VALIDATION REPORT OF

RIO AMOYÁ RUN-OF-RIVER HYDRO PROJECT

ISAGEN S.A. E.S.P

(COLOMBIA)

International Bank for Reconstruction and Development (IBRD) as the trustee of the Netherlands Clean Development Mechanism Fund (NCDMF)

(The Netherlands)

REPORT N°

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Approved by:	*Internal Technical reviewer of ICONTEC*	*Organizational unit:*	*Instituto Colombiano de Normas Técnicas y Certificación – ICONTEC* *Carrera 37 52-95* *Bogotá - Colombia*
Client:	ISAGEN S.A. E.S.P. Carrera 43A No 11 A 80 Medellín, Antioquia Colombia	*Client ref.:*	*Val 07*

Summary:

ICONTEC has performed the validation of the project: "Rio Amoyá Run-of-River Hydro Project" in Colombia on the basis of UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and the subsequent decisions by the CDM Executive Board. This validation report summarizes the findings of the validation.

Rio Amoyá Run-of-River Hydro Project is a large run-of-river renewable hydroelectric plant with a total nominal capacity of 80 MW, located at the left margin of the Amoyá River in the municipality of Chaparral, Department of Tolima, Colombia. The energy generated will be sold to the National Interconnected System of Colombia.

The proposed project activity under validation process is Type I: Renewable Energy Projects. Consolidated baseline methodology for grid connected electricity generation projects (ACM0002 – version 12.1.0).

The validation consisted of the following five phases: i) a desk review of the project design document, ii), On-site visit iii) follow up interviews with the owner of the project and stakeholders iv) request to the project responsible for clarification or further explanations on some specific aspects and the resolution of outstanding issues and the issuance of the final validation report and opinion. As a part of the validation and before the desk review phase, the PDD of the project activity was made publicly available in UNFCCC webpage.

ICONTEC has performed a validation of the "Rio Amoyá Run-of-River Hydro Project". The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting. The validation report has been updated following the request from the UNFCCC Secretariat to fulfill the requirements identified during the information checklist process.

In summary, it is ICONTEC's opinion that the project "Rio Amoyá Run-of-River Hydro Project", as described in the version 5 of the Project Design Document, meets all relevant UNFCCC requirements for CDM and all relevant host country criteria, and correctly applies the baseline and monitoring methodology. Hence, ICONTEC requests the registration of the project as CDM project activity.

ICONTEC INTERNATIONAL	VALIDATION REPORT	

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Report title: Validation report of Rio Amoyá Run-of-River Hydro Project				Climate Change; Kyoto Protocol; Validation; Clean Development Mechanism; Renewable electricity generation

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This report should not be read without reference to the annexed Validation Protocol.

Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CERs	Certified emission reductions
CLA	Clarification Request
CO_2	Carbon Dioxide
CO_2eq	Carbon dioxide equivalent
CORTOLIMA	Regional Environmental Authority
CREG	Comisión de Regulación de Energía y Gas (Regulatory entity of energy sector in Colombia)
DNA	Designated National Authority
DOE	Designated Operational Entity
DR	Desk Review
EE	Energy Sectoral Expert
GHG	Greenhouse Gases
I	Interview
ICONTEC	Colombian Institute of Technical Standards and Certification (Instituto Colombiano de Normas Técnicas y Certificación)
IPCC	Intergovernmental Panel on Climate Change
ISAGEN S.A. E.S.P.	Project participant and owner of the project activity.
MoV	Means of verification
MP	Monitoring Plan
NEON	It is an information service about the Colombian Wholesale Power Market that allows the market agents to obtain, in an interactive way, information of the operational process and the results of the liquidation of the transactions done in the Power Block Market.
PDD	Project Design Document
UNFCCC	United Nations Framework Convention for Climate Change
UPME	Unidad de Planeación Minero-energética (Ministry of Mines and Energy - Energy planning Unit).
XM	"XM" (Experts Market) is a company of the ISA Group providing integral services. (www.xm.com.co).
International Bank for Reconstruction and Development (IBRD) as the trustee of the Netherlands Clean Development Mechanism Fund (NCDMF)	Project participant.

