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

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SECTION A. General description of project activity

A.1 Title of the project activity:

Esti Hydroelectric Project

Project Design Document Version 1 – September 4, 2006.

A.2. Description of the project activity:

The Esti Project (Está) is a run-of-river plant with daily impoundment to partially regulate the dry season daily flow. Esti is projected to have a total installed capacity of 120 MW (111.5 MW of firm capacity) and to generate an average of 620 GWh/year. The project consists of dams and a convergence system (canal and tunnel) and a powerhouse. The project uses the outflow from the existing Chiriqui and Fortuna hydroelectric projects, intervening inflows of the Caldera and Chiriqui Rivers, and the natural flows of the Barrigon River to produce electricity in the Canjilones Power Station. The powerhouse will contain two vertical shaft Francis-type turbine generator units, each rated at 60 MW under a net head of 112.1 m and a design flow of 59 m^3/s. AES has signed with the government of Panama the concession to build and operate (50 years) the Esti hydroelectric Project. The Esti Project was constructed pursuant to a fixed-price, date-certain engineering, procurement and construction ("EPC") contract with a consortium comprising GE Energy (Sweden) AB ("GE Energy"), Skanska International Civil Engineering AB ("Skanska"), Alstom Power Generation AB ("Alstom Power"), and SwedPower International AB ("SwedPower").

The Esti Project was originally conceived when Panama's electricity sector was controlled by the government-owned company IRHE. IRHE awarded a contract to finance, design, equip and construct the Esti Project on a turnkey basis to a consortium of companies including Ingenieros Civiles Asociados, S.A. de C.V., GE Canada, and GE Canada International ("ICA/GE"). Following the reform of the country's electricity industry, the Republic of Panamá "ROP" decided to turn the Esti Project into a build-own-operate scheme by offering the Esti Project concession as part of the privatization of the Chiriquí hydropower plant. Accordingly, the ROP executed an amendment to the contract with ICA/GE. The AES Panama Company (the Company) and ICA/GE signed a second amendment to the contract in March 2000 after the two parties reached an agreement on a fixed price. The Company later exercised its right to terminate the contract by paying $5 million in order to seek a new EPC arrangement more in line with international project finance market standards. Immediately after the termination, the Company began negotiations with GE Energy, Skanska, Alstom Power, and SwedPower (collectively the "Esti Contractor"), a consortium that had previously bid on and was familiar with the Esti Project. The obligations of the members of the Esti Contractor are joint and several and are guaranteed by their respective parent companies, Skanska Sverige AB (Sweden), Alstom Holdings, S.A. (France), General Electric Company (U.S.), and Vattenfall AB (Sweden).

The primary objectives of this project are: 1) inject additional clean, safe and reliable energy capacity to the Panamanian electric system, 2) to increase the efficiency of existing units and to optimize the use of water resources, 3) contribute to the national efforts to reduce emissions globally, resulting in a cleaner environment, and 4) reduce Panama's dependence of imported fossil fuels.

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)	AES Panama S.A.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party (ies):

Republic of Panama

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

Chiriqui Province

A.4.1.3. City/Town/Community etc:

Gualaca District

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

The Está Hydroelectric Project is located in the province of Chiriquí, about 25 kilometers northeast of the city of David and 400 kilometers west of Panama City. The Republic of Panama is located on the narrowest point of the Central America isthmus, which connects the continental of North America and South America.

Figure N°1 Project Location Map

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

According to the CDM modalities and procedures the project activity falls within category Sectoral scope 1: Energy industries (renewable/non-renewable sources). The project activity is grid-connected renewable power generation.

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

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The Esti Project

The Esti Project (Estí) is a run-of-river plant with daily impoundment to partially regulate the dry season daily flow. Esti is projected to have a total installed capacity of 120 MW (111.5 MW of firm capacity) and to generate an average of 620 GWh/year. The project consists of dams and a convergence system (canal and tunnel) and a powerhouse. The project uses the outflow from the existing Chiriqui and Fortuna hydroelectric projects, intervening inflows of the Caldera and Chiriqui Rivers, and the natural flows of the Barrigon River to produce electricity in the Canjilones Power Station. The powerhouse will contain two vertical shaft Francis-type turbine generator units, each rated at 60 MW under a net head of 112.1 m and a design flow of 59 m^3/s.

An EPC contract has been awarded to a consortium made up of Alstom Power Generation AB, GE Energy (Sweden AB), Skanska, and SwedPower. Alstom will be responsible for the generator and electrical work, GE Hydro will be responsible for the turbines, Skanska will be responsible for the civil works, and SwedPower will be responsible for the design work. Alstom and GE have been manufacturing equipment for hydroelectric facilities for decades and have improved the engineering and technology that they use in the design and fabrication of turbines and generators.

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

It is expected that the Project activities will generate on average a total annual amount of 316,496 tCO_2e over a seven (7) years period, with option of two renewal periods. The total estimated reductions in the first crediting period (2004-2010) are 2,215,472 tCO_2e. Estimated emission reductions are achieved by avoiding CO_2 emissions from electricity generation of those fossil fuel-fired power plants connected into the Panama's National Grid.

Years	Annual estimation of emission reductions in tonnes of CO_2e
2004	256'496
2005	326'496
2006	326'496
2007	326'496
2008	326'496
2009	326'496
2010	326'496
Total estimated reductions (tonnes of CO_2e)	**2'215'472**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**316'496**

A.4.5. Public funding of the project activity:

No public funding is provided for the project.

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:

Title of the approved consolidated baseline methodology applied to the project activity: ***"Consolidated baseline methodology for grid-connected electricity generation from renewable sources".*** This baseline methodology shall be used in conjunction with the approved monitoring methodology ACM0002 ***("Consolidated monitoring methodology for grid-connected electricity generation from renewable sources")***.

Reference of the methodology applied to the project activity: ***ACM0002 - Version 06 /19 May 2006***

The additionality of the project activity shall be demonstrated and assessed using the *latest version* of the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board, which is available on the UNFCCC CDM web site.

Reference of Tool: ***Tool for the demonstration and assessment of additionality - Version 2 / 28 November 2005***

The methodology and tool are available on the following website:
http://cdm.unfccc.int/methodologies/PAmethodolgies/approved.html

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

Hydroelectric power generation technology is a renewable electricity generation technology to displace fossil fuel-fired power generation technology to supply electricity to the grid. Therefore the Project complies with the conditions stated in the consolidated baseline methodology ACM0002 approved by CDM EB to determine the project baseline and calculate GHG emission reductions achieved by Hydroelectric power generation, these conditions are:

- The project consists in electricity capacity additions from hydro power projects with existing reservoirs where the volume of the reservoir is not increased.
- The project is not an activity that involves switching from fossil fuels to renewable energy at the project 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

The project boundary is described in the baseline methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 06). The baseline methodology ACM0002 allows project participants to choose the emissions from the grid-connected thermal plants to be included in the project boundary, and the proposed project activity to substitute the generation from thermal plants to obtain emission reductions. The methodology addresses the GHG emissions due to the existence of the project activity, such as flooded lands, transportation, the use of cement, and construction of a power transmission line to connect the project to the grid.

	Source	Gas	Included?	Justification / Explanation
Baseline	Thermal plants	CO_2	Yes	Generation from fossil fuel thermal plants
		CH_4	No	Grid-connected renewable project
		N_2O	No	Grid-connected renewable project
Project Activity	Hydropower plant construction, fuel handling (extraction, processing, and transport), and land inundation	CO_2	Yes	The consumption of fuel and the use of cement during construction of the facility must be considered.
		CH_4	Yes	The project is a run-of-river plant with daily impoundment to partially regulate the dry season daily flow. The impacts of the Esti project will be marginal because: • The area that will be flooded is sparsely populated, therefore the creation of the reservoir will result in very little population displacement. • No protected flora or fauna exist in the area that will be flooded. • The flooded area will be clean. Size of the area to be flooded is very small, compared to other hydro projects, as it only serves as a regulated storage capacity. A total area of only about 3.00 km² will be flooded.
		N_2O	No	Grid-connected renewable project

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

According to the approved consolidated baseline methodology ACM0002 (Version 06), for the baseline determination, project participants shall only account CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity. The **spatial** extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to. For the purpose of determining the build margin (BM) and operating margin (OM) emission factor, as described below, a (regional) **project electricity system** is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints.

Where the application of this methodology does not result in a clear grid boundary, given country specific variations in grid management policies:
(a) Use the delineation of grid boundaries as provided by the DNA of the host country if available; or
(b) Use, Where DNA guidance is not available, the following definition of boundary:

- In large countries with layered dispatch systems (e.g. state/provincial/regional/national) the regional grid definition should be used. A state/provincial grid definition may indeed in many cases be too narrow given significant electricity trade among states/provinces that might be affected, directly or indirectly, by a CDM project activity;
- In other countries, the national (or other largest) grid definition should be used by default.

In Panama the DNA don't provide any grid boundaries delineation, due to the fact that Panama is a small country (approx. 78,000 Km^2) and the electricity market regulations, there is a National Interconnected Grid (NIG) defined as the set of generation power stations, lines and communications nets and complementary distribution of electricity and its facilities that are interconnected, in a single nationwide system.

Basic Information for the National Interconnected Grid as Baseline Scenario

Año	Installed Capacity - MW					Total Generation - MWh					Remarks
	Hydro	%	Thermal	%	Total	Hydro	%	Thermal	%	Total	
2000	613	49%	635	51%	1248	3,048,615	71%	1,243,085	29%	4,291,700	
2001	613	49%	647	51%	1260	2,253,865	49%	2,306,171	51%	4,560,036	
2002	701	49%	722	51%	1423	3,026,350	64%	1,717,838	36%	4,744,188	
2003	833	54%	722	46%	1555	2,449,270	51%	2,391,485	49%	4,840,756	
2004	846	56%	662	44%	1508	3,382,045	68%	1,578,713	32%	4,960,758	
2005*	847	56%	662	44%	1508	958,961	75%	325,868	25%	1,284,829	* Data available for the 1st quarter only
Total						**15,119,106**		**9,563,161**		**24,682,267**	

Source: http://www.etesa.com.pa/en/mercadoFrm.htm
http://www.mef.gob.pa/cope/index.htm

From the description above, the system boundary for NIG can be clearly identified. Furthermore, information on its characteristics and the corresponding data is readily available in a transparent way from the official

governmental agencies, the National Dispatch Center (CND, in Spanish) http://www.etesa.com.pa/en/mercadoFrm.htm; and the Energy Policies Commission (COPE, in Spanish) http://www.mef.gob.pa/cope/index.htm, which makes it suitable to select as the baseline scenario of the proposed project. Without the project activity, the unmet power demand would possibly be supplied by new-built fossil fuel power plants or continual operation of existing thermal plants. Generated electricity by the project will displace part of the electricity generated by fossil fuel power plants, and thus reduce GHG emissions from those power plants.

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 additionality of the proposed project activity is demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" (version 02) agreed by the CDM EB, as following steps:

Step 0: Preliminary screening based on the starting date of the project activity
Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Step 2: Investment analysis.
Step 3: Barriers analysis
Step 4: Common practice analysis
Step 5: Impact of registration of the proposed activity as a CDM project activity.

