CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:

Concepción Hydroelectric Project

A.2. Description of the small-scale project activity:

This PDD presents the Concepción Hydroelectric Project, a proposed small-scale, run-of-river development in Western Panama. The electric energy-generating Concepción Project is designed for an installed capacity of 10.0 MW and is expected to generate in average 67 GWh/yr. Concepción will be connected to EDECHI's distribution line in the "El Porvenir" substation (EDECCHI stands for "the Electric Distribution Company of the Province of Chiriquí"). Via EDECHI, the Project will sell the energy production to various energy-based generators connected to the grid based on an economic dispatch. By so doing, the generation at Concepción will displace parts of certain expensive, polluting generation sources currently connected to National Interconnected System (SIN, a system that integrates all generating plants in the country, as well as all transmission and distribution networks). During year 2004, about 30% of the country generation was based on fuel oil or diesel and, despite the high cost associated with this type of generation, Panama has plans in place to expand the thermal generation within the next few years. Small-Scale developments like Concepción are not factored into the electricity supply-demand planning and consequently, operation of this Project will result in an effective displacement of electricity produced by the expensive, marginal thermal power stations.

The objectives of the Project in the medium- and long-term are:

- Inject additional clean, safe and reliable capacity to the Panamanian Electric System.
- Contribute to the decrease of emissions of Greenhouse Gases (GHG) in Panama, resulting is a cleaner environment
- Reduce the dependence of imported fuels.

The results of Project implementation will be:

- Electricity Generation of 67 GWh/yr
- Generation of short- and long-term employment in the project area (about 200 jobs will be created for local people in Boqueron during the construction phase)
- Direct physical and financial contributions to community infrastructure projects adjacent to the project site (roads, river crossings, etc.)
- Generation of Business to major Panamanian Contractors
- Contribution in the reduction of the price of energy to the end consumers

Calculations based on the simplified methodology allowed for small-scale projects indicate that Concepción will result in an annual emissions avoidance of 38,150 tons of CO_2 equivalent per year (tCO_2e/year). Calculation was based on evaluating the "approximate operating" and the "build" margins based on the electrical system operating as of December 2004 according to data published by the Energy Policy Committee (COPE), the Economy and Finance Ministry (MEF) of the Republic of Panama.

The run-of-river development is located on the Piedra River, downstream the Macho de Monte Hydroelectric Plant, about 26 Km far from the City of David, Province of Chiriquí. The project uses the flows of the Macho de Monte, Bregue y Piedra Rivers. The project consists of a daily regulation dam, a conveyance system and one surface powerhouse. Concepción is a run-of-river development with the intake on the Piedra River, discharging in the same. In detail, the works include a low-height combined concrete and rockfill diversion dam, an intake structure incorporated in the concrete part of the dam, a desander, a fibreglass-reinforced polyester resin pipe conveyance, a surge tank, a steel bifurcation, a surface powerhouse with two horizontal-axis Francis turbine-generators, a tailrace canal and an electric substation. The power works are located on the left bank of the river. The gross head of this plant is 65.0 m and with losses at design discharge of some 6 m, the net head amounts to 59.0 m. The design discharge of the powerhouse is 20.0 m^3/s, resulting in a 10-MW plant installed capacity.

A.3. Project participants:

Name of Party involved	Private and/or public entity(ies) project participants	Party involved wishes to be considered as project participant
Istmus Hydropower Corp	Private Panamanian entity	Yes

Istmus is seeking registration of this small hydroelectric project under the Clean Development Mechanism in order to buffer the high investment costs and financial risks associated with renewable energy marketplace in Panama. The GHG emission reductions associated with the Project Activity described in this PDD will be sold to other entities that wish, or need, to meet commitments under the Kyoto Protocol.

Istmus is the official contact for this CDM project activity. Contact information follows:

ISTMUS HYDRO POWER, CORP.

Alejandro Hanono W.
Presidente

Torre HSBC, 20th Floor
Avenida Samuel Lewis
Panama City, Panama Republic
Phone: 507-263-4400
E-mail: Alex@Vicsons.com

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Republic of Panama
The Government of the Republic of Panama ratified the UNFCCC on May 23rd, 1995, as a non-Annex I country. Panama subsequently ratified the Kyoto Protocol on March 5th, 1999. The contact point in

government is **Lic. Ligia Castro de Doens**, **General Administrator** of the National Authority for the Environment **(ANAM)**.

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

Chiriquí Province, Boqueron District

A.4.1.3. City/Town/Community etc:

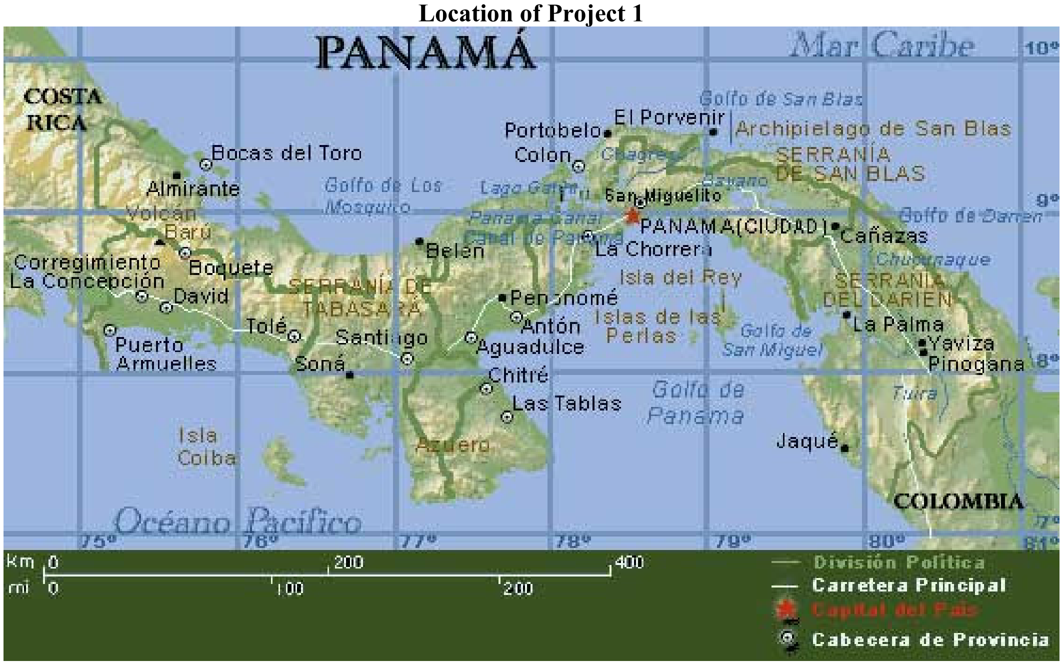
North - East of the Town of Concepción-Bugaba, District of Boqueron, Corregimiento de Boqueron

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):

