel carbon content	Weighted annual carbon content per fuel type per power plant	%C as – received basis	m, e	Yearly, for three years most recent data prior to CDM registration	100%	electronic		Directly from the power plants (including IPPs), or based on IPCC data for Indonesia, or estimated if this is more conservative than using IPCC values

[19] A description of the abbreviations used to identify the groups supplying data is given at the end of Annex 3

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :									
Based on the Average OM method									
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
6b. $COEF_{i,j,y \& i,k,y}$	Emission factor coefficient	Country specific data published by IPCC	t_{CO_2}/mass or volume unit	m					Refer to Revised 1996 IPCC Guidelines for National Greenhouse Inventories: Reference Manual. Chapter 1.
7. $GEN_{i,j,y \& i,k,y}$	Electricity quantity	Electricity generation of each power plant per fuel type	MWh	m	Yearly, for five years most recent data prior to CDM registration	100%	electronic		Data provided by PT PLN (Persero), P3B (Grid Manager), Settlement Group
8.	Plant name	Identification of each power plant for the OM	Text	m					Matches data in 7.
9.	Plant name	Identification of each power plant for the BM	Text	m					Matches data in 7, but adds year of first operation.
9a. Low-Cost/Must-Run	Plant list	Identification of whether each power plant is Low-Cost/Must Run or not	Text	m, e	Yearly, for five years most recent data prior to CDM registration				Supplied by the power plant operators, or assumed by CGI if not supplied. Required to prove that the Average OM EF method can be applied

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

Based on the Average OM method

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
10. λ_y	Parameter	Fraction of time during which low-cost/must-sources are on the margin	Not applicable. This data is not available for the JAMALI grid. This data is only required for the simple adjusted operating margin which is not applied in this project.						
11.	Merit Order	The merit order in which power sources are dispatched	Not applicable. This data is not available for the JAMALI grid. This data is only required for the dispatch analysis which is not applied in this project.						
11a. $GEN_{i,j,y\ \&\ i,k,y}$ *IMPORTS*	Not applicable because there are no imports on the JAMALI Grid								
11b. $COEF_{i,j,y\ \&\ i,k,y}$ IMPORTS	Not applicable because there are no imports on the JAMALI Grid								

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

As per ACM0002 (Version 6): "A baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source (where available) and made publicly available."

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$) based on one of the four following methods:

Per ACM0002, the Operating Margin emission factor ($EF_{OM,y}$) can be based on one of the four following methods:

(a) Simple OM, (SOM) or
(b) Simple adjusted OM (SAOM), or
(c) Dispatch Data Analysis OM (DDOM), or
(d) Average OM (AOM).

"Dispatch data analysis should be the first methodological choice. Where this option is not selected project participants shall justify why and may use the simple OM, the simple adjusted OM or the average emission rate method taking into account the provisions outlined hereafter.

The Simple OM method (a) can only be used where low-cost/must run resources3 constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term normals for hydroelectricity production.

The average emission rate method (d) can only be used

- *where low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply option (b) is not available, and*
- *where detailed data to apply option (c) above is unavailable."*

The JAMALI grid is complex. It includes more than 200 individual electric generators, driven by a variety of turbines, themselves driven by a variety of energy sources.

For the operating margin, data is not publicly available with which to calculate this margin using the dispatch data analysis method. The choice thus narrows to the Simple or Average OM. CGI was able to show (see later) that low-cost/must run resources constituted more than 50% of total grid generation in the five most recent years and therefore that the Average OM could be applied. ACM0002 (Version 6) defines the Average Operating Margin (OM) emission factor ($EF_{OM,average,y}$) as:

the average emission rate of all power plants, using equation (1), but including low-operating cost and must-run power plants. Either of the two data vintages described for the simple OM (a) may be used.*

(*In fact, the correct reference should be to equation (2) in ACM0002 (Version 6), which is:)

$$EF_{OM,y} = \sum_{i,j} F_{i,j,y} \cdot COEF_{i,j} \Big/ \sum_{j} GEN_{j,y}$$

where $F_{i,j,y}$ *is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y,*
j refers to the power sources delivering electricity to the grid, including low-operating cost and must-run power plants, and including imports to the grid,
$COEF_{i,j,y}$ (not simply $COEF_{i,j}$ as shown in equation (2)) *is the* CO_2 *emission coefficient of fuel i* (tCO_2 */ mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and*
$GEN_{j,y}$ *is the electricity (MWh) delivered to the grid by source j* in year(s) y[20].

The CO_2 *emission coefficient* $COEF_i$ *is obtained as:*

$$COEF_i = NCV_i \cdot EF_{CO_2,i} \cdot OXID_i$$

where:
NCV_i *is the net calorific value (energy content) per mass or volume unit of a fuel i,*
$OXID_i$ *is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),*
$EF_{CO_2,i}$ *is the* CO_2 *emission factor per unit of energy of the fuel i.*

Where available, local values of NCV_i *and* $EF_{CO_2,i}$ *should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.*

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:
A 3-year average, based on the most recent statistics available at the time of PDD submission, or (<< this option chosen by CGI)
The year in which project generation occurs, if $EF_{OM\ average,y}$ *is updated based on ex post monitoring.*

[20] Underlined text added for completeness

Data was sought from official sources in order to calculate the operating and build margins for the JAMALI grid. Several approaches were made to generators and the national dispatch center. Several meetings were held with stakeholders through 2005 and 2006 at which the data requirements for ACM0002 were described and discussed. These meetings were called by the government body which had been appointed (by the Minister of the Environment) as the CDM Focal Point for renewable electricity projects, namely the Sub-Directorate of New Energy and Energy Conservation within the Directorate of Electricity and Energy Utilization (DJLPE) of the Ministry of Energy and Mineral Resources. The stakeholders included:

- Ministry of the Environment
- Ministry of Energy and Mineral Resources
- Non Governmental Organisations
- PT Pertamina (Persero)
- PT PLN (Persero) (Pusat, P3B)
- PLN generating companies (PTPJB, PTIP)
- IPPs (coal and geothermal)

The following data was supplied from various sources for the JAMALI grid:

- The electricity dispatched onto the JAMALI grid by each generating unit for the 5 years 2000-2004, and information as to the type of power plant (from the PLN Dispatch Center; P3B)
- Fuel consumed by power plants operated by PTPJB for years 1999-2004 (from PTPJB)
- Year of first operation for all power plants operated by PTIP and of the fossil fuel power plants of PTPJB (from PTIP and PTPJB)
- Low cost / Must Run status of PTPJB's thermal power plants
- Coal consumed by Paiton Energy Company (2002-2004), analyses of coals used plus the mix ratio of these coals
- Coal consumed by Jawa Power Company (2003-2004), analyses of coals used plus the mix ratio of these coals
- PTIP's design coal specification for the Suralaya Power Station, plus some analyses of typical coals supplied to Suralaya
- DJLPE annual Indonesia statistics on electricity and energy for 2000-2004 (including lumped values for electricity generated and fuel consumed by PLN and electricity purchased by PLN from IPPs)
- DJGSDM annual Indonesia statistics on minerals and coal for 2004 (including the quantities of coal consumed by domestic coal users for electricity production 2003-2004)
- Actual non-condensable gas contents and steam consumption data for Darajat Unit II, Gunung Salak Units 1-6, and estimated values for Wayang Windu geothermal power plants.