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

The Esti Project (Estí) is a run-of-river plant with daily impoundment to partially regulate the dry season daily flow. Esti is projected to have a total installed capacity of 120 MW (111.5 MW of firm capacity) and to generate an average of 620 GWh/year. The project consists of dams and a convergence system (canal and tunnel) and a powerhouse. The project uses the outflow from the existing Chiriqui and Fortuna hydroelectric projects, intervening inflows of the Caldera and Chiriqui Rivers, and the natural flows of the Barrigon River to produce electricity in the Canjilones Power Station. The powerhouse will contain two vertical shaft Francis-type turbine generator units, each rated at 60 MW under a net head of 112.1 m and a design flow of 59 m^3/s. AES has signed with the government of Panama the concession to build and operate (50 years) the Esti hydroelectric Project. The Esti Project was constructed pursuant to a fixed-price, date-certain engineering, procurement and construction ("EPC") contract with a consortium comprising GE Energy (Sweden) AB ("GE Energy"), Skanska International Civil Engineering AB ("Skanska"), Alstom Power Generation AB ("Alstom Power"), and SwedPower International AB ("SwedPower").

Therefore the project is designated as a "prompt start", which is defined as projects that started after January 1, 2000 in which the CDM was considered a part of the project design but did not get register with the CDM Executive Board before breaking ground on project construction[1]. Based on this decision by the CDM Executive

[1] This definition of the project start date is based on that presented by the CDM Executive Board in the document, "Glossary of terms used in the CDM project design document (CDM-PDD)."

Board, emission reductions from this type of project will be retroactively awarded for the years between the project starting date and registration[2].

In any case, project participants wish to have the crediting period starting prior to the registration of the project. Hence, step 0 is fulfilling for the project. Meaning the project is additional under step 0.

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 project is an activity that generates electricity by using renewable sources and delivers it through the NIG. The identified realistic and credible alternatives available to the project participants that provide outputs or services comparable with the proposed CDM project activity are three:

1. Implement the project as a hydropower plant development without the CDM component.
2. Implement others plausible and credible alternatives with comparable quality, properties and application areas (e.g. fossil fuel fired power plant, natural gas power plant).
3. Do not implement any power generation project.

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

The alternatives listed in sub-step 1a are in compliance with all applicable legal and regulatory requirements in Panama, including environmental regulations.

Because none of the identified alternatives breaks any legal or regulatory requirement or are posed to do so in the future - including the fact that none of the three alternatives are posed to go against technical standards and current legal dispositions on environmental conservation and cultural heritage conservation, all 3 scenarios are in compliance with all applicable laws and regulations and are also realistic and credible alternatives available to the project participants. Meaning the project is additional under step 1.

According with the Tool for the demonstration and assessment of additionality - Version 2, after comply with step1, and then indicate:

→ Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3.)

Step 2. Investment analysis

[2] Decision -/CP.9 "(c) That a clean development mechanism project activity starting between the date of adoption of decision 17/CP.7 and the date of the first registration of a clean development mechanism project activity may, if the project activity is submitted for registration before 31 December 2005, use a crediting period starting before the date of its registration;" Decision -/CMP.1 – General "4. *Decides* that project activities that started in the period between 1 January 2000 and 18 November 2004 and have not yet requested registration but have either submitted a new methodology or have requested validation by a designated operational entity by 31 December 2005 can request retroactive credits if they are registered by the Executive Board by 31 December 2006 at the latest;

Not applicable

Step 3. Barrier analysis

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

Hydropower plants projects face barriers that prevent them from being carried out if they are not registered as CDM activities.

Investment Barrier

At the time AES was developing this project and looking for capital, the company's stock value dropped drastically (it has since recovered substantially), severely limiting AES Panama's ability to access commercial financing. This led AES Panama to identify a short-term financing option that would allow them to develop the project and later restructure their debt once the project was operational.

While the project was able to get bridge financing without a secured revenue stream from the sale of CERs, the revenue was taken into consideration in the new financial package for the company. CERs (in part) contributed to the project's debt receiving a BBB- rating (investment grade) from Fitch Ratings Services. The sale of CERs is specifically reference in the rating document developed by Fitch. The proposed sale of CERs helped to secure this new financing package and extend loan tenors from eight to approximately ten to fifteen years. It specifically allowed the project to present a higher debt service coverage ratio (a key financial ratio used to determine a project's or company's ability to make timely debt payments).

While AES Panama is only partly owned by AES Corporation, new investment activities and usage of AES capital still must go through an internal corporate review against with investment opportunities which meet a minimum financial hurdle rate. While internal hurdle rates for AES vary, for projects such as this, an incremental difference in the internal rate of return (IRR) of 0.68% is considered significant (financial return with and without CERs are shown below).

Esti Project with Carbon Credits
IRR = 10.17%
NPV (@10%) = 1,235

Esti Project w/o Carbon Credits
IRR = 9.49%
NPV (@10%) = (3,839)

This additional financial return associated with the CER revenues helped in the investment decision-making process.

In addition, AES Panama values the GHG reducing attributes of this project not only for the additional revenue stream from the sale of CERs, but also for the intangible benefits, such as positioning AES Panama in the

emerging carbon market through early participation in a learning-by-doing process, gaining public recognition through national and international certifications, contributing to sustainability, and improving social conditions in a scantly developed rural region.[3]

Technological barrier

The Esti project is not part of the baseline and thus additional due to the following technology barriers:

1) While hydroelectric generation technology makes up more then 5% of the installed capacity in Panama, the Esti project utilizes specific control technology not used in Panama. The project utilizes a SCADA control system that allows the facility managers to optimize the operation of the turbines and generators and improve the efficiency of the plant (and thus reducing waste).

2) While not a traditional technology barrier (nor the one defined in the Baseline Methodology), hydro-electric power plants are generally no longer the technology of choice in Panama. Most new capacity utilizes combustion turbines or internal combustion engines. These technologies have lower installed cost and less environmental regulations to meet before they can go into operation. Due to this, under a business as usual scenario, hydroelectric technology would not be implemented.

Sub-step 3b. Show how the identified barriers would not prevent the implementation of at least one of the alternatives:

The two identified barriers that the project faced will not prevent the alternative: "implement the project as fossil fuel fired power plant"

(a) Investment Barrier (Barrier 1):
Affected less strongly fossil fuel project developments (Alternative 2) because of three reasons:

- The lower investment needed to build a fossil fuel fired power plant. A hydropower plant investment is needier of financing than a fossil fuel fired power plant because of the much higher up-front investment cost needed for the prior. The turnkey[4] cost per installed MW for a hydro project is around of the double for fossil fuel fired project in average.
- The faster time it takes to put the brand-new engines in operation for a fossil fuel fired power plant, which exposes lenders to less risk.
- The shorter time it takes in recovering the initial investment made which exposes lenders to less risk.

[3]AES Panama Energy, an indirect subsidiary of AES, has adopted an internal environmental strategy to deal with all of its business activities and new investments. AES is also a pioneer in Panama in consideration of the CDM as a part of its decision-making process. Since 1999 the Designated National Authority (DNA) of Panama has been sponsoring seminars on the use of CDM for project development activities. Consequently, AES Panama Energy has paid a great deal of attention to the Clean Development Mechanism. In November of 2001, The Netherlands Minister of Housing, Spatial Planning and the Environment and the Panamanian DNA signed a Memorandum of Understanding on co-operation in the field of the CDM. At that time AES Panama Energy hired experts to use the CDM as a financial tool, based on the ongoing negotiations of the UNFCCC.

[4] Turnkey meaning the investment needed to put a power plant in operation.

(b) Technological Barrier (Barrier 2):

Affected less strongly fossil fuel project developments (Alternative 2) because of some reasons as follow:

- Hydro-electric power plants are generally no longer the technology of choice in Panama. Most new capacity utilizes combustion turbines or internal combustion engines. These technologies have lower installed cost and less environmental regulations to meet before they can go into operation. Due to this, under a business as usual scenario, hydroelectric technology would not be implemented.

Since the alternatives are affected less strongly/not prevented by the identified barriers that the project faced, they are both viable alternatives and should not be eliminated from consideration.

Having been identified two barriers that prevented the implementation of this type of proposed project activity, but did not prevent/affect less strongly at least one of the alternatives identified, the project is additional under Step 3.

Step 4. Common Practice Analysis

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

The investment barriers existing in Panama for hydroelectric projects are due that hydroelectric technology has been generally no longer the technology of choice in Panama since 1984. Most of the latest capacity utilizes combustion turbines or internal combustion engines (see table below).

Latest Thermal Facilities for National Interconnected Grid

Company	Unit	Type	Fuel	Capacity (KW)	Year of Commissioning
EGE BABIA LAS MINAS					
BLM	5	G	Marine diesel	33	1988
BLM	6	G	Marine diesel	33	1988
BLM	8	G	Marine diesel	34	1999
BLM	9	G	Marine diesel	60	2000
AES PANAMÁ S. A.					
Sub Estación Panamá	1	G	Diesel	21.4	1983
Sub Estación Panamá	2	G	Diesel	21.4	1983
Company	**Unit**	**Type**	**Fuel**	**Capacity (KW)**	**Year of Commissioning**
PANAM	1 - 6	I.C.	Bunker	96	1999
PEDREGAL	1 - 3	I.C.	Bunker	53.4	2002
COPESA	1	G	Diesel	46	1998
Autoridad del Canal de Panamá					
PCA	3	G	Bunker C	38	Rehab - 2000
PCA	4	V	Bunker C	77	Rehab – 2002

(V) = Steam, (D) = Diesel, (G) = Gas, (I.C.) = Internal Combustion.

Source: http://www.mef.gob.pa/cope/index.htm

In this period of time any hydroelectric power plant has been build. This shows that hydro development can not be considered anymore a common practice.

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

No similar activities (hydropower plants) in terms of access to financing, international investment climate or developed under the conditions prevalence when the Esti Hydroelectric Project start (30/03/2001).

In conclusion, the project is not common practice in Panama. Meaning the project is additional under Step 4.

Step 5. Impact of CDM registration

The impact of the approval and registration of the Esti Hydroelectric Project activity as a CDM activity, and the attendant benefits and incentives derived from the project activity, will alleviate the barriers identified in Step 3. The investment barrier (Barrier 1) that impedes funding is alleviated when CDM registration is achieved. CERs revenues will allow the project to better compete with more efficient technologies available, and thus enable the project activity to be undertaken. Among the benefits and incentives can be achieving by the project are:

- Anthropogenic greenhouse gas emission reductions;
- The financial benefit of the revenue obtained by selling CERs,
- Attracting new players who are not exposed to the same barriers that project faced.
- Reducing the inflation /exchange rate risk affecting expected revenues and attractiveness for the investors.

Since the approval and registration of the project as a CDM activity alleviate the identified barriers (Step 3) to a reasonable extent, it is concluded that the project is additional under Step 5.

Because all of the above steps were satisfied, the CDM project activity is not the baseline scenario. That means the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The project activity is grid-connected electricity generation from renewable energy sources, according to the approved consolidated baseline methodology ACM0002, the emission reductions of the proposed project are determined as following steps:

STEP1. Calculate the Operating Margin emission factor(s) ($EF_{OM,\ y}$) based on one of the four following methods:

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

Each method is described as below.

Method (a) Simple OM

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total grid generation. The proportions of the low-cost/must in Panama's National Interconnected Grid (NIG) which the project is connected are more than 50% from year 2000 to year 2004 (most recent five years) see table in section **B.4**, so the simple OM method can not be adopted.

Method (b) Simple adjusted OM

The simple adjusted OM needs the annual load duration curve of the grid. As the detailed hourly load data (disaggregated data) of NIG are not publicly available (just monthly summary), it is difficult to adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$).

