



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

CONTENTS

- A. General description of project activity
- B. Application of a baseline and monitoring methodology
- C. Duration of the project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan

**SECTION A. General description of project activity****A.1 Title of the project activity:**

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Title: Multipurpose Baba Hydroelectric Project

PDD version number: 01

Date: 26/06/2008

A.2. Description of the project activity:

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Baba Multipurpose Hydroelectric Project (**MBHP**) is being developed by HIDROELECTRICA NACIONAL HIDRONACION S.A.¹ (hereafter HIDRONACIÓN) and will be located in the provinces of Guayas, Manabí and Los Ríos.

The project activity will aim to increase power generation in Marcel Laniado de Wind (MLW) hydropower plant by installing a new hydroelectric generation unit called 'Central Baba' (42 MW). The MBHP will increase the total energy of the system formed by the existing units of MLW and the new Baba unit², and comprises the following elements:

- A new reservoir (Baba) which flood an area of about 1000 hectares, taking the water from the Baba River.
- A transfer of water with a length of about 8 kilometres and a minimum cross-section of 234m². This transfer will allow the connection between the new Baba reservoir and the existing Daule-Peripa reservoir (this reservoirs are located in two different basins). The largest amount of water that will be available will increase the production of energy at the existing units in MLW hydropower plant (3 units of 71 MW each one).
- A new hydroelectric power generation unit (Baba, 42 MW) installed at the end of the transfer. All water turbined at the new Baba unit will be transferred to Daule-Peripa reservoir and consequently, will be turbined once again in the existing units of MLW power plant.

The MBHP will generate clean and renewable energy using hydroelectric resources available in Ecuador. The project activity will reduce the emissions of Greenhouse Gasses (GHGs), by generating 602 GWh/year that would otherwise be generated by power plants that feed the National Interconnected

¹ HIDROELECTRICA NACIONAL HIDRONACION S.A operates and manages the hydroelectric plant Marcel Laniado de Wind (MLW) with 213 MW, which is connected to the National Interconnected System (SNI) of Ecuador. MLW started its commercial operation in 1999 using the waters of the Daule-Peripa reservoir, created in order to supply water for irrigation and control flood.

² Currently MLW has 213 MW of installed capacity but because of its low load factor its generation is equivalent to a 90 MW power plant. MBHP will add 42 MW and will also increase the current generation at MLW. According to CENACE, the implementation of MBHP will allow the total system (MLW, including historic generation, new unit Baba and increase of generation because of the water convey) to have a generation equivalent to a 180 MW power plant.



System (SNI, by the acronyms in Spanish) in Ecuador, some of which use fossil fuels. The project provides a sustainable option in the diversification and increasing of energy production in Ecuador.

The PHMB is a pioneering initiative with an innovative design³ that allows an optimum use of water resources for electricity generation, producing more quantity of energy and minimizing potential social and environmental impacts.

The project activity contributes to sustainable development in Ecuador for the following reasons:

- Replaces thermal generation by clean and renewable generation which will reduce imports of diesel for their generation.
- Improves the country's industrial competitiveness by increasing the supply of hydropower, reducing the cost of energy.
- Environmental improvement - Production of clean energy that replaces the one generated by the combustion of petroleum derivatives.
- It reduces the emission of about 330,000 tCO₂ per year helping to mitigate the effects of climatic change.
- The additional energy input by PBHP contributes to the stability of the entire electrical system of Ecuador, since it is located in the opposite slope of the major hydroelectric power plants, which operate on the eastern slope of the country. As the eastern and western slopes have its higher hydroelectric potential in opposite months, MBHP will produce energy during the month with lower generation in the eastern slope.

A.3. Project participants:

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Table 1: Project Participants

Name of Party Involved	Private and/or public entity (ies) Project participants as applicable	Kindly indicate if the Party involved wishes to be considered project participant (Yes/No)
Ecuador (host)	HIDROELECTRICA NACIONAL HIDRONACION S.A.	No

Contact details are presented in Annex 1.

³ MBHP is the first project in Ecuador that considers the transfer of water from one basin to another, which will allow utilise the resource for hydroelectric generation twice: once in the new unit Baba and another in the existing units of MLW power plant.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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Ecuador

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

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Province of Guayas, Los Ríos and Manabí.

A.4.1.3. City/Town/Community etc:

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Canton Buena Fé and Canton Valencia

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

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The MBHP will be located in the provinces of Guayas, Los Ríos and Manabí as shown in FIGURE 1 below. MLW power plant -which operating rate is improve as part of the project activity- is located between the provinces of Manabí and Guayas, while the existing Daule-Peripa reservoir -which water contents will be increased with the water conveyed from Baba reservoir- is located in the provinces of Manabí, Guayas and Los Ríos. The dam Baba and the new power units will be located downstream the confluence of Baba and Toachi rivers, in the cantons of Buena Fé and Valencia (province of Los Ríos), 20 km north of the main city of the Buena Fé canton, San Jacinto de Buena Fé, as shown in FIGURE 2. The canals connecting both reservoir (Baba and Daule-Peripa) are located in the province of Los Ríos. The coordinates (UTM) of the new power units will be: 670 450 E, 9926 150 N.

FIGURE 1: Schematic location of the project activity.

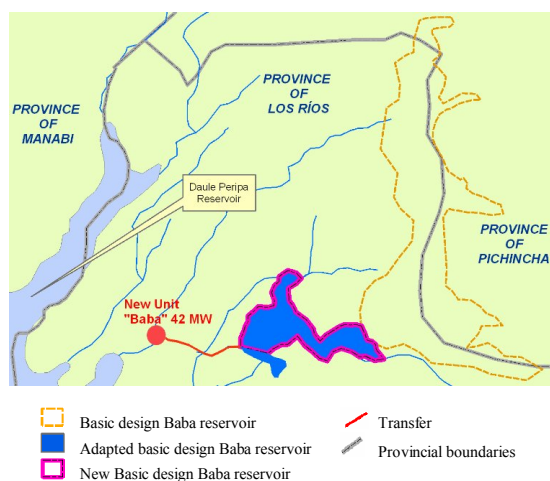
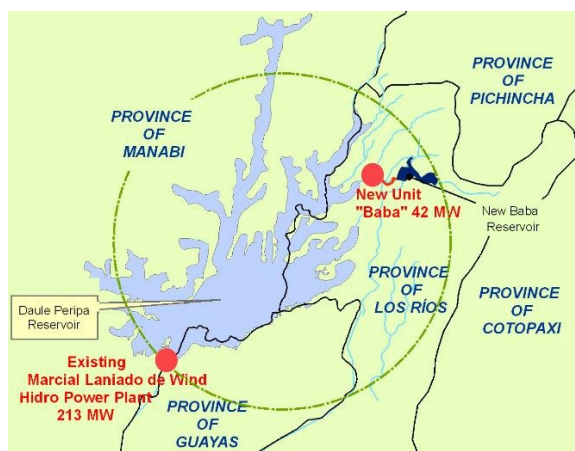


FIGURE 2: Schematic Location of the new reservoir and power unit BABA.



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

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Scope number: 1

Sectoral Scope: Energy industries (renewable - / non-renewable sources)

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

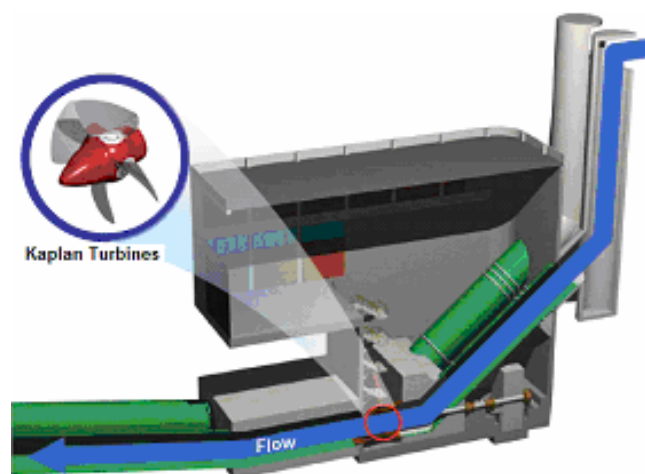
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The MBHP involves the formation of a 1000 Ha. reservoir⁴ with a volume 60 hm³. Among main civil works for the reservoir are four dikes of 20 m high. The highest level of water will be 120 m.a.s.l., while the foundation will be located at 100 m.a.s.l. in the alluvial bed of the Baba River. For convey water from Baba River to Daule-Peripa reservoir and 3 dams, 3 dikes and canals will be constructed. The length of the water transfer is 8 km: 5.6 km will be canals while the rest are natural depressions.

Baba power house will be conventional hydro power units, equipped with two 21-MW horizontal axis Kaplan turbines as shown in the figure below. A Kaplan turbine is a propeller-type water turbine that has adjustable blades allowing efficient power generation in low head applications. Each turbine will have a flow-rate of 86 m³/s, and a 62 m³/s bypass will be constructed. For the connection with the SNI, a substation (in which the voltage will be increased from 13.8 KV to 230 KV) and transmission lines will be constructed.

⁴ As stated in following sections of the PDD, the design has changed several times. The area of the reservoir has been reduced with the new designs; currently the area is approximately 1000 hectares.

FIGURE 3: Schematic view of Baba's power house.



The project activity includes the provision of the following equipment:

- Kaplan turbines
- Generators
- Electrical and mechanical auxiliary equipment
- Transformers
- Circuit breakers
- Switches
- Equipment of high tension
- Transmission line structures, conductors, etc.

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

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In accordance with the ACM0002 version 7, the implementation of the MBHP in the Ecuadorian electric system will reduce 318,991 t CO₂eq/year. Based in this estimated annual CO₂eq reduction by the project activity, the reduction over the first 7-year crediting period will be of 2,232,937 tCO₂eq. (See table below)

**Table 2** Project Emission Reductions Estimation

Years	Annual estimation of emission reductions in tons of CO₂eq
2010	318,991
2011	318,991
2012	318,991
2013	318,991
2014	318,991
2015	318,991
2016	318,991
Total Estimated Reductions (tons of CO₂eq)	2,232,937
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tons of CO₂eq)	318,991

The amount of emission reductions attributable to the project activity will vary directly with the net energy generated by the project. The table above is based on the expected additional generation (602,000 MWh/year) and an emission factor of the grid⁵ of 0.62678 tCO₂eq/MWh.

The emission factor of the grid will be recalculated at the end of each crediting period of 7 years. For the second and third crediting periods the estimated emission reductions will be recalculated taking into account any possible modification to the current baseline.

The average emissions factor of the grid was estimated with the approved “Tool to calculate the emission factor for an electricity system version 1.”, as stated in the consolidated baseline methodology ACM0002, using the technical information of the electrical sector of Ecuador and the data of generation and consumption of all the SNI power plants. This information has been provided by CONELEC⁶ and CENACE⁷ for the years 2004-2006.

⁵ <http://www.cordelim.net/cordelim.php?c=833>

⁶ CONELEC is a regulatory, controlling and law making entity through which the State can delegate activities of generation, transmission, distribution, and commercialization of electrical energy to concessionary companies. CONELEC is also in charge of the development and implementation of the National Electrification Plan.

⁷ The National Centre for Energy Control (CENACE) is a private organization, whose members include all of the generation, transmission, and distribution companies along with the biggest consumers. It contributes to the coordination of the National Interconnected System (SNI) and the management of the technical and financial transactions of the Wholesale Electrical Market (MEM).

**A.4.5. Public funding of the project activity:**

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No public funding from Parties included in Annex I will be utilized for the implementation of the project activity.

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

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The baseline calculations for the Project have been carried out following the baseline methodology ACM0002-Ver 07 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”. 30 November 2007.

The usage of this methodology includes the use of:

- Tool for demonstration and assessment of additionally.
- Tool to calculate the emission factor an electricity system.

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

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Project activity (MBHP) considers mainly the electricity capacity addition in MLW power plant, through the construction of a new generation unit (Baba Hydroelectric Power Unit with an installed capacity of 42 MW) and the increase of electricity generation in MLW power plant by modifying the operational regime. The structures encompassed by the project activity will connect the new Baba reservoir with the existing Daule-Peripa reservoir.

The approved methodology ACM0002 is applicable to the MBHP since the project involves the addition of new installed capacity (unit Baba) with renewable energy (hydroelectric) which will be connected to the grid. Other wise, the project activity will increase the generation at the existing MLW power plant, which is also connected to the SNI of Ecuador. Furthermore the MBHP complies with the specific applicability conditions included in ACM0002 presented below:

- The MBHP is the retrofit of a hydroelectric power plant (MLW) by the addition new installed capacity (new unit Baba, 42 MW) and the modification of the operational regime in the existing units by the increase of hydroelectric resources.
- The project activity considers the creation of a new reservoir (Baba), which is connected to an existing reservoir (Daule-Peripa). The existing reservoir will not increase its area.
- Project activity considers the creation of a new reservoir which power density is grater the 4 W/m².



- The boundary for the project is the National Interconnected System (SNI); information on the characteristics of de SNI is available at the web site of the local electricity agency (CONELEC, www.conelec.gov.ec).
- 5 years of historical data are available.
- The MBHP does not involve switching from fossil fuels to renewable energy at the site of the project activity.

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

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The greenhouse gases and emission sources included from the project boundary are shown in the table below.

Table 3: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO ₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO ₂	Yes	Main emission source. In the baseline, CO ₂ emissions are due to the operation of fossil fuel fired power plants connected to de grid.
		CH ₄	No	Minor emission source.
		N ₂ O	No	Minor emission source.
Project Activity	Emissions of CH ₄ from the reservoir.	CO ₂	No	Minor emission source.
		CH ₄	Yes	Main emission source. The MBHP must consider this emission since the power density is greater than 4W/m ² but less than 10W/m ² .
		N ₂ O	No	Minor emission source.

