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

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Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Increase of Power Generation of the hydroelectric power station Fortuna in Panama (IPGFP)
Version 3
06/12/2006

A.2. Description of the project activity:

The Fortuna Hydroelectric Power Station (Fortuna) is the largest generating plant in Panama, and it accounts for more than 30%[1] of the total electricity generation in the country. Water from the Chiriquí River and other streams and rivers around Lake Fortuna are stored in the reservoir and used to generate energy in the 300 MW capacity power plants. The project seeks to increase the flow of water into the Fortuna reservoir by diverting five additional creeks. This increase in flow will increase electricity generation (MWh) without increasing the installed power capacity of the plant (MW) or requiring construction of new generation infrastructure. The project additional generation will be sold to the Panamanian interconnected grid.

The project is expected to increase Fortuna's electricity production by approximately 3% using renewable resources (corresponding to 47.435 MWh / yr). Considering the share of Fortuna in the energy market in Panama, it represents a 0,7 % increase in the national production.

The IPGFP represents an alternative to building new power plants in developing additional energy generation. The project will improve the efficiency and effectiveness of the existing Fortuna facility by increasing the flow of water into the reservoir, through the diversion of additional creeks and rivers with enough altitude above the reservoir to flow by gravity into the lake. A reduction of 10 %[2] for "ecological flow" will be maintained in order to guarantee a minimum level of the original riverbeds of the five additional creeks.

Emission reductions are thus achieved by increasing the supply of renewable energy from zero emitting sources to the national grid. Furthermore, the project activity contributes to sustainable development as it makes the following possible:

- To increase electric production in Panama without increasing, and hopefully decreasing, the rate of growth of the electric energy prices in the country.
- To more fully utilize Panamanian renewable resources.
- To minimize environmental impacts of electricity generation by conserving the forests and the environment surrounding the project and maintaining the ecological balance necessary to get the rainfall needed for power generation.

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[1] In 2005, Fortuna has generated 1.652.850 MWh, about 32,5 % of the total generation of the SIN (*Sistema Interconectado Nacional*, National Interconnected System), which was 3.417.576 MWh from hydro sources and 1.670.937 MWh form thermal sources in that year, according to CND. For reference and further information please refer to Annex 3 (Baseline Information).

[2] Value defined by the Panamanian National Environment Authority (ANAM – *Autoridade Nacional del Ambiente*), as per its resolution "*Resolución AG Nº -0127-2006 (De 3 de marzo de 2006)*".

- To reduce the need for fuel imports into the country, which are increasing due to the thermal power projects that have recently come on line.

In 2004, a GHG emissions baseline study as per the Small Scale CDM Methodology "Type I: Renewable Energy Project, Category D: Renewable electricity generation for a grid" was performed. As the Small-Scale Working Group (SSC WG) of the UNFCCC decided that the 15 MW small-scale limit applied to the total installed capacity for this type of project (and not only for the capacity increase), the selected methodology ceased to suit to IPGFP. A "pre-validation" of this first version had already been performed, with a pre-Validation Report issued by TÜV SÜD on October 18th, 2004. Version 2 consists thus of fitting IPGFP to the condition of large scale project.

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)
Panama (host)	Private entity Empresa de Generación Eléctrica Fortuna, S.A. - "EGE Fortuna"	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Panama

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

Province of Chiriquí

A.4.1.3. City/Town/Community etc:

Counties of Hornitos and Caldera, District of Boquete and Gualaca.

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

Figure 1 below indicates the location of the project within Panama. **Figure 2** indicates the location of the five creeks (La Tigra, Zarciadero, Las Huacas, Pinola, and Zumbona) in relation to the Fortuna reservoir, located at the bottom right of the zoom picture.

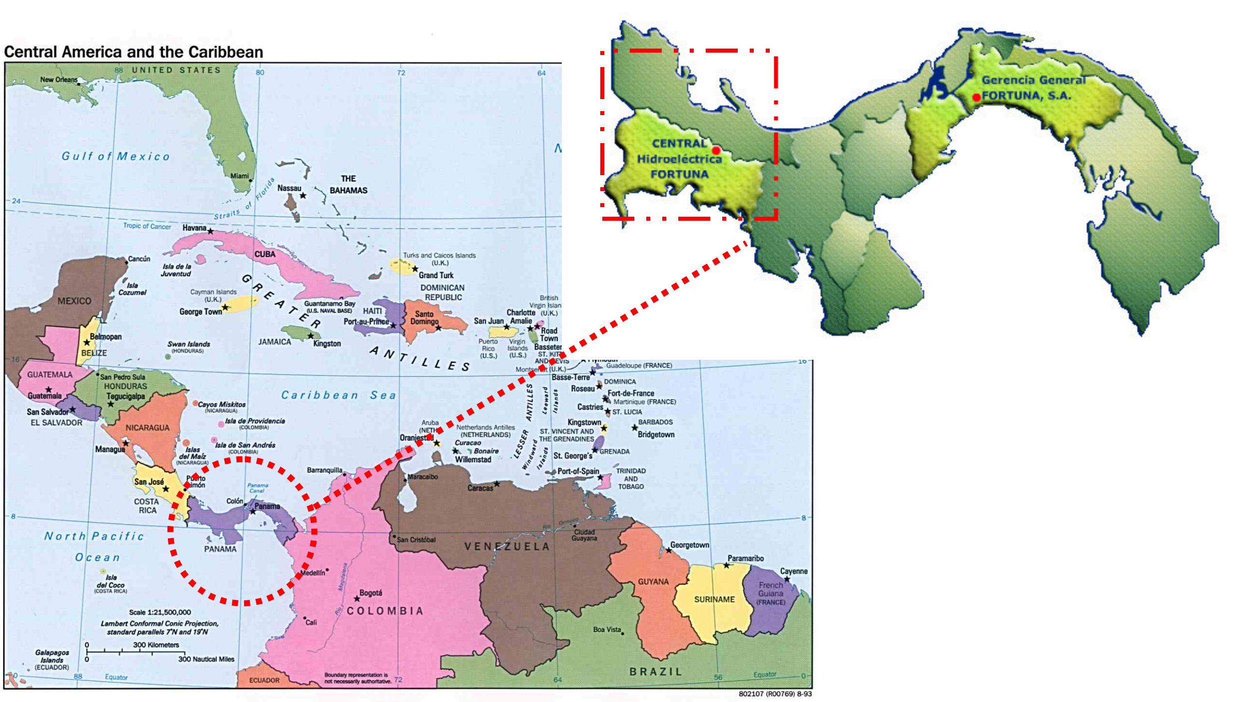

Figure 1: **Location of Fortuna Hydroelectric Project in Panama (Central America)**

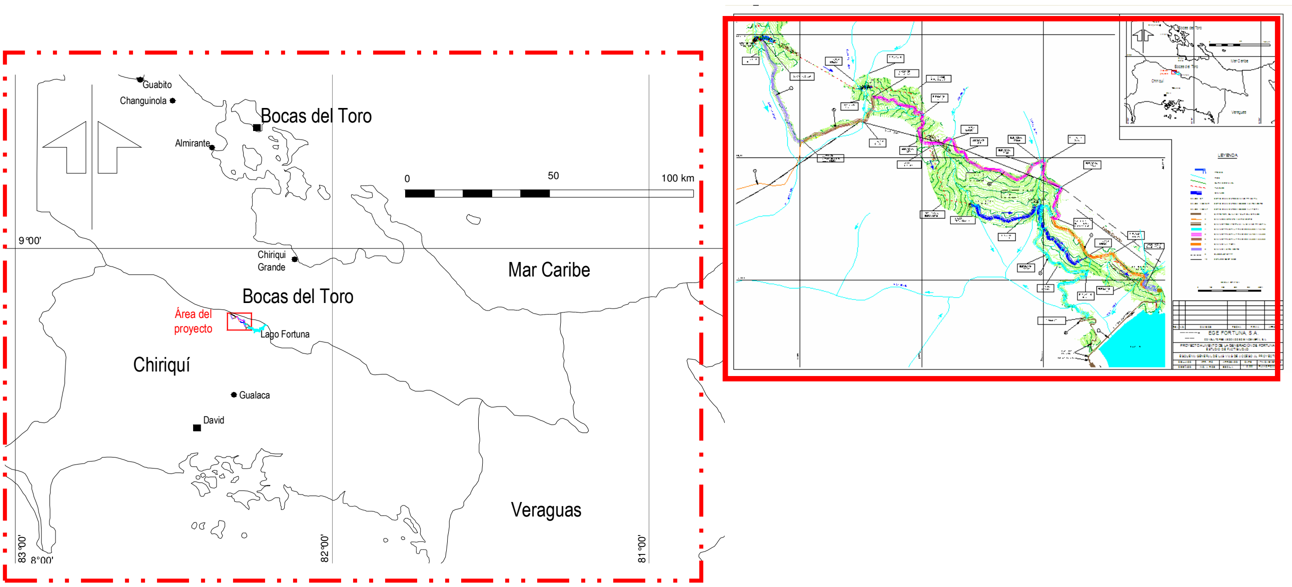

Figure 2: **Location of Fortuna Hydroelectric Project in Panama**

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

Sectoral Scope 1: Energy Industries (renewable- / non-renewable sources)

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

Current situation

Currently, water from the Chiriquí River and other streams and rivers around the lake, with a total flow of 27 m^3 / s, are stored in the Fortuna reservoir, which has a capacity of 166 million m^3. Water is driven from the reservoir through a 6-km tunnel to the plant, which has three 100-MW Pelton turbines (300 MW total capacity, 284 MW firm capacity) with 808 meters of head. The water then passes through an 8-km tunnel, returns to the Chiriquí River, and is later used by the Estí hydroelectric facility, managed by AES.