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1. INTRODUCTION

ISAGEN S.A. E.S.P. and International Bank for Reconstruction and Development (IBRD) as the trustee of the Netherlands Clean Development Mechanism Fund (NCDMF) have commissioned ICONTEC to perform the validation of its CDM project: “Rio Amoyá Run-of-River Hydro Project”.

This report summarizes the findings of the validation of the project, which was performed on the basis of UNFCCC criteria for CDM projects, as well as criteria given to provide for consistent project operations, monitoring and reporting.

According to specific CDM documentation of the project, it consists of the construction of a run of river hydroelectric plant to generate electricity for delivering to the grid.

The nominal capacity of the proposed Rio Amoyá Run-of-River Hydro Project is 80 MW, with a projected yearly average generation to the national grid of 513.6 GWh per year. The project expects to reduce 176,643 tonnesCO2e per year in a 7 years crediting period.

1.1 OBJECTIVE

According to CDM Modalities and Procedures (Decision 17/CP7) the purpose of a validation is to have an independent third party to assess the project design. In particular, the project's baseline, monitoring plan, and the project’s compliance with relevant UNFCCC and host Party’s criteria that are validated in order to confirm that the project design, as documented, is sound and reasonable and meets the identified criteria. Validation is a requirement for all CDM projects and is seen as necessary step to provide assurance to stakeholders of the quality of the project and the intended generation of certified emission reductions generation (CERs).

1.2 SCOPE

The validation scope involves an independent and objective revision to determine that the project design meets the following criteria:

- the UNFCCC criteria: The Kyoto Protocol Article 12 criteria, the modalities and procedures for CDM (Marrakech Accords) and the relevant decisions by the CDM Executive Board, and
- Host Party criteria: National CDM requirements, including sustainable development priorities, and potential specific requirements contained in, for example, the preliminary approval by the Designated National Authority or project agreements between the involved parties.

ICONTEC based on its ethics code and internal procedures for carrying out validation, verification and certification audits of CDM project activities (which, in turn, are based on the Validation and Verification Manual of EB-UNFCCC) focused on the identification of significant risks for CERs generation, and verification of the mitigation.

The validation does not mean to provide any consulting to the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

1.3 CDM PROJECT DESCRIPTION

Project Parties	:	ISAGEN S.A. E.S.P. (Colombia – Host Country) International Bank for Reconstruction and Development (IBRD) as the trustee of the Netherlands Clean Development Mechanism Fund (NCDMF) (The Netherlands)
Title of project activity	:	Rio Amoyá Run-of-River Hydro Project
Project Entity	:	ISAGEN S.A. E.S.P. Carrera 43A No 11 A 80 Medellín, Antioquia Colombia
Location of the project activity	:	Municipality of Chaparral Department of Tolima Colombia. Coordinates: GPS are: -75º 35´35´´ W and 3º 48´22´´ N
Methodology	:	The ACM0002-version 12.1.0 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” is chosen as the most relevant to the project activity.
Project’s crediting period	:	7 years
Estimated amount of emission reductions over the chosen crediting period:		1,236,499 tonnes CO_2-eq

ICONTEC verified that Rio Amoyá Run-of-River Hydro Project is a run-of-river renewable large hydroelectric plant with a total nominal capacity of 80 MW, located at the left margin of the Amoyá River in the municipality of Chaparral, Department of Tolima. The energy generated will be sold to the National Interconnected System of Colombia.

The project activity contemplates the production of clean hydroelectric power using a flow of water. Two Pelton turbines and other ancillary facilities will be installed underground, along one side of the river, thus minimizing impacts on the landscape. A weir will be located at 1,484 m above the sea level. The water will then be conducted through an 8.6 km long intake tunnel, running along the southern side of the river, to reach an underground power house. Most civil works will be located underground. Pelton turbines with vertical axis and a rated capacity of 40 MW each (to efficiently utilize the energy potential of the river) will be used to generate power from the kinetic energy of the fast flowing stream and the potential energy between entry and exit points of the tunnel.