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

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The project activity is the modification of an existing grid connected renewable power plant (MLW Hydro Power Plant). Hence, according with ACM0002, **the baseline scenario** is the following:

In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid (EGbaseline, in MWh/year) at historical average levels (EGhistorical, in MWh/year), until the time at which the generation facility would likely be replaced or retrofitted (DATEBaselineRetrofit). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production



(EG_{baseline}) is assumed to equal project electricity production (EG_y, in MWh/year), and no emission reductions are assumed to occur.

The baseline scenario is identified as the continuation of the current power generation in Marcel Laniado de Wind power plant and the maintenance of the current electricity supplied to the Ecuadorian grid by existing or new power plants and imports.

MLW plant is operating since 1999, and was constructed to be operating for at least 30 years with its current installed power generation capacity (213 MW) and hydropower regimen, which restrict the operating rate. Therefore without the project activity the net electricity generated by MLW will remain around 510,000 MWh/year, and the additional electricity would be generated by grid connected power plants. The current supplying power plants correspond to thermoelectric and hydroelectric generators; the grid is also fed by power imports from Colombia.

According to the Regime Law of the Electricity Sector (LRSE) and as it has been ratified by CONELEC, Ecuadorian hydroelectric and thermal generators participate in the Economic Load Dispatch, having to declare their variable generation costs (marginal costs). This is an optimization process intended to minimize production costs while meeting demand. According to the information provided by CONELEC, electricity imports from Colombia have been given dispatch priority over thermal plants and therefore imports from Colombia have been considered in the calculations as low-cost/must-run resources.

According to the selected approved methodology (ACM0002), the baseline emission factor is defined as EF_y and is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors, regarding the Tool to Calculate the Emission Factor for an Electricity System. For the purpose of determining the build margin and the operating margin emission factors, a project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints.

The project boundary is defined by the emissions targeted or directly affected by the project activities, construction and operation. It encompasses the physical, geographical site of the hydropower generation and all power plants connected physically to the SNI. The boundary is therefore Ecuador's national borders.

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

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For the demonstration of the additionality the methodology ACM0002 states the use of the latest approved version of the “Tool for the demonstration and assessment of additionality⁸” (hereafter referred to simply as “Additionality Tool”).

The Additionality Tool shall be applied to describe how the anthropogenic emissions of GHG are reduced below those that would have occurred in the absence of the project activity. The Additionality

⁸ Tool for the demonstration and assessment of additionality. Version 5.



Tool provides a general step-wise framework for demonstrating and assessing additionality. These steps, numbered from 1 to 4, include:

1. Identification of alternatives to the project activity
2. Investment analysis and/or
3. Barrier analysis
4. Common practice analysis

The application of the additionality tool to the MBHP follows:

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

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

The realistic and credible alternatives to the project are:

- (1) The proposed project activity undertaken without being registered as a CDM project activity.
- (2) Continuation of the current situation (no project activity: MLW hydropower plant continue with its current generation, and the additional electricity that the project activity would supply to the grid remain being generated by the existing and new power plants connected to the SNI).

Sub-step 1b. Consistency with mandatory laws and regulations:

The additionality tool states that the alternatives identified shall be in compliance with all applicable mandatory legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions.

- (1) The achievement of all mandatory applicable legal and regulatory requirements is similar to the project activity and for the proposed project activity undertaken without being registered as a CDM project activity. Considering that MBHP complies with the applicable requirements since the EIA has been approved by CONELEC and the Environmental Licence has been given by the Environmental Ministry (10/11/2006), so it does the project activity undertaken without being registered as a CDM project activity.
- (2) Currently MLW power plant complies with all Ecuadorian legislation, and there are no legal bindings concerning the installation of additional power capacity, thus the continuation of the current situation complies with all the legal requirements.

The identified realistic and credible alternatives scenarios to the project activity that are in compliance with mandatory legislation are:

- (1) The proposed project activity undertaken without being registered as a CDM project activity.
- (2) The continuation of the current situation of electricity supplied to the grid.

Step 3. Barrier analysis

Substep 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity:

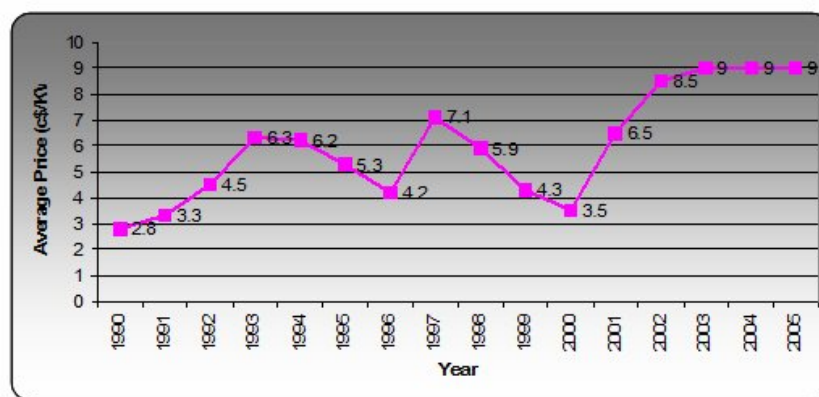
1. Business Risk in Electricity Generation Sector (due to delay or partial payments from distribution companies, tariffs, etc.).

The MBHP will be implemented within a complex situation of tariffs, regulatory aspects and financial crisis affecting the national electricity sector. This situation creates uncertainty for investors in the generation sector and puts barriers to obtaining financing.

The electricity sector in Ecuador faces a deep financial crisis and lack of institutionality⁹. Without the contribution of the State, through budget allocations, subsidies and periodic declarations of sector emergency, as well as the provision of imported energy, Ecuador would have been subject to restrictions for the provision of the service.

In 2003 the tariff of electricity supply was frozen, which, together with the high level of losses in the distribution sector, enshrines the tariff deficit that worsens the situation of generating and distribution companies¹⁰. The debt with the distribution companies is about U.S.\$ 950 million corresponding to the period between April 1999 and December 2005.

FIGURE 4 Average Annual Price (in cents USD)

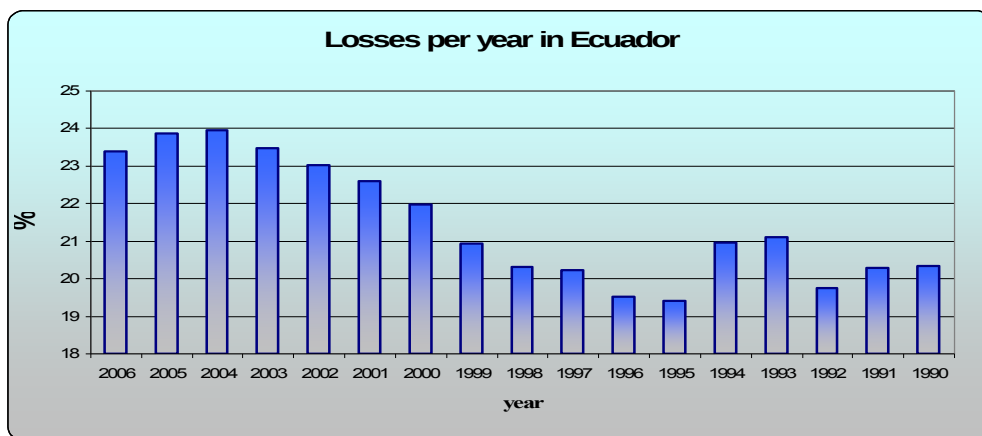


Source: CENACE

The financial crisis of the electricity sector in Ecuador was originated mainly in the distribution sector. The distribution phase of electrical energy represents the most important issue when evaluating the sector's financial crisis, because the quality of its management and logistics determines the degree of business efficiency, which affects directly the stability and sustainability of the electricity sector. The high level of energy losses (commercial and technical) is one of the serious problems faced by the sector.

⁹ CONELEC, CENACE, and "Report from the Central Bank of Ecuador. The Directory Report to the Excellency Mr. President of the Republic and the National Congress, 2006"

¹⁰ Report of the Central Bank of Ecuador and Inter – American Development Bank.

FIGURE 5: Energy Distribution Losses in Ecuador

Table 4 Energy Distribution Losses in Ecuador per company (%)

Company	2006
Ambato	14.27
Azogues	4.79
Bolívar	19.57
CATEG-D	27.39
Centro Sur	9.25
Cotopaxi	12.15
El Oro	29.05
Esmeraldas	32.2
Galápagos	10.00
Guayas-Los Ríos	38.07
Los Ríos	29.56
Manabí	41.92
Milagro	41.88
Norte	14.11
Quito	11.31
Riobamba	19.97
Sta. Elena	25.63
Sto. Domingo	17.98
Sucumbíos	34.85
Sur	13.46
Total	23.39

Source: CONELEC

There is a direct relationship between the level of financial losses registered by distributors and the non-payment of tariff deficit. The distribution companies acquire energy at higher prices than they are authorized to charge to final users, which subtracts them resources and equity, and also does not allow them to engage in processes of reinvestment in new losses-control projects, expansion, maintenance equipment, etc.

The Inter-institutional Commission of the Ecuadorian Electricity Sector (Comisión Interinstitucional del Sector Eléctrico Ecuatoriano – ICEES¹¹) formulated and presented to the Executive Government a document called the "Organic Law of Recognition of Tariff Deficit and Encouragement of Investment in the Electricity Sector" for the recognition, payment and investment in this concept.

The generating companies fail in collecting the bills owed by distributors, which does not allow them to operate normally and above all, cover their debts. According to information of CENACE and the Ministry of Economy and Finance from January to August 2005, companies invoiced US\$ 931.6 million and received partial payments for a total of US\$ 393.8 million (42.27%).

Table 5 Amount of energy paid by distribution companies to generation companies

Company	Value Paid (%)
Ambato	93.64
Azogues	92.43
Bolívar	31.2
CATEG-D	34.58
Centro Sur	99.71
Cotopaxi	101.29
El Oro	33.72
Esmeraldas	3.41
Guayas-Los Ríos	12.5
Los Ríos	15.85
Manabí	8.67
Milagro	33.43
Norte	86.24
Quito	67.78
Riobamba	100
Sta. Elena	11.99
Sto. Domingo	13.87
Sucumbíos	105.97
Sur	30.98
Total general	42.27

Source: Statistics of the Ecuadorian Electricity Sector 2006. CONELEC Table 153

¹¹ The Inter-Institutional Commission of the Ecuadorian Electric Sector (ICEES and CISEE by the acronyms in Spanish) was created through Executive Decree No 1176-A, published in the Official Record No.251 from January 14, 2004; was integrated by the Ministry of Energy and Mines, Economy, the Central Bank, CENACE, CONELEC, Solidarity Fund and Transelectric. This commission was replaced by the Committee for the Execution of the Electric Sector Policy (CEPSE by the acronyms in Spanish), created by Executive Decree No 711 from October 2004 and published in the Official Record No 140 from November 8th, 2005.



The situation mentioned above has caused the financial crisis of the electricity sector in Ecuador: distribution companies have not fully honoured contracts with generation companies for the energy acquired on the Wholesale Electricity Market (WEM). This situation has been ongoing for several years and provoked a chain reaction in the Ecuadorian electrical sector.

2. Lack of incentives for the investment in private energy generation projects.

Current situation of partial and delayed payment from distribution companies to generation companies, their principal creditors, disincentives private investment in generation projects. Private investors are not willing to risk their capital in generation projects aiming to sell to the electricity market without obtaining a governmental payment guarantee.

The possibility of CERs incomes reduces the commercial risk of this kind of project

3. Barriers to Financing.

MBHP has faced difficulties when trying to obtain financing because financial institutions, local and international banks perceive risk in investment projects in the Ecuadorian electricity sector due to the hard financial situation resulting from the high rate of indebtedness in the electricity sector (especially from distribution companies and their inability to pay).

This fact creates important barriers for obtaining long-term credits to finance electrical generation projects in Ecuador. Electrical generation projects normally involve high capital costs and long return periods, requiring 7 to 10 year credits. Local banks operate with a maximum of 5 year for their credits, and do not grant long-term credits, especially for generation projects. As a result, generation projects, specifically hydroelectric ones, have unfavourable development prospects.

MBHP's financial structure had to be changed over time, which had lead to several changes in the legal organization figure and delays in the execution of the project. At the end, the project was developed without the bank financing.

4. Mitigation and compensation costs.

As is the case of MBHP, the construction of new dams for hydropower plants is associated with several environmental impacts, which must be managed through mitigation and compensation measures. Usually, these measures are expensive, which increase the total costs of the project.

MBHP had to include an Environmental Management and Compensation Plan in order to mitigate and reduce the environmental impacts and satisfy community requirements and concerns. This management plan increased the project costs in about US\$ 16.000.0000.

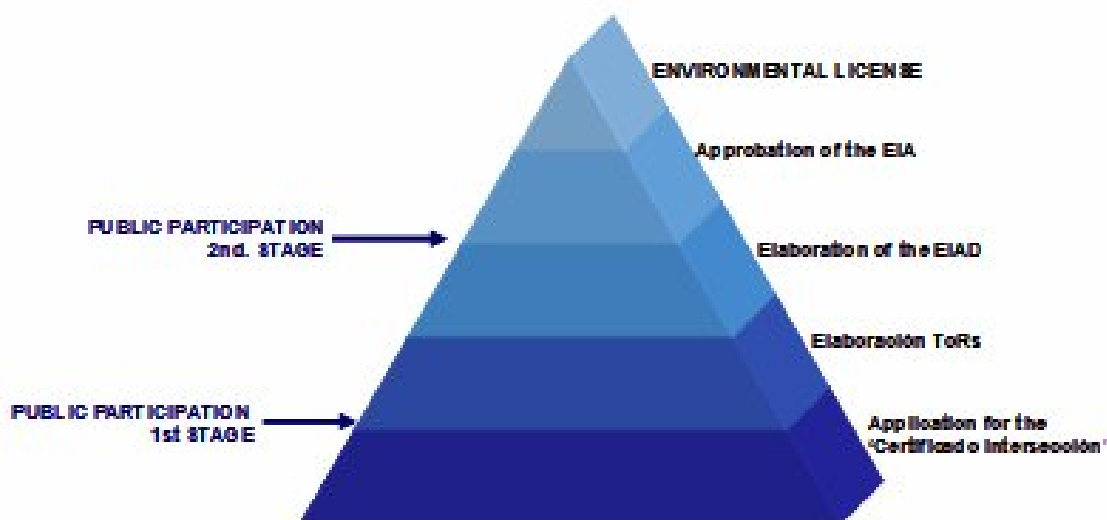
5. Relationship with local communities

Hydroelectric projects face more problems during the social and environmental approval process, due to the presence of flood areas (when there are dams), potential population, resettlement and the use of a fluctuating natural resource that could affect the development of populations that are economically dependent on agriculture or fishing. It is very common stakeholders do not rely in hydroelectric power plants (even when these are run of river type). Thus, hydroelectric projects can face delays or require the implementation of large social or environmental programs in order to achieve acceptance by the population, even if the project is technically and environmentally sound. These delays in process to get all the necessary permits and licences for hydroelectric projects, plus its additional cost may cause discouragement and frustration to the investors.