Method (c) Dispatch data analysis OM

Dispatch data analysis should be the first choice in calculating the baseline emission factor of operating margin ($EF_{OM,y}$) according to the methodology ACM0002. But disaggregated data of NIG are not publicly available in details (just monthly summary), it is difficult to adopt Method (c) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$).

Method (d) Average OM

Method (d) can only be used when low-cost/must run resources constitute more than 50% of total grid generation. According to the proportions of the low-cost/must in Panama's National Interconnected Grid (NIG), it is suitable for the project (see table in section B.4) and using aggregated generation and fuel consumption data public available

Thus, the method **(d) Average OM** be used to calculate the baseline emission factor of operating margin ($EF_{OM,y}$) for the project and the average OM emission factors can be calculated using either of the two following data vintages for years(s) *y*:

- (*ex-ante*) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

(d) *Average OM*. The average OM emission factor ($EF_{OM,average,y}$) is calculated as the average emission rate of all power plants, using equation (1) below, but including low-operating cost and must-run power plants.

$$EF_{OM,average,y} = \frac{\sum\left(F_{i,j,y} \times COEF_{i,j}\right)}{\sum_{j} GEN_{j,y}} \qquad (1)$$

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 of the grid.

$COEF_{i,j\ y}$ 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 $GEN_{i,y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_i \times EF_{CO2,i} \times OXID_i \quad (2)$$

Where: NCV_i is the net calorific value (energy content) per mass or volume unit of $fuel_i$
$OXID_i$ is the oxidation factor;
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the of $fuel_i$

Referred to description in version 6 of ACM002, Where available, local values of NCV_i and $EF_{CO2,i}$ 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 average OM emission factor ($EF_{OM,average,y}$) is calculated as the average emission rate of all power plants for the most recent 3 years for which data are available at the time of PDD submission (*ex-ante*) as the $EF_{OM,average,y}$ of the proposed project activity.

STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} (F_{i,m,y} \times COEF_{i,m,y})}{\sum_{m} GEN_{m,y}} \quad (3)$$

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.

Refer to the description in ACM0002, Project participants shall choose between one of the following two options. The choice among the two options should be specified in the PDD, and cannot be changed during the crediting period. We choose Option 1.

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 plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been

built most recently[5]. Project participants should use from these two options that sample group that comprises the larger annual generation.

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 ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (5)$$

where the weights w_{OM} and w_{BM}, by default, 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_2/MWh.

Step 4: The reduction of emissions in year *y*

The proposed 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 baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y - L_y \quad (6)$$

Where the baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) calculated in Step 3, times the electricity supplied by the project activity to the grid (EG_y in MWh)

$$BE_y = EG_y \times EF_y \quad (7)$$

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

Data and parameters required for assessment and demonstration of additionality and adopted to calculate ex-ante the emission factor that are available when validation is undertaken, they are not monitored throughout the crediting period but are determined only once and thus remains fixed throughout the crediting period.

Data / Parameter:	**OM**
Data unit:	tCO_2/MWh
Description:	Operating Margin emission factor(s) OM , y
Source of data used:	National Dispatch Center http://www.cnd.com.pa/publico/mostrararchivosbuquedaanual.php *and* *Energy Policies Commission* http://www.mef.gob.pa/cope/index.htm,
Value applied:	0.7621
Justification of the choice of data or description of measurement methods and procedures actually	Issued official by Panama's National Dispatch Center. This data is publicly available, but is not disaggregated data, just monthly summary.

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

applied :	
Any comment:	

Data / Parameter:	**BM**
Data unit:	tCO2/MWh
Description:	Build Margin emission factor(s) OM , y
Source of data used:	National Dispatch Center http://www.cnd.com.pa/publico/mostrararchivosbuquedaanual.php *and* *Energy Policies Commission* http://www.mef.gob.pa/cope/index.htm,
Value applied:	0.3478
Justification of the choice of data or description of measurement methods and procedures actually applied :	Issued official by Panama's National Dispatch Center. This data is publicly available, but is not disaggregated data, just monthly summary.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Based on the most recently data which are publicly available at the National Dispatch Center and base on the calculation for this project, the OM and BM emission factors, and according to formula B.5 to calculate the baseline emission factor (CM emission factor), the results are as follows:

Operating Margin EF (tCO2/MWh)	Build Margin EF (tCO2/MWh)	Combined Margin EF (tCO2/MWh)
0.7621	0.3478	0.555

Comments： Based on the most recently data which are available in an open way (2000-2004)

The weights w_{OM} and w_{BM} , by default, are $w_{OM} = w_{BM} = 0.5$

This is a hydropower project with an already existing reservoir; according to approved baseline methodology ACM0002 the GHG emissions by sources from the project can be ignored.

GHG Emissions related to flooded area

The existence of the reservoir results in GHG emissions through the decomposition of organic matter and as a result of the deforestation related to the creation of the reservoir. The impacts of the Esti project will be marginal because:

- There are few people living in the area that will be flooded, so the creation of the reservoir requires not much population displacement and actually these people were relocated.
- No protected flora or fauna exist in the area that will be flooded.

- The flooded area will be clean.
- Size of the area to be flooded is very small, compared to other hydro projects, as it only serves as a storage capacity. A total area of only about 3.00 km² will be flooded.
- The project includes a reforestation of 4.23 km²

However, in order to be conservative, the GHG emissions caused by the flooded land are estimated, as specified by the chosen methodology. This methodology uses the formula below, suggested in a World Bank paper entitled "*Greenhouse Assessment Book, A Practical Guidance Document for the Assessment of Project-Level Greenhouse Gas Emissions, paper nº 064 as of September 1998"*. The use of this formula requires the definition of an Emission Rate that must be chosen depending on the kind of flooding produced by the project. According to the table below, the appropriate value considered for Estí is 13 mgCH_4-C/m².day as the reservoir created would be an ecosystem similar to a lake, flooded during the whole year. However, the reservoir size may vary over the different seasons of the year, decreasing in the dry season, thus diminishing the GHG emissions from the reservoir in that time. To be conservative, the project developer decided to consider the total flooded area (3 km²) during the whole year.

EXHIBIT 5-15
AVERAGE METHANE EMISSIONS AND PRODUCTION PERIODS OF NATURAL WETLANDS

Wetland Categories (mg CH_4/m².day)	Emission Rate (mg CH_4-C/m².day)	Production Period or Length of Time Flooded (days)
Bogs	11 (1-38)	178
Fens	60 (21-162)	169
Swamps	63 (43-84)	274
Marshes	189 (103-299)	249
Floodplains	75 (37-150)	122
Lakes	32 (13-67)	365

Source: Source: UNEP/OECD/IEA/IPCC (1997), and references cited :herein.

Note: These average daily emission rates from Aselmann and Crutzen (1989) are derived from measured emission rates in field experiments (the range in measured emission rates is in parentheses after the average), and average production periods are based on monthly mean temperature data and lengths of inundation.

Table 1 – Average Methane Emission and Production Periods of Natural Wetlands (extracted from A Practical Guidance Document for the Assessment of Project-Level Greenhouse Gas Emissions, paper nº 064 as of September 1998, The World Bank)

Area of Flooded Land (m^2)	x	Duration of Flooding (days/year)	x	Average Daily CH_4 Emission Rate (mg CH_4-C/m^2-day)	x	Conversion Factor (t/mg)	x	Molecular/Atomic Weight Ration (tCH_4/tCH_4-C)	=	FE (Annual CH_4 Emissions Produced) (tCH_4/year)
3.000.000		365		13		10^{-9}		16/12		18.98

Therefore, during the 7 year period, over which the project will be operational, the GHG emissions due to the flooded land in the reservoir are estimated in:

FE = 18.98 tCH_4 x 21 tCO_2e/tCH_4 = 398.6 tCO_2 per year .

Emissions related to transport

Emissions due to fossil fuel consumption in transportation during project construction.

$$ET = FCf \times CVf \times EFf \times Oxf$$

Where:
ET = Emissions due to "f" fossil fuel consumption in transportation (tCO_2e)
FC_f = Total fossil fuel consumption (liters, t or m^3) of fuel "f";
CV_f = Calorific value (TJ/L, TJ/t or TJ/m^3) of fuel "f";
EF_f = Fossil fuel emission factor (tCO_2e/TJ);
Ox = Fraction of carbon oxidized for fuel "f"

And the data provided by the project are:

FC (Gallon) = Fuel estimate = 4,100,000 gal
Fuel Conversion Factor = 3.2684 kg/gal
EF[6] = Fuel Emissions Factor 3,172.31 g/Kg of fuel
Oxidation Rate = 99%
ET = Emissions (tCO_2e) = 4,100,000 x 3.2684 x $3,172.31/10^6$ x 0,99 = **42,084 tCO_2e**

Therefore, PE (Project Emissions) = ET + FE = 42,084 + 398.6 = 42,482.6 tCO_2e to be considered for the **first year of the first crediting period** of Estí Project and **398.6 tCO_2e per year in the subsequent years**.

The Esti project is a gird-connected renewable project, referring to the description in methodology ACM0002. The only leakage to be considered is the emissions originated by the use of cement during the construction of the project.

[6] In this case, it is used the Estimated Emissions Factors for US Heavy Duty Diesel Vehicles of the IPCC Guidelines, therefore there was no need for considering the fuel heat rate.

The only leakage to be considered is the emissions originated by the use of cement during the construction of the project. The methodology proposes a direct calculation of the project emissions by considering an IPCC emission factor for cement production. The emissions of the Está project are obtained as follows:

L = MC x CEF

Where:

L = Leakage due to cement used for project construction (tCO_2e);
MC = Mass of concrete used (t); and
CEF[7] = Concrete Emissions Factor = 0.4985 tCO_2/t cement

The final use for the concrete in the construction of Está was:

- Two dams, on the Chiriquí and on the Barrigón River;
- Power intake of the water conveyance system, consisting of approximately 6,000-meter long canal from the Chiriquí Reservoir to the Barrigón Reservoir;
- A 4,800 m long tunnel;
- An 18-meter diameter and 40 meter-high vertical shaft;
- A 270 meter-long tunnel section followed by two 18 meter-long distributor tubes;
- A 200 meter-long discharge canal from the Canjilones power station to the Está River;
- The powerhouse.

The estimate of the concrete used in construction of the Esti project is 160,000 m³. The density conversion factor for cement is 0.35t/m³. Therefore:

L = 160,000 x 0.35 x 0.4985 = **27,916 tCO_2e**

Indirect off-site emissions, like shifts in demand of electricity or import/export will not be taken into account in the quantification of emissions, as these are very difficult to measure and are not within the control of the project developer. Moreover, changes in demand patterns would not have an impact on how the grid system will be managed. The general principle for managing the grid system is to use low-cost sources first and to use plants operating at higher costs during periods of peak demand. This will be affected by the conditions of the power generators that provide electricity to the grid.

Consequently, **L= 27,916 tCO_2e**.

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

PE + L = 42,482.6 tCO_2e + 27,916 tCO_2e = 70,938.6 tCO_2e to be deducted in the first year

And **398.6 tCO_2 per year** due to CH_4 emissions from the reservoir.

[7] IPCC Guidelines for National Greenhouse Gas Inventories

Overall project emissions are then 73,330 tCO_2e over 7 years.