In 1984, when the Fortuna power station began operation, the dam and reservoir had little capacity to store water, with a reservoir volume of 7,12 million m^3. At that time, it was necessary to continually spill a large volume of water. In 1994, the dam height was increased, expanding the reservoir volume to 166 million m^3 and allowing the project to utilize nearly all the water from the rivers above the dam. The results from that increase can be seen in Table 1, published by ETESA[3].

Table 1: Average monthly level of Lake Fortuna[4].

AVERAGE MONTHLY LEVEL OF LAKE FORTUNA

Operational Upper Level: 1.050 meters
Operational Lower Level: 1.000 meters

	level (masl)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1984	-----	-----	-----	-----	-----	-----	-----	-----	1,010	1,009	1,009	1,010	1,009
1985	1,008	1,007	1,007	1,005	1,004	1,008	1,005	1,008	1,007	1,006	1,007	1,007	1,007
1986	1,008	1,005	1,007	1,005	1,007	1,007	1,006	1,007	1,008	1,009	1,006	1,006	1,007
1987	1,007	1,006	1,002	1,008	1,008	1,007	1,006	1,007	1,006	1,009	1,007	1,007	1,007
1988	1,007	1,009	1,009	1,006	1,006	1,007	1,006	1,008	1,010	1,009	1,007	1,009	1,008
1989	1,008	1,008	1,008	1,007	1,007	1,007	1,006	1,004	1,007	1,005	1,005	1,007	1,007
1990	1,009	1,008	1,007	1,006	1,008	1,007	1,006	1,005	1,004	1,007	1,008	1,008	1,007
1991	1,006	1,007	1,005	1,005	1,006	1,006	1,008	1,008	1,005	1,005	1,004	1,008	1,006
1992	1,007	1,006	1,006	1,003	1,008	1,007	1,007	1,007	1,008	1,007	1,005	1,009	1,007
1993	1,011	1,011	1,012	1,012	1,009	1,007	1,011	1,016	1,016	1,012	1,020	1,032	1,014
1994	1,031	1,028	1,023	1,018	1,012	1,019	1,025	1,026	1,026	1,030	1,033	1,044	1,026
1995	1,042	1,040	1,032	1,024	1,021	1,019	1,028	1,028	1,028	1,034	1,035	1,034	1,030
1996	1,042	1,047	1,043	1,035	1,030	1,030	1,034	1,041	1,041	1,042	1,045	1,049	1,040
1997	1,047	1,047	1,049	1,038	1,030	1,031	1,028	1,031	1,024	1,026	1,030	1,034	1,035
1998	1,033	1,025	1,017	1,016	1,020	1,025	1,033	1,031	1,028	1,027	1,032	1,037	1,027
1999	1,043	1,044	1,042	1,038	1,038	1,035	1,031	1,031	1,033	1,042	1,044	1,049	1,039
2000	1,051	1,048	1,046	1,042	1,038	1,039	1,041	1,043	1,040	1,032	1,029	1,030	1,040
2001	1,032	1,037	1,033	1,026	1,027	1,024	1,040	1,037	1,037	1,032	1,033	1,041	1,033
2002	1,046	1,046	1,044	1,042	1,045	1,046	1,043	1,043	1,044	1,041	1,041	1,048	1,044
2003	1,040	1,034	1,032	1,027	1,020	1,020	1,017	1,022	1,020	1,029	1,036	1,041	1,028
2004	1,045	1,040	1,043	1,040	1,043	1,042	1,042	1,041	1,038	1,036	1,040	1,046	1,041
2005	1,050												
Average	1,027	1,025	1,023	1,020	1,019	1,020	1,021	1,022	1,021	1,021	1,023	1,026	1,022

N.B.: From December 1992 to September 1993 there was the transition concerning the construction of the second stage of the dam.

Source: ETESA

In 1999, the electric power generating stations in Panama were privatized. EGE Fortuna, S.A. was purchased by the consortium Americas Generation Corporation, made up of Coastal Power Company, which was acquired later by El Paso Corporation of the United States, and Hydro Quebec of Canada.

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[3] ETESA – *Empresa de Transmisión Eléctrica S.A.* (http://www.etesa.com.pa/sp/mercadoFrm.htm), Panamanian national electric transmission company, responsible for the electric transmission of the Integrated National System.
[4] masl: meters above the sea-level

Hydro Quebec initiated this purchase, based on their focus of electric power production using hydroelectric resources. Nowadays, Fortuna belongs to ENEL, from Italy, and to Globeleq, from England.

Project activity

The project activity consists of constructing a system of canals and tunnels to divert water into the Fortuna reservoir from the following five creeks:

- La Tigra
- Zarciadero
- Las Huacas
- Pinola
- Zumbona

This project will not require new turbines, generators, or other power-generation infrastructure. Section B.6.3 provides details on electricity production estimates.

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

The estimated emission reductions for the chosen renewable crediting period are presented in the following table:

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2007	26.530
2008	26.530
2009	26.530
2010	26.530
2011	26.530
2012	26.530
2013	26.530
Total estimated reductions (tonnes of CO2e)	185.713
Total Number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	26.530

A.4.5. Public funding of the project activity:

There is no Annex I public funding involved in the IPGFP[5].

[5] Certification on the IPGFP funding was submitted to validation.

SECTION B. Application of a baseline and monitoring methodology

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

- Version 06 of ACM0002 (19/05/2006) "Consolidated baseline methodology for grid-connected electricity generation from renewable sources";
- Version 02 of the "Tool for the demonstration and assessment of additionality".

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

The ACM0002 -Version 6 / 19 May 2006 is applicable to the project activity because of the following conditions:

- The IPGFP is a grid-connected renewable power generation project activity;
- The IPGFP consists of electricity capacity addition from a hydro power project with existing reservoir where the volume of the reservoir is not increased;
- The IPGFP does not involve a switching from fossil fuels to renewable energy at the site;
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.

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

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid Electricity generation	CO_2	Yes	Project participants shall only account CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activities.
		CH_4	No	
		N_2O	No	
Project Activity	There is no emission of the project activity.	CO_2	No	There is no emission to be accounted for hydro projects with existing reservoirs where the volume of the reservoir is not increased.
		CH_4	No	
		N_2O	No	

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

Fortuna will increase the energy dispatched in the national interconnected grid of Panama, which is composed of both thermal plants fuelled by fuel oil, diesel, bunker C and diesel marino, and hydroelectric power plants. As Fortuna increases its electricity delivered to the grid, the fossil fuel thermal plants, which have high fuel costs compared to hydro, are the ones which will operate less due to the energy supplied by the entrant renewable energy project. As aforementioned, the increase of Fortuna's electricity generation results from increasing the flow of water into the reservoir by diverting additional creeks.

The baseline scenario is determined analyzing data from the electricity grid to which the project causes emission reductions. The emission reductions will occur within the Panamanian Interconnected System[6]. For further information on the data used in the calculations, please refer to Annex 3.

Information from the Panamanian Dispatch Centre (CND, *Centro Nacional de Despacho)* and the Panamanian National Commission on Energy Policy (COPE, *Comisión de Política Energética*) is available to obtain the build and operating margins, in accordance with the ACM0002 - Version 06 / 19 May 2006, for the determination of the electricity emission factor and the baseline emissions. For this project activity, data from COPE[7] and CND[8] for years 2003 to 2005 were used.

Table 2 presents the key information and data used to determine the baseline scenario.