The procedures for the attainment of the Environmental Licence in Ecuador state that a project proponent must consider the community opinion in two different stages:

- During the elaboration of the environmental ToRs. The environmental ToRs establish the basic contents and measures to be taken. The aim of the public participation is that their concerns will be included since the beginning of the process.
- Before the formal presentation of the Definitive Environmental Impact Assessment (EIAD). The objective of this stage is to present to the community the EIAD, and to receive final comments.

FIGURE 6 Public participation for the Environmental Licence



In addition to the typical measures considered in the Environmental Management and Compensation Plan, the inclusion of an additional measure was necessary to get public approval: the construction of a 22 km road connecting several locations to the main roads around the lake called 'Via Entrelagos'. This road will allow the transport of agricultural products and the development of local and national tourism. The construction of this road will increase the project costs in about US\$14.000.000.



6. Design barriers

MBHP has faced a long design process, with several studies, modifications and delays. The design of a hydropower plant in an agricultural area is a complex process, because it must be considered simultaneously the technical issues and the management of environmental impacts related with the drowned lands. The reduction and mitigation of the environmental impacts may imply high costs, delays in the beginning of the project or modifications in the original design.

There have been different studies concerning design issues and different configurations¹². After the first design in 1994¹³, another 4 studies¹⁴ modified the original design before the achievement of a configuration that allows an Environmental Impact Assessment¹⁵. Nevertheless, taking into account the environmental impacts related with the design considered, Hidronación decided not to present the EIA to the environmental authorities, adopting a new design which, by reducing the drowned area, reduced the people to be relocated, the affected houses, the affected public infrastructure, the affected roads and agricultural lands. This design was finally presented to the Environmental Authorities for its approval, achieving the Environmental Licence in 10/11/2006.

Even after the achievement of the Environmental Licence by MBHP, it has been necessary to introduce some modifications regarding technical problems related with mechanical properties of soils.

Conclusion

The analysed barriers prevent the implementation of projects like the proposed CDM project (and the project activity without CDM), but the continuation of the current situation does not face these specific barriers.

As it has been stated, the identified barriers do not prevent the implementation of at least one of the alternatives (continuation of current situation). The Additionality Tool stated: “If both Sub-steps 3a – 3b are satisfied, proceed to Step 4 (Common practice analysis)”.

¹² As it can be seen in the studies referred below, the Project has changed its name during the study phase.

¹³ “Proyecto Presa Baba – Estudio de Factibilidad”. Consorcio TAMS-GEA, 1994.

¹⁴ “Revisión de estudio de factibilidad TAMS-GEA y sus posibilidades energéticas”. CEDEX-IBERDROLA, 1997.
“Estudio de la Primera Fase del Sistema Hidráulico del Proyecto de Propósito Múltiple Quevedo – Vines”. TYPESA, 1999

“Proyecto de Licitación Primera Etapa del Sistema Hidráulico de Propósitos Múltiple Quevedo-Vines”. TYPESA, 1999.

“Estudio de Diseño de la Central Hidroeléctrica Quevedo-Vines (Presa Baba)”. Caminosca, 2003-2004

¹⁵ “Estudio de Impacto Ambiental Definitivo del Proyecto Hidroeléctrico Baba” Eficácitas Consultora, 2004.

Step 4. Common Practice Analysis.

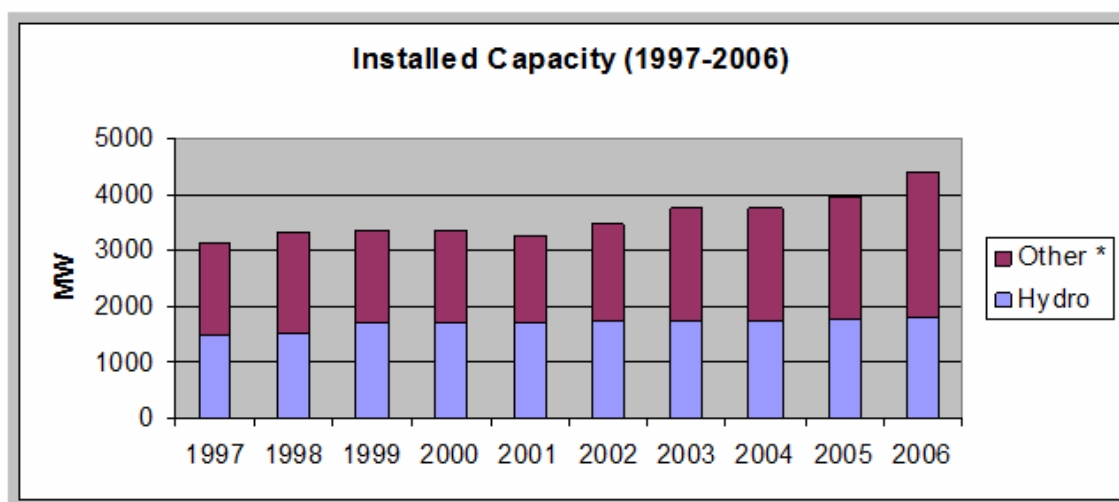
Sub-step 4a. Analyze other activities similar to the proposed project activity:

According to the Recommendations of the Generation Expansion Plan in the Electrification Master Plan 2007-2016 (“Plan Maestro de Electrificación 2007 – 2016”), considering the time of construction and start of operations of different type of equipments, in the short term, the only viable alternative is the thermal generation. This thermal generation must have the minimal efficiency conditions and use the local fuels like fuel oil or natural gas (when possible).

Based on the criteria above, the Project Activity, despite the fact that hydropower plants utilized is a clean source of energy generation and that will reduce the reliance of the National Interconnected System on fossil fuels for power generation, is not the most attractive alternative and is not the business-as-usual scenario in a country where thermal fossil fuel projects are preferable.

According to the Electrification Master Plan 2007-2016 (“Plan Maestro de Electrificación 2007 – 2016”) during the period 1997-2006 the proportion of installed capacity from hydroelectric power plants has decreased, from 55% in 1997 to 48% in 2006. Regarding the energy generated, the hydropower plants have decreased its participation in the Ecuadorian system from 63% in 1997 to 43% in 2006. This results indicate that the increasing in Ecuadorian demand have been mainly covered by thermal power plants and the imported electricity, as shown in the graphics below.

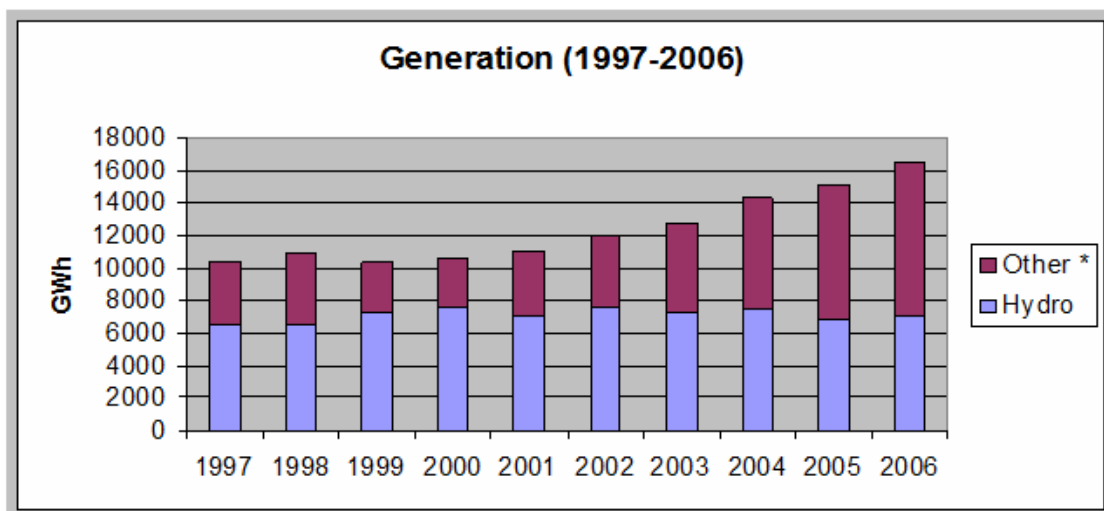
FIGURE 7 Installed Capacity 1997 – 2006



Source: Statistics CONELEC

* Includes thermal power plants and importations from Colombia.

FIGURE 8 Generation 1997 – 2006



Source: Statistics CONELEC

* Includes thermal power plants and importations from Colombia.

Furthermore, in terms of location, the project activity is not the common practice among the hydropower plants. Ecuador has two slopes, the Amazon slope and the Pacific Slope, and most of the hydroelectric power capacity is located in the first one (90%) since that area, according with Electrification Master Plan 2007-2016, is where the best hydrological conditions are.

The hydropower plants incorporated in Ecuador since 2002 are presented in the table below:

Table 6 Hydropower plants recently incorporated in Ecuador

Power Plant	Install capacity (MW)	Start operation (year)	Company
San Francisco	212.00	2007	Hidropastaza
Hidroabanico	37.50	2006	Hidroabanico
Calope	16.50	2006	Enermax
Sibimbe	15.80	2006	Hidrosibimbe
El Carmen	8.20	2000	EMAAP-Q
La Esperanza	6.00	2006	Manageneración
Poza Honda	3.00	2007	Manageneración
Perlabí	2.46	2004	Perlabí
Loreto	2.15	2002	Ecoluz

Source: Electrification Master Plan 2007-2016 (“Plan Maestro de Electrificación 2007–2016”) Table 6.7

Scale Analysis

In the table above it can be seen that only 3 hydroelectric of comparable scale (10-100 MW) have been incorporated to the Ecuadorian system: Hidroabanico, Calope and Sibimbe.

**CDM Projects**

The majority of hydroelectric projects incorporated since 2002 was developed as CDM incentives (Hidroabanico, Calope, Sibimbe, La Esperanza, Poza Honda and Perlabi¹⁶). Only 3 hydropower plants were developed without CDM: San Francisco, El Carmen and Loreto. Among these projects, El Carmen and Loreto started its operation before the registration of the first CDM project.

The importance of CDM for developing hydropower projects in Ecuador is clearly related with the crisis of the electric sector, as described in step 3. In fact, most of the projects in construction or to be developed in the short term consider CDM or are evaluating its CDM potential. According with the Ecuadorian Portfolio for clean energy development¹⁷ and the UNFCCC website, 8 of the hydropower plants projected in the Generation Expansion Plan 2007-2016 are in different stages of the CDM process. The table below presents the hydropower plants projected in the Generation Expansion Plan 2007-2016 and their stage in the CDM process.

Table 7 Projected Hydroelectric Power Plant, Ecuador

Power Plant	Company	Installed capacity (MW)	Start operation (estimation)	Stage in CDM process
Hidrotambo	Hidrotambo S.A.	7.6	2008	Registered
Chorrillos	Hidrozamora C.E.M.	3.96	2008	PDD available / being developed
Mazar	Hidropaute S.A.	190	2009	--
Ocaña	Elecaastro S.A.	26	2009	--
Sigchos	Triolo S.R.L.	17.4	2009	PDD available / being developed
Hidrovictoria	Hidrovictoria S.A.	10	2009	PDD available / being developed
Apaquí	Current Energy of Ecuador S.A.	36	2010	Request for registration
Topo	Pemaf Cía. Ltda.	22.8	2010	PIN
Pilaló	Qualitec Comercio e Industria Cía. Ltda.	9.3	2010	PDD available / being developed
Increase of energy in Paute Molino because of Mazar	Hidropaute S.A.	--	2010	--
Angamarca	Produastro C.A.	75	2011	--
Sopladora	Hidropaute S.A.	312.6	2011	--
Toachi Pilatón	Hidrotoapi S.A.	228.8	2011	Carbon offset potential being assessed

Sources: Electrification Master Plan 2007-2016 ("Plan Maestro de Electrificación 2007 – 2016") Annex 1.1. Ecuadorian Portfolio for clean energy development.

¹⁶ Other renewable projects were also implemented with CDM incentives, like: San Carlos, Ecoelectric, San Cristobal and Galapagos.

¹⁷ See <http://www.cordelim.net/cordelim.php?c=447>



Conclusions

As stated before, none of the hydropower plants constructed since 2002 (without CDM) are similar to the proposed project activity:

1. San Francisco: Different scale (212 MW)
2. Hidroabanico: Registered as CDM project.
3. Calope: Registered as CDM project.
4. Sibimbe: Registered as CDM project.
5. El Carmen: Different scale (8.2 MW)
6. La Esperanza: Registered as CDM project and different scale (6 MW)
7. Poza Honda: Registered as CDM project. Different scale (3 MW)
8. Perlabí: Registered as CDM project. Different scale (2.46 MW)
9. Loreto: Different scale (2.15 MW)

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

As stated in 4.a there are no similar projects undertaken as CDM project.