Because the average annual generation of this project activity will be 589,000 MWh/yr, (EF_y) is calculated ex-ante above and equal to 0.555 tCO2/MWh, so the estimated baseline emissions BE_y are expressed in tCO_2 according the formula as follows:

$E_y \times F_y = EG_y \ BE_y$ =589,000 MWh × 0.555 tCO2/MWh=326,895 tCO_2

Finally, the emission reduction ER_1 by the project activity during the first year is calculated according to formula as follows:

$ER_1 = EF_y - EG_y - L_1 = PE_y \times BE_y - ER_y$ = 256,496 tCO_2

The emission reduction ER_y by the project activity during year y is calculated according to formula as follows:

$ER_y = EF_y - EG_y = PE_y \times BE_y - ER_y$ = 326,496 tCO_2

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

Year	Estimation of Project activity Emission (tonnes of CO2e)	Estimation of baseline emission (tonnes of CO2e)	Estimation of leakeage (tonnes of CO2e)	Estimation of ER (tonnes of CO2e)
2004	70'400	326'496	70'400	256'496
2005	399	326'496	0	326'496
2006	399	326'496	0	326'496
2007	399	326'496	0	326'496
2008	399	326'496	0	326'496
2009	399	326'496	0	326'496
2010	399	326'496	0	326'496
Total (t CO2e)	**72'794**	**2'285'472**	**70'400**	**2'215'472**

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

B.7.1 Data and parameters monitored:

The "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002) requires monitoring of the following:

- Electricity generation from the proposed project activity;
- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);

- Data needed to recalculate the build margin emission factor, if needed, consistent with Consolidated baseline methodology for grid-connected electricity generation from renewable sources"(ACM0002);

Because the proposed project calculates the baseline emission factor ex-ante, just as description in B.6.1., the baseline emission factor for the proposed project equal to 0.555 tCO_2/MWh, which be calculated based on the open data are available at the time of PDD submission and cannot be changed during the first crediting period. This value will be validated by DOE before the registration, detailed information on validation of baseline emission factor already be described in upper **B.6.2.**; in the first crediting period there do not recalculate the OM and the BM, thus monitoring in not needed.

The generated electricity generated electricity by the project activity will be supplied to the national grid NIG. The electricity supplied to the grid $(EG_y)_y$ is needed for calculating the emission reductions of the project activity, which will be measured hourly and recorded monthly by the electronic meters at the top and end of lines, and the two electronic meters double double-checked each other. The metering system will be acquired from a recognized and experienced manufacturer that would provide installation and operating guarantee. This data will be directly used for calculation of emission reductions. Sales records to the grid and other records, e.g. maintenance and plant shut down records, are used to ensure consistency.

Data / Parameter:	Electricity (EG_y)
Data unit:	MWh
Description:	Annual electricity supplied to the NIG by the proposed project
Source of data to be used:	Records of metering system according to monitoring plan
Value of data applied for the purpose of calculating expected emission reductions in section B.5	326,496
Description of measurement methods and procedures to be applied:	Measurement of electricity output. Project electricity generation will be monitored through the use of on site metering equipment at the substation (interconnection facility connecting the facility to the grid). The Main Metering System equipment will be owned, operated and maintained by ETESA S.A. (National Dispatch Center), and the Backup Metering System equipment will be owned, operated and maintained by AES Panama. Both meters will have the capability to be read remotely through a communication line. Both meters will have the provisions to record on memory the accumulated kilowatt-hours. Both meters will be read.
QA/QC procedures to be applied:	The electricity generated by the Project will be supplied to the Panamanian grid. To ensure accuracy, a metering instrument will be installed. The metering system will be acquired from a recognized experienced manufacturer that would provide installation and operating guarantee. This data will be directly used for calculation of emission reductions. Sales records to the grid and other records, e.g. maintenance and plant shut down records, are used to ensure consistency. Data obtained from the grid is considered trustworthy and no further quality assurance activities are necessary apart from ensuring data is correctly transposed and applied in the algorithms for calculation of baseline emission factors.

Any comment:	In order to operate and manage the CDM project activities, AES Panama had constituted detailed rules on CDM project management, and also set up a CDM project team, the team then will assign a qualified person to measure, compile, and archive the necessary data for the monitoring plan. The monitoring data will be compiled amenable to third party audit and delivered periodically to the DOE for verification and certification.

B.7.2 Description of the monitoring plan:

The Monitoring plan will set out a number of monitoring tasks in order to ensure that all aspects of projected greenhouse gas (GHG) emission reductions for the project are controlled and reported. This requires an on going monitoring of the project to ensure performance according to its design and that claimed Certified Emission Reductions (CERs) are actually achieved.

The Project monitoring plan is a guidance document that provides the set of procedures for preparing key project indicators, tracking and monitoring the impacts of the project. The monitoring plan will be used throughout the defined crediting period for the project (2004-2010) to determine and provide documentation of GHG emission impacts from the Project.

This monitoring plan fulfils the requirement set out by the Kyoto Protocol that emission reductions projects under the Clean Development Mechanism have real, measurable and long-term benefits and that the reductions in emissions are additional to any that would occur in the absence of the certified project activity.

The Project must maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems to maintain the information required for an audit of an emission reduction project. These records and monitoring systems are needed to allow the selected Operational Entity to verify project performance as part of the verification and certification process. This process also reinforces that CO_2 reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs). The only significant emission source identified relates to the generation of electricity. Emission reductions will be achieved through avoided power generation of fossil -fuel based electricity in Panama due to the power generated by the project. The amount of electrical output from the Project is therefore defined as the key activity to monitor.

The monitoring plan provides the requirements and instructions for:

- Establishing and maintaining the appropriate monitoring systems for kWh generated by the project;
- Quality control of the measurements;
- Procedures for the periodic calculation of GHG emission reductions;
- Assigning monitoring responsibilities to personnel;
- Data storage and filing system;
- Preparing for the requirements of an independent, third party auditor/verifier.

Monitoring charge: Esti Power Plant Operations Manager, AES Panama
Monitoring and recording frequency: hourly measurement and monthly recording
Approach of data achieved: both in electronic and paper
Monitoring parameter: annual electricity supplied to the grid in MWh

Period of monitoring data delivered to DOE: yearly from 2004 to 2010, at the beginning of following year deliver previous year's data Forms of monitoring data delivered to DOE: monthly records and invoice of electricity sales Comments: the project operator ensures the monitoring data punctually and truly, if there are any questions, they would give further clarification.

Data to be monitored

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	For which baseline method(s) must this element be included	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept	Comments
1. EG_y	Electricity quantity	Electricity supplied to the grid by the project	MWh	Directly measured	Average OM BM	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.
3. $EF_{OM,y}$	Emission factor	CO_2 Operating Margin emission factor of the grid	tCO_2 / MWh	c	Average OM	At the beginning of the crediting period	100%	Electronic	During the crediting period and two years after	Calculated as indicated in the relevant OM baseline method above
4. $EF_{BM,y}$	Emission factor	CO_2 Build Margin emission factor of the grid	tCO_2 / MWh	c	BM	At the beginning of the crediting period	100%	Electronic	During the crediting period and two years after	Calculated as [?i Fi,y*COEFi] / [?m GENm,y] over recently built power plants defined in the baseline methodology
5. $F_{i,y}$	Fuel quantity	Amount of each fossil fuel consumed by each power source / plant	Mass or volume	m	Simple OM Simple Adjusted OM Dispatch Data OM Average OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.
6. $COEF_i$	Emission factor coefficient	CO_2 emission coefficient of each fuel type i	tCO_2 / mass or volum e unit	m	Simple OM Simple Adjusted OM Dispatch Data OM Average OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Plant or country-specific values to calculate COEF are preferred to IPCC default values.
7. GENj/k/n,,y	Electricity quantity	Electricity generation of each power source / plant j, k or n	MWh/ a	m	Simple OM Simple Adjusted OM Dispatch Data OM Average OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.
8	Area	surface area at full reservoir level	m^2	m	For new hydro electric projects	At start of the project	100%	Electronic	During the Crediting Period.	
9	Plant name	Identification of power source / plant for the OM	Text	e	Simple OM Simple Adjusted OM Dispatch Data OM Average OM	Yearly	100% of set of plants	Electronic	During the crediting period and two years after	Identification of plants (j, k, or n) to calculate Operating Margin emission factors
10	Plant name	Identification of power source / plant for the BM	Text	e	BM	Yearly	100% of set of plants	Electronic	During the crediting period and two years after	Identification of plants (m) to calculate Build Margin emission factors
11. λ_y	Parameter	Fraction of time during which low-cost/must-run sources are on the margin	Numbe r	c	Simple Adjusted OM	Yearly	100%	Electronic	During the crediting period and two years after	Factor accounting for number of hours per year during which low-cost/must-run sources are on the margin
12	Merit order	The merit order in which power plants are dispatched by documented evidence	Text	m	Dispatch Data OM	Yearly	100%	Paper for original documents, else electronic	During the crediting period and two years after	Required to stack the plants in the dispatch data analysis.
12a. GENj/k/ll,y *IMPORTS*	*Electricity quantity*	Electricity imports to the project electricity system	kWh	c	Simple OM Simple Adjusted OM Dispatch Data OM Average OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the latest local statistics. If local statistics are not available, IEA statistics are used to determine imports.
12b. $COEF_{i,j\ y}$ IMPORTS	*Emission factor coefficient*	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur)	tCO_2 / mass or volum e unit	c	Simple OM Simple Adjusted OM Dispatch Data OM Average OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate.

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)

The baseline study was completed on 10/09/2006
Responsible entity is: Environmental Business Advisors (EBA), David Toyne, david.toyne@thecarboncentre.com,
The entity is not one of the Project Participants listed in Annex 1 of the document.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

30/03/2001 EPC contract signed

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

25y-0m

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:

15/03/2004

C.2.1.2. Length of the first crediting period:

Seven (7) years, with option of three renewal periods.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not Applicable

C.2.2.2. Length:

Not Applicable

SECTION D. Environmental impacts

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

According to the Environmental Impact Assessment (EIA), during operation and generation, Esti project will not contaminate the water of the Esti River; waters downstream can still be used for other activities.

Both positive and possible negative impacts were identified in the EIA, with the negative impacts being higher in number, but also temporary and easily mitigated. The project developer will collaborate with the Panama National Environment Authority (ANAM) to mitigate the possible negative impacts of the Project as much as possible; mitigation measures were outlined in the EIA.

An Environmental Impact Assessment, under the Panamanian General Environmental Law, was approved by ANAM on July 20, 2001.

The following permits and approvals have been obtained for the Esti Project.