Based on the data received as detailed above, for fossil fuel fired power plants, CGI calculated the mass CO_2 emissions (the numerator in the equation for EF_{OM} above) of each fossil fuel fired generating unit on the JAMALI grid as below. Where information was missing from the above data sets, CGI made assumptions or used IPCC default values (Indonesia-specific where available) in order to calculate the mass emissions. Items [1] through [5] below define the hierarchical approach used by CGI where CO_2 mass emissions were calculated for each generator based on the type of generator and the actual quantity and actual carbon content of the fuel consumed, if any, and if known. When one or either of these two parameters was not available, the next most rigorous source of information was applied, with [1] being the most rigorous, and [5] being the least rigorous.

[1] When actual fuel consumption was given by the generator or was available from DJGSDM data and the actual carbon content of the fuel used by a specific generator was either known or could be estimated [applies to Paiton PTPJB, Paiton IPP (PEC:2002-2004, JP:2003-2004) and PTIP Suralaya (2003-2004) coal plants]

CO_2 emissions = fuel consumed x actual (or estimated) carbon content [converted to mass carbon per unit of fuel consumed] x IPCC oxidation factor x 44/12 (refer Annex 3, Table 6.4)

[2] When actual fuel consumption was not given by the generator but a generator-specific fuel consumption for subsequent years was available from DJGSDM or IPP fuel data together with P3B generation data and the actual carbon content of the fuel used by a specific generator could be estimated [applies to PTIP and IPP coal plants not included in [1]]

CO_2 emissions = lumped specific fuel consumption/MWh x estimated carbon content [converted to mass carbon per unit of fuel consumed] x IPCC oxidation factor x 44/12 x total MWh dispatched by generator (refer Annex 3, Table 6.4)

[3] When fuel consumption by a specific generator was known and actual carbon content of fuel was not known [applies to PTPJB oil and gas plants]

CO_2 emissions = fuel consumed x IPCC Indonesia-specific default carbon content [converted to mass carbon per unit of fuel consumed] x IPCC oxidation factor x 44/12 (refer Annex 3, Table 6.2)

[4] When actual fuel consumption was not given by the generator but a lumped value was available from DJLPE statistics and actual carbon content of fuel was not known [applies to PTIP and IPP steam oil plants and PTIP open cycle gas turbine oil fired plants]

CO_2 emissions = lumped specific fuel consumption/MWh x IPCC Indonesia-specific default carbon content [converted to mass carbon per unit of fuel consumed] x IPCC oxidation factor x 44/12 x total MWh dispatched by generator (refer Annex 3, Table 6.3)

[5] When fuel consumption by generator type or by generator was not known and actual carbon content of fuel was not known [applies to PTIP open cycle gas turbine and IPP combined cycle gas turbine plants]

CO_2 emissions = IPCC Reference Indonesia-specific Fuel-specific Carbon Emission Factor x 44/12 x IPCC oxidation factor x industry-typical heat rate x total MWh dispatched by generator (refer Annex 3, Table 6.5)

Other required assumptions related to fossil fuel combustion were:

[6] When a liquid fuel was combusted in a gas turbine, but the type of liquid fuel was not known, it was assumed to be gas/diesel oil per IPCC. When a liquid fuel was combusted in an oil fired boiler, but the type of liquid fuel was not known, it was assumed to be crude oil per IPCC (refer Annex 3, Table 6.1).

[7] Industry-typical heat rates were selected based on typical values for new plant (refer Annex 3, Table 6.5).

Mass CO_2 emissions from non-fossil fuel power plants were calculated as:

[8] When geothermal CO_2 emissions per MWh were not known [applies to all geothermal plants except Darajat, Gunung Salak and Wayang Windu, for which actual or approximate actual non-condensable gas concentrations and specific steam consumptions were known and thus for which plant-specific CO_2 emissions could be calculated]

CO_2 emissions = Darajat Unit III emissions/MWh x total MWh dispatched by generator (refer Annex 3, Table 10)

[9] For a hydro-electric power plant or a steam turbine in a combined cycle power plant

CO_2 emissions = 0

Other data received, and assumptions made in its absence were:

[10] Year of first operation (required for Build Margin)

This was either as provided by the generators or, if the generators did not provide data, assumed by CGI based on information available to CGI (PTPJB and PTIP provided most of this data for their plants (refer Annex 3, Tables A7 & A8)). The data were presented by year and were not further differentiated by month so if more than one generator came on line in a year, and any one of these generators tipped the 20% required for Build Margin, all generators which came on line in that year were included in the Build Margin calculation.

[11] Low-cost/Must-run (Yes or No for each generating source)

This was either as provided by PTPJB (refer Annex 3, Table A6) or assumed by CGI on the following basis:

- All hydro-electric plants are Yes as they are low cost
- All IPPs are Yes because they are Must Run (Take or Pay)
- All non-IPP coal plants are Yes because they are either Low Cost or Must Run or both
- All PTIP thermal plants, excluding Suralaya, are No
- All PTIP geothermal plants are Yes.

Based on the data in [11] above and the assumptions made by CGI, Low-Cost/Must-Run sources constituted more than 50% of the generation on the JAMALI grid in each of the years 2000-2004, the five most recent years for which some generation data is available (refer Annex 3, Table 8). This precluded the use of the Simple Operating Margin and the Average Operating Margin Emission Factor was calculated instead.

Note that, for coal, use of the actual as-received carbon content and fuel consumption results in power plant specific CO_2 emission values which are 6-11% lower (i.e more conservative) than would have been calculated if only IPCC values were used (1.90-2.00 tCO_2equ/t (as-received coal) [Table 6.4] vs 2.13 [Table 6.1]).

In order to illustrate that the hierarchical approach described above leads to a conservative estimation of the baseline emission factor, consider the following distribution of results for the Average Operating margin calculation from the year 2004:

Category	CO_2 Emitter	Hierarchical Data Ranking*	% of total MWh
[9]	None (hydro)	Highest	14%
[1]	Coal	↓	48%
[2]	Coal	↓	0% **
[3]	Oil & Gas	↓	17%
[8]	Geothermal	↓	7% ***
[4]	Oil & Gas	↓	14%
[5]	Oil & Gas	Lowest	1%

* Highest means CO_2 emissions are calculated based on the least number of assumptions (i.e. they are expected to be closest to the real values), lowest means the calculations are based entirely on IPCC default values

** Not used in 2004

*** Actual emissions are known for approximately 50% of the geothermal generation, hence this is placed midway in the ranking

This table shows that the higher ranked data ([9] & [1]) are a significant component of the calculation (more than 60% of the total generation), which supports the claim that this is a conservative approach (since use of the highest ranked data features strongly in the baseline emission factor calculation and it is associated with lower emissions than use of the IPCC default values).