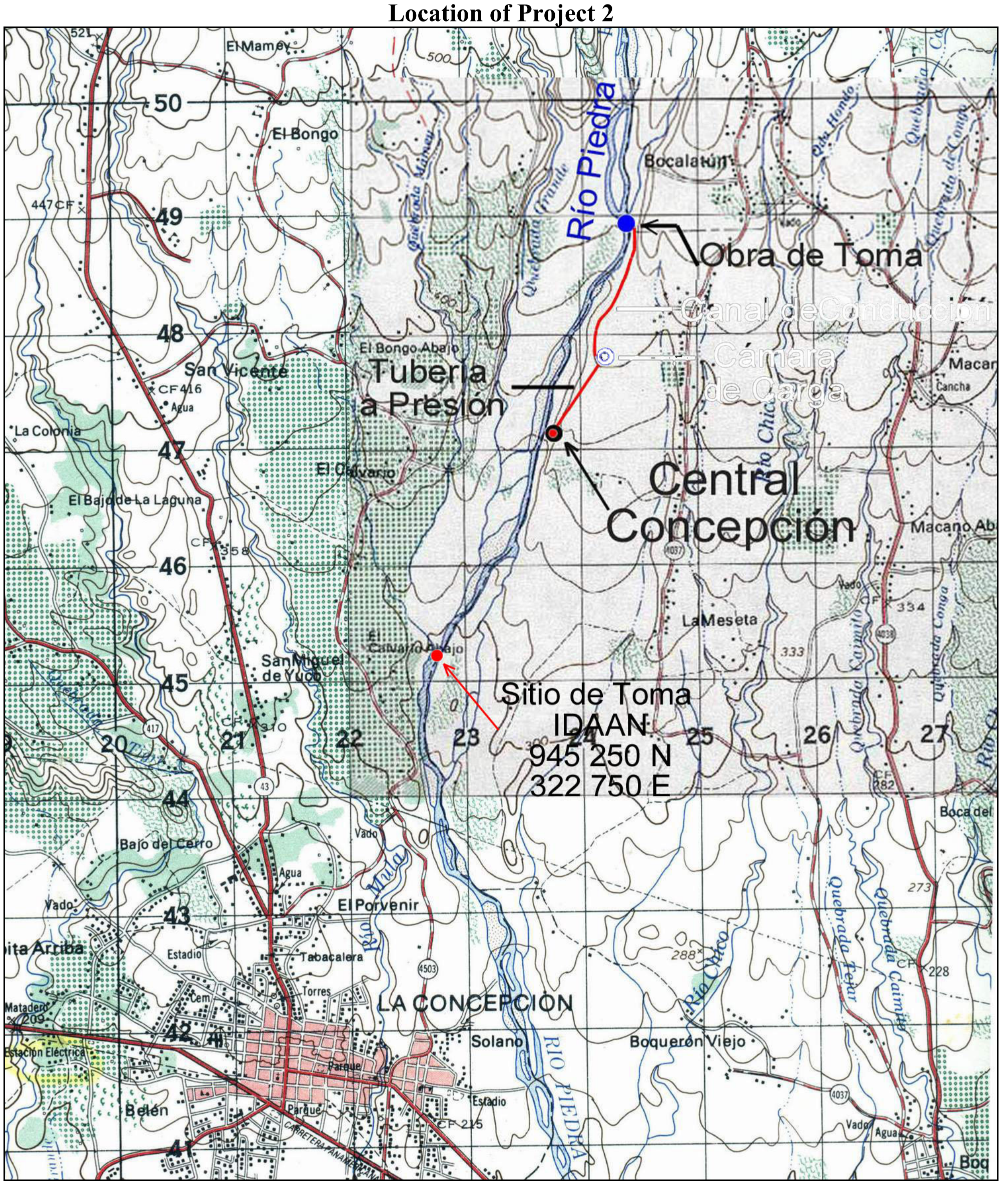
The Concepción Project has the following UTM coordinates:

Dam Site: Longitude / Latitude: 948,900 N / 324,400 E
Power House: Longitude / Latitude: 946,771 N / 323,514 E

Location of Project 1



Location of Project 2



A.4.2. Type and category(ies) and technology of the small-scale project activity:

According to Appendix B to the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, Concepción falls under Type I - RENEWABLE ENERGY PROJECTS, Category 1.D. – Renewable Electricity Generation for a Grid. The project activity conforms to the project category since the nominal installed capacity at Concepción is below the 15-MW upper limit and the plant will sell its generated electricity directly to the national grid or grid customers (spot market).

Concepción is a renewable energy supply-side, grid-connected project activity. As such, it involves reduction of emissions of greenhouse gases in the country energy sector; more specifically, reduction of GHG emissions sources from fuel combustion in energy industries, according to the list of sector/source categories indicated in Annex A of the Kyoto Protocol.

The project involves installation of a run-of-river Hydroelectric plant system using a well-established environmentally safe technology. Indeed, run-of-river projects (no major reservoir in the configuration) are emission-free and considered one of the best forms of low-impact renewable energy available today. The civil structures at Concepción consist of a diversion dam designed to store a low water volume, an intake incorporated in the dam, a desander–forebay arrangement, a conveyance, a penstock ending in bifurcation and individual turbine pipes, a surface powerhouse and tailrace canals. As all run-of-river projects, Concepción will have very low impact on river flows and all water diverted to the powerhouse will be returned to the main stream within 2.3 km. This intermediary river reach will receive a significant eco-flow from the diversion works, commensurate with the average river flow without project.

Concepción will run on two Francis turbines with 5,300 kW nominal output each. This machine type has broad application around the world and was selected as the optimal generating equipment for the particular site being developed. Salient data, as well as detailed engineering, for the Concepción Project can be obtained upon request from the project Owner and operator, Istmus Hydro Power Corp.

All electricity generated by the project will be sent through a transmission line to a substation of Union Fenosa (UF), a national power and distribution utility connected to the National Interconnected System (SIN, the National Grid which integrates all generating units and transmission and distribution lines in the country). Through this configuration, Concepción will be connected to the National Grid as an electricity-generating source, supplying renewable electricity to it. UF will dispatch the electricity produced by the plant to various end users through its distribution lines and deliver to other distribution companies in the country through transmission lines.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

The entering in operation of the Concepción Project will increase the amount of renewable energy connected to the grid. Currently (2004), the Panamanian National Electric Generation System is formed both by hydro and thermal generating sources (34.4% thermal and 65.6% hydro, on the year 2004-generation basis). The regulatory framework establishes the operation of generation plants and units on a merit-order dispatch basis, according to the generation cost. The fact that hydroelectric plants have a low cost for energy production and can be managed to optimise the use of water confers them a higher dispatch priority than thermal generators (Concepción is basically a run-of-river development with zero production costs)

Thus, the increase of low-cost hydro energy available - such as Concepción becoming available - will reduce the use of higher-cost energy produced by fossil fuel fired power plants. Without the Concepción Project, an increase in demand under the business as usual scenario would result in low cost Hydroelectric units coming on line first and then, residual fuel oil and then, diesel generators. During its operation, the Concepción Project will offset these more expensive residual fuel oil and diesel units and this will happen because the dispatch system will seek keeping the electricity price low and therefore, will prioritise low cost production over more expensive units (in the case of thermal units, the major component of the production costs are the variable costs, mainly determined by fuel costs).

At present, there are limited resources and/or possibilities in the country to upgrade older existing power plants, alternative that might sometimes be cheaper than new Hydroelectric plants. Further, since the sector has been deregulated, there is no legislation in place or planning whatsoever to upgrade such facilities, if any. Consequently, it is likely that any non-hydro new capacity will use the lowest-cost technology available such as combustion turbines, internal combustion engines, or combined-cycle technology.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in Tonnes of CO_2 e
Year 1 (2007)	37,579
Year 2 (2008)	38,142
Year 3 (2009)	38,142
Year 4 (2010)	38,142
Year 5 (2011)	38,142
Year 6 (2012)	38,142
Year 7 (2013)	38,142
Year 8 (2014)	38,142
Year 9 (2015)	38,142
Year 10 (2016)	38,142
Year 11 (2017)	38,142
Year 12 (2018)	38,142
Year 13 (2019)	38,142
Year 14 (2020)	38,142
Year 15 (2021)	38,142
Year 16 (2022)	38,142
Year 17 (2023)	38,142
Year 18 (2024)	38,142
Year 19 (2025)	38,142
Year 20 (2026)	38,142
Year 21 (2027)	38,142
Total estimated reductions (tonnes of CO_2 e)	800,419
Total number of crediting years	21
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	38,115

The estimates of annual and total emission reductions in tonnes of CO_2 equivalent were determined in Section E of this PDD.