Esti Permits and Approvals

Permit	Comment
Construction permit	Issued by Town of Gualaca on May 18, 2001
Recommendation for approval for extraction of aggregates	Issued by Autoridad Nacional del Ambiente (ANAM) on March 12, 2001
Recommendation for approval to extract aggregates	Issued by Town of Gualaca on August 28, 2001
Provisional approval for the extraction of Aggregates	Provisional permission, authorized by the Ministerio de Comercio e Industrias (MICI) on July 2, 2001, renewable monthly on inspection by Comisión Consultiva
Clearing and Grubbing Permit 137-00	Clearing and grubbing for construction facilities and access roads, issued by ANAM on December 26, 2000
Clearing and Grubbing Permit 199-2001	Clearing and grubbing of reservoir areas, issued by ANAM on November 7, 2001
Environmental Impact Resolution IA-074-01	Approval by ANAM of updated environmental impact study, commissioned by AES for Estí project, issued on July 20, 2001

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:

Given that the plant is already constructed and in operation, and the upgrading of the two existing units and the installation of the third unit will have a minimal impact on the water regime downstream of the plant, a Category I environmental impact assessment was deemed all that was required for the upgrading project. This assessment identified only three impacts and mitigation measures to be addressed during the construction phase, as follows:

Esti Environmental Impacts and Mitigation Measures

Resource/Impact	Mitigation	Responsibility	Project Phase
Alteration of the landscape	Re-vegetation of disturbed areas	Contractor	Construction
Deterioration of water quality	Construction of new water plant for	Contractor	Construction
Erosion of river banks, sides of reservoir, and borrow areas	Rivers: Structural reinforcement of weak points; reservoir: no mitigation required; borrow	AES & Contractor	Construction and Operation
Increased noise	Mufflers on vehicles; control of	Contractor	Construction
Changes of flows	Agreed upon minimum releases	AES	Operation
Alteration of terrestrial habitat	Watershed reforestation; native forest protection	AES	Construction and Operation
Alteration of aquatic habitat	Ecological releases at dams	AES	Operation
Loss of vegetative cover	Re-vegetation of disturbed areas; reforestation of watershed	AES	Construction
Barrier to wildlife movements, risk to livestock	Fence canal	AES	Construction
Social effects of immigrants seeking project	Job training by AES and municipality	AES	Construction
Alteration of daily life	Public communication, job training,	AES	Construction
Alteration of regional production system	Project employment; technical training	AES & Contractor	Construction
Barrier within land holdings, due to canal	Provide bridges, three vehicular, two foot	Contractor	Construction
Barrier to river crossing (Esti) due to increased	Provide five new foot bridges	AES	Construction
Effects on local road network	Roads being improved by project	Contractor	Construction

SECTION E. Stakeholders' comments

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

A complete stakeholder participation review process is required by the current environmental legislation of Panama for this kind of project..

The stakeholders consultation was celebrated on May 12, 2001 at the Gualaca Fire Department Auditorium. The invitation for this consultation was follow the stated on the current environmental regulation of Panama; the invitation was publish during (3) days (April 28, 29 and 30, 2001) in a nationwide newspaper. During the meeting were collect all the comments and observation made by the participants for AES people.

E.2. Summary of the comments received:

The comments received are presented in Annex 5

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

The Autoridad Nacional del Ambiente (**ANAM,** Panama's Environmental Authority) approved in 2001 the Environmental Impact Statement (EIS). Before final approval, the EIS was evaluated by the Authority and, according to Article 27 of Law 41 (July 1st, 1998) and to the Executive Decree Nr. 59, Article 28 (March 16, 2000), this evaluation underwent a Public Consultation Period that included a Public "Town Meeting" where all citizens affected by, or in any way related to the project implementation had their right and opportunity to voice their comments and/or requirements. The Town Meeting was organized by the developer and held on 12, 2001 at the Gualaca Fire Department Auditorium. Many citizens inquired about the size of the project and component structures, about local jobs to be generated during the construction and operation phases, etc. The explanations on the potential positive and negative impacts of the project, on the economic effects of its implementation within the community and on the project configuration and operation characteristics were given by AES staff.

During this evaluation process of the EIS by citizenship at large, there were no complaints related to the implementation of the project. At the conclusion of the Town Meeting, local stakeholders have shown their unanimous acceptance of the implementation of this project activity. The outcome of this public evaluation represented one of the basis of ANAM's approval of the EIS.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	AES PANAMA S.A.
Street/P.O.Box:	Nicanor de Obarrio avenue (50 street) and Aquilino de la Guardia
Building:	Continental Bank Tower 25th floor
City:	Panama
State/Region:	Panama
Postfix/ZIP:	0816-01990, Panamá, República de Panamá
Country:	Republic of Panama
Telephone:	(507) 206-2600
FAX:	(507) 206-2613
E-Mail:	luiscarlos.penaloza@aes.com; evaristo.alvarez@aes.com
URL:	www.aes.com (Global Corporate site)
Represented by:	
Title:	General Manager
Salutation:	Eng.
Last Name:	Sundstrom
Middle Name:	John
First Name:	David
Department:	General Manager
Mobile:	
Direct FAX:	(507) 206-2612
Direct tel:	(507) 206-2603
Personal E-Mail:	dave.sundstrom@aes.com;

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is not public funding in the Esti Hydroelectric Project

Annex 3

BASELINE INFORMATION

Gross Generation by Type and Power Plants of the System

Years: 2000 - 2004 Units: GWh

Type & Power Plant	Installed Capacity (MW)	Year Commercial Operation	Type of Fuel	2000	2001	2002	2003	2004
Total of System				**4,820.01**	**5,101.63**	**5,258.95**	**5,561.77**	**5,756.90**
Total - National Interconnected Grid (NIG) (1a+2a+3a+4a+5+6)	**1,263.20**			**4,351.31**	**4,605.03**	**4,813.95**	**4,922.07**	**5,040.50**
Total - Panama Canal Authority - PCA (1b+2b+3b+4b) /c/	**175.00**			**452.20**	**469.70**	**415.70**	**603.70**	**680.70**
Total - Total - Isolated System(7)	**19.00**			**16.50**	**26.90**	**29.30**	**36.00**	**35.70**
1. Total Hydro	**735.00**			**3,398.11**	**2,478.36**	**3,367.05**	**2,794.47**	**3,764.95**
1a. NIG Hydro	**675.00**			**3,100.81**	**2,295.46**	**3,092.35**	**2,530.27**	**3,461.05**
Arkapal - /auto-edechi/	0.68	-	Hydro	1.50	1.40	2.00	2.80	1.80
Ascanio Villalaz (Bayano) ***	150.00	1976	Hydro	754.25	330.86	574.84	481.18	476.52
Dolega - /edechi/	3.12	1937 Rehab 2001	Hydro	10.70	7.30	12.60	16.40	14.70
Edwin Fábrega (Fortuna)	300.00	1984	Hydro	1,816.46	1,483.73	1,943.30	1,380.85	1,776.33
Estí	120.00	2003	Hydro				89.98	611.11
Hidro Panamá - /indep-edemet/	1.80	2000	Hydro	7.20	5.00	7.10	8.50	11.30
La Estrella	42.00	1978	Hydro	228.86	236.06	247.01	232.49	239.85
La Yeguada - /edemet/	7.00	1967	Hydro	31.70	26.00	34.60	41.20	39.50
Los Valles	48.00	1979	Hydro	249.05	203.22	261.20	264.76	278.20
Macho Monte - /edechi/	2.40	1938 Rehab 2002	Hydro	1.10	1.90	9.70	12.10	11.70
1b. Panama Canal Authority - PCA /c/	60.00	-	Hydro	297.30	182.90	274.70	264.20	303.90
2. Steam (Bunker)	**179.00**			**293.15**	**830.61**	**327.93**	**464.36**	**580.89**
2a. Steam Power Plant in NIG	**120.00**			**138.75**	**544.71**	**198.73**	**255.86**	**325.39**
Central 9 de Enero No 2	40.00	1969	Bunker C	37.90	203.57	29.20	49.37	98.84
Central 9 de Enero No 3	40.00	1972	Bunker C	71.87	170.96	92.61	129.17	155.13
Central 9 de Enero No 4	40.00	1974	Bunker C	28.98	170.17	76.92	77.33	71.42
2b. Panama Canal Authority - PCA /c/	59.00	-	Bunker C	154.40	285.90	129.20	208.50	255.50
3. Internal Combustion (Bunker/Diesel)	**227.40**			**784.40**	**1,001.47**	**738.88**	**1,501.84**	**1,123.18**
3a. Internal Combustion in NIG	**209.40**			**784.40**	**1,001.47**	**727.38**	**1,370.94**	**1,001.98**
Panam	96.00	1999	Bunker/Diesel	636.95	728.83	639.59	701.82	606.43
Pedregal Power	53.40	2002	Bunker/Diesel			2.90	384.91	391.44
Petroelectrica	60.00	1997	Bunker/Diesel	147.45	272.64	84.88	284.20	4.11
3b. Panama Canal Authority - PCA /c/	18.00	-	Bunker/Diesel			11.50	130.90	121.20
4. Gas Turbine (Light Diesel)	**126.80**			**28.34**	**13.90**	**6.30**	**3.60**	**1.50**
4a. Gas Turbine in NIG	**88.80**			**27.84**	**13.00**	**6.00**	**3.50**	**1.40**
Copesa	46.00	1996	Light Diesel	25.70	10.71	4.87	2.95	0.57
Subestación Panamá	42.80	1983	Light Diesel	2.14	1.58	0.66	0.49	0.19
4b. Panama Canal Authority - PCA /c/	38.00	-	Light Diesel	0.50	0.90	0.30	0.10	0.10
5. Gas Turbine (Marine Diesel)	**160.00**			**290.20**	**750.39**	**789.10**	**761.20**	**250.59**
Central 9 de Enero (JB) **	160.00		Marine Diesel	290.20	750.39	789.10	761.20	250.59
6. Sub-Total (Light Diesel)	**10.00**			**9.30**	**0.00**	**0.40**	**0.30**	**0.10**
Capira - /edemet/	5.50	-	Light Diesel	0.00	0.00	0.20	0.00	0.00
Chitré - /edemet/	4.50	-	Light Diesel	0.00	0.00	0.20	0.30	0.10
Petroterminales		-	Light Diesel	9.30	0.00	0.00	0.00	0.00
7. Isolated Systems	**19.00**			**16.50**	**26.90**	**29.30**	**36.00**	**35.70**
Petroterminales (Light Diesel)	6.70	-	Light Diesel		11.50	11.80	12.80	12.60
Other Isolated Systems		-		16.50	15.40	17.50	23.20	23.10
Light Diesel	8.46	-	Light Diesel		15.40	17.50	17.80	12.70
Bunker C	3.84	-	Light Diesel				5.40	10.40

Notes:

/c/ The PCA, just can transfer to the NIG 40 MW due physical restriction on intercotection system

/edemet/ Power Plant owned by Edemet and gives energy direct to Edemet

/edechi/ Power Plant owned by Edechi and gives energy direct to Edechi

/indep-edemet/ Independet Generator to gives energy direct to Edemet.

/auto-edechi/ Self-generator who give energy excedent directly to Edechi.