The ranking of the inputs to the Build Margin, although not shown directly here, is even more significant due to the preponderance of coal (>80% of MWh) in the Build Margin calculation for 2004. Thus this hierarchical approach, which places coal at highest equal data ranking, strengthens the argument that the approach taken is conservative for both Operating Margin and Build Margin (because coal has the highest impact on the baseline calculation). It should be noted that the coal carbon contents used here are based on only a few data points. Nevertheless, as these are deemed to be representative, and their use leads to a conservative result, their use is appropriate.

For each JAMALI generator a total emission value in tCO_2 was calculated for each year 2002-2004. The Average Operating Margin Emission Factor ($EF_{OM,average,\ y}$), in tCO_2equ/MWh, is the sum of the carbon dioxide emissions of all generators for the years 2002-2003 in tonnes, divided by the sum of all electricity dispatched onto the JAMALI gird for the same period in MWh.

The actual calculation is presented in Annex 3, Table 8. The value of the Average Operating Margin Emission Factor so calculated is 0.688 tCO_2equ/MWh.

STEP 2. *Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (tCO_2equ/MWh) of a sample of power plants m, as follows:*

$$EF_{BM,y} = \sum_{i,m} F_{i,m,y} \cdot COEF_{i,m} \Big/ \sum_{m} GEN_{m,y}$$

where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are ***analogous to the variables described for the simple OM method above for plants m***[21].

ACM0002 permits two options:

Option 1. Calculate the Build Margin emission factor $EF_{BM,y}$ ex ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of either

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

[21] The bold font is used to indicate wording which supports use of the three year data vintage (refer to the OM definitions), in the BM calculation

Project participants should use from these two options that sample group that comprises the larger annual generation. If 20% falls on part capacity of a plant, that plant is fully included in the calculation.

Option 2. For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually ex post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in option 1 above. The sample group m consists of either

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

Project participants should use from these two options that sample group that comprises the larger annual generation. If 20% falls on part capacity of a plant, that plant is fully included in the calculation.

CGI has chosen Option 1. The data required to calculate the value of the Build Margin Emission Factor is a sub-set of the data points used to calculate the Average Operating Margin Emission Factor. To choose the sub-set (*m*) of data points, in each of the three years 2002, 2003 and 2004, the most recent plants are selected to achieve the 20% criteria in the year 2004. The same set of plants which meets this criterion in 2004 is fixed and selected again for both 2003 and 2004. Developing the Build Margin Emission Factor based on three years provides a representative sample of capacity additions on the grid and follows the methodology which states that the sub-set (*m*) of data points as defined in the Simple Adjusted Operating Margin should be used. ACM0002 is not 100% clear regarding how many years of data should be applied to calculate the Build Margin. Alternatives to the position taken here would be (1) use only the most recent data (2004), or (2) calculate the set of plants meeting the criteria in 2002, 2003 and 2004, and in each of these years choose the set of plants which meets the criteria in that year (this could result in three different sets of plants, with overlap). The Build Margin was calculated according to the three different alternatives. The chosen alternative was the most conservative (i.e. it gave the lowest value for the Build Margin).

The Build Margin Emission Factor ($EF_{BM,y}$), in tCO_2equ/MWh, is the sum of the carbon dioxide emissions in 2002, 2003 and 20004 of the set of m_i generators selected for the year *i* =2004, in tonnes, divided by the sum of all electricity dispatched onto the JAMALI grid for the same three year period in MWh by this set of generators. The actual calculation is presented in Annex 3, Table 8. The value of the Build Margin Emission Factor so calculated is 0.820 tCO_2equ/MWh.

STEP 3. Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin Emission Factor ($EF_{OM,y}$) and the Build Margin Emission Factor ($EF_{BM,y}$):

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

where the weights w_{OM} and w_{BM} are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2equ/MWh.

The value of the JAMALI Baseline Emission Factor so calculated is 0.754 tCO_2equ/MWh. The application of ACM0002 to calculate the JAMALI Baseline Emission Factor was reviewed by the stakeholders and acknowledged by them on 17 April 2006. The value calculated at that time was officially submitted as the JAMALI Baseline Emission Factor for 2004 by the Director General of Electricity and Energy Utilization, Ministry of Energy and Mineral Resources, to the Chairperson of the Designated National Authority of Indonesia on 28 April 2006 (Refer Annex 3, Attachment 3.1). Subsequently an updated value of 0.754 tCO_2equ/MWh was agreed with stakeholders on 22 August 2006. The Designated National Authority notified this updated value on 12 September 2006 (Refer Annex 3, Attachment 3.2).

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Option 2 is not applied.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Option 2 is not applied.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
21. EG_{yI}, EG_{yII}	*Electricity quantity*	*Electricity supplied to the grid by Unit I and*	*MWh*	*(m)*	*hourly*	*100%*	*Electronic & paper*	*A daily log will also be kept for each of these units. The reason(s) for any average*

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

		Unit II						*daily dispatch less than 90% of the nameplate rating will be noted in the logs.*
22. 5YrEG$_{yI}$, 5YrEG$_{yII}$	*Electricity quantity*	*5 Year historical average electricity supplied to the grid by Unit I and Unit II, based on nameplate ratings*	*MWh*	*(m)*	*hourly*	*100%*	*Electronic & paper*	
23. EGEx$_{yII}$	*Electricity quantity*	*Cross-over electricity supplied to Unit II by Unit III*	*MWh*	*(m), (e)*	*hourly*	*100%*	*Electronic & paper*	*This is the sum of the electricity export measurements from three cross-over meters. This is the opposite of leakage and is additive with EG$_y$. (see D4)*
24. EGIm$_{yII}$	*Electricity quantity*	*Cross-over electricity supplied to Unit III by Unit II*	*MWh*	*(m), (e)*	*hourly*	*100%*	*Electronic & paper*	*This is the sum of the electricity import measurements from three cross-over meters. This is leakage and is subtractive with EG$_y$ (see D4)*

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

As per ACM0002: "The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation. Project participants do not need to consider these emission sources as leakage in applying this methodology. Project activities using this baseline methodology shall not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario."