A.4.4. Public funding of the small-scale project activity:

Financing for the project will come from the project developer, Istmus Hydro Power Corp., and from commercial banks in Panama. No Annex I Party public funding is involved in the proposed project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

Concepción consists of a stand-alone small-scale Hydroelectric plant. The proposed project **is not** a debundled component of a larger project activity since project participants have not registered or operated another project in the region surrounding the project boundary.

SECTION B. Application of a baseline methodology:

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

Project TYPE I – RENEWABLE ENERGY PROJECTS

Category 1.D. – Renewable Electricity Generation for a Grid (technology: hydropower as replacement for existing fossil fuel power).

B.2 Project category applicable to the small-scale project activity:

As part of the National Grid, the small-scale Concepción Hydroelectric Plant will sell electricity to various distribution companies and end users or, alternatively, will feed the National Grid, displacing this way more expensive and polluting fossil fuel-fired plants. Thus, the option available to the project developer that completely qualifies under the SSC CDM Category 1.D. was to REDUCE THE EMISSION OF GHG's AS A RESULT OF ITS ACTIVITY (ELECTRICITY GENERATION). Specifically, the **BASELINE** for this small-scale, run-of-river hydropower project activity was **"the kWh produced by these renewable generating units, multiplied by an emission coefficient (kg CO_2equ/kWh)".**

The basic assumptions in applying this baseline methodology for the Concepcion project activity was based on the provisions of Appendix B of the simplified modalities and procedures for CDM small-scale project activities presented in the latest version of the small-scale CDM project guidelines from July 2005. This reference offers two options for calculating baseline emissions of category 1.D. projects, which covers this project activity:

(a) *The average of the "approximate operating margin" and the "build margin"*

OR

(b) *The weighted average emissions (kg/CO_2 / kWh)of the current generation mix.*

The baseline for the Concepción Project was based on option *(a)* above because the project will displace mostly fossil-fuel generating sources that are at the margin of the electricity generation system. According to the data used by the *Comision de Politica Energetica* (Energy Policy Commission or COPE), the majority of future generating capacity expected to come on line over the next several years will be primarily fossil-fuel plants.

Calculations of the Operating Margin, Build Margin, and Combined Margin emission factors, and of effective emission reductions, are presented under Part E. For the "Build Margin", the alternative "5-most recent plants" resulted in the greater MWh generation, specifically at 1,550,598 MWh in 2004. The generation for the "most recent 20% of existing plants" resulted in only 1,193,630 MWh in 2004, year when the total generation was 5,760,400 MWh.

Further calculations prepared in this study show that the average of the "approximate operating margin" and the "build margin" lead to a representative emission factor of **587 tCO_2e/GWh**

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

ADDITIONALITY was evaluated and proved in this study by applying to the Concepcion Project the modalities and procedures for the CDM, specifically the **Attachment A to Appendix B** of the Simplified M&P for small-scale CDM project activities. Specifically, **ADDITIONALITY** was proved by showing that this particular project activity would not have occurred under a "business as usual" scenario due to a series of existing barriers in implementing it. These barriers were:

- Investment Risk Barrier
- Low market Penetration of Technology / Non-prevailing Practice Barrier
- Uncertainty in Power Purchase Agreement (PPA) Conditions Barrier

These barriers and their negative effects in trying to implement a small-scale, run-of-river hydropower project, are described below.

(i) INVESTMENT RISK BARRIER

Foreign banks are not ready to lend for hydropower development into the country without significant levels of guaranties and secured hard currency backup. The difficult access to foreign capital by this type of projects with high up-front capital expenditures resulted lately in the need to rely to high-interest local financing. This was the case with the Esti HPP, the latest most recent hydropower development in the country, and this is the case with Concepción. Besides high up-front capital needs, this type of project activity presents other characteristics described below that can appear as risks exposure to potential local lenders and result right away in taxing financial packages.

It is recognized that the run-of-river, environmentally acceptable configuration applied to Concepción is characterized by the lack of a habitat-damaging, land-flooding large reservoir in the scheme. But this nod to a clean environment has a downside that imposes hardship to the developer: it limits the firm output of the plant to maximum 25% of the installed capacity (about 2.5 MW from the 10 MW installed), as seasonal transfer of water volumes to enable generation during dry periods is not feasible under this run-of-river configuration.. Unlike the case of major hydropower developments and thermal plants, the Owner/operator here will not receive a capacity payment from the grid. This is mainly due to the low-level firm output and the Owner will be only paid for the electricity generated. Because of lack of regulation of the river natural flows through a large reservoir, these revenues can fluctuate considerably from year to year and it is well known that small hydro developers can and have suffered in the past losses in individual years.

Another characteristic of this Project activity that acts as an investment barrier is the high construction cost as compared to the project size. Whether small or large, all hydropower developments involve costly constructive procedures that include good foundation treatments, slope consolidations, effective sediment control and redundant measures to control hydrodynamic transient regimes along waterways.

All above realities were integrated in a Financial Model in order to determine investment profitability. Various scenarios for the Model runs by the potential Developer/Owner considered the potential monetization of the CO_2 credits (i.e., the certified emission reduction or CERs) that the Project would produce and various crediting periods, including a 21-year total crediting period with 3 separate crediting components. Model runs show that a **nominal project IRR of about 13% - 14%** is a minimum value required to keep the total project investment budget stable at the limit. This rate was only possible to attain in the scenario of a 21-year total crediting period and the monetization of the CER’s. Model runs also indicated that IRR would drop by minimum one to two percentage points in the scenarios where CER’s monetization was not considered. At the level of 11% to 12%, IRRs are not attractive. Currently, government bonds have an interest of about 8% in Panama and this small margin would not be sufficiently attractive as it does not confer the security of facing the investments risks detailed above.

Basic field studies initiated recently. But it is important to note that passing from investigations and studies to construction will not be possible unless the Concepcion Project is registered as CDM small scale and if monetization of CERs would grant the required financial support.

The financial modelling has taken into consideration CERs in the investment analysis and they proved to be necessary for development. Consequently, **it can be concluded that Concepcion Project activity provides ADDITIONALITY from a financial point of view.**

(ii) LOW MARKET PENETRATION OF TECHNOLOGY / NON-PREVAILING PRACTICE BARRIER

Hydropower in not a new technology in Panama: in year 2004 it represented 56.1% of the installed capacity in generating plants and 65.6% of the electricity generated. However, the majority of that capacity is made up of large plants, with large volume reservoirs. The existing small-hydro developments barely account for 1.5% of the total installed capacity in hydro plants, having generated slightly over 2% of the total hydro generation in 2004. Despite its limited development, small hydro represents a new technology in the country, a technology that comes with features and configurations aimed at protecting the environment. In fact, from the environmental point of view, small-hydro developments are a more technologically advanced alternative to the large hydropower plants and even more so, to the thermal plants. In addition, in the particular case of the Concepción project activity, a very modern and completely new technology in country will be implemented: a Pro-SCADA control system (Powerbase) that allows the Owner and its managing personnel to optimise the operation of the turbine-generators and improve the overall efficiency of the plant will be part of the development. **Tables B1** (2004 Small-Scale against Total Hydro Plants), **B2** (2004 Small-Scale against Total Thermal Plants), and **B3** (2004 Small-Scale against Total generation System) present the Panamanian electrical system configuration as of December 2004, including its installed capacity and electricity generation, as well as the existing Small-Scale Hydro installation and production measured against the totals of hydropower, thermal power and electrical system respectively.