The power plant is connected to the grid in the Tuluní substation located to 18.6 km at the end of the 115 kV transmission line connecting Amoyá River plant.

The project will generate electricity for the Colombian power grid with low emissions technology. The power plant will have a total nominal capacity of 80 MW, with a predicted power supply to the grid of 513.6 GWh per year. Thus, the project will increase the supply of electricity to the grid, offsetting thermal generation with a renewable source of energy, and consequently reducing greenhouse gases emissions. The project is expected to reduce 176,643 tonnes CO2e per year.

The project is being implemented by ISAGEN S.A. E.S.P, a public services company of assuming the electric energy generation, transmission, distribution and trading functions.

2. VALIDATION METHODOLOGY

The validation consists of the following four phases after to make public available the PDD:

i) A desk review of the project design documents
ii) On-site Assessment
iii) Follow up interviews with project stakeholders
iv) The resolution of outstanding issues and the issuance of the final validation report and opinion.

As mentioned in clause 1.2 of this report ICONTEC, based on its ethics code and internal procedures, carries out validation, verification and certification audits of CDM project activities (which, in turn, are based on the Validation and Verification Manual of EB-UNFCCC) focused on the identification of significant risks for CER generation, and verification of the mitigation.

These internal procedures define the validation protocol which consists of tables that are described in Annex A “Validation protocol tables”.

The validation protocol resulting from the Validation of Rio Amoyá Run-of-River Hydro Project is enclosed in Annex A of this report.

Findings established during the validation can be seen as:

- a non-fulfillment of validation protocol criteria, or
- an identified risk to the fulfillment of the project objectives

The findings could take the form of a Corrective Action Request (CAR), Forward action request (FAR) or a Clarifications Request (CLA).

Corrective action requests (CAR) are issued, where:

i) the project participants have made mistakes which directly will influence the ability of the project activity to achieve real, measurable and additional emission reductions;
ii) the CDM requirements have not been met; or
iii) there is a risk that emission reductions cannot be monitored or calculated

A Forward Action Request is made to highlight issues related to project implementation that will require review during the next verification of the project activity.

A Clarification is required where information is insufficient, or not clear enough to establish whether a requirement is met.

2.1 REVIEW OF DOCUMENTS

The PDD submitted by ISAGEN S.A. E.S.P. and the additional background documents related to the project design and baseline were assessed during the validation. Three versions of PDD were successively submitted by the project participant along the process, reacting to clarifications, corrective and forwards actions request of the DOE.

Main documents reviewed were:

- PDD, Version 1, PDD Version 3, PDD Version 4 and PDD version 5.
- Financial project assessment for the project activity (Additionality assessment)
- Emissions reduction calculations
- Maintenance records and procedures for monitoring equipment
- Quality assurance procedures
- Analysis of the related environmental impacts (Environmental impacts assessment)
- Letter approving the project issued by the Designated National Authority (Colombian and The Netherlands)
- Letter confirming the voluntary participation of the parties
- Records on the early identification and considerations of the project as a CDM activity
- Comments of the interested parties received up to date and how these has been treated
- Records of the meeting to inform local stakeholders about the project activity
- Information from electrical generation companies and the electrical interconnected grid
- Single line diagram of the distribution grids in the project area

2.2 FOLLOW UP INTERVIEWS

ICONTEC performed interviews with project stakeholders to confirm the selected information and to resolve issues identified during the desk review. The main topics of the interview are summarized in the Table 1.

Table 1. Follow up Interview

Date	Place	Interview delegate	Organization	Interview topics
09 12 2009	Amoya River on-site location	Luis Posada Director of Development projects ISAGEN Carlos Mauricio Mesa Director of Amoya River project ISAGEN Mauricio González Chief Environmental planning ISAGEN Carlos Andrés Pérez Project Analyst ISAGEN Jorge Benitez Project Analyst ISAGEN María Andréa Patiño Environmental Project Analyst ISAGEN David Sánchez Environmental Project Analyst ISAGEN Olga Lucia Posada Social Worker Professional ISAGEN Isabel Velázco Project Engineer ISAGEN Nestor Montoya Director of Supervision SEDIC Diana Campo Social Worker Professional SEDIC Carlos Vargas Environmental Resident SEDIC Lina Jaramillo Environmental Engineer SEDIC Juan Andrés López World Bank Specialist Manuel Luengo World Bank Deal Manager	ISAGEN S.A. SEDIC Ltda	Further clarification on: - On-site visit of the project - Control of the environmental impacts - Development of construction in different locations - Mitigation actions
10 12 2009	Rio Amoyá project on-site location	Jorge García Asohermosas José Torres Asohermosas Luis Sánchez Asohermosas	Asohermosas Community members	Social benefits of the project Expectations on other benefits of the project (example: improvements in economical conditions, new opportunities of employ)