In summary, this project cannot be considered common practice and therefore is not a business-as-usual type scenario. And it is clear that, in the absence of the incentive created by the CDM, this project would not be the most attractive scenario and then would not be implemented under this energetic context.

As demonstrated through the Additionality Tool, the project is additional and therefore its implementation will reduce GHGs emissions below those that would have occurred in the absence of MBHP.

Consideration of CDM benefits

Guidelines for completing the PDD establish that if the starting date of the project activity is before the date of validation, it must be demonstrated that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. The following paragraphs show how the CDM was considered in the different stages of the project.

CDM benefits for the project have been considered since 2005. In order to assess the CDM potential of the project activity and the additional incomes from the issuance of CERs, a PIN was elaborated. In August 2005 the Strategic Partner¹⁸ started to develop the document with the support of the Ecuadorian

¹⁸ In 2005 the project considered the selection and participation of a Private Strategic Partner, whose main function was to provide funding sources. Please note that Consorcio Hidroenergético del Litoral started to develop the document before being formally selected as Strategic Partner.



CDM Promotion Office (CORDELIM). Since august 2005 until June 2007 the PIN was reviewed and improved in a joint work (Hidropacífico, through the Strategic Partner, supported by CORDELIM) in parallel with the advances in others aspects of the project (administrative, financial, design and regulatory matters).

An instruction given by the President of Ecuador in June 2007 established that the Strategic Partner had to be replaced by a governmental institution; in September 2007 CEDEGE was defined as the governmental institution which would replace the Strategic Partner. This substitution generated modifications in the administrative structure, the modalities of financial, property and administration of the benefits, and several bureaucratic processes in order to do operative the new structures. In order to face the changes and problems related with this situation, a contingency plan was carried out¹⁹.

With the changes in the administrative structure, the persons in charge of the CDM process did not continue as part of the company and the documentation (PIN) was not finished: there were still some unclarified subjects and methodological uncertainties.

In September 2007 specialized companies were publicly called to present their proposals for the elaboration of the current PDD and the development of the complete CDM process. In January 29th 2008 the selected firm signed a contract according with the condition requested in the call to present proposals.

As it can be seen in the previous paragraphs, the CDM was considered as part of the project activity since 2005, but the development of documentation and the start of the formal process was delayed because of several modifications in the administrative and financial structure.

Further information regarding the chronology can be requested by the DOE.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The process to determine the emission reductions attributable to the project activity according to the selected approved methodology is described below.

PROJECT EMISSIONS

As stated in ACM0002 (version 7), for hydro power project activities that result in new reservoirs with a power density greater than 4 W/m² and less than or equal to 10 W/m², project emissions shall be account and estimated as established in equation (1):

$$PE_y = \frac{EF_{Res} \cdot TEG_y}{1000} \quad (1)$$

¹⁹The Contingency Plan included the termination of the construction works for an approximate of 6 months. Besides, it also implied adjustment to the cost of the projects related to the increase on the construction timeframe, interests, price index and cost-growth of the works.



Where:

- PE_y = Emission from reservoir expressed as tCO₂e/year
 EF_{res} = is the default emission factor for emission from reservoirs, and the default value as per EB23 is 90 Kg CO₂e/MWh
 TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).

The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (2)$$

Where:

- PD = Power density of the project activity, in W/m²
 CAP_{PJ} = Installed capacity of the hydro power plants after the implementation of the project activity (W)
 CAP_{BL} = Installed capacity of the hydro power plants before the implementation of the project activity (W). For the new hydro power, this value is zero.
 A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²)
 A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For the new reservoir, this value is zero.

BASELINE EMISSIONS

Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = (EG_y - EG_{baseline}) \bullet EF_{grid.C.M.y} \quad (3)$$

Where:

- BE_y = Baseline emission in year y (tCO₂/yr).
 EG_y = Electricity supplied by the project activity to the grid (MWh).
 $EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For the new power plants this value is taken as zero.
 $EF_{grid.C.M.y}$ = Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”.

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

**Calculation of $EG_{baseline}$**

Considering that the project installs an additional power unit:

$$EG_{baseline} = EG_{historical, \text{ untill } DATE_{Baseline \text{ Retrofit}}} \quad (4)$$

$$EG_{baseline} = EG_{y, \text{ on/after } DATE_{Baseline \text{ Retrofit}}} \quad (5)$$

Where:

- $EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For the new power plants this value is taken as zero.
- $EG_{historical}$ = Average of historical electricity delivered by the existing facility to the grid (MWh)
- EG_y = Electricity supplied by the project activity to the grid (MWh)
- $DATE_{BaselineRetrofit}$ = Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).

Considering that the without the project activity Marcel Laniado de Wind power plant would have its current power capacity until the end of the proposed crediting period:

$$EG_{baseline} = EG_{historical} \quad (6)$$

According with equations 3. and 6., baseline emissions are:

$$BE_y = (EG_y - EG_{historic}) \cdot EF \quad (7)$$

Calculation of $EG_{historical}$

$EG_{historical}$ is the average of electricity delivered by Marcel Laniado de Wind power plant between 2003 and 2007, expressed in MWh per year. This period represents the 5 most recent years.

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

According to the “Tool to calculate emission factor for an electricity system- version 01”, Project Participants shall apply the following six steps to the baseline calculation:

- STEP 1 - Identify the relevant electric power system.
- STEP 2 - Select an operating margin (OM) method.
- STEP 3 - Calculate the operating margin emission factor according to the selected method.
- STEP 4 - Identify the cohort of power units to be included in the build margin (BM).
- STEP 5 - Calculate the build margin emission factor.
- STEP 6 - Calculate the combined margin (CM) emissions factor.

**STEP 1 - Identify the relevant electric power system**

For the purpose of determining the electricity emission factors, a project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

Similarly, a connected electricity system, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

As it was explained before, in Ecuador the project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines in the “Sistema Interconectado Nacional”(SNI). The SNI is an electricity system with imports from de Colombian System.

STEP 2 - Select an operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch data analysis OM, or
- (d) Average OM.

The selection of the appropriate calculation method depends, among other factors, on the characteristics of the electrical national grid and the available information about it. For the proposed project activity the Operating Margin has been calculated using the Simple Adjusted Method due to the following reasons:

- There is no public information available to allow the use of option (c) Dispatch Data Analysis OM. According to the methodology, the calculation of the OM emission factor, using option (c), is determined ex-post. In order to write the PDD, project developers may use models to estimate the reductions prior to validation. Such models should be able to simulate the operation of the hydroelectric project along with the other interconnected power plants during the crediting period, and, to achieve this, the data of many years of hydrological behaviour are needed. The data on hydrology are not available.
- In Ecuador low-cost resources constitute more than 50% of the total generation of the national grid, which prevents from using option (a) Simple OM.

Then, the Simple Adjusted Method has been chosen, then $EF_{OM,adjusted,y} = EF_{grid,OM,y}$ for this project activity. This method involves the division of generation sources (including energy imports) into low-cost/must-run and other sources feeding the national grid. Public official information is available for the separation of these Ecuadorian generation resources (through the websites of CONELEC and CENACE).

**STEP 3 - Calculate the operating margin emission factor according to the selected method**

The simple adjusted operating margin emission factor ($EF_{OM,adjusted,y}$ in tCO_2/MWh) is a variation on the simple operating margin, where the power sources (including imports) are separated in low cost/must-run power sources (k) and other power sources (j). The $EF_{OM,adjusted,y}$ will be calculated in an ex ante basis.

$$EF_{grid,OM-adj,y} = (1 - \lambda_y) \times \frac{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_j EG_{j,y}} + \lambda_y \times \frac{\sum_{i,k} FC_{i,k,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_k EG_{k,y}} \quad (\text{Equation 6, Tool})$$

Where:

- λ_y = Is the number of hours for which low-cost/must-run sources are on the margin in year y .
- $FC_{i,j,y}$ = Amount of fossil fuel type i consumed in power units j in the project electricity system in year y (ton)
- $FC_{i,k,y}$ = Amount of fossil fuel type i consumed in power units k in the project electricity system in year y (ton)
- k = Refers to units which are either low-cost or are must-run.
- j = Refers to the units that are not either low-cost or are must-run.
- $NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ /ton)
- $EF_{CO_2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
- $EG_{k,y}$ = Net electricity generated and delivered to the grid by power units k serving the system in year y (MWh)
- $EG_{j,y}$ = Net electricity generated and delivered to the grid by power units j serving the system, in year y (MWh)
- i = All fossil fuel types combusted in power sources in the project electricity system in year y
- y = The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation since the calculation is ex ante

Net electricity imports are considered low-cost / must-run plants.

λ_y is defined as stated in the Tool to calculate the emission factor for an electricity system.

STEP 4 - Identify the cohort of power units to be included in the build margin

The sample group of power units m used to calculate the build margin consists of power units that comprises the larger annual generation, between the next options:

- (a) The set of five power units that have been built most recently, or
- (b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

**STEP 5 – Calculate the build margin emission factor**

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units *m* during the most recent year *y* for which power generation data is available. This emission factor will be calculated in an ex ante basis. The formula used is:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (\text{Equation 12, Tool})$$

Where:

- $EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year *y* (tCO₂/MWh).
 $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh).
 $EF_{EL,m,y}$ = CO₂ emission factor of power unit *m* in year *y* (tCO₂/MWh).
m = Power units included in the build margin.
y = Most recent historical year for which power generation data is available.

The CO₂ emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in step 3 (a) for the simple OM in the Tool (options A, B or C), using for “*y*” the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

Option 1 is chosen because for the power units data on fuel consumption and electricity generation is available, then the emission factor ($EF_{EL,m,y}$) is determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad (\text{Equation 3, Tool})$$

Where:

- $EF_{EL,m,y}$ = CO₂ emission factor of power unit *m* in year *y* (tCO₂/MWh)
 $FC_{i,m,y}$ = Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (ton)
 $NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / ton)
 $EF_{CO2,i,y}$ = CO₂ emission factor of fossil fuel type *i* in year *y* (tCO₂/GJ)
 $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m = Power units included in the build margin
i = All fossil fuel types combusted in power unit *m* in year *y*
y = The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation since the calculation is ex ante (2007, 2006, 2005)

Where several fuel types are used in a power unit, the fuel type with the lowest CO₂ emission factor for $EF_{CO2,m,i,y}$ will be used.

**STEP 6 – Calculate the combined margin (CM) emissions factor EF_y .**

The combined margin emissions factor is calculated as follows:

$$EF_{\text{grid,CM},y} = EF_{\text{grid,OM},y} \times w_{\text{OM}} + EF_{\text{grid,BM},y} \times w_{\text{BM}} \quad (\text{Equation 13, Tool})$$

Where:

$EF_{\text{grid,BM},y}$	= Build margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$EF_{\text{grid,OM},y}$	= Operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
w_{OM}	= Weighting of operating margin emissions factor (%)
w_{BM}	= Weighting of build margin emissions factor (%)

For projects that are not solar or wind power generation, $w_{\text{OM}} = 0.5$ and $w_{\text{BM}} = 0.5$ for the first crediting period, and $w_{\text{OM}} = 0.25$ and $w_{\text{BM}} = 0.75$ for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Project participants can submit alternative proposal, for revision of tool if the weightage does not reflect their situation with an explanation for the alternative weights for future crediting periods.

LEAKAGE

The main emissions potentially giving rise to leakage in the context of hydroelectric sector projects are emissions arising due to activities such as power plant construction and land. According to methodology ACM0002 project participants do not need to consider these emission sources as leakage in applying this methodology.

EMISSION REDUCTIONS

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (8)$$

Where:

ER_y	= Emission reductions in year y (t CO ₂ e/yr).
BE_y	= Baseline emissions in year y (t CO ₂ e/yr).
PE_y	= Project emissions in year y (t CO ₂ /yr).
LE_y	= Leakage emissions in year y (t CO ₂ /yr).

**B.6.2. Data and parameters that are available at validation:***(Copy this table for each data and parameter)*

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO ₂ /MWh
Description:	Emission factor for the Ecuador interconnected grid (SNI)
Source of data used:	Calculated according to the approved “ <u>Tool to calculate the emission factor for an electricity system</u> version 1.” as stated in the methodology – ACM0002, version 7. In put Data provided by CENACE and/or CONELEC.
Value applied:	0.62678
Justification of the choice of data or description of measurement methods and procedures actually applied :	The baseline emission factor ($EF_{grid,CM,y}$) is calculated as a combined margin (CM), consisting of the combination of operating margin ($EF_{grid,OM,y}$) and build margin ($EF_{grid,BM,y}$) factors.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO ₂ /MWh
Description:	The simple adjusted OM emission factor
Source of data used:	Calculated according to the approved “ <u>Tool to calculate the emission factor for an electricity system</u> version 1.” as stated in the methodology – ACM0002, version 7. In put Data provided by CENACE and/or CONELEC.
Value applied:	0.65386
Justification of the choice of data or description of measurement methods and procedures actually applied :	The simple adjusted operating margin emission factor ($EF_{OM,adjusted,y} = EF_{grid,OM,y}$ in tCO ₂ /MWh) is a variation on the simple operating margin, where the power sources (including imports) are separated in low cost/must-run power sources (k) and other power sources (j).
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.



Data / Parameter:	EF_{grid,BM,v}
Data unit:	tCO ₂ /MWh
Description:	The build margin emissions factor
Source of data used:	Calculated according to the approved “ <u>Tool to calculate the emission factor for an electricity system v.1.</u> ”as stated in the methodology – ACM0002, version 7. In put Data provided by CENACE and/or CONELEC.
Value applied:	0.59969
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	λ_y								
Data unit:	-								
Description:	Fraction of time during which low-cost/must-run sources are on the margin								
Source of data used:	Calculated according to the approved “ <u>Tool to calculate the emission factor for an electricity system version 1.</u> ”as stated in the methodology – ACM0002, version 7. In put Data provided by CENACE and/or CONELEC.								
Value applied:	<table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>2004</td><td>0.01320583</td></tr> <tr> <td>2005</td><td>0.00022831</td></tr> <tr> <td>2006</td><td>0.00011416</td></tr> </tbody> </table>	Year	Value	2004	0.01320583	2005	0.00022831	2006	0.00011416
Year	Value								
2004	0.01320583								
2005	0.00022831								
2006	0.00011416								
Justification of the choice of data or description of measurement methods and procedures actually applied :	-								
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.								