Table B1 - 2004 Small-Scale against Total Hydro

Plant Name	Installed Capacity MW	Electricity Generation MWh/yr	2004 Plant Factor %	Obs.
Fortuna	300.0	1,779,400	67.6	
Bayano	260.0	478,000	21.0	
La Estrella	42.0	241,900	65.7	
Los Valles	48.0	280,700	66.7	
Esti	120.0	615,600	58.5	
PCA	60.0	303,900	57.8	
Small-Scale	16.0	79,000	56.3	[1], [2]
Total Hydro	846.0	3,778,500	----	

Table B2 - Small-Scale against Total Thermal

Plant Name	Installed Capacity MW	Electricity Generation MWh/yr	2004 Plant Factor %	Obs.
Bahia las Minas	280.0	576,000	23.5	
Pan Am	96.0	612,000	72.7	
Petroelectrica	0.0	4,100	-----	
Pedregal	53.4	375,800	80.3	
PCA	115.0	376,800	37.4	
T.G. Panama	42.8	200	0.1	
COPESA	46.0	1,200	0.3	
Other Thermal	29.0	35,800	14.1	
Total Thermal	662.2	1,981,900	----	
Small-Scale Hydro	16.0	79,000	56.3	[3], [4]

Table B3 - 2004 Small-Scale against Total Generation System

Plant Name	Inst. Cap. MW	Electricity Generation MWh/yr	2004 Plant Factor %	Comments
Gen. System	1508.2	5,760,400	43.6	
Sm.-Sc. Hydro	16.0	79,000	56.3	[5], [6]

Notes:

[1] Small-Scale of Total Hydro MW in 2004 was 1.9%
[2] Small-Scale of Hydro MWh/year in 2004 was 2.1%
[3] Small-Scale Hydro of Thermal MW in 2004 was 2.4%
[4] Small-Scale Hydro of Thermal MWh/year in 2004 was 4%
[5] Small-Scale Hydro of Generating System MW in 2004 was 1.1%
[6] Small-Scale Hydro of Generating System MWh/year in 2004 was 1.4%

Unfortunately, despite limited incentives in place for developing small-hydro projects and despite the recent increases in fuel costs, most new capacity in the country utilizes less advanced technologies (from the environmental point of view), such as combustion turbines or internal combustion engines. While the existing generating system is predominantly based on hydropower, the expansion plans focus on growth in thermal power. This is simply because of the lower cost of installation, shorter construction time schedule and less environmental regulations to meet before commercial operation and also, because of the performance uncertainty of small hydro and its low current market share. Government and banks still see today thermal plants as less risky.

All this fully qualifies the project activity as an addition, as a marginal technology in Panama that is bound to stay like this unless government agencies and major power companies increase the incentives to enable small-hydro developers to take on the high risks associated with investing in small run-of-river projects. **Concepcion is therefore ADDITIONAL from an environmental and technological point of view because the potential thermal alternatives would produce greater quantities of greenhouse gases. From the point of view of the prevailing practice, this project cannot be obviously considered common practice and therefore is not a "business as usual" type scenario.**

(iii) UNCERTAINTIES IN POWER PURCHASE AGREEMENT (PPA) CONDITIONS BARRIER

The low-level firm MW output (as compared to the installed capacity) that characterizes this otherwise very environmentally-friendly project activity generates major difficulties in getting signed a Power Purchase Agreement (PPA) with prospective users (generally distribution companies in the country). Consequently, this project will sell to the spot market and sometimes, even if successful, get the market price at the particular time of sale which may, at times, be lower that an average price that would be settled through a PPA. This uncertainty and potential to be obliged to sell for less brings a series of problems in trying to assemble a financing package, ranging from the project receiving low rating, to punitive interests, and to short loan tenors. All the above supports the validity of the scenario wherein Concepcion Project financing package counts on the monetization of the CERs. In other words, **it can be concluded again that this project provides ADDITIONALITY from the financial point of view.**

The above analysis of three different barriers suggests that small hydropower investments in Panama like the one in Concepción is indeed ADDITIONAL to a national baseline that is still favouring large-scale developments, be they hydropower or thermal plants.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

The guidance for the applicable project category (Appendix B of the simplified M&P for small-scale CDM project activities) states that "**the project boundary encompasses the physical, geographical site of the renewable generation source**."

An obvious fact should be clarified from the very beginning: although the boundary includes the Concepción generating facility (powerhouse and generating equipment), the direct emissions related to the electricity production are considered to be zero as hydropower is an emission-free, clean energy source. The definition given below for the "Baseline Electric Grid" that is part of the "boundary" explains the selection of the methodology for the baseline.

Other than this, the project boundary is defined as follows:

Hydropower Plant - For the construction period of Concepción, the guidelines-stated boundary will cover the hydropower plant itself, including as potential direct site emission sources the following:

- The concrete structure construction (dam, desander, anchor blocks, powerhouse) with the required crushing and concrete plants and their operation
- The transportation activity related to project construction.

All above potential emissions are under the control of the project developer.

Baseline Electric Grid - The boundary extends when project enters in operation, and incorporates the electric grid with all the thermal plants supplying electricity to it. Here the boundary covers indirect emissions or variation thereof resulting from changes in energy production in other facilities, specifically the thermal plants connected to the grid. It is important to mention that the emissions resulting from operations of other plants are not under the control of the project developer. This project activity however will feed electricity to the grid and as a result, will replace an equivalent electricity production currently generated by thermal plants (baseline issue).

B.5. Details of the baseline and its development:

Appendix B of the simplified modalities and procedures for CDM small-scale project activities presented in the latest version of the small-scale CDM project guidelines from July 2005, presents the methodology applicable to this project activity. The baseline for this project activity was selected from that Appendix B and details of the use of the selected simplified methodology are given under **B3** above**.**

The final draft of this baseline was completed on 15/9/2005. A revised presentation of the baseline was completed on 15/10/ 2005.

Person and Entity determining the baseline:

Alexis C. Vircol

Istmus Hydropower Corp.
Torre HSBC, 20th Floor
Avenida Samuel Lewis
Panama City, Panama Republic
Phone: 507-263-4400
Fax: 507-269-9458
E-mail: avircol@aol.com

Mr. Vircol is Technical Advisor of Istmus Hydropower Corp., the main project participant listed in Annex 1 of this document. He is also an experienced International Consultant in Hydropower developments.

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

15/01/2007

C.1.2. Expected operational lifetime of the small-scale project activity:

50y-0m.

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

This project activity will use a three (3) renewable crediting period

C.2.1. Renewable crediting period:

The renewable crediting period will be 7-years-long

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

15/01/2007

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

N/A

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

SECTION D. Application of a monitoring methodology and plan:

The monitoring plan described below is based on a methodology applicable to Concepción HPP according to the simplified M&P for small-scale CDM project activities. The plan will monitor and measure the plant production as it is directly related to the annual emission reduction calculation.