		José Sánchez Asohermosas		
10 12 2009	Cortolima Office´s Environmental Regional Authority. Ibague (Department of Tolima)	Olga Lucia Oviedo Lowyer Cortolima Fernando Rodríguez Professional Cortolima Octavio Salazar Generation Specialist Cortolima	Cortolima Office´s Ibague - Tolima	Further clarification on: - Environmental aspects of the project - Legal requirements of the CDM project activity
11 12 2009	ISAGEN S.A. E.S.P. Office´s Medellín (Department of Antioquia)	Luis Posada Director of Development projects ISAGEN Carlos Mauricio Mesa Director of Amoya River project ISAGEN María Andréa Patiño Environmental Project Analyst ISAGEN David Sánchez Environmental Project Analyst ISAGEN Mónica Pedraza Asurance Coordinator Hernán Palacios Equipment Coordinator William López Dispach Coordinator William Amador Transaction Specialist Juan Carlos Morales Transaction Specialist Miguel González Planning Analyst María Luz Pérez Manager of Generation Projects	ISAGEN S.A. E.S.P.	Further clarification on : - Establishment of the baseline, monitoring plan, and emission reduction calculation. - Comments of the interested parties received up to date and how these have been treated. - Environmental aspects of the project - Social benefits of the project. - Responsibility, authority and procedures for monitoring, measuring and reporting data. - Cross checking strategy to verify measurements of energy delivered to the grid - Establishment and applicability of the monitoring plan. - Training needs - Project design engineering facilities. - Technical and Operational issues of the plant - Social benefits of the project. - Operation procedures. - Corrective action plans for the CLA´s, CAR´s and FAR´s.
14 12 2009	Ministry of Environment of Colombia Climate Change Team (DNA)	Sandra Garavito Sectorial Energy Expert	Ministry of Environment office	Issues related to: - No objection letter to the project - Process of National Approval (register) of the project (Contribution to Sustainable Development) and voluntary participation of the parties.

2.3 RESOLUTION OF FORWARD, CLARIFICATION AND CORRECTIVE ACTION REQUESTS

Corrective action and clarification requests raised by ICONTEC, presented to the project participants were resolved through communication and meetings between ISAGEN S.A. E.S.P. and ICONTEC. To guarantee the transparency of the validation process, the concerns raised and the response provided by the project participants are documented in more detail in the validation protocol in Annex A.
Since modifications to the project design document were necessary to resolve ICONTEC´s concerns, the client decided to review the PDD and re-submit corrected versions of the PDD. After

the period of public consultation and after reviewing the last version of the PDD (version 05), ICONTEC issued this validation report and opinion.

2.4 INTERNAL QUALITY CONTROL

This report that includes the validation findings underwent a technical review before being submitted to the project participants.

The technical review and the quality control of the process was performed by an internal technical reviewer in accordance with ICONTEC internal procedures for carrying out validation, verification and certification audits of CDM project activities. The technical reviewers are qualified in accordance with ICONTEC qualification scheme for CDM validation and verification.

2.5 VALIDATION TEAM

The validation team consists of the following personnel:

Table 2. Validation team

ROLE/QUALIFICATION	LAST NAME	FIRST NAME	COUNTRY
Lead Auditor	Gracia	Juan Alberto	Colombia
Sectoral Energy Expert	Gómez	Fernando	Colombia

The validation team is qualified in accordance with ICONTEC qualification scheme for CDM validation and verification services.