Data / Parameter:	$FC_{i,j,y}$
Data unit:	ton
Description:	Amount of fossil fuel type i consumed in power units j in the project electricity system in year y
Source of data used:	Data provided by CENACE and/or CONELEC.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	I_i is official data.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$FC_{i,k,y}$
Data unit:	ton
Description:	Amount of fossil fuel type i consumed in power units k in the project electricity system in year y
Source of data used:	Data provided by CENACE and/or CONELEC.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is official data.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ /ton
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Values are not provided by the fuel supplier of the power plants in invoices. There are no regional or national average default values.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.



Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO ₂ /GJ
Description:	CO ₂ emission factor of fossil fuel type <i>i</i> in year <i>y</i>
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Values are not provided by the fuel supplier of the power plants in invoices. There are no regional or national average default values.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$EG_{k,y}$
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power units <i>k</i> serving the system in year <i>y</i>
Source of data used:	Data provided by CENACE and/or CONELEC.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is official data.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$EG_{j,y}$
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power units <i>j</i> serving the system, in year <i>y</i>
Source of data used:	Data provided by CENACE and/or CONELEC.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is official data.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.



Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid by power unit m in year y
Source of data used:	Data provided by CENACE and/or CONELEC.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is official data.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$EF_{EL,m,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of power unit m in year y
Source of data used:	Calculated according to the approved “ <u>Tool to calculate the emission factor for an electricity system v.1.</u> ” as stated in the methodology – ACM0002, version 7.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	To calculate $EF_{EL,m,y}$ option 1 is chosen because for the power units data on fuel consumption and electricity generation is available
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$FC_{i,m,y}$
Data unit:	ton
Description:	Amount of fossil fuel type i consumed by power unit m in year y
Source of data used:	Data provided by CENACE and/or CONELEC.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is official data.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.



Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid by power unit m in year y .
Source of data used:	Data provided by CENACE and/or CONELEC.
Value applied:	Data used is presented in the spreadsheet for ER calculation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is official data.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	w_{OM}
Data unit:	(%)
Description:	Weighting of operating margin emissions factor
Source of data used:	As indicated in the “Tool to calculate emission factor for an electricity system”.
Value applied:	50
Justification of the choice of data or description of measurement methods and procedures actually applied :	As stated in the methodology project proponent shall use $w_{OM} = 50\%$ and $w_{BM} = 50\%$
Any comment:	The value is fixed for a crediting period and will be revised at the renewal of each crediting period. Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	w_{BM}
Data unit:	(%)
Description:	Weighting of build margin emissions factor
Source of data used:	As indicated in the “Tool to calculate emission factor for an electricity system”
Value applied:	50
Justification of the choice of data or description of measurement methods and procedures actually applied :	As stated in the methodology project proponent shall use $w_{OM} = 50\%$ and $w_{BM} = 50\%$
Any comment:	The value is fixed for a crediting period and will be revised at the renewal of each crediting period. Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.



Data / Parameter:	EF_{Res}
Data unit:	kgCO ₂ e/MWh
Description:	Default emission factor for emissions from reservoirs.
Source of data used:	-
Value applied:	The default value as per EB23 is 90 kgCO ₂ e/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	The use of this value is stated in ACM0002
Any comment:	-

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data used:	Project site.
Value applied:	213,000,000W
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value represents the total power capacity, considering the 3 existing units in MLW power plant.
Any comment:	-



Data / Parameter:	<i>ABL</i>
Data unit:	m ²
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m ²).
Source of data used:	Project site.
Value applied:	270,000,000m ²
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official value
Any comment:	-

Data / Parameter:	<i>EG_{historical}</i>												
Data unit:	MWh												
Description:	Average of historical electricity delivered by the existing facility to the grid												
Source of data used:	Official statistics												
Value applied:	510,179 MWh												
Justification of the choice of data or description of measurement methods and procedures actually applied :	For the calculation of the average historical electricity delivered it has been considered the 5 most recent years. The values applied correspond to public and official information obtained from CONELEC statistics (www.conelec) <table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>2003</td><td>637,580</td></tr> <tr> <td>2004</td><td>471,688</td></tr> <tr> <td>2005</td><td>430,990</td></tr> <tr> <td>2006</td><td>490,820</td></tr> <tr> <td>2007</td><td>519,815</td></tr> </tbody> </table>	Year	Value	2003	637,580	2004	471,688	2005	430,990	2006	490,820	2007	519,815
Year	Value												
2003	637,580												
2004	471,688												
2005	430,990												
2006	490,820												
2007	519,815												
Any comment:	--												

Data / Parameter:	<i>DATA_{BaselinRetrofit}</i>
Data unit:	date
Description:	Point in time when the existing equipment would need to be replaced the absence of the project activity.
Source of data used:	Project activity site
Value applied:	2029
Justification of the choice of data or description of measurement methods and procedures actually applied :	Typical average technical lifetime of the type equipment.
Any comment:	-

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

>>

PROJECT EMISSIONS

As stated in B.6.1, power density (PD) is calculated with equation 2.

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

The installed capacity before the implementation of the project activity (**Cap_{BL}**) is the current installed capacity in Marcel Laniado de Wind plant: 213,000,000W; the installed capacity after the implementation of the project activity (**Cap_{PJ}**) will be 255,000,000 W (the existing 213,000,000 W and 42,000,000 W in the new unit); the area of the reservoir before the implementation of the project activity (**A_{BL}**) correspond to the area measured in the surface of the existing reservoir (Daule-Peripa) when it is full 270,000,000 m². The area of the reservoir after the implementation of the project activity (**A_{PJ}**) will be 280,000,000 m² (270,000,000 m² of the existing reservoir and 10,000,000 m² of the future Baba reservoir²⁰). Thus the power density will be:

$$PD = 4.2 \text{ W/m}^2$$

As stated in B.6.1 equation 1 is utilised for the calculation of project emission, since the power density of the project activity is between 4 and 10 W/m²:

$$PE_y = \frac{EF_{Res} \bullet TEG_y}{1000}$$

The total electricity that will be produced by the project activity (**TEG_y**) corresponds to the electricity generated by the new power unit Baba and the additional generation of the existing unit in Marcel Laniado de Wind due to the additional hydropower resources, and it has been estimated in 602,000 MWh per year. Considering the default emission factor for reservoirs (**EF_{Res}**) established by the methodology (90kgCO₂e/MWh), the project emissions are:

$$PE_y = 54,180 \text{ t CO}_2\text{e/year}$$

BASELINE EMISSIONS

As stated in section B.6.1. baseline emissions for MBHP are:

$$BE_y = (EG_y - EG_{\text{historic}}) \bullet EF$$

²⁰ As stated in section A.2 the area of the existing reservoir (Daule-Peripa) will not be increased.



- **Calculation of the $EF_{grid,CM,y}$**

Calculate the operating margin emission factor according to the selected method

The simple adjusted operating margin emission factor ($EF_{OM,adjusted,y}$) is: 0.65386 tCO₂/MWh.

See detail information about this calculation in Annex 3.

Calculate the build margin emission factor

The build margin emissions factor ($EF_{grid,BM,y}$) is: 0.59969 tCO₂/MWh.

See detail information about this calculation in Annex 3.

Calculate the combined margin (CM) emissions factor EF_y .

The combined margin emissions factor is: 0.62678 tCO₂/MWh.

See detail information about this calculation in Annex 3.

- **$EG_{Historic}$ and EG_y**

The historic generations ($EG_{Historic}$) is 510,179 MWh, the electricity supplied to the grid by MBHP (EG_y) will be 595,378 MWh per year, and the emission factor of the Ecuadorian grid (SNI) is 0.62678 t/MWh. Thus:

$$BE_y = 377,027 \text{ tCO}_2/\text{year}$$

LEAKAGE (L_y)

$$L_y = 0.$$

Emission Reduction

According with equation 8., the emission reductions of MBHP are:

$$ER_y = BE_y - PE_y - LE_y$$

$$ER_y = 373,171 - 54,180 - 0$$

$$ER_y = 318,991 \text{ tCO}_2/\text{year}$$

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

>>

Year	Estimation of project activity emissions (t of CO ₂ e)	Estimation of baseline emissions (t of CO ₂ e)	Estimation of leakage (t of CO ₂ e)	Estimation of overall emission reductions (t of CO ₂ e)
2010	54180	373,171	0	318,991
2011	54180	373,171	0	318,991
2012	54180	373,171	0	318,991
2013	54180	373,171	0	318,991
2014	54180	373,171	0	318,991
2015	54180	373,171	0	318,991
2016	54180	373,171	0	318,991
Total (tons of CO₂e)	379260	2,612,197	0	2,232,937

B.7 Application of the monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**

Data / Parameter:	EGy
Data unit:	MWh
Description:	Electricity supplied by the project activity to the grid
Source of data to be used:	Project activity site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimation of annual electricity generation delivered to grid: 1,105,557 MWh.
Description of measurement methods and procedures to be applied:	The generation will be measured by meters and the values of all the units will be supplied to the grid (existing MLW and the new units installed as part of MBHP). Data will be hourly measured and aggregated on a monthly basis
QA/QC procedures to be applied:	Meters will be calibrated according to national standards or manufacturer information. Data measured by meters will be cross checked against receipt sales and/or official information. Official information will be used in case of discrepancies between values.
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.



Data / Parameter:	TEGy
Data unit:	MWh
Description:	Total electricity produced by de project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y.
Source of data to be used:	Project activity site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimation of total annual electricity generation: 602,000 MWh.
Description of measurement methods and procedures to be applied:	The generation will be measured by meters (existing MLW and the new units installed as part of MBHP). Data will be hourly measured and aggregated on a monthly basis.
QA/QC procedures to be applied:	Meters will be calibrated according to national standards or manufacturer information. Data measured by meters will be cross checked against receipt sales and/or official information. Official information will be used in case of discrepancies between values.
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Project activity site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	255,000,000W
Description of measurement methods and procedures to be applied:	The installed capacity will be determined based on recognized standards. Yearly monitoring frequency:
QA/QC procedures to be applied:	-
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.



Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Project activity site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	280,000,000 m^2
Description of measurement methods and procedures to be applied:	Measured from topographical surveys, maps, satellite pictures, etc. Yearly monitoring frequency.
QA/QC procedures to be applied:	-
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

B.7.2 Description of the monitoring plan:

>>

Methodology applicable to this project is the approved consolidated monitoring methodology ACM0002, version 7, 2007.

The Monitoring Plan describes the procedures for data collection and auditing required for the project, in order to determine and verify emission reductions achieved by the project. This project will require only very straightforward collection of data, described in this PDD, which will be collected routinely.

The purpose of the monitoring plan is to ensure that the required data is accurately monitored and recorded to enable the calculation of the emission reductions achieved by the project, then before the start of the crediting period of the project activity, the following procedures and activities will be implemented:

- Establish and maintain data measurement, collection and recording systems.
- Procedures for quality assurance for internal and external data acquisition.
- Procedures for project performance review before submitted for verification
- Procedures for storing and maintain records (paper trail).
- Identification of training needs to enable operational staff to meet the needs of the project and this monitoring plan.
- Procedures for maintenance of equipment.
- Procedure for corrective actions to improve future monitoring and reporting.
- Emergency Response Procedures.

Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

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

>>

Date of completing the final draft of this baseline section: 29/05/2008.

Name of person/entity determining the baseline:

Company: Deuman

Telephone number: +56 2 335 26 07 / +51 1 242 45 27

Fax number: +56 (2) 335 26 09 / +51 1 242 45 27

E-mail: info@deuman.com

Deuman Ltda. is the Project Advisor.

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:**

>>

The starting date of the project activity is **November 2006**, corresponding to the achievement of the Environmental License and the start of previous works.**C.1.2. Expected operational lifetime of the project activity:**

>>

30 years

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period****C.2.1.1. Starting date of the first crediting period:**

>>

01/01/2010

C.2.1.2. Length of the first crediting period:

>>

7 years

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:

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The project owners have developed the documents required in Ecuador for establish the Environmental Impact Assessment: Preliminary Environmental Impact Assessment document (Estudio de Impacto Ambiental Preliminar, EIAP) and Definitive Environmental Impact Assessment document (Estudio de Impacto Ambiental Definitivo, EIAD). In Section 6 and 7 of the EIAD the environmental impacts has been studied for every component of the environment and for every stage of the project activity.

The approval of the EIAD by CONELEC is an administrative requirement for the attainment of the Environmental Licence from the Environmental Ministry, which was attained in 10/11/2006. This fact evidences that all environmental impacts was correctly analysed and assessed, according with Ecuadorian legislation.

It must be mentioned that the construction of Baba dam will contribute to deluge and flash floods control²¹. The transfer of water to Daule Peripa dam will not affect its ability for flash floods control since the transfer will be interrupted when is required.

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:

>>

In Section 11 of the EIA, management plans have been provided to Ecuadorian authority, explaining the measures to be taken in order to prevent, minimize and mitigate the impacts. Since the project has obtained its Environmental Licence, environmental impact has been successfully assess and managed according with procedures and legal requirements.

The main environmental impacts identified and the mitigation/compensation actions taken are presented in the table below.

²¹ With the construction of Baba dam, the peak flash floods which usually occur every 10 years, are expected to happen every 50 years.