*** Bayano Power Plant in November 2003 began used of Unit 3 (85 MW); Replaced Units 1 began in year 2003 and Unit 2 began in year 2004

** Central 9 de Enero (JB) Unit 8 (100) began in 1988 Unit 9 (60 MW) began in year 2000

Sources: "Compedio Estadistico Energetico 1970-2004 – Generacion Electrica" http://www.mef.gob.pa/cope

http://cdm.unfccc.int/UserManagement/FileStorage/IVYSA8ECF4V4WHEPBMCN6SEKGBQ4YA - page 30

http://www.prismaenergy.com/businesses/blm.html

http://www.cnd.com.pa/publico/mostrararchivosbuquedaanual.php

Project Heat Rate Estimation

Plant /Unit	2004Generation	Fuel		Energy Content		Heat Rate
		Type	Consumption			
	(MWh)		(10^3 Gallons)	(Btu/Gallon)	GJ/10^3 Gallons	(GJ/MWh)
[1]	[2]	[3]	[4]	[5]	[6 = 5*0.0010551]	[7 = 6*4/2]
Bunker C & Light Diesel						
Central 9 de Enero No 2	98,843.58	Bunker C	8,688.00	152,500.00	160.90	14.14
		Light Diesel	261.00	135,000.00	142.44	0.38
						14.52
Central 9 de Enero No 3	155,127.21	Bunker C	12,491.00	152,500.00	160.90	12.96
		Light Diesel	375.00	135,000.00	142.44	0.34
						13.3
Central 9 de Enero No 4	71,415.93	Bunker C	6,042.00	152,500.00	160.90	13.61
		Light Diesel	181.00	135,000.00	142.44	0.36
						13.97
Panama Canal Authority - PCA #6	121,200.00	Bunker C	6,695.00	152,500.00	160.90	8.89
		Light Diesel	201.00	135,000.00	142.44	0.24
						9.13
PANAM	606,428.03	Bunker C	36,512.00	152,500.00	160.90	9.69
		Light Diesel	1,095.00	135,000.00	142.44	0.26
						9.95
Pedregal	391,441.56	Bunker C	18,536.00	152,500.00	160.90	7.62
		Light Diesel	556.00	135,000.00	142.44	0.2
						7.82
Petroelectrica	4,109.77	Bunker C	250.00	152,500.00	160.90	9.79
		Light Diesel	7.00	135,000.00	142.44	0.24
						10.03
Bunker C (BC)						
Panama Canal Authority - PCA #3,4	255,500.00	Bunker C	19,762.00	152,500.00	160.90	**12.45**
Isolated System (Other BC Plants)	10,400.00	Bunker C	742.00	152,500.00	160.90	**11.48**
Light Diesel (LD)						
Panama Canal Authority - PCA #1,2.5	100.00	Light Diesel	15.60	135,000.00	142.44	**22.22**
Subestación Panamá	189.40	Light Diesel	20.00	135,000.00	142.44	**15.04**
COPESA	565.05	Light Diesel	88.00	135,000.00	142.44	**22.18**
Isolated Systems (Other LD Plants)	25,300.00	Light Diesel	2,208.00	135,000.00	142.44	**12.43**
Marine Diesel						
Central 9 de Enero (JB)	250,593	Marine Diesel	20,322.00	100,000.00	105.51	**8.56**

Table 1 - Calculation of Approximate Operation Margin

Thermal Plants in NIG in 2004	Installed Capacity (MW)	Type of Fuel	Heat Rate (GJ/MWh)	Energy CO2 EF (tCO2/GJ)	Oxidation Factor (%)	CO2 EF (tCO2/MWh)	Average of Generation 2002 - 2004 (MWh/yr)	Average of CO2 Emission (tCO2/yr)	NIG Average Emission (tCO2/MWh)
Central 9 de Enero No 2	40.00	BC/LD	14.52	0.0774	99.0	1.1126	59,137.54	65,796.42	
Central 9 de Enero No 3	40.00	BC/LD	13.30	0.0774	99.0	1.0191	125,634.80	128,034.43	
Central 9 de Enero No 4	40.00	BC/LD	13.97	0.0774	99.0	1.0705	75,219.16	80,522.11	
Panama Canal Authority - PCA #3,4	59.00	BC	12.45	0.0774	99.0	0.954	197,733.33	188,637.60	
Panama Canal Authority - PCA #6	18.00	BC/LD	9.13	0.0774	99.0	0.6996	87,866.67	61,471.52	
PAN AM	96.00	BC/LD	9.95	0.0774	99.0	0.7624	649,278.64	495,010.04	
Pedregal	53.40	BC/LD	7.82	0.0774	99.0	0.5992	259,752.10	155,643.46	
Isolated System (Other BC Plants)	3.84	BC	11.48	0.0774	99.0	0.8797	5,266.67	4,633.09	
Petroelectrica	60.00	BC/LD	10.03	0.0774	99.0	0.7686	124,400.91	95,614.54	
Sub-Total 1	**410.24**						**1,584,289.82**	**1,275,363.21**	**0.8050**
Central 9 de Enero (JB)	160.00	Mar Diesel	8.56	0.0748	99.5	0.6371	600,297.23	382,449.36	
Sub-Total 2	**160.00**						**600,297.23**	**382,449.36**	**0.6371**
Subestación Panamá	42.80	LD	15.04	0.0741	99.0	1.1033	449.02	495.40	
Panama Canal Authority - PCA #1,2.5	38.00	LD	22.22	0.0741	99.0	1.63	166.67	271.67	
COPESA	46.00	LD	22.18	0.0741	99.0	1.6271	2,809.50	4,571.33	
Isolated Systems (Other LD Plants)	25.20	LD	12.43	0.0741	99.0	0.9119	28,400.00	25,897.96	
Sub-Total 3	**152.00**						**31,825.18**	**31,236.36**	**0.9815**
TOTAL	**722.24**						**2,216,412.22**	**1,689,048.93**	**0.7621**

Sources: "Compedio Estadistico Energetico 1970-2004 – Generacion Electrica" http://www.mef.gob.pa/cope

Average Annual Energy Generation

The generation of the Esti hydroelectric power station, is determined by the SDDP[8] model by mainly considering the average monthly inflows. Average daily inflows will have higher peaks and lower minimum flows than the monthly inflows. In projects with large capacity reservoirs, these extreme high and low flows will be attenuated by the reservoir. In projects with no reservoirs or small capacity reservoirs, such as Bayano, daily inflows greater than the diversion and storage capacity of the project would be spilled.

In order to determine the reduction in energy due to daily flows at Está project power station, daily flow duration curves for the project were developed. The inflow over the diversion and storage capacity of the project was estimated and a factor was developed to reflect the reduction in average annual energy due to the consideration of daily flows was developed. This factor for Está is 0.959, which means that about 4.1% (1.0 – 0.959 = 0.041) of possible annual electricity generation is lost to spillage due to the inability of Está to store and capture 100% of the energy embodied in the daily flows of the river.

The estimated annual electric energy generation after the Está plant is expanded was estimated using the SDDP model. After taking into account the projected effect of spillage, as discussed above, the estimated generation by the expanded Está plant is presented in the following table.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
Generation (GWh)	671	642	662	659	622	637	645	632	654	636	**646**

Generation of Expanded Está Hydroelectric As Estimated by SDDP

The average annual generation adjusted by the daily flow reduction is:
Average Generation x Adjusted Factor, Generation (GWh) = 646 x 0.959 = 620

In order to be conservative, we apply a 95% safety factor to the 620 GWh of expected annual generation to arrive at an assumed annual generation attributable to the plant expansion which serves as the basis for estimating emissions reductions:

Assumed average GWh/year = 620 x 0.95 = **589 GWh/year**

[8] SDDP (Stochastic Dual Dynamic Programming) is an optimization model developed in Brazil and used extensively in Latin America (including Panama) to optimize the dispatch of all plants in a system for short or long term planning horizons. Simulations require a description of the load and generation system, including historical inflow records, reservoir and power plant data, fuel and variable costs for thermal plants, capital costs of new projects, demand forecasts and discount rates. Key features of the model include : a) the hydrology module, which can generate 50 stochastic series of inflows for each hydro project based on historical data; b)the hydrothermal scheduling module, which determines the sequence of hydro releases which will minimize the expected operation cost (given by the variable costs of the thermal plus penalties for rationing), and is used to derive the value (shadow price) of hydro; c) the load module, which provides an approximation of the load shape within the time step; for Panama, monthly demand was represented by three blocks corresponding to the peak, shoulder and base demand in a month. Simulations can be carried out on a daily, weekly or monthly basis along the planning horizon.

Table 2A - Option 1a - Five Most Recently Power Plants Build at the time of PDD submission

Thermal Plants in NIG in 2004		Start Year of Operation	Installed Capacity (MW)	Technology	2004 Generation MWh/yr
1	PEDREGAL	2002	53.4	Internal Combustion	391,441.56
2	Panama Canal Authority - PCA #3,4	2000-2002	59.0	Steam Turbine	255,500.00
3	Central 9 de Enero (JB) Unit 9 *	2000	60.0	CCycle Gas Turbine	78,763.00
	Sub-Total Thermal		**172.4**		**725,704.56**
Hydro Plants in NIG in 2004					
4	HPP Esti	2003	120.0	Hydropower	611,109.82
5	Bayano Expansion**	2003-2004	110.0	Hydropower	182,784.49
	Sub-Total Hydro		**230.0**		**793,894.31**
	TOTAL		**402.4**		**1,519,598.87**

Table 2B - Option 1b - Power Plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently at the time of PDD submission

Thermal Plants in NIG in 2004		Start Year of Operation	Installed Capacity (MW)	Technology	2004 Generation MWh
1	PEDREGAL	2002	53.4	Internal Combustion	391,441.56
	Sub-Total Thermal		**53.4**		**391,441.56**
Hydro Plants in NIG in 2004					
2	HPP Esti**	2003	120.0	Hydropower	611,109.82
3	Bayano Expansion	2003-2004	110.0	Hydropower	182,784.49
	Sub-Total Hydro		**230.0**		**793,894.31**
	TOTAL		**283.4**		**1,185,335.87**

** In this calculation is included the CDM project activity: Esti Project

Sources: "Compendio Estadistico Energetico 1970-2004 – Generacion Electrica" http://www.mef.gob.pa/cope

http://www.prismaenergy.com/businesses/blm.html

Build Margen Emission Factor

	Thermal Plants in NIG in 2004	Start Year of Operation	Installed Capacity (MW)	Technology	Type of Fuel	Heat Rate (GJ/MWh)	Energy CO2 EF (tCO2/GJ)	Oxidation Factor (%)	CO2 EF (tCO2/MWh)	Generation 2004 (MWh/yr)	CO2 Emission (tCO2/yr)	NIG Emission (tCO2/MWh)
1	PEDREGAL	2002	53.4	Internal Combustion	BC/LD	7.82	0.0774	99.0	0.5992	391,441.56	234,551.78	
2	Panama Canal Authority - PCA #3,4	2000-2002	59.0	Steam Turbine	BC	12.45	0.0774	99.0	0.954	255,500.00	243,747.00	
3	Central 9 de Enero (JB) Unit 9 *	2000	60.0	CCycle Gas Turbine	Mar Diesel	8.56	0.0748	99.5	0.6371	78,763.00	50,179.91	
	Sub-Total Thermal		**172.4**							**725,704.56**	**528,478.69**	**0.7282**
	Hydro Plants in NIG in 2004											
4	HPP Esti	2003	120.0	Hydropower						611,109.82	0.00	
5	Bayano Expansion**	2003-2004	110.0	Hydropower						182,784.49	0.00	
	Sub-Total Hydro		**230.0**							**793,894.31**	**0.00**	**0.0000**
	TOTAL		**402.4**							**1,519,598.87**	**528,478.69**	**0.3478**

Project Leakeage

Project Emission

CONCRETE

Project	Concrete					Emission
	m3	Kg/m3	Kg	Tonne	EF tCO2/tCement	t CO_2
Esti	160,000	350	56,000,000	56,000	0.4985	27,916
					Esti Project	27,916

CEF[1] = Concrete Emissions Factor = 0.4985 tCO2/t cement

[1] IPCC Guidelines for National Greenhouse Gas Inventories

Transportation Emissions

Project	Fuel				Emission tCO_2
	Consumption (gal)	Convertion Factor (kg&gal)	EF (g/Kg)[1]	Oxidation Rate	
Esti	4,100,000.00	3.27	0.00317	99%	42,085
				Esti Project	42,085

[1] In this case, it is used the Estimated Emissions Factors for US Heavy Duty Diesel Vehicles of the IPCC Guidelines, therefore there was no need for considering the fuel heat rate.