3 VALIDATION FINDINGS

3.1 OVERVIEW

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of verification and the results from validating the identified criteria are documented in more detail in the validation protocol in Annex A.

3.2 PARTICIPATION REQUIREMENTS

The project activity is proposed by ISAGEN S.A. E.S.P. which is also the project owner. The host country is Colombia.

By CAR 1 the project responsible were asked to define more concisely the institutional arrangements for the implementation of the project. In the last version of the PDD a better explanation was given. The Ministry of Environment, Housing and Territorial Development as a DNA issued in 27-04-2004 the letter of approval to the project to be known as "Amoya River Environmental Services." After the name change by the Ministry of Environment endorsed the project with the new name "Rio Amoyá Run-of-River Hydro Project" in 20-10-2008. Colombia

meets all participation requirements, and the Designated National Authority (Climate Change Mitigation Group of the Ministry of Environment, Housing and Territorial Developing) has approved the project with a letter of approval dated October 20, 2008 and has provided confirmation that the project contributes to the country in the search of sustainable development (Resolution 551 of 2009). According with the LoA of Colombian DNA the name of the project activity is “Rio Amoyá Run-of-River Hydro Project” (CLA 1).

The host country meets all participation requirements, and the Designated National Authority of the host country has approved the project with the letter of approval describing as follows:

Table 3. Approval letter

Date of issue:	*27-04-2004 and 20-10-2008 (Colombian DNA)* *01-03-2010 (Netherlands DNA)*			
Description:	It provides confirmation that the project contributes to the country in the search of sustainable development.			
Supporting documentation (if it is applicable)	According with Resolution 551 of 2009 of Ministry of Environment of Colombia NL-100-08-0 Netherlands CDM purchase programme			
Date of ICONTEC reception	*14-12-2009 (Colombian DNA)* *02-05-2010 (Netherlands DNA)*			
Entity that sent the letter to ICONTEC	*Project participants*		*Directly from the DNA*	
			X	
Means of validation employed to assess the authenticity	Copies of the letters were received during the interview with Ms. Sandra Garavito who is a Sectorial Energy Expert of the Ministry of Environment, Housing and Territorial Developing. Copies of the letters were received by email from Netherlands DNA.			
Additional specification (if it is applicable)		*YES*	*NO*	*version number*[1]
	PDD	*X*		*01*
ICONTEC Conclusion	All parties involved have approved the project activity. The letters is authentic and valid for the proposed CDM project activity under validation. It confirms and it is unconditional with respect to: (a) The Party is a Party to the Kyoto Protocol; (b) Participation is voluntary; (c) In the case of the host Party, the proposed CDM project activity contributes to the sustainable development of the country;			

[1] This version is the same submitted for registration

	(d) It refers to the precise proposed CDM project activity title in the PDD being submitted for registration.

3.3 PROJECT DESIGN

ICONTEC has been capable of validating that the project has been designed according to the characteristics indicated and the equipments that were specified are being purchased for their installation as follows:

The Rio Amoyá Run-of-River Hydro Project is based on the construction of a new run-of-river power plant that will be integrated to the National Interconnected System of Colombia.

In the power house there will be two Pelton turbines (hydraulic reactor turbine in which the flow exits the turbine blades in a radial direction) connected to a synchronous generator with capacity up to 40 MW each one. The technical characteristics of the major equipment are presented in the following table.

Pelton Turbines specifications		
Vertical axis (2)	40	MW
Valves (2)	1.10 m D	Meters
Synchronic generator (2)	43.33	M V A
	13.8 nominal	kV
Load bridge	800	kN
Transformers (2)	13.8/115	kV
Sub-station	115	kV

Status of the implementation

The construction started on 16-06-2008 and is now anticipated to be completed by 07- 2011. Overall progress in construction is close to 42% as of 11-2009.

In the initial version of the PDD data of power and annual generation were 80 MW and 510 GWh/year. CLA 1 was raised to ask explanations about models and criteria under which these figures were defined. In the final version of the PDD corresponding engineering studies, made in 1998 and 2005, were related. As a result of the revision, the annual energy was corrected to 513.6 GWh/year and on this basis the ex-ante estimation of emission reductions was made

3.4 BASELINE DETERMINATION

The DOE verified the data and parameters described in: “B.6.2. Data and parameters that are available at validation” of the PDD. For every Data/Parameter indicated, ICONTEC analyzed the original content under each heading.