**Table 8: Main environmental impacts.**

IMPACT	MITIGATION/COMPENSATION ACTIONS
Socioeconomic impacts	Development and implementation of the Project Diffusion and Information Plan.
	Indemnity and Relocation Plan, for the affected families.
	Relocation of the local school and chapel.
	Development and implementation of an Integrated Solid Waste Management System for the local community.
	Good agricultural practice training process for local inhabitants.
	Rural Electrification Program (only 20% of local homes had electricity connection).
	Tourism Development Plan.
	Cultural and Archaeological Resources Management Program
Biological impacts and water quality	Relocation and monitoring of wild species (flora and fauna)
	Biological management of Baba river basin.
	Waste Water Management Plant.
	Management and control of aquatic weeds.
	Maintenance of ecological flows.
Ground impacts	Erosion Control Program.
	Modification of the original design, reducing the inundation area.

SECTION E. Stakeholders' comments

>>

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

>>

Stakeholders' comments have been invited as part of the observance of Ecuadorian laws for the achievement of environmental licence. As shown in the figure below, Ecuadorian environmental procedures²² establish the following instances:

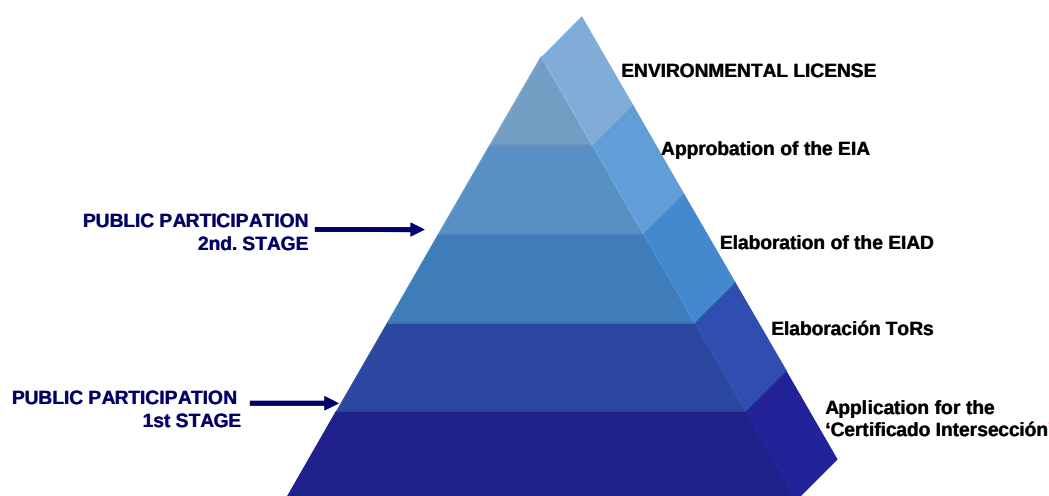


FIGURE 9: Public participation for the Environmental Licence

- During the elaboration of the environmental ToRs. The environmental ToRs establish the basic contents and measures to be taken. The aim of the public participation is that their concerns be included since the earlier design. The next activities were developed:
 - **Public Information Centre.** This centre was located in the city of Buena Fé, and had by purpose to provide information to the community and receive their opinions and concerns.
 - **Interviews** with stakeholders' representatives. The process was made according articles 28 and 29 of the Environmental Management Law. The process included 35 members of the local and regional community, and national institutions. Some of the participant were representatives of:

²² For the achievement of the Environmental Licence the follow stage must be carried out: attainment of the 'Certificado de Intersección' in which the Environmental Ministry states if the project is located in the same place than any protected area; approval of the ToRs for the development of the EIA and environmental management plan by the Environmental Ministry; Request for the approval of the EIA and environmental management plan to the Environmental Ministry; the project owner must pay to the Ministry the 0,001% of the total cost of the project plus the costs for the first year of monitoring the environmental management plan; inscription of the Environmental Licence by the Environmental Ministry.



municipalities (3), regional council (1), central government (1), health agency (1), local bank (1), education agency (1), education institutions (2), farmers (5), local leaders (3), guilds of producers (10), NGOs (4), other local organizations (3). These interviews enabled to know the subjects to be considered in the next stages.

- **Workshop and working group.** The participants were the stakeholders identified above, a representative of the Environmental Ministry, a representative of CONELEC and representatives of Hidronación. The aim of this working group was to receive the demands of the community. According with the law, the ministry representative is the responsible for the decision of which demands must be implemented, regarding the technical and economical feasibility.
- Before the formal presentation of the Definitive Environmental Impact Assessment (EIAD). This stage had the objective of present to the community the EIAD, and received final comments. The activities developed were:
 - Public information centre. This centre was located in the city of Buena Fé, and had by purpose to provide information to the community and receive their opinions concerning the EIAD. The comments received were provided to the developers of the EIA to be considered in the final analysis.
 - Public presentation of the results of the EIAD. The last stage before the application for the Environmental Licence was the presentation of the final document. To this event attended the same representatives of the community considered in the interviews described below, a representative of CONELEC, a representative of the Environmental Ministry.

Hidronación has announced at its website (January 3rd 2007) information related with the project. The level of project's progress is published periodically at the website. Additionally the development of MBHP as a CDM project, and an invitation to the community to give opinions or ask for clarifications about the process has been announced in the web since May 19th 2008.

E.2. Summary of the comments received:

>>

The most relevant stakeholders' comments were related with the loss of agricultural lands and houses.

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

>>

Considering the comments received, the original design of MBHP was modified, reducing the extent of drown lands, the relocated families and the affected infrastructure as shown in the next table.

**Table 9: Comparison between original and approved design.**

	ORIGINAL DESIGN	APROVED DESIGN
Relocated people	778 inhabitants	191 inhabitants
Affected houses	240 houses	41 houses
Affected public infrastructure	6 schools 2 churches 8 bridges	1 school
Length of affected local roads	31 km	3.5 km of privates roads.
Agricultural lands	3,760 ha	502 ha
Total affected lands	4,420 ha	1,150 ha

According with Ecuadorian law, stakeholders comments must be taken into account and must be included in the EIAD if it is technically and economically possible. This process must be supervised by a representative of the Environmental Ministry. The achievement of the Environmental Licence proves that a complete and correct process has been made in order to inform the community about MBHP, and that all attainable requests were properly considered in the final project deign.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	HIDROELÉCTRICA NACIONAL HIDRONACIÓN S.A.
Street/P.O.Box:	Carchi 702 and Av. 9 de Octubre
Building:	Salco. 5 th floor
City:	Guayaquil
State/Region:	
Postcode/ZIP:	
Country:	Ecuador
Telephone:	(593 4)2 393918
FAX:	(593 4)2 396112
E-Mail:	hdn-financiero@hidronacion.org
URL:	www.hidronacion.org
Represented by:	
Title:	General Manager
Salutation:	Sr.
Last name:	Punina Lozano
Middle name:	
First name:	Cristobal
Department:	
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Direct FAX:	
Direct tel:	
Personal e-mail:	cpunina@hidronacion.org



Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Parties included in Annex I will be utilized for the implementation of the project activity.

Annex 3

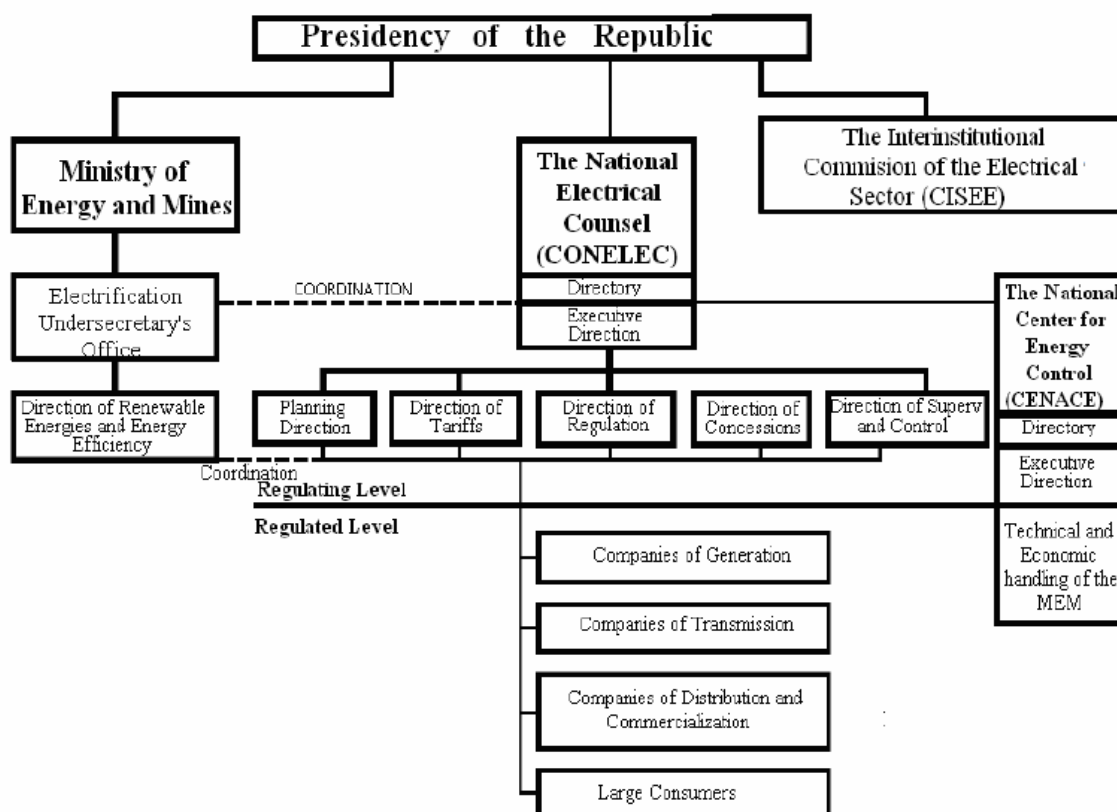
BASELINE INFORMATION

I. THE ELECTRICAL SECTOR IN ECUADOR

a) General Organization and Structure.

The Ecuadorian institutional and regulatory electrical sector frameworks are established by the Electrical Sector Regime Law (LRSE), issued in 1996. The Ecuadorian electrical sector is organized as shown in the following graphic:

General organization and Structure of the Electrical Sector



CONELC is a regulatory, controlling and law making entity through which the State can delegate activities of generation, transmission, distribution, and commercialization of electrical energy to concessionary companies. CONELC is also in charge of the development and implementation of the National Electrification Plan.



Art. 26 of the LRSE, allowed for the generation and transmission installations, previously property of the State, to be transferred to the Solidarity Fund, constituting themselves as corporations and initiating their operation on the 1st day of April, 1999, all this through the actions of the former INECEL.

The generation, transmission and distribution companies of which the Solidarity Fund holds shares can have private sector participation (some distributors already do). Up to 51% of the shares can be transferred to qualified operators, who will run the companies.

The National Centre for Energy Control (CENACE) is a private organization, whose members include all of the generation, transmission, and distribution companies along with the biggest consumers. It contributes to the coordination of the National Interconnected System (SNI) and the management of the technical and financial transactions of the Wholesale Electrical Market (MEM) The Inter-institutional Commission of the Electrical Sector (CISEE), was created by Presidential Decree with the aim of developing electrical sector policies and presents them to the executive for consideration.

B) Policy and Strategy of the Sector.

The Ecuadorian electrical sector is currently undergoing a financial crisis that makes highly unattractive private investment in hydroelectric generation projects. The continuous increase in national demand has lead to an increasing use of fossil fuel sources, since the initial investment is lower for thermal plants than for hydroelectric power plants. Due to this, generation costs have increased and the amount of exportable hydrocarbons has been reduced, while there is an increasing importation of some other fossil fuels.

The National Government in an attempt to stop this critical situation, has undertaken along with various electrical sector institutions, some initiatives oriented towards meeting the country's increasing energy demand and encouraging private investment in generation projects. The principal political and strategic measures to be taken are:

- Creation of the CISEE, this is an inter-institutional electrical sector commission (created through Decreto Ejecutivo No.1176-A, published at Official Register No.251 January 14th 2004) working as a presidential consulting organism, whose mission is the search for solutions to the Ecuadorian electrical sector crisis. CISEE's participants were: Energy Ministry, Economy Ministry, Central Bank, CENACE, CONELEC, Solidarity Found and Transeléctric.
- Encouragement of private investment in the electrical sector: The new CISEE project named "Organic Law of Guarantees to Promote New Electricity Generation", aims to the promotion of private investment in economical and efficient generation projects, to improve the national energy matrix and to assure electricity provision while reducing electrical fares.
- CISEE was replaced by the Executive Comity for the Electric Sector Policy, CEPSE (created through Decreto Ejecutivo N° 711, October 2004, published al Official Register N° 140 November 8th 2005).
- Promotion of economical power generation: In order to satisfy national demand the government is promoting, through CONELEC, the construction of new hydroelectric power plants.



- Extension of Ecuadorian international connections: The enhancement of capacity in the existing interconnection with Colombia, as well as the construction of a new interconnection with Peru, as stated in the National Expansion Plan.
- Encouragement of small hydroelectric projects: The approval of CONELEC Regulation No. 004/04 encourages the development of small hydroelectric power plants (up to 10 MW) in order to cover the national demand.
- Plan for the reduction of electrical losses in distribution companies: This is a complete, global, obligatory, and financed plan for all distribution companies in order to achieve the reduction of energy losses and the improvement of management. The plan has been born from a commission made up of four entities: The National Modernization Advisory Board (CONAM), the Solidarity Fund, the National Center for Energy Control (CENACE) and the Ministry of Energy and Mines.

C) Electrical Sector Statistics.