Reductions in output from Darajat Units I and II may occur for several reasons: maintenance schedule, changes in the system power factor, equipment failure, natural decline in the reservoir, management decisions and the existence of the project activity. Any reductions in electricity supplied to the grid from Darajat Unit I or Unit II that are attributable to the project activity would be leakage. The quantity of electricity supplied to the grid from Darajat Unit I and Unit II (as referenced in table D.3.) will be compared against five year historic average levels. Deviations from historic average electricity supplied will be evaluated to determine if they are attributable to the project activity. Leakage MWh is the reduction in electricity supplied from Darajat Units I & II attributable to the project activity. For the purpose of calculating emissions reductions by the project activity, leakage MWh from Darajat Unit I and Unit II will be deducted from the total MWh supplied to the grid by the project activity.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year *y* is the difference between the baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where the baseline emissions (BE_y in metric tons CO_2) is the product of the baseline emissions factor (EF_y in tCO_2equ/MWh, calculated in Step 3), times the electricity supplied by the project activity to the grid (EG_y in MWh):

$$BE_y = EG_y \cdot EF_y$$

For this geothermal project activity project participants shall account for the following emissions sources[22], as applicable:

- Fugitive emissions of carbon dioxide due to release of non-condensable gases from produced steam; and
- Carbon dioxide resulting from combustion emissions of fossil fuels related to the operation of the geothermal power plant.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.3 1. EG_y	Low	Revenue quality metering, but requires routine calibration to meet the requirements of the electricity sales agreement.
D.2.1.3 2. EF_y & 3. $EF_{OM,y}$ & 4. $EF_{BM,y}$	Medium	These are calculated based on data supplied under D.2.1.3 items 5, 6, and 7. Where data under item 5 and 6 is not directly available, values are calculated in the manner described in Section D.2.1.4.

[22] As per ACM0002 fugitive carbon dioxide and methane emissions due to well testing and well bleeding are not considered as they are negligible.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.3 5. $F_{i,j,y\ \&\ i,k,y}$	Low	The fuel consumption data, where available, is cross-checkable with data reported by DJLPE and DJGSDM.
D.2.1.3 6. $CC_{i,j,y\ \&\ i,k,y}$	Medium	The fuel carbon content data for coal is based on analyses of the different coals combusted in the different coal fired power plants. IPCC default values resulted in higher carbon contents than what are actually used so this approach is conservative.
D.2.1.3 6b. $COEF_{i,j,y\ \&\ i,k,y}$	Low	For oil and gas, the IPCC default values are used, converted to the volume units reported in Indonesia.
D.2.1.3 7. $GEN_{i,j,y\ \&\ i,k,y}$	Low	Provided by the grid operator. This is based on the metering provided at the electricity export point of each generator. Generally it will be revenue quality metering, which will require routine calibration to meet the requirements of the electricity sales agreement between the generator owner and the grid operator.
D.2.1.3 9 (Year)	Low	This is the data for year of first operation. Some data was supplied by power plant owners, other data assumed by Project Proponent based on a literature search. For plants constructed before approximately 1996, the year of first operation does not affect the calculation.
D.2.1.3 9a (Low Cost/Must Run)	Low	This is the data for whether a plant is low cost/must run or not. Some was data supplied by power plant owners, other data is assumed by the Project Proponent based on assumptions described in Section D.2.1.4.
D.2.1.1 12. $M_{S,y}$	Low	The venturi meter is a physical device and the only checking required is the occasional inspection of the internal dimensions to ensure that wear has not taken place. Routine calibration/checking of the primary measurement elements (differential pressure transmitter, absolute upstream pressure transmitter and thermocouple) will be undertaken to ensure that the measurement system is working correctly. The backup steam flow calculation requires measurement of the following variables: generator MW, auxiliary steam flow (using an orifice plate flowmeter), turbine exhaust pressure, non-condensable gas content (refer items 13 & 14 in this table D3). The equipment measuring these variables will be checked and calibrated on a regular basis.
D.2.1.1 13. w_{Main,CO_2}	Low	QA/QC procedures cover all aspects of this data including preparation of solutes and titrants, the method of sampling, the laboratory measurement of dissolved species and condensed steam and the laboratory measurement of residual quantity and composition.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.1 14.w_{Main,CH_4}	Low	QA/QC procedures cover all aspects of this data including preparation of solutes and titrants, the method of sampling, the laboratory measurement of dissolved species and condensed steam and the laboratory measurement of residual quantity and composition.
D.2.1.1 18. $F_{i,y}$	Low	Logging of the fuel used in the project for diesel driven fire pump, diesel driven standby generator and fuels used in the project vehicle fleet is required for accounting purposes and is therefore captured quite accurately.
D.2.3.1 21. EG_{yI}, EG_{yII}	Low	Revenue quality metering, routinely calibrated to meet the requirements of the electricity sales agreement for Darajat Unit I and II.
D.2.3.1 22. $5YrEG_{yI}$, $5YrEG_{yII}$	Low	Revenue quality metering, routinely calibrated to meet the requirements of the electricity sales agreement for Darajat Unit I and II.
D.2.3.1 23. $EGEx_{yII}$	Low	Industrial quality metering, routine calibration
D.2.3.1 24. $EGEx_{yII}$	Low	Industrial quality metering, routine calibration

The data used to calculate the combined margin emission factor for the Java-Madura-Bali (JAMALI) interconnected electricity grid has been gathered from a variety of sources. In the case of data from an official source the quality of this data is accepted on an as-is basis. In some cases it has been possible to compare the same data from more than one source. Wherever there was a choice, the data which was selected was that which resulted in a more conservative value for the emission factor (e.g. the use of actual coal carbon content rather than IPCC default values).

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

Chevron's efforts to manage and reduce greenhouse gas emissions are built upon the enterprise-wide SANGEA™ energy and emissions estimating system. The company began development of the system in 2000 and completed its implementation in 2002. The SANGEA™ system allows Chevron to account for and report all known sources of carbon dioxide, methane, and nitrous oxide emissions, and to estimate energy and fuel use in a comprehensive, systematic manner.

Chevron also established its first greenhouse gas emissions inventory protocol, which was updated on February 17, 2004, and provides guidelines, sets boundaries and establishes scope for what to report. It also defines emissions accounting principles and specific terminology for greenhouse gas emissions accounting and reporting. Together, the Protocol and the SANGEA™ system form the foundation for greenhouse gas emissions management throughout Chevron.

Reductions in output from Darajat Units I and II may occur for several reasons: maintenance schedule, changes in the system power factor, equipment failure, natural decline in the reservoir, management decisions and the existence of the project activity. Any reductions in electricity supplied to the grid from Darajat Unit I or Unit II that are attributable to the project activity would be leakage. The quantity of electricity supplied to the grid from Darajat Unit I and Unit II (as referenced in table D.3.) will be compared against five year historic average levels. Deviations from historic average electricity supplied will be evaluated to determine if they are attributable to the project activity. Leakage MWh is the reduction in electricity supplied from Darajat Units I & II attributable to the project activity. For the purpose of calculating emissions reductions by the project activity, leakage MWh from Darajat Unit I and Unit II will be deducted from the total MWh supplied to the grid by the project activity.