- Data unit
- Description
- Source of data used
- Value applied
- Justification of the choice of data or description of measurement methods and procedures actually applied
- Any comment

CLA 5 was raised due to inconsistencies in Table B.6.2 related to $EG_{PJ,h}$ (Net electricity supplied to the grid by the project activity) definitions. Corrections were made by the project responsible in the last version of the PDD. Other changes in Table B.6.2 were made reflecting the final methods and options adopted to baseline determination.

The ACM0002 version 12.1.0 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” was chosen as the most relevant to the project activity. This methodology, as applied in this project activity, also refers to the latest approved version of the following Tools: (i) the Tool to calculate the emission factor for an electricity system (version 02), and (ii) the tool for the demonstration and assessment of additionality (version 05.2). CLA 2 was raised to ask for clarification about version of the “Tool used to calculate the emission factor”, since different versions were mentioned along the PDD. Version 02 was finally adopted.

As it was verified by ICONTEC (via desk review, investigation of additional sources, follow up interviews and during the on site visit), the project complies with the eligibility criteria of this methodology because:

- The proposed project activity involves the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield run-of-river power plant without reservoir).

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

- The project comprises a renewable energy generation plant (hydroelectric) that supply electricity and displace electricity from an electricity distribution system that would have been supplied by some fossil fuels fired in thermal generation units (mainly coal and natural gas in the Colombian Interconnected System.).

- The project does not involve combined heat and power (co-generation) systems

Baseline Scenario

In accordance with the methodology, for this type of project the baseline scenario is the electricity

delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" Version 02.

Baseline emissions determination

According to ACM0002 version 12.1.0, baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,Y} * EF_{grid,CM,y}$$

Where,

BE_y: Baseline emissions in year "y" (tCO_2e)
EG_{PJy}: Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid, CM,y}$: 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 v.02"* (tCO_2e/MWh) in year "y"

Combined margin CO2 emission factor calculations

Methods and options presented in the PDD -Version 1- for combined margin emission factor calculations, were changed by Project responsible along the Validation procedure: Method to determine the Operating Margin was changed from "Dispatch data analysis OM" to "Simple adjusted OM" and ex-ante option for data vintage was selected; Vintage of data to determine Build Margin was changed from Option 2 to Option 1. This section of the Validation Report is referred to methods and options, as registered in the final version of the PDD. Some CAR's and CLA's were raised by the DOE relative to the application of the six steps of the Tool, and respective responses were produced by project participant, as referred in the following:

***Step 1**. Identify the relevant electricity system*

The project will provide electricity to the national grid.

In the *Project boundary* presentation, it is clear that Colombian national grid satisfies the conditions for the relevant electricity system as claimed by the tool

***Step 2:** Choose whether to include off-grid power plants in the project electricity system (optional)*

Project participant has decided to include only grid power plants in the project electricity system and hence chosen Option 1.

***Step 3**. Select a method to determine the operating margin (OM)*

The calculation of the operating margin emission factor ($EF_{grid,\ OM,y}$) is based on the simple adjusted OM. Vintage data will be ex-ante.

The initial choice to determine the Operating Margin was the "Dispatch data analysis OM" method, method c). Nevertheless, in the final version of PDD, method b), "Simple adjusted OM" was selected. On this concern, the DOE verified that in the Colombian Interconnected System low-cost/must run resources constitute more than 50% of total grid generation on a long term average bases, so that method (b) is a valid one. Besides that, the DOE verified that data required to apply this method are available in data bases of the energy market operation in Colombia. Regarding data vintage, ex-ante option was chosen. However, the CLA 8 was raised to inquire about the documentation for this choice, based on the exigency of the tool, about documentation in the CDM-PDD of data vintage choice. The Project answer was included in the PDD as referred in Table 3 of this Report.