Table 2: Summary of the data used to determine the baseline scenario

Variable	Data variable	Value	Data Unit	Data Source
$EG_{historical}$	Yearly average electricity generation by Fortuna from 2000 to 2005	1.685.189	MWh	Measured by Fortuna
$EF_{Baseline\ (ex\text{-}ante\ 2003\text{-}2005}$	CO_2 emission factor of the Grid	0,5593	tCO_2e/MWh	Calculated *ex-ante* for the years 2003-2005
$EF_{OM,\ 2003\text{-}2005}$	CO_2 Operating Margin simple adjusted emission factor of the grid	0,7435	tCO_2e/MWh	Calculated using data from COPE[7] and CND[8]
$EF_{BM,\ 2005}$	CO_2 Build Margin emission factor of the grid	0,3752	tCO_2e/MWh	Calculated using data from COPE[7] and CND[8]
λ_y	Fraction of time during which low-cost/ must-run sources are on the margin	$\lambda_{2003} = 0$ $\lambda_{2004} = 0{,}1050$ $\lambda_{2005} = 0{,}0547$	-	Calculated using data from COPE[7] and CND[8]

<u>Baseline lifetime</u>

The project installation consists of civil structures and floodgates. The floodgates are new and made of steel, with a lifetime longer than 30 years. The equipment installed in the 300 MW power plant follows a preventive program of maintenance and gradual replacement of equipments like 230 kV underground cables and even more careful maintenance of generators and turbines. The power plant was commissioned in 1984 and since then two main upkeeps in units 1 and 2 and one in unit 3 has been accomplished. Costly spare parts are as well kept in a warehouse for emergency repairs and corrective maintenance. Thus, according to the common practices in EGE Fortuna and considering replacement

[6] SIN – *Sistema Interconectado Nacional*

[7] COPE, *Comisión de Política Energética* (Panamanian National Commission on Energy Policy)
[8] CND – *Centro Nacional de Despacho Panamá* (National Dispatch Center Panama)

schedules (historical replacement records for similar equipment), the project has a 30-years remaining lifetime.

There are also expensive spare parts in warehouse (like transformer of 100MVA of 230/13.8KV, a turbine, needles of turbines, coils of the generator, etc.) for quick repairs in the case of damages and for corrective maintenance.

Spill-over

An issue related to the project's generation that should be addressed is the potential for spilling water. If the volume of water in the reservoir exceeded capacity, water would have to be spilled out of the reservoir without passing through the turbines. In this case, there may be a question whether additional water supplied by the project would generate electricity or would be spilled. Spills occur very rarely. When they occur, they are primarily due to an increase in rainfall. Because this increase is typically regional, it is reasonable to assume that a spill is caused by a proportional increase of existing flow and project flow. It is unlikely project flow will increase by more percentage than the existing flow.

Even in the event of a spill, the procedures used to manage the reservoir also indicate that calculating the project's generation based on the proportion of new flow and total flow would still be appropriate. At the beginning of every year, the CND plans the production of the Fortuna plant and the final level of the reservoir at the end of the year. The reservoir level decreases during the course of the year to lower values at the end of year. Each week, they run a load dispatch program evaluating the weekly production, and the projected production and reservoir level through the end of the year. Halfway through the year, the level of the reservoir should be between 1025 and 1032 meters above sea level, so that the rains at the end of the year raise it again to near or slightly above 1040 meters. The principal objective is to reach the year-end level of the reservoir, so that all the water entering the reservoir (with or without the contribution of the creeks project) will be passed through the hydro turbines and generate electricity. Without the contribution of the Creeks project, the reservoir will still be managed to maintain a particular level, but less energy will be produced, i.e. the Creeks project will by definition generate more electric power even in the event of programmed spills.

Furthermore, a brief analysis on the years in which spilling has occurred and the corresponding diverted amount gives information on the relative relevance of the issue:

2005: 18 days
2002: 4 days
2000: 8 days
1999: 5 days
1996: 3 days

Thus, the historical data of the sum of the days that the dam flowed out the additional amount of water without power generation (38 days) during all the time period from 1996 to 2005 (10 years) is considered, this represents an average of 3,8 days / year flowing water out. It corresponds to the negligible quantity of about 1 %.

Finally, by the baseline approach spill-over periods are already integrated in the average generation figure. The approach given above enables calculating emission reductions from additional power generation above baseline level. Hence any spill-over would reduce the potential and therefore such periods would not result in any over-estimation.

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

The water flow that will be diverted into Fortuna's reservoir will increase the amount of renewable energy produced in Panama and supplied to the electric grid. In the absence of the Fortuna "Creeks" project (or "Las Quebradas" in Spanish), the same energy amount would be provided by fossil fuel power generation sources.

Currently, the Panamanian electric grid is supplied both by hydro and thermal generating sources. The least-cost solution governs the operation, or dispatching order, of the existing generation plants. Least-cost dispatching favors the operation of available generation sources with the lowest variable costs, or short-term marginal costs. Since thermal plants have significant fuel costs, their variable costs are higher than those of hydro plants.[9] Thermal plants with expensive fuels, low efficiencies and higher maintenance costs are the most expensive plants to operate, or alternatively the least cost effective generating resources. The increased generation from Fortuna will therefore displace energy generation from thermal plants. The reason for this is due to the logic that governs the dispatch order in a generation system with significant number of hydroelectric sources: since the hydro resources are the most cost effective in terms of variable cost, they will be dispatched to generate energy as much as possible (the load duration curves, which shows the sources on the margin along the year, for the years 2003, 2004 and 2005 are presented in Annex 3).

Therefore, net GHG emissions will be reduced by the resulting reduction in the operation of the least cost effective thermal power plants in the grid.

The IPGFP has been designed with the CDM parameters as a central driver for the project since its concept phase in 2001, especially because it is a significant investment amount with a very long payback period.

This is due to the barriers and the challenges in developing renewable energy projects in emerging markets, which are typically more significant than those faced by traditional (fossil fuel) energy projects.

Sufficient information exists to conservatively demonstrate that 1) the Project faces prohibitive barriers, and its registration as a CDM project would allow it to overcome those barriers, and 2) the project activity is not common practice, since it is rare for an operating hydroelectric plant to be expanded by the diversion of additional water sources.

The project's additionality can be demonstrated by using the guidance provided by the "*Tool for the demonstration and assessment of additionality*" (version 02), approved by the Executive Board (Annex 1, EB 16).

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[9] Thermal generation facilities run on distillate or residual fuels; natural gas is currently unavailable in the market and there are no specific plans to make it available to Panama, at least for the foreseeable future. Thermal generators presently purchase most of their fuel from brokers around the world.

Application of the Tool for the demonstration and assessment of additionality for IPGFP

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

(a) The starting date of this project falls between 1 January 2000 and the date of the registration of a first CDM project activity (18 November 2004), which is evidenced by the Approval of Environmental Impact Study (RESOLUTION DINEORA IA - 050 2004) released by the Republic of Panama Environmental National Authority (ANAM – *Autoridad Nacional del Ambiente*) on 25th August 2004.

(b) In 2001, a pre-feasibility study was carried out, which indicated positive results for the development of the project. During 2001, Fortuna project managers participated in a series of CDM seminars and baseline methodology training courses, and thereafter incorporated into the project financial analysis and viability the benefits of CDM registration and, as a result, decision making at Fortuna to proceed with the Project fully incorporated CDM benefits to the proposed project as of 2001. In January 2002, Fortuna submitted an application to the CERUPT 2001 (Certified Emission Reduction Unit Procurement Tender, managed by the Netherlands) and was selected by CERUPT later in the year to enter into contract negotiations.

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

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

The following alternatives have been considered:

<u>Alternative 1</u>: The proposed IPGFP, increasing Fortuna's electricity production by approximately 3% using renewable resources, not undertaken as a CDM project.

<u>Alternative 2</u>: Continuation of current situation in Panama, with no implementation of the project activity.

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

Both alternatives are in compliance with all relevant legal and regulatory requirements of Panama.

Step 2. Investment analysis

Left blank on purpose (According to the "Tool for the demonstration and assessment of additionality (version 02)", project participants may select between investment analysis and barrier analysis. Barrier analysis was chosen).

Step 3. Barrier analysis

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

<u>Prevailing practice</u>
The project activity is the "first of its kind": No project activity of this type is currently operational in the host country or region.

To the best of our knowledge, there are no similar activities to the proposed project occurring in Panama. We are not aware of any of the other hydroelectric reservoirs increasing their flow through the construction of a Creeks project.

Investment Barrier:
The domestic financial market in Panama has been characterized by high interest rates and short term loan maturities at the time that the project feasibility studies were carried out. This has forced the sponsors of the project to consider international financial markets that offer more attractive rates and longer loan maturities for financing, but it is correspondingly more challenging to obtain international financing.

The main issue is that IPGFP has a high unitary installed cost in terms of the total investment required and a very long payback period that would under normal "business as usual" circumstances not justify an investment decision.