Emissions related to flooded area

Project	Area of Flooded Land (km^2)	Duration of Flooding (days/year)	Average Daily CH_4 Emission Rate (mg CH_4-C/m^2-day)[1]	Conversion Factor (t/mg)	Molecular/Atomic Weight Ration (tCH_4/tCH_4-C)	FE (Annual CH_4 Emissions Produced)	Emission tCO_2/year
Esti	3	365	13	0.001	1.333333333	18.98	399
						Esti Project	399

[1] Greenhouse Assessment Book, A Practical Guidance Document for the Assessment of Project-Level Greenhouse Gas Emissions, paper nº 064 as of September 1998

Project Activity Emissions Reduction

Operating Margin EF (tCO2/MWh)	Build Margin EF (tCO2/MWh)	Combined Margin EF (tCO2/MWh)	Project Generation (Mwh/yr)	Baseline Emissions (tCO2/year)	Project			
					Emissions in first year (tCO2/yr)	Emissions in following years (tCO2/yr)	Emission Reduction in first year (tCO2/yr)	Emission Reduction (tCO2/yr)
0.7621	0.3478	0.555	589'000	326'895	70'399.83	398.58	256'495	326'496

Project Emission Reduction for various Crediting Periods

Credit Period (years)	Emissions Reduction (tCO_2e)	Period (years)
7	2'217'865	2004 - 2010
10	3'198'550	2004 - 2013
14	4'506'130	2004-2014*
21	6'794'395	2004-2024*

Notes:

[1] Project emissions will occur only during first year

[2] Project emissions calculation for leakeage resulted in 360 tCO2/year (cement use during the upgrade of the Bayano plant.)

[3] Baseline will be renewed at the start of each seven (7) year crediting period as emission reductions for the new seven (7) year crediting periods may change due to changes in the national grid configuration.

* Baseline must be renewed for these cases. Values may vary according to national electric generating mix composition.

Annual estimation of emission reductions

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2004	256'496
2005	326'496
2006	326'496
2007	326'496
2008	326'496
2009	326'496
2010	326'496
Total estimated reductions (tonnes of CO_2e)	**2'215'472**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**316'496**

Annex 4

MONITORING INFORMATION

MONITORING PLAN

This Monitoring plan will set out a number of monitoring tasks in order to ensure that all aspects of projected greenhouse gas (GHG) emission reductions for the project are controlled and reported. This requires an on going monitoring of the project to ensure performance according to its design and that claimed Certified Emission Reductions (CERs) are actually achieved.

The Project monitoring plan is a guidance document that provides the set of procedures for preparing key project indicators, tracking and monitoring the impacts of the project. The monitoring plan will be used throughout the defined crediting period for the project (2004-2010) to determine and provide documentation of GHG emission impacts from the Project.

This monitoring plan fulfils the requirement set out by the Kyoto Protocol that emission reductions projects under the Clean Development Mechanism have real, measurable and long-term benefits and that the reductions in emissions are additional to any that would occur in the absence of the certified project activity.

Managers of the Project must maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems to maintain the information required for an audit of an emission reduction project. These records and monitoring systems are needed to allow the selected Operational Entity to verify project performance as part of the verification and certification process. This process also reinforces that CO_2 reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs). The only significant emission source identified relates to the generation of electricity. Emission reductions will be achieved through avoided power generation of fossil -fuel based electricity in Panama due to the power generated by the project. The amount of electrical output from the Project is therefore defined as the key activity to monitor.

The monitoring plan provides the requirements and instructions for:

a) Establishing and maintaining the appropriate monitoring systems for kWh generated by the project;
b) Quality control of the measurements;
c) Procedures for the periodic calculation of GHG emission reductions;
d) Assigning monitoring responsibilities to personnel;
e) Data storage and filing system;
f) Preparing for the requirements of an independent, third party auditor/verifier.

AES Panama, who is developing the Project, will use this document as guide in monitoring of the project emission reduction performance and will adhere to the guidelines set out in this monitoring plan. This plan is designed to be used in parallel with the monitoring (i.e. metering) of the kWh, according with the standard procedures used in the Electrical Market in Panama.

Main Definitions

The monitoring plan will use the following definitions of monitoring and verification

- **Monitoring:** the systematic surveillance of the Project's performance by measuring and recording performance-related indicators relevant in the context of GHG emission reductions.
- **Verification:** the periodic ex-post auditing of monitoring results, the assessment of achieved emission reductions and of the project's continued conformance with all relevant project criteria by a selected Operational Entity.

Project Basic Information

The Esti Project (Estí) is a run-of-river plant with daily impoundment to partially regulate the dry season daily flow. Esti is projected to have a total installed capacity of 120 MW (111.5 MW of firm capacity) and to generate an average of 620 GWh/year. The project consists of dams and a convergence system (canal and tunnel) and a powerhouse. The project uses the outflow from the existing Chiriqui and Fortuna hydroelectric projects, intervening inflows of the Caldera and Chiriqui Rivers, and the natural flows of the Barrigon River to produce electricity in the Canjilones Power Station. The powerhouse will contain two vertical shaft Francis-type turbine generator units, each rated at 60 MW under a net head of 112.1 m and a design flow of 59 m^3/s. AES has signed with the government of Panama the concession to build and operate (50 years) the Esti hydroelectric Project. The Esti Project was constructed pursuant to a fixed-price, date-certain engineering, procurement and construction ("EPC") contract with a consortium comprising GE Energy (Sweden) AB ("GE Energy"), Skanska International Civil Engineering AB ("Skanska"), Alstom Power Generation AB ("Alstom Power"), and SwedPower International AB ("SwedPower").

The monitoring plan follows the project boundaries as defined in the PDD according with ACM0002 – Version 06.

Crediting Period

The crediting period for the Project is 7 years, starting in 2004 and ending in 2010. At the end of each calendar year annual electricity sales will be monitored. The monitoring results and subsequent emission reductions will be verified on an annual basis as well by the selected Operational Entity.

CO_2 emissions reduction calculation estimation

This section presents the method for calculating CO_2 emission reductions. The emission reductions from the project are generated due to the displacement of electricity generated from existing grid energy technologies by electricity generated by the Project.

The CO_2 emission reductions from the project will be calculated as follows:

1. Determine the net electric output measured in GWh for the period from the Project by accumulating the monthly results from the measurements made by the Project and ETESA, S. A.
2. Multiply this by the average carbon emissions factor as defined in the Baseline and validated by the Operational Entity (tCO_2 / GWh).
3. The Net annual CO_2 emissions displaced by the project (tonnes CO_2e).

4. Deduct emissions from project (CEF project multiplied by net monitored electric output project). For the project this is nil, as agreed in the baseline.
5. Total CERs generated by the project for the period.

Measurement of Electricity Output

Project electricity generation will be monitored through the use of on site metering equipment at the project's electrical substation (interconnection point to the grid). The Main Metering System equipment will be owned, operated and maintained by ETESA, and the Backup Metering System equipment will be owned, operated and maintained by the project. Both meters will have the capability to be read remotely through a communication line. Both ETESA and AES Panama have the right to read either meter. Both meters will have the provisions to record on memory the accumulated kilowatt-hours. Both meters will be read. The results from the Main Meter will be supplied by ETESA to AES Panama on a monthly basis. The monitoring tasks are to measure Project's electric output, and steps to derive the emissions reductions are:

- ETESA reads main meter and records result - monthly - within 3 working days of month end
- ETESA supplies reading to AES Panama
- AES Panama supply reading and file for Verifier
- AES Panama accumulates readings for payment period and calculates CERs for sale, and invoice Buyer
- AES Panama file paperwork for Verifier

The meter reading records will be readily accessible for auditors, Calibration tests records will be maintained for the auditors.

Calibration of Meters

According with the establish procedures by ETESA defines the metering calibration and the required quality control procedures to ensure accuracy. Some of those are described below:

- The metering equipment will be properly calibrated and checked annually for accuracy. The metering equipment shall have sufficient accuracy so that any error resulting from such equipment shall not exceed +0.5% of full-scale rating.
- Both Meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.
- All the meters installed shall be tested by ETESA within 10 days after (a) the detection of a difference larger than the allowable error in the readings of both meters, (b) the repair of all or part of meter caused by the failure of one or more parts to operated in accordance with the specifications, and/or each anniversary of the Commercial operations date. If any errors are detected the party owning the meter shall repair, recalibrate or replace the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity.
- The Net Energy Output registered by the Main Meters alone will suffice for the purpose of billing and emission reduction verification as long as the error in the Main Meter is within the permissible limits.

Calibration is carried out by ETESA with the records being supplied to AES Panama, and these records will be maintained by AES Panama at power plant.

Data Management Systems

This system provides information on record keeping of the data collected during monitoring. Record keeping is the most important exercise in relation to the monitoring process. Without accurate and efficient record keeping, project emission reductions cannot be verified. Below follows an outline of how project related records will be managed.

Proposed information management system for emissions reduction monitoring

Overall responsibility for monitoring of GHG emissions reduction will rest with AES PANAMA, and which will be located at AES Panama central office, located at Nicanor de Obarrio Ave. and Aquilino de la Guardia, Continental Bank Tower 25th floor Panama City, Panama. The following section sets out the procedures for tracking information from the primary source to the end-data calculations, in paper document format. AES PANAMA will provide the CERs and necessary data to allow it to transfer to the Buyer.

Paper-based Documentation

Physical documentation such as paper-based maps, diagrams and environmental assessments will be collated in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to Project and AES Panama Company, the project material and monitoring results will be indexed. All paper-based information will be stored by at the AES Panama main office in Panama City.

Data storage Table

Document index reference number	Document title	General description of document	Individual or Dept submitting this information	Date entered
	PDD, including the electronic spreadsheets and supporting documentation (assumptions, data			
	CO_2 ER Calculations & Monitoring Plan			
	Validation Report			
	Dispatch Meter calibration Reports.			
	Documentation related to assessments and any site visits carried out by Operational Entity for verification of the annual emission reductions			
	Monthly Meter reading reports			

	Records on CO_2 emission reductions (CERs)			
	Records on project management, including data collection and			

Verification and Monitoring Results

The verification of the monitoring results of the Project is a mandatory component, which is required for all CDM projects. The main objective of the verification is to independently verify that the project has achieved the emission reductions as reported and projected in the PDD. It is expected that the verification will be done on an annual basis.

AES Panama has the following responsibilities for the Verification and Monitoring

- Contract an Operational Entity and agree a time schedule for carrying out verification activities throughout the crediting period in accordance with the Buyer and the CDM Executive Board requirements.
- AES Panama will make the arrangements for the verification and will prepare for the audit and verification process to the best of its abilities.
- The selected Operational Entity must be an Accredited Entity with a proven track record in environmental auditing and verification, experience with CDM projects and work in developing countries. The Operational Entity should be accredited by the CDM Executive Board.
- AES Panama will facilitate the verification through providing the Operational Entity with all the required necessary information, before, during and, in the event of queries, after the verification.
- AES Panama will fully cooperate with the Operational Entity and instruct its staff and management to be available for interviews and respond honestly to all questions from the Operational Entity.