The emission reductions from Darajat Unit III are calculated from the product of the combined margin emission factor and the electricity dispatched by Darajat Unit III, less any CO_2equ emissions from the Darajat Unit III project (from CO_2 and CH_4 in the steam supplied to the project), less any leakage as per previous paragraph.

Additional to the SANGEA™ energy and emissions estimating system, CGI will prepare a Monitoring Plan for Emissions Reductions from the Darajat Unit III Project prior to the commencement of generation of emissions reductions. This will define what variables are to be monitored, how frequently they will be monitored, how the quality of the variable data gathered will be checked and maintained and archived, and who (within the CGI organization) will be responsible for the implementation and routine management, reporting and auditing of the ongoing Monitoring Plan. This process will assure the accuracy and validity of the emissions reductions calculated on a regular basis and submitted to the DOE for CERs Certification.

As mentioned in D2.1, CO_2 and CH_4 in the steam supplied to the project will be monitored through regular sampling of the steam supplied to the project, as defined in the Monitoring Plan. The calculation of mass of CO_2 and CH_4 in the steam supplied to the project involves two main variables: steam flow and CO_2 and CH_4 concentration in the steam flow. Steam flow is measured continuously and stored in a database. The process variables required to measure steam flow are steam temperature, steam pressure and differential pressure across the venturi flow meter. These parameters are recorded continuously and the primary elements will be checked and calibrated based on a frequency defined in the Monitoring Plan. Calibration will be carried out by the Darajat Unit III instrument technicians following a procedure, and to a frequency which will be included in the Monitoring Plan. In addition to regular calibration of the primary measurement elements, additional Quality Control will be exercised on a not-less-than hourly basis by retrospectively comparing the measured venturi steam flow against a check steam flow calculated from a) the actual measured gross turbine power and the known relationship between gross turbine power and turbine steam flow (including the impact of significant variables on this relationship) plus b) the measured auxiliary steam flow measured by an orifice plate flowmeter. In any hour if the measured venturi steam flow data is missing or varies significantly from the check steam flow, the value to be used for steam flow will be the higher of the measured venturi steam flow or the check steam flow except if the measured steam flow is more than 105% of the check steam flow in which case the value to be used will be 105% of the check steam flow. The CO_2 and CH_4 concentration in the steam flow will be analysed from samples taken from the steam line supplying steam to Unit III at the frequency defined in the Monitoring Plan. Such samples will be obtained using ASTM method E 1675 referred to in ACM0002 and analysed in an accredited laboratory for the constituents of interest, CO_2 and CH_4 (and CO will be analyzed for as long as it takes to confirm the assumption that this is not present). At each sampling, duplicate samples will be taken and both will be analysed. If the CO_2 analysis results of the duplicate samples vary by more than 10%, further samples will be taken until agreement is obtained within 10%.

To monitor potential leakage associated with Darajat Units I and II, the Monitoring Plan will call for the routine logging of the status of Darajat Units I & II, as well as the electricity generated by Darajat Unit I & II. The reason for any reduction in gross output more than 10% below the nameplate rating of the unit will be noted in the log. Whenever the annual output of Darajat Unit I or II is below five year historic average levels (based on nameplate ratings), the unit log will be examined to determine whether or not the reduction in output is attributable to Darajat Unit III.

The Monitoring Plan will call for review and confirmation that the electrical energy dispatch meters associated with Darajat Units I, II and III are routinely calibrated. Regular calibration is required by the Electricity Sales Contract covering these three units, and the purpose of the Monitoring Plan will be to focus regularly on ensuring that this does happen.

Consistent with ACM0002, Version 6, Darajat Unit III Project is required to monitor: “carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant”. The methodology is silent on whether or how this should be apportioned when the CDM Project is added to an existing facility in which there is existing use of fossil fuels. ACM0002, Version 7, includes a "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" to be used for the calculation of project emissions from fossil fuel combustion. Under $FC_{i,j,y}$ (Quantity of fuel type i combusted in process j during the year y) this notes "The consistency of metered fuel consumption quantities should be crosschecked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records". However, this tool does not provide any guidance on how to apportion fuel consumption to a CDM project when the measured quantities cover activities which are wider than the CDM project activity.

Options for apportioning the total asset fossil fuel consumption to the Darajat Unit III Geothermal Project could be (from highest project emissions to lowest project emissions) include:

(a) Allocate based on the ratio: (installed gross generation capacity of Darajat Unit III)/(total installed gross generation capacity at the Darajat asset operated by CGI)

(b) Allocate based on the increase in consumption of fossil fuels at the Darajat asset above a historical baseline of consumption over the five years preceding the operation of the Darajat Unit III power project.

Option (b) is supportable, but is not as conservative as option (a). CGI will use option (a) to determine the "carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant". The total fossil fuel consumption for the Darajat asset will include fuel consumed for operational and maintenance activities as purchased by the Darajat asset, and fuel consumed for drilling activities at the Darajat geothermal resource, either purchased by CGI or CGI's subcontractors. It is conservative as it does not allocate fossil fuel consumption to CGI's steam supply activities associated with Darajat Unit I.

The Darajat Unit III Geothermal Project has been added to a geothermal reservoir where two existing non-CDM electricity generating units (Units I & II) take steam from the same reservoir and convert this to electricity delivered to the interconnected grid. As there are one medium voltage (6.8kV) and two low voltage (380V) connections (cross-overs) between Unit III and the adjacent Unit II which is located in the same powerhouse building, it is possible for Unit III to supply electricity to Unit II (the quantum of which ($EGEx_{yII}$) must be added to the net electrical energy delivered to the grid since it has lead to a reduction in baseline emissions elsewhere) and for Unit II to supply Unit III (the quantum of which ($EGIm_{yII}$) must be deducted from the net electrical energy delivered to the grid since it has lead to an increase in baseline emissions elsewhere – this is conservative as there are some common services supplied by Unit III which may need to be fed from Unit II when Unit III is not operational). This cross-over electricity is normally zero (the cross-over circuit breakers being normally open). Bidirectional electrical energy metering will be installed at each cross-over and used to obtain values for $EGEx_{yII}$ and $EGIm_{yII}$. Additionally, until the meters are installed (and if the meters, once installed, are not operating), the position of the cross-over circuit breakers will be monitored and if they are closed the duration of closure will be recorded and the estimated electrical energy flow will be estimated from the connected loads and the period of closure.

D.5 Name of person/entity determining the monitoring methodology:

Mr. Maher Sungkar
Chevron Geothermal Indonesia
Sentral Senayan I
Jl. Asia Afrika No. 8
Jakarta 10270
INDONESIA
OE/HES Manager
Ph.: +62 21 5798 4278
Fax.: +62 21 5798 4477
Email: mahersk@chevron.com

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

Greenhouse gas emissions from the Darajat Unit II plant during 2004 have been estimated by CGI at 23,903 tonnes of CO_2equ, based on monthly steam production rates and periodic sampling and analysis of the non-condensable gases contained in the geothermal steam. This information shows that all non-condensable gases (in aggregate) constituted just 0.53% (weight basis) of the steam processed by the plant (Refer Annex 3, Table 10).