The main indicator of the investment barrier is the installed capacity cost ($ / kW installed), which is US$ 1,367 / kW, and when compared to alternative investments in Panama in recent years, namely fossil fuel based projects, which average approximately US$ 500[10] / kW installed, shows approximately a 173 % higher unit cost for the installed capacity.

Transaction cost barrier[11]:
Due to its small size, the project faces a development barrier because of the inelastic development costs (which are a function of time required by the professional staff, legal advisors, engineering companies and other consultants, and not the absolute size of the project) and because the financial transaction costs are disproportionately high, due to the fact of a small project requiring structured finance. This is frequently the case in small renewable energy projects.

Since this project was initially conceived in 2001, the total cost in developing this project to date has been approximately:

1.	Engineering studies:	US$ 600,000
2.	Legal fees:	US$ 5,000
3.	Environmental Studies:	US$ 65,000
4.	Consultants:	US$ 85,000
5.	Permits, governmental requirements:	US$ 5,000

Total Estimated Development Costs: US$ 760,000

These costs do not include any of costs for the development of the project as a CDM project. When compared with the overall capital cost of IPGFP, the development cost represents approximately 8% of the total project costs. As Fortuna is a large project development company, owned by international

[10] The "Statistical Compendium of Energy" (*Compendio Estadístico Energético, CEE 1970-2005*) published by the Panamanian Ministry of Economy and Finance - Energy Policy Committee, presents on its page 14, table "*Parámetros Típicos de Inversiones Iniciales*" (Typical parameters of initial investments), the ranges of 400 – 1.000 US$/kW for thermal energy and 1.300 – 2.000 US$/kW for hydroelectric energy projects. Available at http://www.mef.gob.pa/cope/.

[11] Studies on the positive impacts of registering the IPGFP as a CDM project activity were made by the time of its early conception. The estimated CER revenue stream presented here corresponds thus to that calculated in version 1 of the PDD, when the project was still envisaged as small-scale.

utilities like ENEL and Globeleq, normally a project of this small size is not considered economical and hence the costs of development (i.e. transaction costs) are prohibitive and projects of this small size are not undertaken.

Considering that the present value (at a 14% discount rate) of the CER revenue stream is approximately US$ 600.000[11]. Fortuna is expecting that the additional revenue will cover a certain portion (approximately 80%) of the development costs, and that therefore in addition to the energy revenues consideration, the CER revenues has indeed supported the investment decision by Fortuna. Indeed, the project has been expecting the CER revenues since its early development stage.

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

In case of Alternative 2 (continuation of current situation), there will be no effect of the identified barriers, as this represents a continuation of current practices or development of thermal power stations, usual technology in Panama.

Step 4. Common Practice Analysis

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

As aforementioned, to the best of our knowledge, there are no similar activities to the proposed project occurring in Panama. We are not aware of any of the other hydroelectric reservoirs increasing their flow through the construction of a Creeks project.

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

We are not aware of any other company engaged in a similar activity in Panama.

Step 5. Impact of CDM Registration

There are a number of positive impacts on the IPGFP derived from the CDM Registration.

1. The financial benefit of the revenue obtained by selling the CERs is material to the project, and especially if the project can sell CERs in a second and third crediting period. A simple forward calculation (undiscounted) yielded approximately 11 % of the total capital cost of the investment[11]; this impact is based on a total of 8 years of CERs derived economic benefits.
2. It can also be stated that the impact of the CDM registration is significant to ENEL and Globeleq, the managing partners of the Fortuna company, in that it represents a “learning by doing” example. Within ENEL and Globeleq, IPGFP is considered an important test for further CDM related activities.
3. Anthropogenic greenhouse gas emission reductions of GHGs by displacing thermal power plants dispatched at the margin of the Panamanian grid. In the absence of the project, more energy would be partly produced by non zero emission power plants.
4. The relationship of the present value of the CER revenues to the present value of the energy revenues from the eight-year period in which the CER revenues occur is 6 %.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Following the relevant methodological choices are explained and justified:

- **Operating Margin emission factor**. The project activity follows the steps provided by ACM0002 – Version 06 / 19 May 2006. For the calculation of the operating margin emission factor in the STEP 1, the calculation method chosen was: (b) *Simple Adjusted OM*, since data are not available for the application of the first methodological choice – (c) *Dispatch Data Analysis OM*. For the calculation of the build margin emission factor in STEP 2 of ACM0002 – Version 06 ("Calculate the Build Margin emission factor"), Option 1 (*ex-ante* equation **(2)**) was chosen. Method (b) *Simple Adjusted OM* was adopted: no data was available to apply the first methodological choice (c) *Dispatch Data Analysis OM*. Calculations were made on basis of *ex-ante* data vintage (2003-2005) and using conservative assumptions.

- **Build Margin emission factor**. *Option 1* was adopted: the Build Margin emission factor was calculated *ex-ante*, according to the configuration of the SIN in 2005.

- **Weights for the Operating Margin and the Build Margin emission factors**: 0,5 (Default values presented in ACM0002 - Version 06 / 19 May 2006).

There is no emission to be accounted for hydro projects with existing reservoirs where the volume of the reservoir is not increased. Thus, project emissions (PE_y) = 0.

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 (for hydroelectric projects – see applicability conditions above). Project participants do not need to consider these emission sources as leakage in applying this methodology. Thus, leakage (L_y) = 0.

Average Operating Margin Emission Factor Calculation

According to ACM0002 - Version 06 / 19 May 2006, the Average OM Emission Factor ($EF_{AverageOM,y}$), is given by the following equation:

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

(1)

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,

COEFi,j y 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
GENj,y is the electricity (MWh) delivered to the grid by source *j*.

Build Margin Emission Factor Calculation

The build margin was calculated *ex-ante*, based on the most recent information available on plants already built for sample group *m* at the time of PDD submission, as it is defined in ACM0002 - Version 06 / 19 May 2006:

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

(2)

According to the methodology, "The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently[12]. Project participants should use from these two options that sample group that comprises the larger annual generation."

The "five power plants that have been built most recently" approach was adopted, as it comprised the larger annual generation (Annex 3).

Combined Margin Emission Factor Calculation

The combined margin emission factor was calculated as the weighted average of the Operating Margin emission factor ($EM_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

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

(3)

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0{,}5$), and $EF_{,y}$ is expressed in tCO_2/MWh.

Baseline emissions
Finally, as presented in ACM0002 - Version 06 / 19 May 2006, *"the baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) (…), times the electricity supplied by the project activity to the grid (EG_y in MWh) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities ($EG_{baseline}$ in MWh)"*, as follows:

$$BE_y = (EG_y - EG_{baseline}) \cdot EF_y$$

(4)

[12] If 20% falls on part capacity of a plant, that plant is fully included in the calculation.

Emission reductions

As presented in ACM0002 - Version 06 / 19 May 2006, "The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y)", as follows:

$$ER_y = BE_y - PE_y - L_y \quad \textbf{(5)}$$

As during all the renewable crediting period the value of PE_y and L_y is defined to be zero, **(5)** is simplified and the emission reductions equal baseline emissions, defined by equation **(4)**:

$$\boldsymbol{ER_y = (EG_y - EG_{baseline}) \cdot EF_y} \quad \textbf{(6)}$$

The dealing with negative emission reductions is going to occur in compliance with guidance from the EB (EB21, paragraph 18):

'(…) if a project activity temporarily results in "negative emission reductions", i.e. baseline emissions minus project emissions minus leakage effects are negative, any further CERs will only be issued when the emissions increase has been compensated by subsequent emission reductions by the project activity'.

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

Data / Parameter:	**Baseline emission factor ($EF_{Baseline\ (ex\text{-}ante\ 2003\text{-}2005)}$)**
Data unit:	tCO_2 / MWh
Description:	Combined margin CO_2 emission factor of the grid
Source of data used:	Calculated
Value applied:	0,5593
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data will be archived electronically and according to internal procedures, until 2 years after the end of the crediting period
Any comment:	Calculated as a weighted sum of the OM and BM emission factors

Data / Parameter:	**Operating margin emission factor ($EF_{OM,\ 2003\text{-}2005y}$)**
Data unit:	tCO_2 / MWh
Description:	CO_2 Operating Margin emission factor of the grid
Source of data used:	Factor calculated with data from COPE[7] and CND[8]
Value applied:	0,7435
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data will be archived electronically and according to internal procedures, until 2 years after the end of the crediting period
Any comment:	Calculated *ex-ante* (2003-2005) as indicated in the relevant OM baseline method above.