Given the short-lived and very low order of magnitude of project activity own emissions, the plan is not designed to measure emissions occurring within the project boundary (fuel use for transportation during project construction) or leakage (cement use for concrete production) that are described and conservatively calculated under Part E below. However, these own GHG emissions were taken into consideration in Part E in the determination of emission reductions for the first three months of project activity.

The Owner / Operator will:

- Register the Monitoring Plan described herein with the market agents
- Will provide the data through Monitoring Reports at regular intervals (on a monthly basis)
- Keep the data for verification for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

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

Appendix B to the simplified M&P for small-scale CDM project activities indicates for the category of the Concepción HPP (Type I – RENEWABLE ENERGY PROJECTS, *1.D.* – Renewable electricity generation for a grid) that the Monitoring Plan **"Shall consist of metering the electricity generated by the renewable technology"** which is the run-of-river hydropower electricity generation in the case of this project activity.

Basically, the Monitoring Plan shall cover following requirements and contain instructions for:

- Assigning monitoring responsibilities;
- Establishing and maintaining the appropriate monitoring systems for the CO_2 emissions reduction estimation;
- Detailing / explaining measurement and management operations;
- Calculating emission reductions based on measurements;
- Storing data and setting out the filing / record-keeping system;
- Preparing for independent audits and verifications.

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

The electricity produced (MWh) by the Concepción HPP units is the data to be measured and collected under the applicable methodology. This data is required in the calculation of the CO_2 emission reductions because under Concepción HPP project activity, its electricity production will replace portions of thermal generation within the Panamanian electric system.

The concepts and principal assumptions of the methodology, including geographic and system boundaries, time boundary and baseline review protocol, calculation algorithms for the baseline CO_2 emission rate, are all presented below under Part E.

D.3 Data to be monitored:

In order to demonstrate the credibility of the levels of emission reductions (ERs) claimed for this project, the Owner/operator assumes following obligations:

- Will collect sufficient information to allow calculation of ERs in a transparent manner and the successful verification of these ERs
- Will record the net generation of the Concepción Project every month. This data will be obtained from the metering system of the Concepción Plant at the feed-in point to grid consumers. The data will be crosschecked with the metering and billing information provided by the grid operator.

The electricity production will be registered by two meters installed at the Concepción HPP powerhouse substation. One meter is the backup of the other called the principal and the use of two meters is one of the Electric market requirements.

The Panamanian Electric Market requires these meters and their technical characteristics will fulfil the Electric market requirements, including accuracy, calibration and duality, as their readings will be used to settle the monthly payments under contracts and spot market. The meters will register the net energy (MWh) delivered to the distribution company or to the grid by the project activity. The recorded information will be provided to the distribution company and to the National Dispatch Center (CND, the entity that handles and controls the generation in the Panamanian Electric Market), as part of the monthly transaction document.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

The table below presents the data to be provided under the monitoring methodology chosen for the proposed project activity from the simplified monitoring methodologies for this small-scale CDM project activity identified under projects **Type I, Category *1.D.*** in the Appendix B to the simplified M&P for small-scale CDM project activities. The table below will have a summary (total) line at the end of the crediting period that would serve for the carbon credit claims corresponding to the concluded crediting period.

Table D1 – Monthly and Annual Electrical Generation at Concepción HPP for Year 20__

Period	Electricity Generation (MWh) [1]	Source	Recording Frequency	% Time Monitoring	Data Storage Modality	Storage Length [2]
Year 20__						
Mo.1	--------------	Measured	Continuous	100	Electronic	
Mo.2	--------------					
Etc.	--------------					
TotalYr.20__						
Year 2						
Etc.						

- [1] – Metered at the Plant
- [2] - The data will be kept for verification for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Monitoring activities will also cover data preparation and actualizations for the next seven (7) year crediting period, that is, the update of the baseline. As usual in this update methodology. A series of emission and conversion factors will represent the basis for the calculations to be performed at the start of each new seven (7) year crediting period by the Owner / operator in order substantiate his claim of GHG emission reductions for the next crediting period. These factors will represent all types of fuel and thermal technologies operating in the Republic of Panama at the start of the next seven (7) year crediting period. The parameters are well-known physical caloric contents of various fuels and conversion factors between various forms of energy according to the SI system of units and measures. Following table presents these required factors at today's level (will have to be updated in case technologies change):

Table D2 – Conversion factors and Assumptions for Year 20__

Fuel Type/ Technology	Carbon Emission Factor (tC/GJ) (a)	Carbon Content (tCO_2/tC) (b)	Energy Emission Factor (tCO_2/GJ) (c)=(a)*(b)	2004 Fuel Heat Rate (GJ/MWh) (d)	Oxidation Factor (e)	Electric Emission Factor (tCO_2/MWh) (f)=(c)*(d)*(e)
Bunker C/ Steam Turbine	$21.1*10^{-3}$	3.667	0.0774	11.61… 13.16	0.99	0.8896… 1.0084
Bunker C/ Internal Combustion	$21.1*10^{-3}$	3.667	0.0774	9.01…9.48	0.99	0.6904… 0.7264
Marin Diesel/ C. Cycle Gas Turbine	$20.4*10^{-3}$	3.667	0.0748	8.31	0.995	0.6185
Light Diesel/ Gas Turbine	$20.2*10^{-3}$	3.667	0.0741	15.47… 15.83	0.99	1.1349… 1.1613
Light Diesel/ Internal Combustion	$20.2*10^{-3}$	3.667	0.0741	11.66	0.99	0.8554

Notes:

[1] Column (a) – Values from IPCC, 1996: Greenhouse Gas Inventory Guidebook
[2] Column (b) – Generally valid physical measure
[3] Column (a), (b), (e) – Valid for any calculation period, as long as thermal technology plant and fuel used remain the same in the system; for new combinations, generally valid parameters are or will be available at the start of the new seven (7) year crediting period.
[4] Column (d) – Heat rate recorded for the 2004 electricity generation; for any subsequent baseline update calculation at the start of the new seven (7) year crediting period, heat rates should be obtained from the particular plants entering the calculation package (group) or directly from the grid operator.

The data from table D2 will be used in establishing the updated baseline for the next seven (7) year crediting period as shown in table D3:

Table D3 – System Average Emission to be used for Crediting Period 2007 - 2013 .—

Grid-connected Thermal Plant (a)	Fuel Type/ Technology (b)	Electrical Generation (MWh/yr) (c)	El. Emission Factor (tCO_2/MWh) (d)	GHG Emissions (tCO_2/yr) (e)= (c)*(d)	Average System Emission (tCO_2/MWh) (f)=SUM(e)/SUM(c)
Plant A1					
Plant A2					
Etc.					
		SUM		SUM	SUM(e)/SUM(c)
Plant B1					
Plant B2					
Etc.					
		SUM		SUM	SUM(e)/SUM(c)
PlantC1					
Plant c2					
Etc.					
		SUM		SUM	SUM(e)/SUM(c)
TOTAL THERMAL		**SUM**		**SUM**	**SUM(e)/SUM(c)**

Notes:

[1] Columns (a) and (b) represent grid-connected and generating thermal plants at the start of the new seven (7) year crediting period (last year of the just-ended crediting period)
[2] Column (c) – from ETESA for the year of reference (last year of the previous crediting period)
[3] Column (d) – Last column from Table D2

The monthly emissions reductions due to Concepción HPP operation will be calculated as follows:

$$\textbf{\textit{ERs (tCO}}_2\textbf{\textit{) = MED (MWh) x ASEF}}$$

Where:

Where:	ERs (tCO_2)	= CO_2 Emission Reduction
	MED (MWh)	= Energy Delivered by the project activity ((last year of operation within the previous crediting period)
	ASEF	= Average System Emission Factor for the last year of generation mix within the just-ended crediting period, from Table D3 above.