During 2004, Unit II dispatched 793 GWh of electricity (Refer Annex 3, Table 8). In combination with the estimated emissions presented above, these data indicate an emission factor for 2004 of 30.14 kg CO_2equ/MWh.

Estimation of the CO_2 emissions from the proposed Darajat Unit III Project is based on a generation capacity of 121 MW gross, an average capacity factor over the first seven years crediting period of 93.5% (resulting in an annual average gross generation of 991,062 MWh) and the emission factor of 0.03014 tonne CO_2equ/MWh derived from Darajat Unit II emission records. Hence, the average annual CO_2equ emissions from the proposed Darajat Unit III Project are estimated as:

991,062MWh generation output x 0.03014 tonne CO_2equ/MWh = 29,870 tonnes CO_2equ/year

E.2. Estimated leakage:

Leakage emissions are expected to be zero.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

The sum of E.1 and E.2 is estimated to be approximately: 29,870 tonnes CO_2equ per year.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

The baseline emissions (BE_y in metric tons CO_2) are the product of the baseline emissions factor (EF_y in tCO_2equ/MWh, calculated in Step 3), times the electricity supplied by the project activity to the grid (EG_y in MWh):

$BE_y = EG_y \cdot EF_y$

Where
EG_y = 991,062 MWh/annum
EF_y = 0.754 tonnes CO_2equ/MWh

The estimated gross annual baseline emissions are = 747,261 tonnes CO_2equ.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

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

$ER_y = BE_y - PE_y - L_y$

The emissions reductions are expected to be 717,391 tonnes CO_2equ/annum.

E.6. Table providing values obtained when applying formulae above:

Table E.6. Emissions Reductions

Year	Estimation of project activity emissions (tonnes CO_2equ)	Estimation of baseline emissions (tonnes CO_2equ)	Estimation of leakage (tonnes CO_2equ)	Estimation of emissions reductions (tonnes CO_2equ)
Annual	29,871	747,261	0	717,391
First crediting period (7 years)	209,094	5,230,828	0	5,021,734

SECTION F. Environmental impacts

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

The proposed Darajat Unit III Project is designed to contribute to the supply of electricity in the JAMALI Interconnected Grid system and generate electricity from clean and environmentally-friendly resources. The plant will be located in Garut, West Java adjacent to the existing Darajat Unit II plant and will utilize existing transmission lines, steam lines, and wells. There will be little added environmental impact to the existing plant site and infrastructure. In the steam field, three existing outlying wells will be connected by two steam pipelines to the existing steam system supplying Unit II. There will be some environmental effect due to construction but this will be minimised and is covered by existing Environmental Management and Monitoring Guidelines already approved for the project.

The development activities will consist of three activity phases, namely construction, operational, and post operational phases.

An Environmental Impact Assessment prepared for the facility predicted a number of impacts which are outlined below. There were several areas where the facility was expected to have impacts, potentially affecting the physiography and geology, hydrology and water quality, land space and soil, flora and fauna, and air quality of the site. These impacts would be due to: 1) land clearing and preparation and drilling of production wells during the construction phase (there are no new wells for Unit III), 2) plant operation, including make-up production and reinjection wells and 3) the post-operational or decommissioning phase. Based on these predictions, these impacts were mitigated through implementation of an Environmental Management and Monitoring Guideline which is regularly reported to the Government environmental body.

Mitigation Measures: The purpose of an Environmental Management and Monitoring Guideline is to limit the negative significant impacts while increasing the positive impacts.

A technological approach is required in handling/minimizing negative impacts caused by development activities of geothermal steam field during construction, operational, and post operational phases. The technological approach previously used to minimize negative impacts for Darajat Units I & II, and which will be used for Darajat Unit III where applicable, is as follows:

- Avoiding slope cutting that will increase local slope angle beyond 50%, cascade, drainage, and revegetation on original soil. These measures are conducted to prevent the possibility of erosion caused by changes in land form.
- Using directional drilling method to minimize land use
- Construction of rain drainage with a slight slope. Construction of cascade in the channel system and conduct a routine cleaning and construct an over flow equipped with a water gate.
- Maintenance of standby diesel generator machinery according to the applied standard to ensure normal condition that can minimize impacts on air quality, especially during the operational phase.
- Utilization of silencer to reduce noise intensity caused by drilling and well production testing activities.
- Conduct management of drilling waste for both liquid and solid waste. Wastewater from drilling, after sedimentation, will be reused for drilling, while drilling sludge and cutting wells settled must be further handled.
- Maintenance of condensate wastewater reinjection system.
- Addition of traffic signs at traffic jam and main accident sensitive locations, especially at access roads leading to the project site. Execution must be coordinated with related institutions to avoid traffic jams and accidents.
- Reforestation of project area during post operational phase will recover land fertility through top soil richening will also reduce the occurrence of soil erosion and it is expected to recover until a permitted level of erosion.

F.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:

The new Unit III will be located adjacent to the Darajat Unit II plant and will utilize existing transmission lines and wells. This part of the project will therefore have little added environmental impact to the existing plant site and infrastructure. Three existing outlying wells will be connected by two steam pipelines to the existing steam system supplying Unit II which will also be used to supply steam to Unit III.

The incremental environmental impacts of the proposed Darajat Unit III Project are expected to be minor and mitigated through implementation of an Environmental Management and Monitoring Guideline which is regularly reported to the Government environmental body.

- Construction Phase – by placing the new power plant unit adjacent to the existing Darajat Unit II plant and utilizing the existing infrastructure there will be negligible environmental impacts on the hydrology and water quality and aquatic biota. Measures include: ensure that work opportunities for the local citizens are maximized and that there is regular supervision of workers; prevent land subsidence caused by land clearing; anticipate the possibility of erosion and sedimentation caused by land clearing; reduce erosion of land surface and anticipate the deterioration of surface water quality; identify negative impacts on vegetation; identify success level of management on water quality; monitor the level of noise intensity and assure that the rock muffler is properly functioning; identify community changes especially changes in species composition, species diversity and fauna population; detect changes in groundwater quality.
- Land Clearing and Preparation – the proposed Darajat Unit III power plant will be located adjacent to the existing Darajat Unit II plant, therefore, little additional land clearing or preparation will take place for the new facility.
- Drilling of Production Wells – no new wells are expected to be drilled for the initial operation of Unit III. Make-up wells will be required in the future to support operation of the power plant units.
- Connection of three existing wells - construction of the two steam pipelines will require some land clearing in steep forested areas. Careful attention to the pipeline design and careful consideration of the construction methodology will minimise the potential adverse impacts. During construction the work will be closely monitored by CGI and the relevant authorities to ensure that adverse impacts are minimised.
- Operational Phase of Steam Field – Requires attention on the air quality (H_2S) concentration and management, no significant impact is expected on physiography and geology, hydrology, fauna, and aquatic biota.
- Plant Operation – Requires attention on the NCG emissions, air quality and H_2S concentration, and noise. The plant is not expected to have significant negative impacts on ambient air quality, physiography and geology, hydrology and water quality, fauna, and aquatic biota.
- Post-Operational Phase – no significant impacts are expected.