Data / Parameter:	**Build margin emission factor (*$EF_{BM,2005}$*)**
Data unit:	tCO_2 / MWh
Description:	CO_2 Build Margin emission factor of the grid
Source of data used:	Factor calculated with data from COPE[7] and CND[8]
Value applied:	0,3752
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data will be archived electronically and according to internal procedures, until 2 years after the end of the crediting period
Any comment:	Calculated *ex-ante* (2005) according to ACM0002 - Version 06 / 19 May 2006.

Data / Parameter:	**Historical electricity generation *($EG_{historical}$)***
Data unit:	MWh
Description:	Historical electricity production previous to the implementation of the project
Source of data used:	Data on net electricity production of Fortuna for the 6 most recent years. For information on measurement procedures, please refer to Annex 4.
Value applied:	1.685.189
Justification of the choice of data or description of measurement methods and procedures actually applied :	A minimum of 5 years (60 months) of historical generation data for hydro facilities is required in the case of hydro facilities (ACM0002 - Version 06 / 19 May 2006).
Any comment:	Left blank on purpose

Data / Parameter:	***$DATE_{BaselineRetrofit}$***
Data unit:	years
Description:	Time at which the generation facility would be likely be replaced or retrofitted in the absence of the CDM project activity
Source of data used:	Information from Fortuna, based on maintenance program and usual replacement schedule. Details in section B.4.
Value applied:	2036
Justification of the choice of data or description of measurement methods and procedures actually applied :	Approach (b) in ACM0002 - Version 06 / 19 May 2006, was taken into account: "The common practices of the responsible company regarding replacement schedules may be evaluated and documented, e.g. based on historical replacement records for similar equipment."
Any comment:	The parameter is calculated as the current year (2006) plus estimated remaining lifetime (30 years).

Data / Parameter:	$Flow_{new}$
Data unit:	m^3/s
Description:	Annual average flow into Fortuna reservoir from the newly diverted creeks
Source of data used:	Detailed hydrologic study of watershed of the five creeks diverted into the reservoir, as activity of the IPGFP
Value applied:	0,76
Justification of the choice of data or description of measurement methods and procedures actually applied :	The study analyzed 31 years of historical data (1970-2000) to quantify the average annual precipitation that would feed the creeks. The data covers a wide range, including both very rainy and very dry years. The study also constructed a model based on historical data to estimate the water lost to evapotranspiration.
Any comment:	Left blank on purpose

Data / Parameter:	$Flow_{historical}$
Data unit:	m^3/s
Description:	Historical annual average flow from the original reservoir sources, previous to IPGFP
Source of data used:	Measurement by Fortuna
Value applied:	27
Justification of the choice of data or description of measurement methods and procedures actually applied :	Continuously monitoring on site.
Any comment:	Left blank on purpose

B.6.3 Ex-ante calculation of emission reductions:

Project emissions (PE_y)

As already asserted in section B.6.1, according to ACM0002 - Version 06 / 19 May 2006, there is no emission to be accounted for hydro projects with existing reservoirs where the volume of the reservoir is not increased.

$$PE_y = 0 \quad \textbf{(7)}$$

Leakage (L_y)

Flooding of land for a hydroelectric reservoir can reduce terrestrial carbon storage due to land-use change and can produce methane emissions from the anaerobic decomposition of plant matter on flooded land. However, this project will not increase the size of the Fortuna reservoir, so there will be no change in carbon storage or methane emissions. We therefore do not quantify these emissions.

Fortuna calculates that 7.766 metric tons of concrete, which includes 1.524 metric tons of cement, will be used to construct the project. The production of cement used in this concrete will generate 760 tons of

CO_2, using the IPCC Handbook emission factor of 0,4985 tons CO_2 per ton cement. These emissions are far less than 1 % of the total emission reductions of the project, so they are considered to be negligible.

CO_2 emissions result from on-site fuel consumption for activities such as project construction and transportation. Fuel consumption may increase slightly due to the project, but the impact is negligible when compared to the total emission reductions.

It is important to note the components that lie outside the project boundary. Among these, the upstream impacts of production and transportation of fuel for Panama's thermal power plants is outside the project boundary. These impacts are small enough to be negligible, and they are effectively unquantifiable.

The downstream effect of transmission and distribution (T&D) losses in the electric system is also neglected. It is assumed that T&D losses are equal for power delivered by Fortuna or by the baseline source that the project will displace. As a result, 1 MWh of additional electricity produced by the new Project at Fortuna will displace exactly 1 MWh from another power plant.

Finally, and most important, according to ACM0002 - Version 06 / 19 May 2006, "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 (for hydroelectric projects – see applicability conditions above). Project participants do not need to consider these emission sources as leakage in applying this methodology".

$$L_y = 0 \quad \textbf{(8)}$$

<u>Baseline emissions</u>

Historical Electricity Production ($EG_{historical}$)

The historical electricity generation was determined considering historical generation data for the 6 most recent complete years, and thus respecting the lower limit for hydro facilities, as presented in Table 3:

Table 3: Net electricity generation in Fortuna – historical data

Year	Net electricity generation (MWh)
2000	1.826.165
2001	1.494.734
2002	1.962.551
2003	1.400.187
2004	1.775.121
2005	1.652.375
Average	**1.685.189**

$$EG_{historical} = 1.685.189 \text{ MWh / year} \quad \textbf{(9)}$$

Baseline Electricity Production

As presented in section B.4, the baseline electricity production depends on "the time at which the generation facility would be likely be replaced or retrofitted in the absence of the CDM project activity ($DATE_{BaselineRetrofit}$)".

The approach on determining it, alternative (b) in ACM0002 - Version 06 / 19 May 2006, was to take into account "The common practices of the responsible company regarding replacement schedules may be evaluated and documented, e.g. based on historical replacement records for similar equipment."

According to that approach, $DATE_{BaselineRetrofit}$ was informed by the contact person in Fortuna (Annex 1) as being – upmost conservatively - 2036, and can be demonstrated by requested documentation.

$$DATE_{BaselineRetrofit} = 2036 \qquad \textbf{(10)}$$

According to this, considering that the renewable crediting period lasts for up to 21 years, the baseline electricity production equals – during the whole lifetime of IPGFP – the historical electricity generation:

$$\boldsymbol{EG_{baseline} = EG_{historical}} \qquad \textbf{(11)}$$

Substituting equation **(9)** in equation **(11)**, it results**:**

$$\boldsymbol{EG_{baseline}} \textbf{ = 1.685.189 MWh / year} \qquad \textbf{(12)}$$

Estimation of Project Electricity Production (EG_y)

The project electricity production is going to be measured and monitored during the crediting periods. Nevertheless, in order to estimate likely project emission reductions for the proposed crediting period, the project generation is conservatively estimated, using the following equation:

$$\boldsymbol{EGy = EG_{Historical}\ x\ [(Flow_{historical} + Flow_{new}) / Flow_{historical}]} \qquad \textbf{(13)}$$

Where:

- $\boldsymbol{EG_{Historical}}$ = Fortuna electricity generation (MWh), net of on-site consumption;
- $\boldsymbol{Flow_{new}}$ = annual average flow (m^3/s) into the reservoir from the newly diverted creeks;
- $\boldsymbol{Flow_{historical}}$ = historical annual average flow (m^3/s) from both the original reservoir sources, previous to IPGFP.

The additional electricity generation is thus assumed as directly proportional to the additional volume of water diverted into the reservoir. To determine this volume, Fortuna has commissioned a detailed hydrologic study of watershed of the five creeks diverted into the reservoir, as activity of the IPGFP. The study analyzed 31 years of historical data (1970-2000) to quantify the average annual precipitation that would feed the creeks. The data covers a wide range, including both very rainy and very dry years. The study also constructed a model based on historical data to estimate the water lost to evapotranspiration. The average annual flows calculated by the study are shown in Table 4 below. Approximately ten percent of the creeks' flow will not be diverted into the reservoir, but will remain in the creeks. This "ecological flow" is required for plant and animal life downstream. The total flow into the reservoir will therefore be 0,76 m^3/s on average.

Table 4: Average annual flow of the creeks diverted into the reservoir

Creek	Annual Flow (m^3/s)
La Tigra	0,063
Zarciadero	0,473
Las Huacas	0,150
Pinola	0,076
Zumbona	0,087
Total Annual Flow	0,849
Reduction for "Ecological Flow"	10 %
Total Flow to Reservoir	**0,76**

The estimated project generation also takes into account historical data for annual average flow into the reservoir, which is 27 m^3 / s, and average annual generation (2000-2005), which is 1.685.189 MWh / year. An estimated project generation was calculated using equation **(13)** and the information from Table 4:

Thus, the project electricity production is conservatively expected to be **1.732.624 MWh / year**.