The same methodology to computed ASEF for year 2004 is detailed and used in Part E below.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

The operational and management structure of Istmus Hydropower Corp will include software and hardware, as well as engineering staff at hand, in order to perform the following activities required to monitor emission reductions and leakage:

- Monthly and annual electrical generation by the plant will be measured every year. Energy generation will be measured at the plant (two revenue meters, one for backup) and the data will be stored for verification two years after the end of each crediting period.
- Conversion factors for the Panamanian electrical generating system will be updated by Owner's staff at the initiation of each new crediting period
- Based on the data on latest annual electrical generation by the national system and on the updated conversion factors, the engineering staff will calculate a new system average emission to be applied over the new crediting period.

The President of Istmus himself will lead the operating and engineering staff engaged in monitoring.

D.6. Name of person/entity determining the monitoring methodology:

Alexis C. Vircol

Istmus Hydropower Corp.
Torre HSBC, 20th Floor
Avenida Samuel Lewis
Panama City, Panama Republic
Phone: 507-263-4400
Fax: 507-269-9458
E-mail: avircol@aol.com

Mr. Vircol is the Technical Advisor of Istmus Hydropower Corp., the main project participant listed in Annex 1 of this document. He is also an experienced International Consultant in Hydropower developments.

SECTION E.: Estimation of GHG emissions by sources:

The project implementation timetable is needed in order to estimate both anthropogenic emissions by sources of greenhouse gases due to the project activity and in the baseline. Following timetable was used:

- Project construction main activities: November 15, 2005 – October 31, 2006
- Project construction finishing activities: November 1, 2006 – January 31, 2007
- Reservoir flooding effects: October 1, 2006 – January 31, 2008
- Commercial operation: January 15, 2007

Also, for the purpose of GHG emission calculations, project activity was characterized by output in terms of MW of installed capacity, and by production in terms of MWh/year of electricity generation. The two values considered were:

- Concepción Installed Capacity: $P_{Conc.}$ = 10 MW

- Concepción Electricity generation: $E_{Conc.}$ = 67,000 MWh/year

In order to maintain the emission reductions estimates at a conservative level, a 97% factor was applied to the average production of the plant, resulting in an annual generation $E_{Conc.}$ of only 65,000 MWh/year.

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

N/A

E.1.2 Description of formulae when not provided in appendix B:

>>

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

The sources considered here within the project boundaries included technology, reservoir construction and transportation.

Technology – Run-of-river hydropower is a clean technology in itself so no GHG emissions will be produced by electricity generation. Following formula was used:

$$EM_{Tech.} = E\ (MWh/yr) \times EMF_{Tech.} (tCO_2/MWh) = 65{,}000 \times 0 = 0\ tCO_2/year \quad (I)$$

Where: $EM_{Tech.}$ = Emissions from electricity generation in tCO_2/year
$EMF_{Tech.}$ = Technology Emission Factor in tCO_2/MWh

Reservoir Construction – For hydropower projects with medium- and large-size reservoirs, reservoir construction and flooding may trigger the activity of three sources of GHG emissions: an initial decomposition of the organic matter covered by lake water, deforestation effects, and a life-cycle series of emissions from the reservoir during project activity operation. In the case of Concepción, emissions from all three sources are negligible. Being a run-of-river development, the flooded area will be very small, barely 3.3 ha. The small pondage area (not a reservoir per say) will include mostly boulders and bed-load material. No flora or fauna will be covered by water and no deforestation activity will be performed. Consequently no initial, nor life-cycle decompositions and subsequent methane emissions will occur from this project activity. Following formula was used:

$$EM_{Res.} = A\ (ha) \times EMF_{Res.} (tCO_2/ha) = 3.3 \times 0 = 0\ tCO_2/year \quad (II)$$

Where: $EM_{Res.}$ = Emissions from reservoir construction in tCO_2/year
$EMF_{Res.}$ = Reservoir Flooding Emission Factor in tCO_2/MWh

Transportation Activities – GHG emissions will occur at Concepción due to fuel consumption during construction activities. However, most of construction activities should be over at the moment of commercial operation initiation. The project implementation timetable indicates that fuel consumption-related emissions will affect electricity generation only during the last three months of year 2006 which are part of the first year of plant operation (first year runs between October 15, 2006 and October 15, 2007). Potential emissions were calculated for the entire project implementation period and a very conservative 10% of the emissions were assigned to the first three months of on-site project activity. Following formula was used to calculate direct on-site emissions due to fuel consumptions:

$$EM_{Trans.} = 0.1 \times F\ (gal) \times 0.00378\ (t/gal) \times EMF_{Fuel.}\ (tCO_2/tFuel)$$

(0.1 x 350,000 x 0.00378 x 3.17 = **420 tCO_2/first 3 months)** **(III)**

Where: $EM_{Trans.}$ = Emissions from transportation activities in tCO_2/first three months
F = Fuel consumption estimate for the project implementation period (350,000 gal.)
$EMF_{Fuel.}$ = Fuel Emission Factor of 3.17 tCO_2/tFuel

In summary, total GHG emissions due to the project activity within project boundaries amount to **420 tCO_2 and they affect just the first year of plant operation (Oct. 15th, 2006 – Oct.15, 2007)**

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

The leakage considered in the emissions calculation originates in the use of cement during the construction of the project. The project implementation timetable indicates that cement use-related emissions will affect electricity generation only during the first three months of year 2007 which are part of the first year of plant operation (first year runs between January 15, 2007 and January 15, 2008). During these first three months of year 2007, some final construction activities are still being completed and they cover architectonic works at the powerhouse, painting works, as well as construction and maintenance roads being repaired and improved for their use as permanent accesses, etc. Potential emissions were calculated for the entire project implementation period and a very conservative 10% of the emissions were assigned to these first three months of on-site project activity. Following formula was used to calculate direct leakage emissions due to cement use:

$$EM_{Cem.} = 0.1 \times [C1\ (m^3 conc.) \times F1mix\ (tcem/m^3) + C2\ (m^3 conc.) \times F2mix\ (tcem/m^3)] \times EMF_{Cem.}\ (tCO_2/tCem.)$$

(0.1 x [6,500 x 0.370 + 3000 x 0.150] x 0.4986 = **143 tCO_2/first 3 months)** **(IV)**

Where: $EM_{Cem.}$ = Emissions from cement use in tCO_2/first three months
C1, C2 = Structural and Mass Concrete volume estimates for project implementation (6,500 and 3,000 m^3, respectively)
F1, F2 = Structural and mass concrete mix characteristics (370 and 150 kg cement/m^3 concrete, respectively)
$EMF_{Cem.}$ = Cement-use Emission Factor of 0.4985 tCO_2/tCement

In summary, total GHG leakage emissions due to the project activity amount to **143 tCO_2 and they affect just the first year of plant operation (January 15, 2007 – January 15, 2008)**

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

The total project activity emissions amounts to **563 tCO_2**. This amount only affects the first year of plant electricity generation (October 15th, 2006 – October 15th, 2007). Specifically, the emissions occur during the last three months of construction and transportation activities and the calculation assumption was that these will overlap with the first three months of project activity (January 15, 2007, through April 15, 2007) and that they will stop at the end of calendar year 2006.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