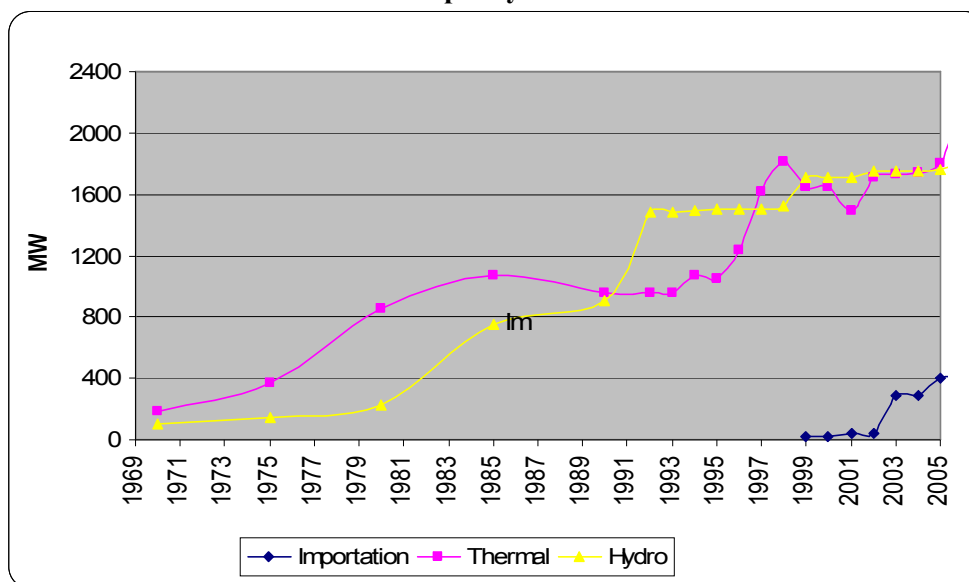
Installed SNI Capacity

The following table shows the SNI installed capacity since 1970, and the percentage of each source type.

Installed SNI Capacity. (MW)

Año	Importation	%	Termal	%	Hydro	%	Total
1970	-	-	186	63.7	106	36.3	292
1975	-	-	368	72.4	140	27.6	508
1980	-	-	856	79.1	226	20.9	1082
1985	-	-	1073	58.8	751	41.2	1824
1990	-	-	958	51.3	911	48.7	1869
1992	-	-	961	39.3	1486	60.7	2447
1993	-	-	960	39.2	1487	60.8	2447
1994	-	-	1069	41.7	1496	58.3	2565
1995	-	-	1046	41.0	1504	59.0	2550
1996	-	-	1235	45.1	1504	54.9	2739
1997	-	-	1619	51.8	1507	48.2	3126
1998	-	-	1818	54.4	1526	45.6	3344
1999	20	0.6	1644	48.8	1707	50.6	3371
2000	20	0.6	1644	48.8	1707	50.6	3371
2001	40	1.2	1493	46.0	1715	52.8	3248
2002	40	1.1	1705	48.8	1746	50.0	3491
2003	290	7.7	1729	45.9	1746	46.4	3765
2004	290	7.7	1738	46.1	1746	46.3	3775
2005	400	10.1	1803	45.4	1764	44.5	3967
2006	400	9.1	2196	49.9	1801	41.0	4397

Source: Statistics of the Ecuadorian Electricity Sector 2006. CONELEC.

Installed SNI Capacity. Period 1970 -2004


Source: Based on information from CONELEC

Electricity generation

Generation 1990 – 2006 (GWh)

Year	Hydro	Steam	Gas	Natural Gas	ICE*	Importation	Total	Self consume	Net
1990	4,986.7	1,191.8	63.5	0.0	106.9	0.0	6,348.9	107.4	6,241.4
1991	5,075.9	1,702.8	78.8	0.0	116.9	0.0	6,974.5	137.7	6,836.7
1992	4,973.6	1,739.7	310.1	0.0	172.7	0.0	7,196.0	133.9	7,062.1
1993	5,810.1	1,346.3	152.6	0.0	102.2	0.0	7,411.3	110.8	7,300.5
1994	6,565.3	1,273.1	182.3	0.0	123.3	0.0	8,144.0	111.2	8,032.8
1995	5,160.6	1,975.1	739.6	0.0	553.3	0.0	8,428.6	146.2	8,282.4
1996	6,343.4	1,734.5	722.0	0.0	540.0	0.0	9,339.9	139.2	9,200.7
1997	6,534.2	2,134.2	606.9	0.0	1,086.5	0.0	10,361.7	158.5	10,203.3
1998	6,506.1	2,296.4	727.1	0.0	1,360.7	0.0	10,890.4	180.6	10,709.7
1999	7,176.7	2,328.7	527.2	0.0	275.5	23.8	10,331.9	196.9	10,135.0
2000	7,611.2	1,162.6	1,512.4	0.0	326.2	0.0	10,612.4	197.6	10,414.9
2001	7,070.7	2,205.7	1,246.6	0.0	526.9	22.2	11,072.0	264.8	10,807.2
2002	7,524.3	2,355.2	1,123.7	374.1	510.3	56.3	11,943.9	287.6	11,656.3
2003	7,180.4	2,476.9	484.6	938.6	465.7	1,119.6	12,665.7	278.1	12,387.6
2004	7,411.7	2,307.4	671.6	1,073.2	1,120.9	1,641.6	14,226.5	232.2	13,994.3
2005	6,882.6	2,905.7	1,239.4	1,030.3	1,345.9	1,723.5	15,127.5	288.5	14,839.0
2006	7,129.5	2,998.8	1,779.0	885.5	2,021.0	1,570.5	16,384.2	456.5	15,927.7

ICE = internal combustion engine

Source: Statistics of the Ecuadorian Electricity Sector 2006. CONELEC.



Energy Losses

Distribution Company Losses (%)

Company	2006	2005	2004	2003	2002	2001	2000	1999	1998
Ambato	14.27	14.33	14.49	13.36	14.75	13.98	13.86	14.51	11.61
Azogues	4.79	5.57	6.4	6.84	7.02	10.02	12.66	9.95	8.74
Bolívar	19.57	18.34	22.32	22.55	23.60	18.94	20.86	24.75	18.39
CATEG-D	27.39	27.46	26.09	25.28	26.14	24.97	24.42	23.88	26.76
Centro Sur	9.25	9.48	8.65	9.23	9.74	11.39	10.33	10.39	9.51
Cotopaxi	12.15	13.44	17.64	17.37	16.62	17.82	18.70	14.08	15.90
El Oro	29.05	30.35	29.75	28.34	25.74	25.68	27.31	22.86	18.61
Esmeraldas	32.2	30.42	29.67	28.72	26.45	27.17	22.14	18.42	15.96
Galápagos	10	7.84	9.09	10.39	11.09	11.35	11.08	11.69	17.60
Guayas-Los Ríos	38.07	38.13	41.15	42.32	40.17	33.96	32.42	27.45	23.09
Los Ríos	29.56	31.15	28.77	29.57	27.05	26.87	22.85	25.87	24.66
Manabí	41.92	40.12	35.83	33.45	29.53	27.55	30.32	28.90	24.65
Milagro	41.88	41.85	40.45	40.24	41.46	40.21	25.37	27.94	26.19
Norte	14.11	14.58	15.86	17.31	17.34	17.34	18.45	15.33	14.56
Quito	11.31	13.14	15.42	15.31	15.16	16.12	16.44	16.63	14.79
Riobamba	19.97	19.6	20.11	19.47	17.38	18.31	16.32	12.77	13.05
Sta. Elena	25.63	31	32.16	29.39	26.32	25.83	22.12	16.98	14.70
Sto. Domingo	17.98	18.97	19.77	20.67	19.22	24.84	23.83	18.94	16.82
Sucumbíos	34.85	38.07	35.81	37.57	35.82	32.53	32.00	28.10	24.54
Sur	13.46	13.86	14.45	14.67	15.22	15.07	17.44	15.68	13.67
Total general	23.39	23.87	23.96	23.47	23.02	22.61	21.99	20.92	20.32

**Distribution Company Losses . (%) (continuation)**

Company	1997	1996	1995	1994	1993	1992	1991	1990	Maximum
Ambato	13.09	12.88	12.69	17.37	17.66	17.22	18.34	20.07	17.37
Azogues	8.30	9.27	10.95	12.16	13.68	15.25	22.81	24.74	12.66
Bolívar	20.81	26.96	15.40	24.62	29.78	9.57	9.28	9.80	26.96
CATEG-D	26.29	24.13	22.67	23.43	25.95	24.41	22.84	21.30	27.46
Centro Sur	9.60	11.03	10.29	11.43	12.93	12.31	13.40	14.14	11.43
Cotopaxi	16.74	17.05	15.00	18.59	18.03	14.00	17.44	19.90	18.70
El Oro	20.28	18.23	20.05	21.07	21.69	18.49	21.86	18.93	30.35
Esmeraldas	19.10	19.48	21.40	20.77	25.13	26.28	23.17	30.32	32.20
Galápagos	17.10	17.01	13.60	13.32	13.09	13.11	17.10	17.10	17.60
Guayas-Los Ríos	20.13	17.42	18.93	22.02	20.24	19.60	20.11	17.86	42.32
Los Ríos	25.68	24.65	24.88	24.64	25.48	23.37	24.31	26.12	31.15
Manabí	29.63	27.43	28.85	27.70	21.56	21.40	20.00	24.74	41.92
Milagro	25.69	24.72	21.73	24.47	25.14	22.54	29.99	23.74	41.88
Norte	12.83	13.88	14.30	17.36	13.64	13.62	15.34	18.36	18.45
Quito	13.43	15.00	15.42	18.27	15.54	14.71	17.28	18.16	18.27
Riobamba	13.91	15.05	17.73	17.94	24.39	17.03	16.71	17.45	20.11
Sta. Elena	12.23	12.88	15.02	19.48	25.00	22.96	22.67	25.11	32.16
Sto. Domingo	13.58	15.74	17.73	19.61	19.41	19.26	17.38	19.57	24.84
Sucumbíos	27.28	33.16	33.80	29.07	18.69	30.11	43.42	49.02	38.07
Sur	15.17	15.70	13.81	17.86	18.39	17.91	20.20	19.60	17.86
Total general	20.22	19.52	19.40	20.97	21.09	19.75	20.28	20.34	23.96

**II. DETERMINATION OF GRID EMISSION FACTOR****a) Required information**

A summary of the information sources of the variables and parameters used for the calculation of the Baseline Emission Factor is shown below.

Variable	Unit	Source
Name	-	CONELEC*
Fuel Consumption by power plant	Fuel Oil, Diesel y Nafta = Galons (Gal) Natural Gas = (Mft3)	CONELEC (Annual Statistics)
Electrical Generation	MWh/year	CONELEC(Annual generation) and CENACE (hourly generation)
Fuel Characteristics (density, VNC, carbon content, etc)	ton/m ³ TJ/10 ³ ton ³ tC/TJ etc.	IPCC**
Function, Role	Generator Distributor Self-producer	CONELEC

* National Electricity Council (<http://www.conelec.gov.ec/>)

** Intergovernmental Panel on Climate Change (www.ipcc.ch)

b) Procedure to determine the EF of the SNI (Combined Margin - CM)**Build Margin**

To determine the most adapted option for the group *m* of power units, the criteria used in Tool to calculate the emission factor for an electricity system v.1 indicates that the participants of the project activity must choose for the group that includes the major annual generation of electricity. In this sense:

a) The five power units that have been built most recently,
= 237,924.29 MWh

b) The power units capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently
= 3,299,105.19 MWh



Project participants should use from these two options that sample group that comprises the larger annual generation, in this case that is option b).

Power Plant	Start operation	Generation (MWh)	Accumulated Generation (MWh)	Percentage (%)
Termoguayas	december-06	71,571.04	71,571.04	0.54%
Generoca	december -06	4,589.07	76,160.11	0.58%
La Esperanza	november-06	4,019.31	80,179.42	0.61%
Ecudos A-G	june-06	77,676.37	157,855.79	1.20%
Selva Alegre	february-06	80,068.50	237,924.29	1.80%
Lucega	july-05	-	237,924.29	1.80%
Ecoelectric	June-05	25,988.48	263,912.77	2.00%
Sillunchi I	2004	593.91	264,506.68	2.00%
Sillunchi II	2004	2,113.97	266,620.65	2.02%
Celso Castellanos	2004	-	266,620.65	2.02%
Jivino	2004	-	266,620.65	2.02%
Payamino	2004	-	266,620.65	2.02%
Enrique García (Pascuales) re-op. *	february -04	363,933.70	630,554.35	4.78%
Power Barge I	september-03	40,330.22	670,884.57	5.08%
Bajo Alto 1 (Machala Power)	september -02	885,448.20	1,556,332.77	11.79%
HCJB Loreto	june-02	12,564.16	1,568,896.93	11.89%
El Carmen	april-00	43,878.73	1,612,775.66	12.22%
Victoria II	Agugust-99	426,095.20	2,038,870.86	15.45%
Marcel Laniado	april-99	496,490.49	2,535,361.35	19.21%

The fuel consumption for the group (m) of selected power units is:

Fuel Type	Unit	Value
Fuel Oil	Gl	56,188,885
Diesel	Gl	39,912,566
Nafta	Gl	34,439,503
NG	M ft ³	9,891,927
Crude oil	Gl	-
Others	Gl	4,568,034