Baseline emission factor

The method chosen to calculate the Operating Margin (OM) for the electricity baseline emission factor is option (b) *Simple Adjusted OM,* since no data for calculation option (c) *Dispatch Data Analysis OM* were available.

Calculations were based on data from COPE[7] and CND[8], comprising the most recent information available: years 2003, 2004 and 2005.

Thus, $\mathbf{EF_y = 0,5593\ tCO2 / MWh}$ **(14)**

Furthermore, considering the fixed values for the baseline electricity production and for the baseline emission factor, presented respectively in equation **(12)** and **(14)** the emission reductions can be written as follows:

$$ER_y = (EG_y - 1.685.189) \cdot 0,5593 \quad (15)$$

Where EG_y shall be given in MWh / year and the calculated value for ER_y is in tCO_2/year.

The *ex-ante* estimation of emission reductions (Table 5) is accomplished by admitting EG_y to be **1.732.624 MWh / year**, as previously calculated in a transparent and conservative manner.

Table 5: Ex-ante estimation of emission reductions

Increase of Power Generation of the hydroelectric power station Fortuna in Panama (IPGFP)									
Estimated Emission Reductions	Item	2007	2008	2009	2010	2011	2012	2013	Total CERs
	EGy (MWh)	1.732.624	1.732.624	1.732.624	1.732.624	1.732.624	1.732.624	1.732.624	
	$EG_{Baseline}$ (MWh)	1.685.189	1.685.189	1.685.189	1.685.189	1.685.189	1.685.189	1.685.189	
	Increased electricty production (MWh)	47.435	47.435	47.435	47.435	47.435	47.435	47.435	
	$EF_{Baseline\ (ex\text{-}ante\ 2003\text{-}2005)}$ (tCO2e / MWh)	0,5593	0,5593	0,5593	0,5593	0,5593	0,5593	0,5593	
	ER_y (tCO_2)	**26.530**	**26.530**	**26.530**	**26.530**	**26.530**	**26.530**	**26.530**	**185.713**

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

Year	**Estimation of project activity emissions (tonnes of CO_2e)**	**Estimation of the baseline emissions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of overall emission reductions (tonnes of CO_2e)**
2007	0	26.530	0	26.530
2008	0	26.530	0	26.530
2009	0	26.530	0	26.530
2010	0	26.530	0	26.530
2011	0	26.530	0	26.530
2012	0	26.530	0	26.530
2013	0	26.530	0	26.530
Total (tonnes of CO_2e)	0	185.713	0	185.713

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**Electricity generation (EG_y)**
Data unit:	MWh
Description:	Electricity supplied to the grid by the project (net electricity generation)
Source of data to be used:	Readings of the electricity meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1.732.624
Description of measurement methods and procedures to be applied:	The information registered by the equipment will be collected by a data logger that will store it. This data will be archived electronically and according to internal procedures, until 2 years after the end of the crediting period. For details, please refer to Annex 4.
QA/QC procedures to be applied:	Please refer to Annex 4.
Any comment:	Please refer to Annex 4.

B.7.2 Description of the monitoring plan:

The emission factors shall be reviewed and recalculated in the same transparent and conservative way by the time of the renewal of the crediting period.

The only variable to be monitored in this project activity, during the first crediting period is the total amount of electricity produced by Fortuna. This variable will be monitored from 2007 up to the end of the crediting period. As the core business of Fortuna is to sell energy, the monitoring occurs as common practice in the power plant. Moreover, the quantity of energy exported to the grid will be cross-checked through the energy invoice emitted by Fortuna to the energy distributor.

Detailed information on the monitoring plan and it will ensure the delivery of high quality data is presented in Annex 4.

The archiving will occur up to two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

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

Date of completion of the application of the baseline study and monitoring methodology: 16/11/2006.

The entity determining the baseline is Econergy Brasil Ltda, (telephone: +55 (11) 3555-5700; e-mail: info@econergy.com.br), which is not a project participant.

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:

25/08/2004 [13]

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

30y-0m[14]

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

C.2.1. Renewable crediting period

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

01/01/2007

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Left blank on purpose

C.2.2.2. Length:

Left blank on purpose

[13] The project start date corresponds to the begin of the constructions related to the project, evidenced by the Approval of Environmental Impact Study (RESOLUTION DINEORA IA - 050 2004) released by the Republic of Panama Environmental National Authority (ANAM – *Autoridad Nacional del Ambiente*).

[14] Details in section B.4.

SECTION D. Environmental impacts

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

An Environmental Impact Study of the project has been performed. It has been approved by the National Environmental Authority (ANAM), signaling governmental approval that the project will be developed according to Panamanian environmental standards.

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

The EIS, approved in RESOLUTION DINEORA IA - 050 2004 released by the Republic of Panama Environmental National Authority (ANAM – *Autoridad Nacional del Ambiente*) on 25th August 2004, finds that the project will have the following impacts:

Positive impacts:

- Control of water resources
- Expansion of wooded areas (through reforestation projects after construction)
- Improvement of the local road infrastructure
- Avoidance of costs related to atmospheric pollutant emissions
- Savings in fossil fuel purchases

Negative impacts:

- Temporary deterioration of surface water quality during construction
- Noise and vibration pollution during construction
- Alteration of the composition and population of fauna during construction
- These impacts may affect the routines of the people who live near the project area

The mitigation measures will be the following:

- Sediment control and control of erosion on open land
- Maintenance of ecological abundance and management of fauna
- Control of noise and vibration
- Adequate collection, handling, and disposal of waste
- Re-vegetation and maintenance of plant covering
- Development of alternative programs for the agricultural and cattle populations
- Training in the use of appropriate and sustainable agricultural technologies for the communities

The EIS found that the project presents a good opportunity to apply measures that guarantee environmental sustainability. The environmental cost-benefit analysis displays a positive balance both from the point of view of the company's interests and from the perspective of environmental regulation. The net social benefits are shown with clarity and give a clear assurance that the project, if managed well, will result in increased future benefits for all, including the environment. The risk analysis gives values above 10, which indicates that the investments proposed to prevent risks are also justified. In every sense, the project is viable and feasible from an economic point of view and with the internalization of the CDM financial benefits, the investment is justified.

SECTION E. Stakeholders' comments

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

The process by which comments from local stakeholders have been invited and compiled was the following:

- Several meetings regarding the project were held in nearby communities to inform them about the whole process of the project.
- Informative pamphlets containing summarized information about the project were distributed to each attendee.
- A Forum of Public Consultation was held in accordance with the General Environmental Law of Panama.

It should also be noted that the project will not impact indigenous communities, since none resides in the area affected by the project activity.

E.2. Summary of the comments received:

The comments expressed by the attendees to the public consultation meetings (local stakeholders), can be summarized in the following questions:

1. Does the project ensure adequate water flows for plant and animal life and other activities?

R: Detailed studies have been performed by hydrologists and specialists in fauna and aquatic flora, to maintain a flow that supports the ecology downstream of the project.

2. Have you contemplated reimbursing landowners for the necessary use of land to access the project works?

R: Although the project will need to use very little such land, evaluations are being carried out of the historical and commercial prices, as references for the negotiation. The project has been developed in such a way that local people will be able to continue leading their normal lives.

3. Will residents be allowed to use the road to transport products or animals once the project is completed?

R: The road is property of Petroterminales of Panama. They are the ones who must authorize the use of the road.

4. What program of support will be offered to the neighbors of the area?

R: Organization and training of pilot nurseries for cultivation, organic agriculture, re-conversion cattle, small cattle farming, reforestation, improvements to existing infrastructures, etc.

5. Has local manpower been considered, both during and after construction?

R: In the bid documents for the construction of the project, it has been requested that the contractors hire local personnel for non-specialized manpower. After the project, little manpower will be required, because the project will require little maintenance. A few people will be hired to take readings, to clean the channels, etc.

6. When does the project begin?

R: Once the Environmental Impact Assessment is approved, possibly in the summer.

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

The following steps are planned:

- To carry out an inventory of the organized groups and those not organized in the areas of the project's direct and indirect influence.
- To incorporate the new human elements to the participative methodologies for obtaining information.
- To incorporate the areas affected by the project and their communities into a "permanent entity" with the intention of addressing the people's concerns in matters related with the project's changes to the areas' water resources and these changes' impact on their quality of life.
- To involve state and private authorities in the discussions that one way or another concern the project area and their area of influence.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Empresa de Generación Eléctrica Fortuna, S.A.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no Annex I public funding involved in the IPGFP.

Annex 3

BASELINE INFORMATION

The baseline methodology ACM0002 – Version 06 / 19 May 2006 considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario.