The baseline emissions were calculated based on the formula:

$$E_{baseline} = E_{Concepción}\ (MWh/year) \times CM\ (tCO_2/MWh) \quad (V)$$

Where: $E_{Conc.epcion}$ = Project activity electricity generation in the average year, amounting to 65,000 MWh/yr
CM = The Combined Margin emission factor, which is the average of the Approximate Operating Margin (OM) and the Build Margin (BM), as shown in the following:

$$CM = 0.5 \times (OM_{2004} + BM_{5plants})\ (tCO_2/MWh) \quad (VI)$$

OM_{2004} and $BM_{5\text{-}plants}$ were calculated according to the allowed baseline methodology for Small-Scale CDM project activities (Version 05: 25 February 2005) and following formulae were used:

Approximate Operating Margin – was calculated as the weighted average emissions of all generating plants serving the system in year 2004, except hydro, geothermal, wind, low-cost biomass, nuclear and solar energy (basically, low-cost/must-run facilities).

$$OM_{2004} = \Sigma(E_i)/\Sigma(EG_i)\ (tCO_2/MWh) \quad (VII)$$

Where: E_i = Total tones of CO_2-equivalent emissions per year of plant "i", including all generating plants serving the system in 2004. E_i was calculated per type of fuel and technology for plant "i" as follows:

$$E_i = HR_i \times EM_i \times OX_i \times EG_i \quad (VIII)$$

Where: HR_i = Heat Rate for the fuel used in the thermal plant (GJ/MWh)
EM_i = Fuel and Technology Emission Factor (tCO_2/GJ)
OX_i = Fraction of Oxidized Fuel
EG_i = Total annual energy generated (MWH/year) by plant "i" in 2004, including all generating plants serving the system in 2004.

Build Margin – was calculated based on the same algorithms, for the 5 recent additions to the system , alternative that corresponded to the highest system generation in 2004.

Emissions Reduction - The system average emissions corresponding to the Approximate Operation Margin, the Build Margin based on the 5-plants alternative characterized by a greater MWh generation, the Combined Margin and the resulting Emission Reduction are summarized below:

OM_{2004} = 0.8104 tCO_2/MWh
$BM_{5\text{-plants}}$ = 0.3631 tCO_2/MWh
CM = 0.5868 tCO_2/MWh
$E_{baseline}$ = **(**0.5868 tCO_2/MWh **) X 65,000 MWh / year = 38,142 tCO_2/year**

All above values are substantiated in the six tables presented under E2 below.

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

The difference represents the emission reductions due to the project activity for the first year of plant electricity generation, which is January 15th, 2007 to January 15th, 2008. It amounts to **37,579 tCO_2/year.**

Beyond the first year of operation (and, in fact, beyond January 1st, 2007), there are no more GHGs emissions from the project activity. For the rest of the selected credit period, E.1.2.4 represents the full emission reduction and it amounts to **38,150 tCO_2/year**.

E.2 Table providing values obtained when applying formulae above:

Tables E1 (Approximate Operating Margin), **E2A (Electrical $Generation_{5\text{-plants}}$) and E2B (Electrical $Generation_{20\%}$),** E3 (Build Margin) and **E4 (Project Activity Emission Reductions)** presented in the following reflect the calculations of baseline and project activity emissions, as well as the annual emission reductions due to the operation of the Concepción HPP. **Table E5** presents emission reductions over various crediting periods.

Table E1 - Calculation of Approximate Operation Margin

-

2004 Grid Th.Plants (F. Fuel)	Installed Capacity MW	Technology	Fuel	Heat Rate (GJ/MWh)	Energy CO2 Em. Factor (tCO_2/GJ)	Oxid. Factor (%)	Electrical CO2 Em. Factor (tCO_2/MWh)	Electrical Generation in 2004 (MWh/yr)	GHG Emission in 2004 (tCO2/yr)	System Average Emission (tCO2/MWh)
Bh. las Minas #2	40.00	Steam Turbine	Bunk C	13.16	0.0774	99.0	1.0084	99,600.00	100,436.64	
Bh. las Minas #3	40.00	Steam Turbine	Bunk C	12.30	0.0774	99.0	0.9425	155,200.00	146,276.00	
Bh. las Minas #4	40.00	Steam Turbine	Bunk C	13.16	0.0774	99.0	1.0084	72,200.00	72,806.48	
PCA #2	59.00	Steam Turbine	Bunk C	11.61	0.0774	99.0	0.8896	255,500.00	227,292.80	
PCA #3	18.00	Internal Comb.	BunkC/LD	18.99	0.0774	99.0	1.4551	121,200.00	176,358.12	
PAN AM	96.00	Internal Comb.	BunkC/LD	9.01	0.0774	99.0	0.6904	612,000.00	422,524.80	
Pedregal	53.40	Internal Comb.	BunkC/LD	9.48	0.0774	99.0	0.7264	375,800.00	272,981.12	
Other Bunker	3.84	Internal Comb.	BunkC/LD	9.48	0.0774	99.0	0.7264	10,400.00	7,554.56	
Petroelectrica	0.00	Internal Comb.	BunkC/LD	9.48	0.0774	99.0	0.7264	4,100.00	2,978.24	
Sub-Total 1	**350.24**							**1,706,000.00**	**1,429,208.76**	**0.8378**
Bh. las Minas #1	160.00	CCGTurbine	Mar Diesel	8.31	0.0748	99.5	0.6185	249,000.00	154,006.50	
Sub-Total 2	**160.00**							**249,000.00**	**154,006.50**	**0.6185**
T.G. Panama	42.80	Gas Turbine	Lt Diesel	15.47	0.0741	99.0	1.1349	200.00	226.98	
PCA #4	38.00	Gas Turbine	Lt Diesel	15.83	0.0741	99.0	1.1613	100.00	116.13	
COPESA	46.00	Gas Turbine	Lt Diesel	9.76	0.0741	99.0	0.7160	1,200.00	859.20	
Other Thermal	25.20	Internal Comb.	Lt Diesel	11.66	0.0741	99.0	0.8554	25,400.00	21,727.16	
Sub-Total 3	**152.00**							**26,900.00**	**22,929.47**	**0.8524**
TOTAL	**662.24**							**1,981,900.00**	**1,606,144.73**	**0.8104**

Table E2A - 2004 Electrical Generation (5-plants alternative)

Plant No.	Grid-Connected Thermal Plants (Fos. Fuel, 2004)	Start-up Year or Date	Installed Capacity MW	Technology	Electrical Generation in 2004 (MWh/yr)
1	PEDREGAL	2002	53.4	Internal Combustion	375,800.00
2	PCA#2	2000-2002	59.0	Steam Turbine	255,500.00
3	BLM #1 (Addition)	2000	65.2	CCycle Gas Turbine	101,468.00
	Sub-Total Thermal		**177.6**		**732,768.00**
	Grid-Connected				
	Hydro (2004)				
4	HPP Esti	2003	120.0	Hydropower	615,600.00
5	Bayano Expansion	2002-2004	110.0	Hydropower	202,230.00
	Sub-Total Hydro		**230.0**		**817,830.00**
	TOTAL		**407.6**		**1,550,598.00**

Table E2B - 2004 Electrical Generation (20%-recent alternative)

Plant No.	Grid-Connected Plants	Start-up Year or Date	Installed Capacity MW	Technology	Electrical Generation in 2004 (MWh/yr)
1	PEDREGAL	2002	53.4	Internal Combustion	375,800.00
	Sub-Total Thermal		**53.4**		**375,800.00**
3	HPP Esti	2003	120.0	Hydropower	615,600.00
4	Bayano Expansion	2002-2004	110.0	Hydropower	202,230.00
	Sub-Total Hydro		**230.0**		**817,830.00**
	TOTAL		**283.4**		**1,193,630.00**