A complete Environmental Impact Assessment (ANDAL) and Environmental Management and Monitoring Plans were prepared for Darajat Unit III in accordance with Indonesian laws. Adherence to the requirements of these plans will be ongoing.

SECTION G. Stakeholders' comments

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

A stakeholder consultation was held in the multifunction room, Pendopo Bupati, Garut on 19th November 2003. The meeting was advertised in national and regional newspapers (Jakarta Post, Kompas and Pikiran Rakyat) in both English and Bahasa Indonesia on the 12th November and the 19th November 2003. In addition to the advertisements, CGI (then Amoseas Indonesia, Inc.) sent invitations to several specific stakeholders including: the Ministry of Environment, Ministry of Energy, PLN, universities (including Garut University), NGOs (including the Rural Community Network) as well as regional and community leaders. Over 200 people attended the meeting which was conducted in Bahasa Indonesia.

The format of the meeting was:

1. Welcome & Introductions
2. Brief remarks about the proposed Darajat Unit III Project by CGI & Government officials
3. Project overview
4. Questions & Answers

The meeting was videotaped.

G.2. Summary of the comments received:

Overall the local community was supportive of the proposal to expand the Darajat plant. The majority of the questions related to the economic and community aspects of the project, such as the number of jobs that would be created, empowerment of the local community, new local business and community development projects, and local government tax revenues generated. The questions asked addressed social, economic, and environmental considerations:

- Social
  - How many local people are working with CGI, what is the percentage?
  - Will local people be given the opportunity to work in the new project?
  - How will CGI transfer technology to vocational schools present in the regency and enable the people of Garut to acquire new skills.
  - Is it possible to implement social projects in other locations instead of Kecamatan Pasirwangi?
  - Could street lighting be installed along roads in the Pasirwangi district? This would help reduce road accidents and crime.
- Economic
  - How does CGI participate in to local government (Garut) income Contribution?
  - What is the expected tax revenue for local government (Garut)?
- Environmental
  - What are the negative impacts of CGI's activities? An accurate environmental impact assessment should be submitted prior to the licensing of the Darajat Unit III Project.

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

All the questions and comments were addressed at the meeting to the satisfaction of those who attended:

- Social
  Mr. Hidayat Yusuf (Chevron Geothermal Indonesia, Ltd) projected increased construction activities that require more workers. CGI and the contractor selected to build the Darajat Unit III Project will initiate coordinating measures on manpower recruitment. The contractor will refer to the local Office of Manpower and the Garut Regency administration as the need arises. Employment requirements will be adjusted to the expertise and skills needed for every type of work, including knowledge on industrial safety. CGI will ask the contractor to provide training on skills and industrial safety to prospective workers.

  Mr. Hidayat Yusuf stated that CGI had assisted in the provision of street lighting along certain roads in Garut Regency. He said that CGI made the contribution after the Garut Regency administration claimed that traffic accidents and acts of crime occurred frequently on sections of those roads. The street lighting, he said, would reduce vehicular accidents and street crimes. Mr. Hidayat Yusuf noted that the local government must be consulted on any assistance that CGI wishes to extend. The foregoing is especially true when it comes to establishing priorities.

  Mr. Hidayat Yusuf said that the Darajat Unit III Project would be built by a contractor selected based on an open bidding. CGI will pay the contractor upon completion of the project. Therefore, additional workers recruited during construction of Unit III are those of the contractor rather than of CGI.

  Most of the workers employed by the Darajat project hailed from Garut and the surrounding areas. CGI will request the Darajat Unit III Project contractor to give priority to local recruits who possess the required skills and knowledge on industrial safety.

  In the past CGI implemented community development programs in areas around its operations. The programs sought to empower local economic initiatives. In the future, the programs will be stepped up to meet present needs. However, there are no figures as yet on the extent of the programs.

  CGI also contributed to improvements of educational facilities and development of instruction programs. They include construction of new facilities and renovations of existing schools in areas around its operations. CGI also contributed to improve teachers' capacities and assisted more than 1,100 pupils. These activities represented contributions to human resources development in areas around Darajat.

- Economic
  CGI has complied with all government regulations, particularly on remittance of taxes to the central government of the Republic of Indonesia. These tax remittances undoubtedly represent portions of the contributions made by Chevron Geothermal Indonesia, Ltd to local revenues. CGI will comply if the central government directs that tax payments be made directly to Garut regency administration based on the sharing of revenues between the central government and regional administrations.

- Environmental
  An Environmental Impact Assessment has been prepared for the project. As Unit III will utilize existing transmission lines, steam lines, and wells there will be little added environmental impact to the existing plant site and infrastructure.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Chevron Geothermal Indonesia, Ltd
Street/P.O.Box:	Sentral Senayan I
Building:	Jl. Asia Afrika No. 8
City:	Jakarta
State/Region:	--
Postfix/ZIP:	10270
Country:	Indonesia
Telephone:	+62 21 573 1020
FAX:	+62 21 5798 4477
E-Mail:	--
URL:	--
Represented by:	Maher Sungkar
Title:	OE/HES Manager
Salutation:	Mr
Last Name:	Sungkar
Middle Name:	--
First Name:	Maher
Department:	Operational Excellence / Health Environment & Safety
Mobile:	--
Direct FAX:	+62 21 5798 4477
Direct tel:	+62 21 5798 4278
Personal E-Mail:	mahersk@chevron.com

Organization:	Chevron Limited
Street/P.O.Box:	1 Westferry Circus
Building:	--
City:	London
State/Region:	--
Postfix/ZIP:	E14 4HA
Country:	UK
Telephone:	--
FAX:	--
E-Mail:	--
URL:	www.chevron.com
Represented by:	The Company Secretary
Title:	--
Salutation:	--
Last Name:	--
Middle Name:	--
First Name:	--
Department:	Legal
Mobile:	--
Direct FAX:	--
Direct tel:	+44 20 7719 5124
Personal E-Mail:	--

Annex 2

INFORMATION REGARDING PUBLIC FUNDING.

There is no public funding for this project.

Annex 3

BASELINE INFORMATION

The combined margin emission factor for the JAMALI interconnected electricity grid is calculated in the MICROSOFT© EXCEL® spreadsheet *JAMALI_Baseline_22Aug06.xls*. A text only version of the spreadsheet has been submitted for registration together with this PDD.