***Step 4.** Calculate the operating margin emission factor according to selected method.*

It is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM-Adj,y} = (1-\lambda_y)\frac{\sum_m EG_{m,y} * EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y \frac{\sum_k EG_{k,y} * EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

Where,

$EF_{grid,\ OM-adj,\ y}$	=	*Simple adjusted operating margin CO2 emission factor in year y (tCO2/MWh)*
λy	=	*Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y*
$EG_{m,\ y}$	=	*Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)*
$EG_{k,\ y}$	=	*Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)*
$EF_{EL,m,\ y}$	=	*CO2 emission factor for power unit m in year y (tCO2/MWh)*
$EF_{EL,k,\ y}$	=	*CO2 emission factor for power unit k in year y (tCO2/MWh)*
m	=	*All grid power units serving the grid in year y except low-cost/must-run power units*
k	=	*All low-cost/must run grid power units serving the grid in year y*
y	=	*The relevant year as per the data vintage chosen in Step 3*

To calculate the CO2 emission factors $EF_{EL,\ m,\ y}$ and $EF_{EL,\ k,\ y}$ of power units *m and k* in year y (tCO2/MWh), Option A2 was used, as data on electricity generation and the fuel types and the efficiency of the power unit are available. Under this option, the following approach was used by project owner (See CLA 6c ahead): the fuel efficiency of every unit (MBTU/MWh) was converted to TJ/MWh so that the EF (tCO2/TJ) from IPCC can be used, through the equation:

$$EF_{EL,m,y} = EF_{CO2,i,m,y} * \eta_{m,y} * CONV$$

Where

$EF_{EL,m,y}$	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$EF_{CO2,m,y}$	CO2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO2/TJ) obtained from IPCC
$\eta_{m,y}$	Fuel efficiency of power plant *m* in year y in MBTU/MWh
CONV	1 MBTU = 0.001055056TJ
i	Types of fuels used by the unit *m*

The set of emission factors of power unit *m* calculated ex-ante will be reviewed at the beginning of the next crediting period based on the official and publicly available data.

This approach is deemed satisfactory for the DOE, since is equivalent to the original formulation (eq. (3)) in the Tool.

Regarding parameter $\lambda_{y,}$ the DOE verified that it was calculated according to the four steps described in the Tool, and using the right data.

Step 5. *Identify the group of power units to be included in the build margin (BM)*

The sample group of power units m used to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that are most recent.

The DOE verified that this option (option b) comprises the larger annual generation, compared with the set of five power units that have been built most recently, (option a), taking into account the option 1 of vintage of data. In terms of vintage of data, project participants chose option 1: Calculate the build margin emission factor ex-ante, based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. However, CLA 8 was raised to inquire about the documentation for this choice, based on the exigency of the tool, about documentation in the CDM-PDD of data vintage choice. The Project answer was included in the PDD as referred in Table 3.

Step 6. *Calculate the Build Margin emission factor*

The build margin emission 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, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} * EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \qquad \text{(B.6.3.5)}$$

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

To calculate the CO2 emission factors $\mathbf{EF_{EL,m,y}}$ of power unit *m* in year y (tCO2/MWh), an approach similar to that used in operating margin calculations was used, and, therefore, is deemed satisfactory for the DOE

Step 7. *Calculate the Combined Margin (CM) emission factor*

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$$

Where,

$EF_{grid,BM,y}$ = *Build margin CO2 emission factor in year y (tCO2/MWh)*
$EF_{grid,OM,y}$ = *Operating margin CO2 emission factor in year y (tCO2/MWh)*
W_{OM} = *Weighting of operating margin emissions factor (%)*
W_{BM} = *Weighting of build margin emissions factor (%)*

The weights W_{OM} and W_{BM} have been given default value of 0.5 for the first crediting period, according to the methodological tool.

3.5 ADDITIONALITY

3.5.1 Starting date of the CDM project activity and prior consideration of the CDM

As regards demonstration of continuing and real action were taken to secure CDM status for the project in parallel with its implementation taking into account the "Guidance on the demonstration and assessment of prior consideration of the CDM" v.3 EB49 as the project starting date is before 02-08-2008, the project developer submitted documentary evidences that confirm the real actions taken by the developer since beginning till the submission of the project for the validation. The validation team has checked and confirmed validity of all the documentary proofs mentioned in the 'Chronology of events' table mentioned in the PDD.