Table 3 - Calculation of Build Margin (5-plants)

-

Grid-Connected Thermal Plants (Fossil Fuel, 2004)	Start Year or Date	Installed Capacity MW	Technology	Fuel	Heat Rate (GJ/MWh)	Energy CO2 Emission Factor (tCO_2/GJ)	Oxid. Factor (%)	Electrical CO2 Emission Factor (tCO_2/MWh)	Electrical Generation in 2004 (MWh/yr)	GHG Emission in 2004 (tCO2/yr)	System Average Emission (tCO2/MWh)
PEDREGAL	2002	53.4	Internal Comb.	BunkC/LD	9.48	0.0774	99.0	0.7264	375,800.00	272,981.12	
PCA#2	2000-02	59.0	Steam Turbine	BunkC	11.61	0.0774	99.0	0.8896	255,500.00	227,292.80	
BLM #1 (Addition)	2000	65.2	CCG Turbine	Mar. Diesel	8.31	0.0748	99.5	0.6185	101,468.00	62,757.96	
Sub-Total Thermal		**177.6**							**732,768.00**	**563,031.88**	**0.7684**
Grid-Connected											
Hydro (2004)											
HPP Esti	2003	120.0	Hydropower	N/A	N/A	N/A	N/A	0.00	615,600.00	0.00	
Bayano Expansion	2002-04	110.0	Hydropower	N/A	N/A	N/A	N/A	0.00	202,230.00	0.00	
Sub-Total Hydro		**230.0**							**817,830.00**	0.00	**0**
TOTAL		**407.6**							**1,550,598.00**	**563,031.88**	**0.3631**

Notes:

[1] Estimate of emissions for the Bayano expansions were taken from the CDM-PDD draft for the Project in 01/2004 by Ecoenergy Int. Corporation

[2] Estimate for emissions for the Esti HPP were taken from the Baseline Report (CDM) for the Project completed in 07/2002 by AES Panama.

Table E4 - Project Activity Emissions Reduction

Operating Margin Emission Factor (tCO_2/MWh)	Build Margin Emission Factor (tCO_2/MWh)	Combined Margin Emission Factor (tCO_2/MWh)	Concepcion Generation (MWh/yr)	Baseline Emissions (tCO_2/year)	Concepcion Emissions (tCO_2/first yr.)	Emission Reduction (tCO_2/first yr.)	Emission Reduction (tCO_2/year)
0.8104	0.3631	0.5868	65,000	38,142	563	37,579	38,142

Table E5 - Concepcion Emission Reduction for various Crediting Periods

Credit Period (years)	Emissions Reduction (tCO_{2})	Period (years)
7	266,431	1/15/07-1/15/14
10	380,857	1/15/07-1/15/17
14	533,425	1/15/07-1/15/21
21	800,419	1/15/07-1/15/28

Notes:

[1] Concepción HPP emissions will occur only during first year of operation (first three months)
[2] Concepción HPP emissions calculation for the first year of operation resulted in 563 tCO2/year (cement and fuel use)
[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.

SECTION F.: Environmental impacts:

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The Environmental Impact Statement (EIS) was completed at the pre-design phase in accordance with the Panamanian law. Hard copies in Spanish are available with the Owner/Participant. The EIA outcome resulted favourable for this project activity, which was found not to have significant environmental impacts. The impacts of low significance identified during both construction phase and the operation phase have their mitigation measures defined within the EIS.

One copy of the EIS (including the proposed mitigation measures) will be provided to the Operational Entity appointed to validate the project activity.

Construction Phase

Hydropower plant construction may affect the environment when it alters vegetation or when changes in the habitat of aquatic or terrestrial populations are necessary in order to implement the project scheme of component structures. Concepción HPP structures are all located in areas with little or no vegetation at the dam and powerhouse sites, and the conveyance alignment is located entirely on cattle ranch lands that have very little vegetation and are far from being wildlife ideal habitat. The two access and maintenance roads (to the dam site and to the powerhouse building) will be constructed along existing vicinal roads and the maintenance road to be built along the conveyance will be located, as the conveyance is, on cattle ranch land.

There will be a slight modification of the hydrologic regime at both dam site and powerhouse site due to the construction of the cofferdams and to the construction activities in the dry that are taking place behind them. Given the small sizes and low heights of the component structures, as well as the compact construction time schedule, the effects of the construction site in terms of water quality and sediment transport in the Piedra River and downstream are going to disappear by themselves quite soon after the commercial operation starts.

Other impacts occurring during the construction phase include the use of fuel and lubricants and the ensuing generation of liquid waste, the generation of solid waste and of suspended particles in the river, and the noise pollution. Again, the compact construction time schedule helps in limiting such impacts. But traditional and good engineering practices that include adequate management of fuels and lubricants, a good liquid and solid waste disposal system, the construction of cofferdams around the major structures and, most importantly, limiting interventions to the minimum construction site requirements, are in themselves major mitigation measures.

Operation Phase

There will be a permanent alteration of the hydrologic conditions along a 2.2-km-long reach of the river between the diversion structure and the powerhouse. This alteration includes the reduction of flows along that stretch, which in turn will cause changes in the water quality indicators such as increasing the average water temperatures and lowering the dissolved oxygen amounts. Such changes have the potential to negatively affect aquatic life (amphibians, aquatic insects, fish, river shrimps, etc.) by transforming their habitat over this river section, unless mitigation measures are provided. For this reason, the

Concepción Project is designed to accommodate a continuous eco-flow release whose volume is commensurate with the requirements to maintain the ecological systems in the river, including the morphology of the riverbed and banks, as well as the survival of the aquatic life.

SECTION G. Stakeholders' comments:

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

Meetings have been held with residents in the community of Meseta de Boqueron with the occasion of EIS preparation and land acquisition visits for project development and structures implementation. On these occasions, the project configuration and scope were explained, including a series of development and operation issues. Also on these occasions, the environmental and social impacts and their mitigation, as well as the social benefits, were described to the residents. Further visits and town meetings are planned in order to answer all local inquiries and interests.

G.2. Summary of the comments received:

The Autoridad Nacional del Ambiente (**ANAM,** Panama's Environmental Authority) approved in 2004 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 June 25, 2004, from 10:00 AM through 11:30 AM, in the Village of Bocalatun, Guayabal Township, Boqueron District. The assistance included upwards of 90 community members, as well as the Mayor of Boqueron District, Mrs. Lusbelia Cabrera. 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 the technical advisors to the developer, Humberto Alvarez and Enier Portugal. Assurances that there will be a local job market for project construction, together with some permanent infrastructure implemented in the area (access roads, river crossings) were also given to the attendance. 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.

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

There were no negative comments submitted by Stakeholders and therefore, there was no need to incorporate them into project designs, or to modify the project or the planned construction procedures in any way.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**Istmus Hydropower Corp.**
Street/P.O.Box:	Avenida Samuel Lewis
Building:	Torre HSBC, 20th Floor
City:	Panama City
State/Region:	Panama Province
Postcode/ZIP:	
Country:	Panama Republic
Telephone:	507-263-4400
FAX:	507-269-0458
E-Mail:	Alex@Vicsons.com
URL:	
Represented by:	
Title:	President
Salutation:	Mr.
Last Name:	Hanono
Middle Name:	
First Name:	Alejandro
Department:	
Mobile:	507-6677-3020
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NOT APPLICABLE

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