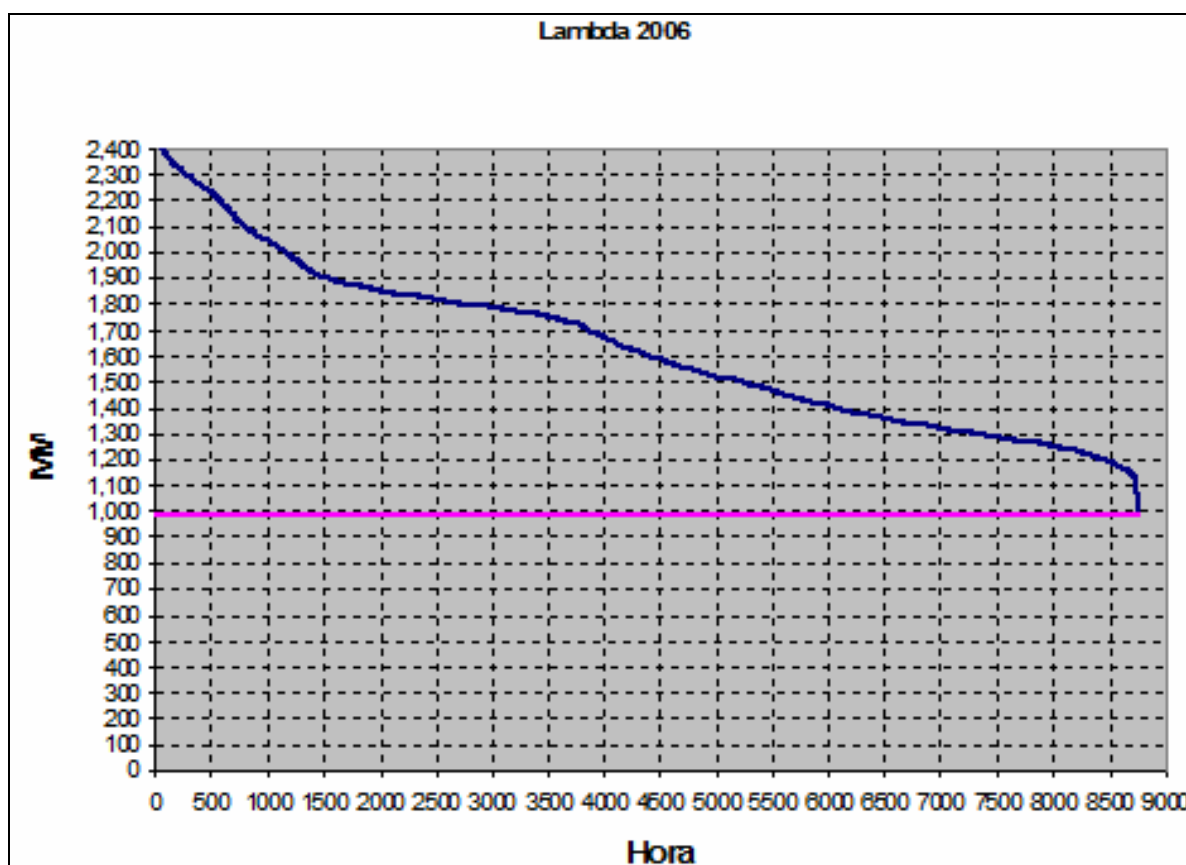
Operating Margin

The Simple Adjusted Method implies the following calculation for the prior 3 year previous to the presentation of the PDD.

Data 2006

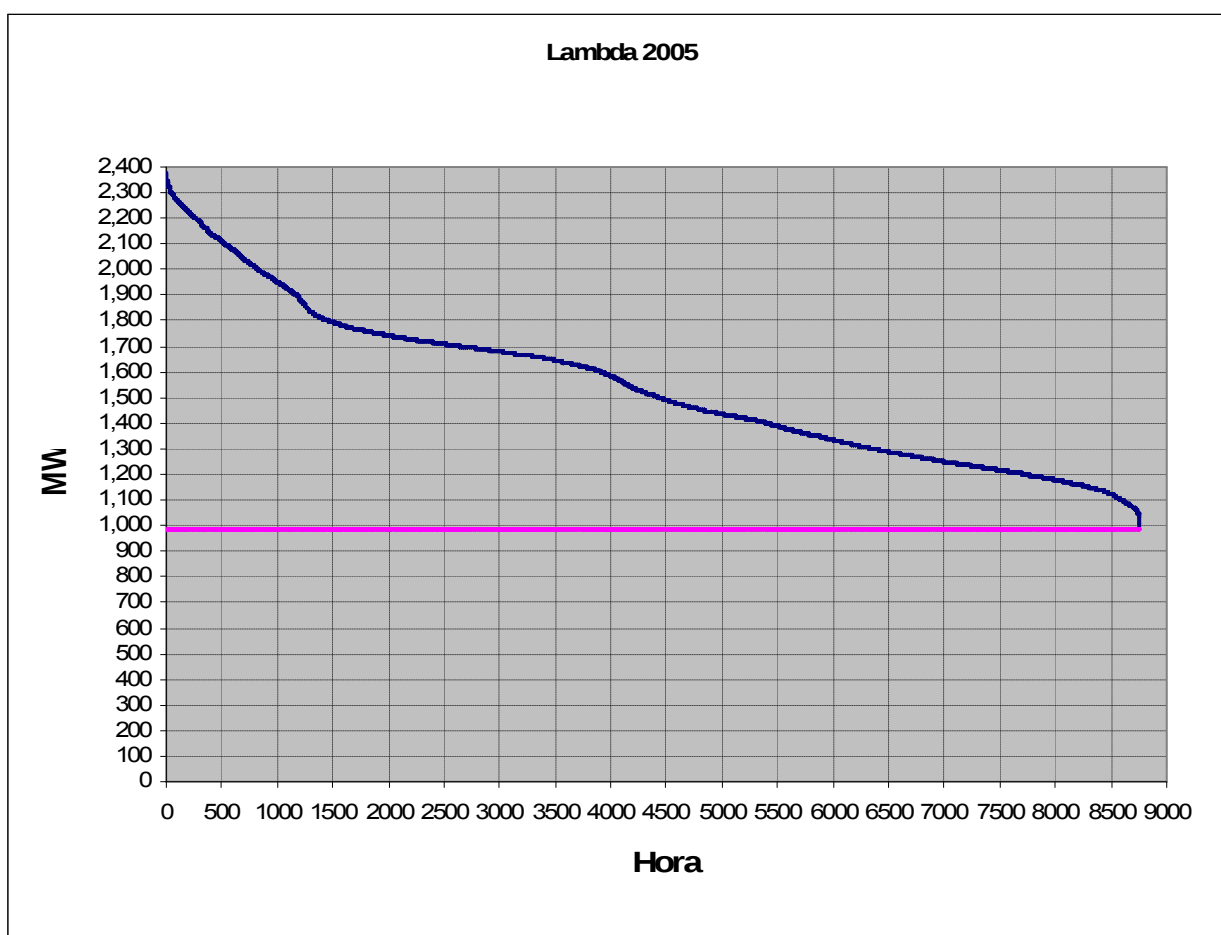
Lambda 2006

$$\begin{array}{rcl} \lambda & = & 0.00011416 \\ 1-\lambda & = & 0.99988584 \end{array}$$



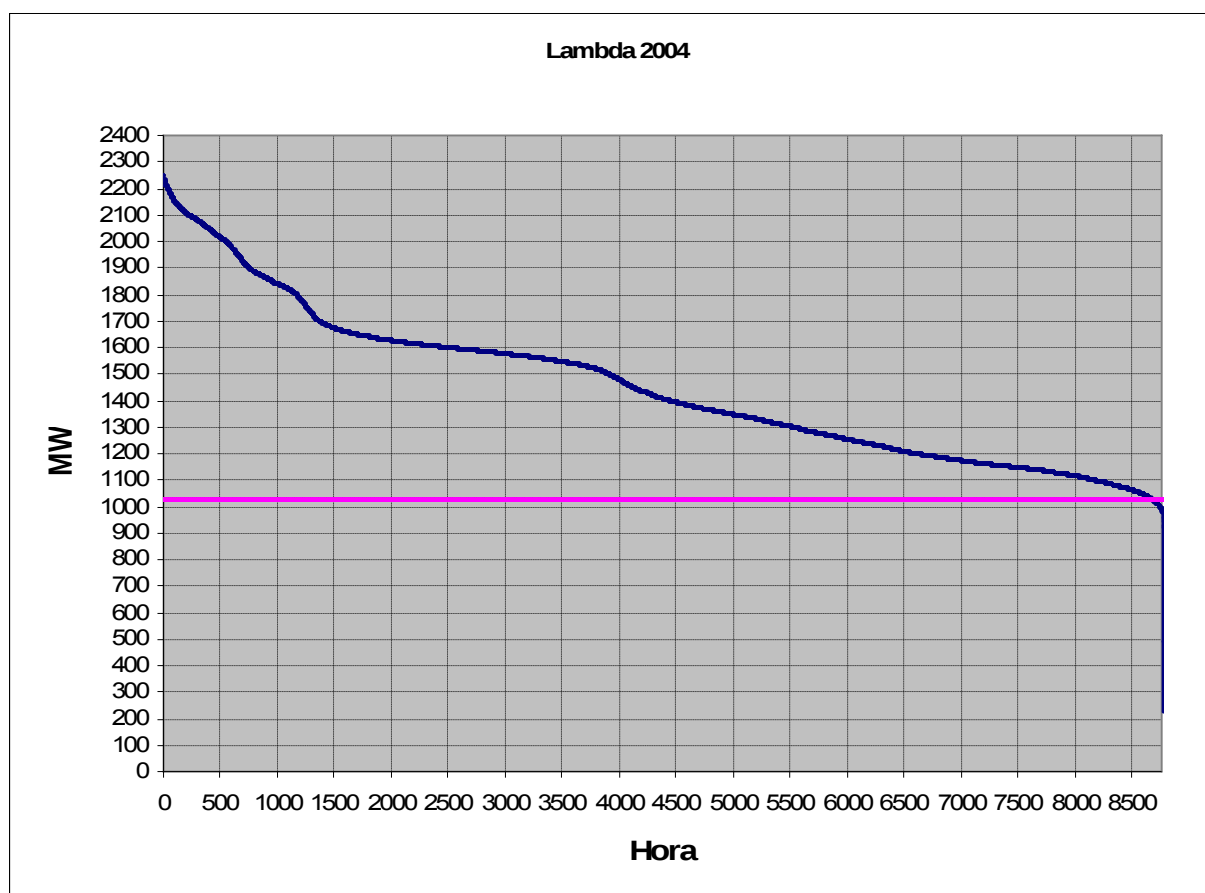
Data 2005**Lambda 2005**

$$\begin{aligned} \lambda &= 0.00022831 \\ 1-\lambda &= 0.99977169 \end{aligned}$$



Data 2004**Lambda 2004**

$$\begin{aligned} \lambda &= 0.01320583 \\ 1-\lambda &= 0.98679417 \end{aligned}$$

**EF SNI (Combined Margin)**

The Emission Factor for the SIC is:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot xw_{OM} + EF_{grid,BM,y} \cdot xw_{BM} = \underline{\underline{0.62678 \text{ t CO}_2 / \text{MWh}}}$$



Annex 4

MONITORING INFORMATION

Management of Project Registration, Monitoring, Measurement and Reporting

The Project Developer's Head Office will have final responsibility for all aspects related to data measurements, monitoring of data recording and emissions and will sign off all reports on monitoring.

Data will be collected and consolidated by the On-site Technician and Operations Manager. The last one will also draw up the monthly and annual emission reduction monitoring reports.

Monitoring itself will be integrated as far as possible into existing plant operating procedures. The bulk of data required for the monitoring of the emission reductions will come from data already collected as part of the plant's operations.

Data will be recorded at regular intervals. The actual measured data will be entered into a "ER Spreadsheet" (or informatics program) to calculate the emission reductions for the period.

Paper documentation will be collected in a central place, together with this monitoring plan. In order to facilitate auditor's reference, monitoring results should be indexed. All paper-based information will be stored and kept at least one copy.

The data monitored and required for verification and issuance are to be kept at least for two years after the end of the crediting period or the last issuance of CERs for this proposed project activity, whatever occurs later.

Training of Monitoring Personnel

All people that participate in the monitoring process for the CDM project will be suitably qualified and trained in the operation and maintenance of the plant. The training for operating and maintaining the plant may be provided by the supplier of electro-mechanical and hydro-mechanical equipment as part of the contract terms with the equipment suppliers or have especial training under the guidance of the project developer.. They will also receive appropriate training in the CDM monitoring requirements, which will include an overview of the CDM and all elements of the monitoring plan in detail. A copy of the project monitoring plan will be distributed to all the people involved and an additional copy will be easily accessible at appropriate locations on site.

Calibration of monitoring equipment

The calibration of metering equipment will be performed following national legislation or guidance of the manufacturer in case the first one does not exist.

**Monitoring data adjustment procedures**

Data will be consolidated on a monthly basis where the data will be checked for quality control purposes with official reports or statistics. If there are discrepancies in the data, the source of the variation will be identified, be it the main measured value or the control value.

When reviewing the information and the emission reductions reports the Project developer's head office will examine the report for data anomalies and compare the report with previous ones for consistency.

If any discrepancies are found they will be investigated and corrected. The discrepancies and corrective actions will be recorded in an appendix to the relevant report. If the corrective actions result in any adjustments to monitoring data then the relevant report will be revised.

Emission Reductions

Emission reductions will be calculated on a daily basis using the project and baseline emission data. Emission reductions occurring as a result of the project activity will be summarized in a trimester report that will be prepared by the Operations manager.

Updating the Baseline Emission Factor

The baseline emission factor will be updated at the end of each crediting period. The baseline emission factor will be calculated in accordance with Tool to calculate the emission factor for an electricity system. A report summarizing this information will be prepared at the end of each crediting period by Operations manager. The report will be submitted to the Project developer's head office.

Data and reports review procedures

Data will be reviewed by the Operation Manager and signed off on a trimester basis.

Internal GHG audit procedures

There are no requirements for internal audits of GHG project compliance with the plants operational requirements.

Operational procedures and responsibilities for monitoring and quality assurance of emissions reductions from the project activity are presented in the next table:



Task	On-site technician	Operations manager	Project developer's head office	Head of Maintenance / External company
Collect Data	E	E/R	N/A	N/A
Enter data into Spreadsheet/system	N/A	E	R	N/A
Make trimester and annual reports	N/A	E	R	N/A
Archive data & reports	N/A	E	E	N/A
Calibration / Maintenance	I	R	I	E

(E = responsible for executing the task, R = responsible for overseeing and assuring quality, I = to be informed)