A listing of all the individual tabs (pages) within the spreadsheet appears at the end of this Annex 3.

Printed versions of the following tabs (pages) from the spreadsheet are directly attached to the PDD in this Annex 3:

Process — Process used in calculating the JAMALI Baseline Emission Factor.

Table 1. — JAMALI Grid, 2000. Electricity produced and fuel consumed, according to Electricity and Energy Statistics produced by the Ministry of Energy and Mineral Resources, Directorate General of Electricity and Energy Utilization.

Table 2. — JAMALI Grid, 2001. Electricity produced and fuel consumed, according to Electricity and Energy Statistics produced by the Ministry of Energy and Mineral Resources, Directorate General of Electricity and Energy Utilization.

Table 3. — JAMALI Grid, 2002. Electricity produced and fuel consumed, according to Electricity and Energy Statistics produced by the Ministry of Energy and Mineral Resources, Directorate General of Electricity and Energy Utilization.

Table 4. — JAMALI Grid, 2003. Electricity produced and fuel consumed, according to Electricity and Energy Statistics produced by the Ministry of Energy and Mineral Resources, Directorate General of Electricity and Energy Utilization.

Table 5. — JAMALI Grid, 2004. Electricity produced and fuel consumed, according to Electricity and Energy Statistics produced by the Ministry of Energy and Mineral Resources, Directorate General of Electricity and Energy Utilization.

Table 6. — Calculation of Fuel-Specific CO_2 Emission Rates from Fossil Fuel Combustion.

Table 7. — Calculation of Operating Margin Emission Factor based on DJLPE Statistics.

Table 8. — Calculation of Baseline Emission Factor, JAMALI Interconnected Electricity Transmission Grid, Average Operating Margin Method.

Table 9. — RUKN (National Electricity Plan) 2005-2025. JAMALI Interconnected Grid.

Table 9a. — RUKN (National Electricity Plan) 2005-2025. JAMALI Interconnected Grid. (Graphs).

Table 10. — Non-condensable Gas Emissions from Geothermal Power Plants.

Attachment 3.1 — Submission of the JAMALI Baseline Emission Factor by the Director General of Electricity and Energy Utilization (DJLPE) of the Ministry of Energy and Mineral Resources, to the Chairperson of the Designated National Authority of Indonesia, letter 1393/45/600.6/2006 dated 28 April 2006.

Attachment 3.2 — Notification of the updated baseline emission factor for the JAMALI grid agreed to by stakeholders on 22 August 2006. A letter from the Chairperson of the Designated National Authority of Indonesia to the Director General of Electricity and Energy Utilization (DJLPE) of the Ministry of Energy and Mineral Resources (ref: B-5915/Dep.III/09/06).

List of tabs (pages) in the spreadsheet *JAMALI_Baseline_22Aug06.xls*.

Process	Overview of how the baseline calculation is performed and what assumptions are made when data is not available from an official source
Table 1	DJLPE published data for 2000 (fuel consumption & gross electricity generated by PLN companies, net electricity purchased from IPPs)
Table 2	DJLPE published data for 2001 (fuel consumption & gross electricity generated by PLN companies, net electricity purchased from IPPs)
Table 3	DJLPE published data for 2002 (fuel consumption & gross electricity generated by PLN companies, net electricity purchased from IPPs)
Table 4	DJLPE published data for 2003 (fuel consumption & gross electricity generated by PLN companies, net electricity purchased from IPPs)
Table 5	DJLPE published [in preparation] data for 2004 (fuel consumption & gross electricity generated by PLN companies, net electricity purchased from IPPs). Draws on data from Tables B1/B2/B3.
Table 6	Carbon emissions from fuel combustion based on IPCC values, specific fuel consumption for gas and liquid fuels based on PLN P3B dispatch data and DJLPE fuel consumption, specific fuel consumption for coal plants based on PLN P3B dispatch data and DJGSDM fuel consumption (reconfirmed by IPPs) and default generation specific carbon dioxide emission factors based on IPCC reference data and industry-typical heat rates
Table 7	Calculation of Operating Margin Baseline Emission Factor, using DJLPE Data for Fuel Consumption & Electricity Produced and IPCC Defaults for Carbon Emission per Fuel Type
Table 8	The main calculation sheet for the baseline emission factor
Table 9	The National Electricity Plan for the JAMALI Grid - Capacity and Energy
Table 9a	The National Electricity Plan for the JAMALI Grid - Capacity and Energy (Same as Table 9, but formatted to print the graphs)
Table 10	Non-condensable Gas Emissions from Geothermal Power Plants
Table A1	JAMALI electricity dispatch data 2000-2004 prepared by PLN P3B Unit Setlemen (the group responsible to pay all the JAMALI generators for the electricity they dispatched)
Table A2	Fuel consumption data 1999-2004 as reported by PTPJB
Table A3	Fuel consumption by PT Paiton Energy Company for the years 2002 until 2005, and typical coal analyses
Table A4	Typical analyses for Indonesian coals burnt for electricity production on the JAMALI grid
Table A5	Typical analyses of coals produced by PT Bukit Asam
Table A6	Status low-cost/must-run from PTPJB for their generators
Table A7	Year of first operation from PTIP for their generators
Table A8	Year of first operation from PTPJB for their generators
Table A9	Suralaya coal fired power station coal specification (owned by PTIP)
Table B1	DJLPE electricity generation data for 2004 for PLN companies
Table B2	DJLPE PLN electricity purchases from IPPs data for 2004
Table B3	DJLPE fuel consumption data for 2004 for PLN companies

Legend

JAMALI	Java-Madura-Bali
IPCC	Intergovernmental Panel on Climate Change
DJLPE	Directorate General of Electricity and Energy Utilization, Ministry of Energy and Mineral Resources
DJGSDM	Directorate General of Geology and Mineral Resources, Ministry of Energy and Mineral Resources (now DJMBPB, Directorate General of Minerals, Coal and geothermal Energy)
PLN	PT PLN (Persero), the state owned electricity company which owns several generating companies and manages the JAMALI grid
PTIP	PT Indonesia Power, a PLN subsidiary generating company
PTPJB	PT Pembangkitan Jawa Bali, a PLN subsidiary generating company
PTPMT	PT Pembangkitan Muara Tawar, a PLN subsidiary generating company
IPP	Independent Power Producer, a generator selling electricity to PLN and dispatching this onto the JAMALI grid
PLN P3B	PT PLN (Persero) Penyaluran dan Pusat Pengatur Beban Jawa Bali. The PLN business unit responsible for managing the JAMALI grid operations, specifically UBS (Unit Bisnis Setelemen)

Annex 4

MONITORING PLAN

The requirements of ACM0002 (Version 6) are followed. Refer to Section D.