Annex 5

FORO PUBLICO ESTI

En el Auditorio del Cuartel del Cuerpo de Bomberos del Corregimiento de Gualaca, Distrito de Gualaca, Provincia de Chiriquí, siendo las 10:05 a.m. del sábado 12 de mayo de 2001, se dio inicio al Foro Público para la presentación de la Ampliación del Estudio de Impacto Ambiental (Optimización de Diseño) Categoría III, correspondiente a la Optimización, del Diseño del Proyecto Hidroeléctrico Esti, foro que fuera convocado para las 9:00 a.m. de ese día y en ese lugar, según consta en los avisos publicados en el periódico "La Estrella de Panamá", durante los días 28, 29 y 30 de abril de 2001, mismos que forman parte del expediente que sobre el referido estudio reposa en la oficina de Impacto Ambiental de la ANAM.

Participaron del Foro:

- **Por la Comunidad:**
  Alcalde de Gualaca : Sr. Laurencio Guerrero
  Representante del Corregimiento de Gualaca: Sra. Leticia Ortega

- **Invitados**
  Director Nacional de Impacto Ambiental
  Jefe de la Unidad Ambiental (MIVI)
  Director General del I.D.A.A.N.
  Unidad Ambiental del Ministerio de Salud
  Director Presidente del Ente Regulador de los Servicios Públicos
  Jefe de la Unidad Ambiental del Ministerio de Obras Públicas
  Policía Nacional de Gualaca

- **Asistentes por la Comunidad**
  Cooperativa Servicios Múltiples y Desarrollo Integral de Gualaca
  Estudiantes de V año Facultad de Ciencias Agropecuarias (Universidad de Panamá)
  Productores Agropecuarios
  Asociación de Usuarios del Canal de Riego Casa Blanca
  Usuarios de Agua del Río Chiriquí
  Comité Prodefensa Integral de los Intereses de Gualaca
  Maestros de la Escuela Primaria de Gualaca
  ANAGAN

- **Por AES:**
- **Empleados**
- **Consultores**
  HARZA – Consultores de AES para el Proyecto Hidroeléctrico Estí

- **Contratista del Proyecto Esti**
  Skanska - Contratista del Proyecto Hidroeléctrico Esti
  Swed Power – Presidente del Consorcio del Proyecto Hidroeléctrico Estí.
  Alston Power
  Ge Energy

Ing. José Victoria (AES) relató los antecedentes del Proyecto Estí
Ing. Franklin Quintero (AES) - Expuso sobre la descripción técnica del Proyecto Esti
Ing. Manuel Zárate – Representante de Planeta Panamá Consultores, S.A. informó sobre resultados de la Ampliación del Estudio de Impacto Ambiental de la Optimización del Diseño del Proyecto Hidroeléctrico Estí, elaborado por ellos.

Luego de la disertación de los ingenieros Victoria, Quintero y Zárate, se dio inicio al Período de Preguntas y Respuestas:

1. **¿Dentro del Plan Maestro de uso de tierra existe alternativa para cambiar la cultura ganadera?**

El MIDA dentro de la política de reconversión debe crear incentivos y capacitar al ganadero, para que pase de la ganadería extensiva a una ganadería intensiva y hay áreas destinadas a la ganadería intensiva en el plan maestro.

También señala zonas para agricultura

Buscar tecnificación de la producción que impiden seguir deteriorando el suelo.

IDIAP y MIDA, deben tomar estas recomendaciones para la reconversión del sistema agropecuario que es su responsabilidad.

2. ¿Qué políticas y estrategia garantizará el éxito de este proyecto desde el punto de vista ambiental?

Trabajo conjunto y consulta entre AES, Comunidad y demás entidades interna.

3. ¿Que beneficios tendrá la población?

a) Generación de infraestructuras

a.1 Carreteras pavimentadas Gualaca – Caldera que permitirá intercambio cultural, comercial y agropecuario.

a.2 Generación de Empleos
- a.2.1 50% Mano de obra en Gualaca
- a.2.2 Negocios en el área

a.3 Planta potabilizadora para Gualaca proveniente de los embalses, del Proyecto Hidroeléctrico Esti mientras tanto se construirá pozos para anexarlo al sistema actual y aumentar a la disponibilidad de agua para uso de la población.

a.4 Museo arqueológico

4. ¿ Quién pagará los cambios de tecnología productiva tradicional?

Eso es recomendación del Estudio de Impacto Ambiental, pero no compete a AES sino al MIDA.

5. ¿Qué incentivos ofrece AES como respuesta a la Comunidad?

a. Pago justo de tierras
b. Construcción viviendas modernas (a los reubicados)
c. Becas a hijos de familias de escasos recursos
d. Mejoramiento a la abastecimiento de agua en La Esperanza
e. Abastecimiento agua a Gualaca antes de entrada en vigencia la Planta Potabilizadora a través de pozos.

6. ¿ Qué medidas se han tomado para mejorar el servicio de agua potable? sabemos que esto no le compete pero es preocupante ya que a veces pasan días que no hay agua.

Eso era un Impacto Ambiental por eso AES asume su mitigación.

Respuesta: Pregunta No.3 punto a.3; Pregunrta No5 Respuesta e.

7. ¿En que va a consistir el impacto Ambiental positivo sobre el mejoramiento de la diversidad biológica?

Hay áreas de agroforestia
Hay áreas destinadas a la fruticultura
Hay áreas destinadas al manejo de los bosques existentes
Hay áreas destinadas a una recuperación de los habits boscosos con carácter natural.

8. ¿La pregunta mía es que me mantengo en agricultura de maiz y arroz?

El MIDA e IDIAP deberán estableeer las políticas de orientación a los productores.

9. ¿Los productos orgánicos (abonos y otros) su importancia en los proyectos, en la reconstrucción del suelo y el medio ambiente?

Productos orgánicos, para la Cuenca Está son de gran importancia en los proyectos en reconstrucción del suelo y Medio Ambiente.

10. ¿Participación del IPAT en el desarrollo del proyecto teniendo en cuanta el turismo pasajistico, eco-turismo y la creación de paradores, hoteles y albergues?

Terminado el Proyecto Hidrocléctrico habrá mucho atractivo turistico.
Primer Museo en el centro de Gualaca.
Planes futuros, nuestra actividad primaria es la generación de energia pero podemos coordinar como ente facilitador de aprovechamiento turistico.
Ejemplo: somos dueños de tierras alrededor de Canjilones, Museo Arqueológico, Hallazgos de objetos, 70 restaurados, 40 en restauración; se está analizando otro rescate para el 2002.

11. Con qué especies se reforestarían las áreas_

Se hizo parcelas de introducción para determinar las más apropiadas al área de las cuales se obtuvo como las más prominentes la acasia, cedro espino, y teca.

Las especies nativas tienen cierta dificultad para establecerlas en implantaciones. Más sin embargo se continuarán las investigaciones.

12. ¿ Si el Proyecto contara con un vivero propio?

Se obtuvo de la investigación de Gualaca qué no tenía una cultura forestal; se quiso dar participación a otras áreas del país, pero tenían precios elevados.
Apoyamos formación de empresas locales Mario Ríos, Cooperativa y otros, se les condicionó su contratación al pago de salario mínimo y cobertura del trabajador con la Caja de Seguro Social (CSS) de sus empleados.

13. ¿ Si el Río Chiriquí muere como río pero sigue funcionando como sistema, cuáles son las ventajas para el uso cultural en la administración del agua?

No muere como río, hay área de disminución de caudal con 1.5m^3/seg en época de lluvia. El nivel de vida natural en esta zona tiene una alta intervención mucho antes del Proyecto Hidroeléctrico Estí

Propone producción de agricultura con el uso adecuado del agua.
El embalse también humedece el suelo.
Plan maestro no es una responsabilidad directa de AES, su aporte se elimita a una coordinación para mejorar la actividad en la región con la participación de todas las entidades involucradas con sus responsabilidades definidas en el programa o Plan Maestro.
Recomienda que los usuarios de la cuenca se unan para coordinar y determinar el uso del agua a través del Consejo de Cuenca.

El comité pro defensa del Río Chiriquí y El Canal de Riego Casa Blanca, preguntamos:

14. **¿Cuándo se llevará a Notaría el acuerdo ya firmado con ustedes (AES) en el cual se dejaría un caudal ecológico en el Río Chiriquí de 5.5 mts^3/s y de 750 Hs^3/s en el canal de riego, Casa Blanca en época seca de manera permanente?**

El Proyecto Esti es el primero que establece un caudal ecológico. Después de negociación directa con los usuarios por más de un año, se arribó a su acuerdo de 3.5 m^3 /ség seca y 1.5 m^3/seg lluviosa.

1. Se confirmó una carta de entendimiento que se modificó; y sé.
2. Se firmó el acuerdo. Se entregará notariado la próxima semana, contiene compromisos que AES cumplirá.

15. **¿ Se recomienda a la Compañía que hizo el Estudio de Impacto Ambiental, que se sugiera al gobierno y a la empresa AES Panamá cierto tipo de compromiso con los productores, especialmente los más pequeños y medianos, en lo que a mercado se refiere, ya que someterse a un cambio de reconversión no es tan sencillo?**

Reconoce que la reconversión no es fácil ni barata, pero es responsabilidad directa del MIDA e IDIAP.

16. **a) ¿José Felix: Me agradaría que profundizaras en relación a lo que concierne a las lagunas de abrevadero, quise captarle a Zárate que la recomendación del estudio es que no se construyan..**

b) Por otro lado especifica lo relacionado a los pasos pentonales, su ubicación y el impacto que provocan en el enlace entre unas comunidades y otras,

c) La Planta Potabilizadora, en qué momento de la construcción del proyecto se va a construir y es bueno destacar que resuelve el problema de plano de la falta de agua permite llevar él líquido a otras comunidades del distrito.

R.a) Si se construirán

R.b) Cinco pasos peatonales su construcción se mantiene.
Se adicionan pasos en el área del Canal de conducción de agua.
La planta potabilizadora como va a usar las aguas del embalse se construirá después de construido éste.
Por ello, se están tomando medidas alternas, como la perforación de pozos
A la fecha no ha sido posible la contratación de una compañía privada: en la zona lo que hacen estos trabajos tiene problemas con disponibilidad de equipos.

17. ¿Cuándo hablan de Planta Potabilizadora cual va a ser su capacidad?

Cubrirá la Población actual y su crecimiento en los próximos 20 años.
Temor de la comunidad por aumento en el costo; pero hoy pagan y no tienen el servicio de suministro de agua.

18. ¿ Todo rio posee en equilibrio dinámico de sus aguas que define el curso de su caudal; al aumentar el caudal del Río Estí con aguas derivadas, ¿Tienen algún conocimiento del Caudal de este río o posibles problemas de inundación? ¿Qué dicen los estudios Hidrológicos?

Sí está previsto, en el Estudio de Impacto Ambiental
Reforzamiento de las áreas.
Indemnización en los casos que amerite

19.¿ Lo que usted dice es muy bonito para la conservación de los Recursos Naturales, pero ¿están dispuestas las personas a cambiar su actividad de subsistencia por otra que esté acorde al uso adecuado de la tierra? Gracias

Es importante que el pueblo participe en la toma de decisiones que afecten su sistema actual y su vida futura.

Cierre: Siendo la 1:00 p.m. y no habiendo más preguntas de los participantes, se dio por concluido el foro.

Adj. Se acompañan copias de las listas de las firmas de todos los asistentes.
Copias de las preguntas formuladas por los participantes del Foro.
Copias de las cartas de invitación a las distintas entidades.