The grid to be considered here is the Panamanian interconnected system (SIN – *Sistema Interconectado Nacional*), presented in Figure 3:

Figure 3: Panamanian Interconnected System (SIN – *Sistema Interconectado Nacional*)

A summary with the emission factors of the Panamanian interconnected grid from 2003 to 2005 is presented in Table 6. Subsequently, the calculation of the OM is presented in Table 7. The load-duration curves used for λ calculation are presented in Figure 4 to Figure 6. Calculation on the BM is presented in Table 8.

Table 6: Emission factors for the Panamanian interconnected system

Emission factor for the Panamanian interconnected grid			
Baseline (including imports)	$EF_{OM,simple\ adjusted,y}$ [tCO_2/MWh]	Generation [MWh]	λ
2003	0,7770	5.576.603	0,0000
2004	0,7032	5.760.404	0,1050
2005	0,7513	5.826.911	0,0547
	$EF_{OM,simple\ adjusted,\ y}$ [tCO_2/MWh]	$EF_{BM,2005}$	
	0,7435	0,3752	
	Default weights	Weights	
	w_{OM} = 0,50	w_{OM} = 0,50	
	w_{BM} = 0,50	w_{BM} = 0,50	
	Default EF_y [tCO_2/MWh]	EF_y [tCO_2/MWh]	
	0,5593	**0,5593**	

Table 7: Simple adjusted OM for the SIN[6] Panama, 2003-2005

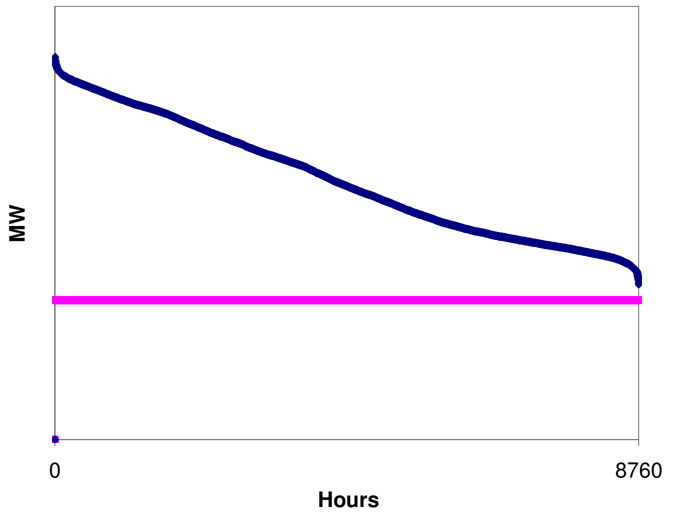
Year	Power plant	Emissions (tCO2)	Energy Production (MWh)	λ	$EF_{OM,\ simple\ adjusted,\ 2003}$ (tCO_2/MWh)	Fuel type	Emissions (MtC)	Emissions (tCO2)	Energy production (MWh)
2003	**Imports**	**0**	**0**	0,0000 (λ_{2003})	0,7770	Diesel Liviano	16.996,9	62.322	34.540
	Hydro	**0**	**2.823.375**			Diesel Marino	173.089,8	634.663	757.694
	Thermal	**2.139.121**	**2.753.228**			Bunker C	393.310,0	1.442.137	1.960.994
	TOTAL	**2.139.121**	**5.576.603**			Total thermal	583.396,7	2.139.121	2.753.228
2004	**Imports**	**0**	**0**	0,1050 (λ_{2004})	0,7032	Diesel Liviano	13.821,2	50.678	26.864
	Hydro	**0**	**3.778.454**			Diesel Marino	57.506,4	210.857	248.975
	Thermal	**1.557.065**	**1.981.950**			Bunker C	353.326,4	1.295.530	1.706.111
	TOTAL	**1.557.065**	**5.760.404**			Total thermal	424.654,0	1.557.065	1.981.950
2005	**Imports**	**0**	**0**	0,0547 (λ_{2005})	0,7513	Diesel Liviano	16.403,0	60.144	31.215
	Hydro	**0**	**3.723.732**			Diesel Marino	21.394,8	78.448	92.844
	Thermal	**1.671.503**	**2.103.179**			Bunker C	418.066,6	1.532.911	1.979.120
	TOTAL	**1.671.503**	**5.826.911**			Total thermal	455.864,4	1.671.503	2.103.179

Source

CND - "Centro Nacional de Despacho Panamá": Estadísticas\Comportamiento del Sistema. Available at http://www.cnd.com.pa.

COPE - "Comisión de Política Energética": Compendio Estadístico Energético 1970-2004. Available at http://www.mef.gob.pa/Cope.

COPE: "Emisiones de CO_2".



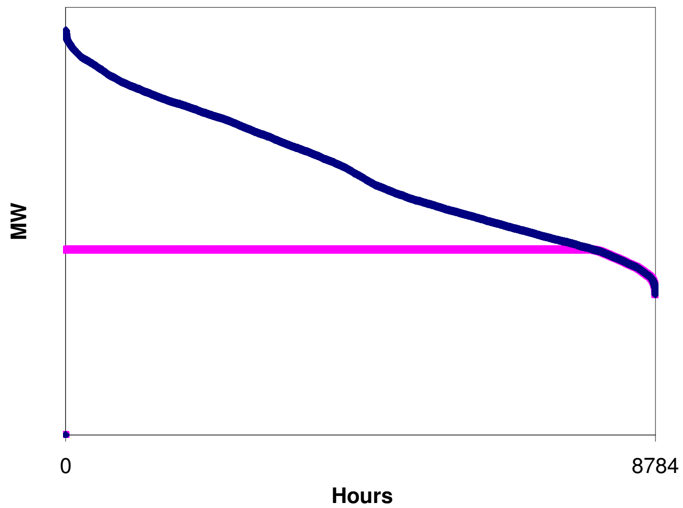
Sources on margin (hours)		
Low-cost / must-run	Other	Total
0	8.760	8.760
Total LCMR (MWh)		
2.823.375		
LCMR bound (MW)		
322,30308		

λ_{2003}

0,00%

Source: Calculated with data from the CND - Centro Nacional de Despacho Panamá, pers. comm. Mr. Victor González (e-mail subject "Panamanian electric grid", 05 October 2006)

Figure 4: Load duration curve for the SIN[6] Panama, 2003



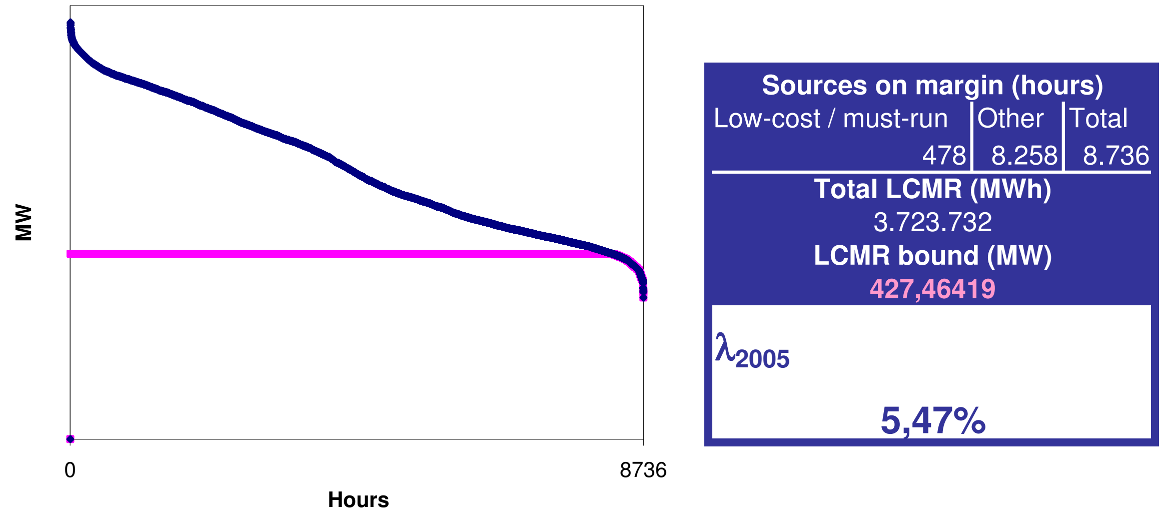
Sources on margin (hours)		
Low-cost / must-run	Other	Total
922	7.862	8.784
Total LCMR (MWh)		
3.778.454		
LCMR bound (MW)		
433,47404		

λ_{2004}

10,50%

Source: Calculated with data from the CND - Centro Nacional de Despacho Panamá, pers. comm. Mr. Victor González (e-mail subject "Panamanian electric grid", 05 October 2006)
Note: Leap year

Figure 5: Load duration curve for the SIN[6] Panama, 2004



Source: Calculated with data from the CND - Centro Nacional de Despacho Panamá. jan/feb: pers. comm. Mr. Victor González (e-mail subject "Panamanian electric grid", 05 October 2006); mar-dec: "tabla_para_sistema". Available at http://www.cnd.com.pa (Estadísticas\Comportamiento del Sistema). Accessed in October 2006.
Note: Data for 31 October 2005 was not available

Figure 6: Load duration curve for the SIN[6] Panama, 2005

Table 8: BM for the SIN[6] Panama, 2005

	Power plant	Start year of operation	Energy Production (MWh)	Emissions (MtC)	Emissions (tCO2)	Accumulated emissions (tCO2)	Accumulated generation (MWh/year)	Accumulated generation (%)	$EF_{BM, 5-plants, 2005}$ (tCO_2/MWh)
	Imports		**0**	**0**	**0**				
	Hydro		**3.723.732**	**0**	**0**				
	Thermal		**2.103.179**	**455.864**	**1.671.503**				
	TOTAL		**5.826.911**	**455.864**	**1.671.503**				
1	Pedregal Power	2002	379.494,5	61.823	226.685	226.685	379.494	6,51%	0,3752
2	ACP - Autoridad del Canal de Panamá #3,4	2000-2002	395.243,9	107.183	393.005	619.689	774.738	13,30%	
3	BLM - Central 9 de Enero (JB) No 9	2000	28.889,7	5.020	18.405	638.094	803.628	13,79%	
4	AES Panamá - Estí	2003	660.072,6	0	0	638.094	1.463.701	25,12%	
5	AES Panamá - Bayano Expansion (150MW-->260MW)	2003-2004	236.868,1	0	0	638.094	1.700.569	29,18%	

Source
CND - "Centro Nacional de Despacho Panamá": Estadísticas\Comportamiento del Sistema. Available at http://www.cnd.com.pa.
COPE - "Comisión de Política Energética": Compendio Estadístico Energético 1970-2004. Available at http://www.mef.gob.pa/Cope.
COPE: "Emisiones de CO_2".

Annex 4

MONITORING INFORMATION

EGE Fortuna generates electricity in three facilities, each one with 100 MW power capacity. The energy is primarily measured as gross electricity leaving each of the three generators in the power plant. The total **gross energy** is the sum of the energy of the three generators.

There is a point of water measurement at the outflow of the tunnel of unloading to the reservoir, a point of measurement of the lake level (volume), three points of measurement of the energy in each generator (MWh), and a clock which marks the hour synchronously.

Two contributions shall be measured: the one of the project (IPGFP) and the total contribution:

To calculate the total contribution in a day including waters of IPGFP it is necessary to know the energy generated in the plant (sum of the three generators), the level of the lake at 00:00, the level of the lake at 24:00 and the equation of the reservoir (level of the lake versus volume). This is an official equation, used by the CND[8] to program the energy dispatch of the whole SIN (*Sistema Interconectado Nacional*: Interconnected National System). The CND has this equation for Fortuna, and also for the other plants connected to the SIN.

The IPGFP contribution is measured with a Waterlog H-331 (shaft encoder, specifications at http://www.semrad.com.au/enviro/waterlog-h-331/Waterlog-H-331.pdf) that is a meter of the water level by unloading. With this value and the geometry and roughness of the channel in the unloading an equation of level versus great volume can be derived. The H-331 equipment outputs the signal storing it in a data logger, and the reading of this is to be gathered every 15 minutes by satellite in the electronic server in the offices of Fortuna. Another form of equation is measuring the water level by the unloading with the H-331 equipment and different volumes with a portable flow meter. The obtained equation shall very similar.

In case of proper installation, the supplier states an accuracy of 99.995 % for the Waterlog H-331. The accuracy of the measurement is estimated to be above 95 %.

The calibration of the energy meters of each of the generators of the power plant is verified annually by request of the CND[8]. The Waterlog H-331 equipment does not need calibration; it remains working good for several years (avoiding that water covers the sensor and protecting it from lightning). Nonetheless, a biennial verification of a third party will be carried out.

In its operation, Fortuna consumes energy in auxiliary equipments (**auxiliary energy**), mainly in cooling water pumps, venting and air conditioning systems, pressure pump and oil circulation engines, lighting and cranes (the last ones used only during the installation of the project).

Each generator supplies energy for its own operating equipments in a Unitary Substation – US (*Subestación Unitaria*). In each Unitary Substation there is a meter for the energy consumption and in each generator there is a meter for the energy production. **The difference between the energy production (gross energy) and the energy consumption (auxiliary energy) is the net energy**, which is exported to a 230 kV substation through independent transmission lines.

Three independent air transmission lines leave the 230 kV substation (so-called 230-7, 230-8 and 230-18), bringing the energy to the national grid and to the clients. The energy passed on by each transmission line is directly measured by a main meter and a back-up meter. The meters are Nexus 1250; they are annually calibrated and fall into a 0,2 % accuracy class[15]. The calibration interests both Fortuna and the clients, who want to be sure of paying only the energy effectively consumed.

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[15] Documents from 27th March 2006 on auditing, tests and calibration (*Auditoría, pruebas y calibración*) of the main and back-up meters in each transmission line is available and was submitted to validation.

This is the energy invoiced and sold to the clients observing the rules of the Panamanian electric market, managed by the Public Services Regulatory Authority (*Autoridad Reguladora de Servicios Públicos*) and the CND[8]. Invoices are used to ensure the data consistency.

Figure 7 illustrates the electricity metering scheme.

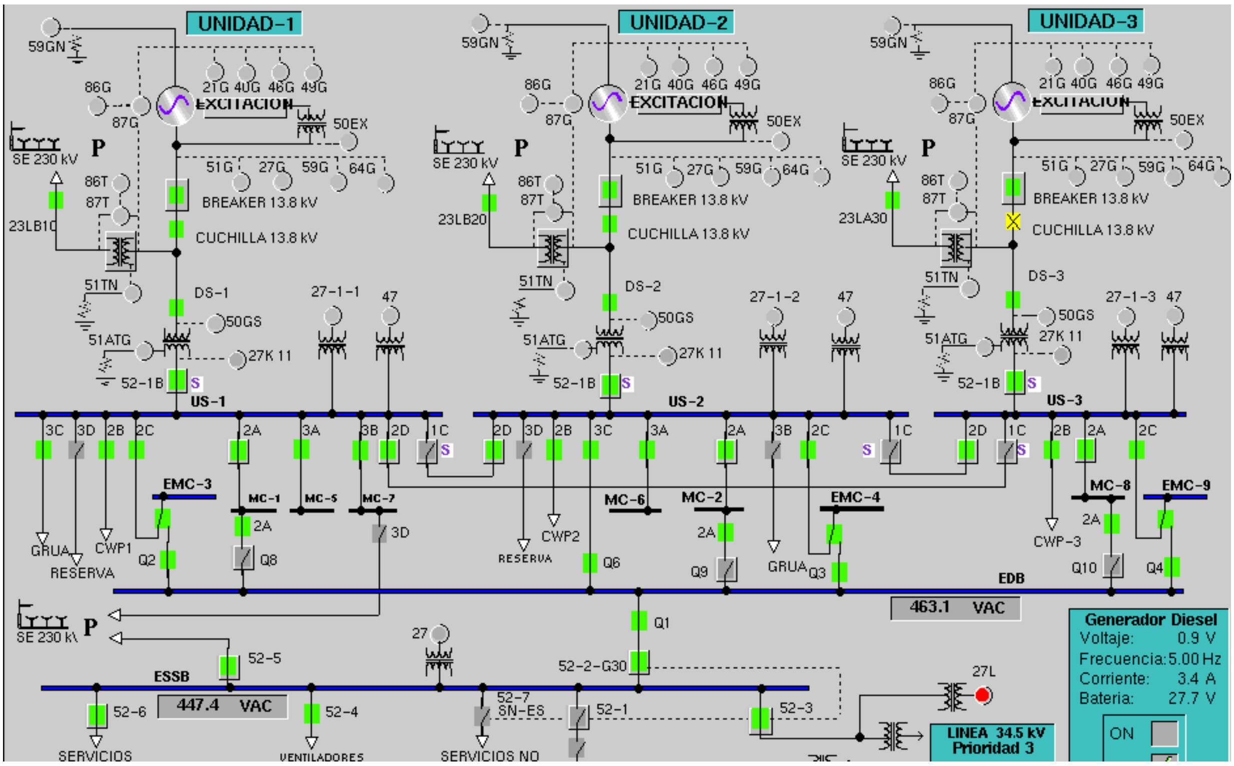

Figure 7: Electricity metering scheme

US-1	Unitary Substation 1
EDB	Emergency Distribution Board
ESSB	Emergency Substation Board
CWP	Cooling Water Pump