ICONTEC had access to all documents as evidence during the validation process that confirms the following.

All the chronology was included in the section B.5 of the PDD version 5.

The chronology of events of the project activity is presented below:

Date	Events	Evidences

04-2002	Submission of the Project Idea Note (PIN) to the World Bank by the Project Entity (HIDROGER at that moment)	World Bank, 2002
23-09-2002	Signature of the Letter of Intent (LOI) between the World Bank and the Project Entity (HIDROGER)	LOI 2002
01-2003	Project Concept Note approved by the World Bank	World Bank 2003
06-2003	World Bank environmental safeguards assessment completed	World Bank 2003
16-07-2003	Extension of LOI exclusivity period	LOI Extension 2003
11-2003	World Bank social safeguards assessment completed	World Bank 2003
01-2004	Santander Investments began analysis on financial closure	
27-04-2004	Letter of Approval, Colombian DNA	LoA Colombia, 2004
10-05-2004	World Bank Project Appraisal Document	World Bank, 2004
27-05-2004	ERPA Signed between the World Bank and the Project Entity (HIDROGER)	ERPA 2004
05-2005	Santander Investment informed that it was not able to find interested investors	ISAGEN, 2005
08-05-2006	ISAGEN Executive Board approved the Project	ISAGEN, 2006
08-05-2006	Novation and ERPA amendment signed with ISAGEN	ERPA amendment, 2006
18-12-2007	Memo signed between local authorities and ISAGEN on social benefits for the local communities	ISAGEN, 2007
07-05-2008	Civil works contract signed with Rio Amoyá consortium. CDM Project Starting Date	ISAGEN, 2008
16-06-2008	Construction of the project started	
21-10-2008	Change of name of the project by the DNA	LoA Colombia, 2008
08-05-2009	World Bank contracted ICONTEC to perform the validation of the project	World Bank, 2009
08-11-2009	PDD published for global stakeholder consultation during the period Nov 8, 2009 to Dec 8, 2009	
07-2011	Expected date of Project commissioning	

The Rio Amoyá Run-of-River Hydro Project was originally sponsored by a consortium of companies including “Generadora Union”, CEMEX and ISAGEN among other investors. The name of this consortium was Hidroger. In early 2002, due to the financial unattractiveness of the project, Hidroger decided to seek CDM benefits in order to go ahead with the project. The Project Entity submitted a Project Idea Note to the World Bank and after its consideration; a Letter of Intent was signed in 23-09-2002 to develop the project using the Clean Development Mechanism. As a result, during 2002-2004, Hidroger and the World Bank developed different related studies, reaching to the signature of an ERPA in 27-05-2004. In parallel, Hidroger and ISAGEN hired

Santander Investments to seek a financial closure for the project. In May 2005, after over 18 months of work, Santander Investments informed the project sponsors that they were not able to find interested investors.

During the validation visit, the Validation Team also understood that given the financial unattractiveness of the project, the basis on which the board of directors of ISAGEN in 08-05-2006 decided to go ahead with the project was the renegotiations of the price of the emissions reductions under the Emissions Reduction Purchase Agreement, and considering its own internal financial analysis with a confidence that renewed ERPA price would make project more attractive and bring necessary investment from external investors in the market.

In 07-05-2008 the contract for the construction was signed between ISAGEN and the Consorcio Hidroeléctrica Amoya (contract N° 46/2712), in 16-06-16, 2008 the construction started, in 20-10-2008 the Colombian DNA approved a change of the CDM name of the project and in 09-05-2009 the World Bank hired the DOE to conduct the validation. The project is expected to be commissioned by July 2011.. The validation team also received evidences relating to the social dialogue with communities in the project area during 2006-2007, leading to the signature of a memo between local authorities and ISAGEN on social benefits for the local communities in 18-12-2007. This social component was an integral part of the CDM project, as it is proven in the World Bank documents, including the ERPA, which provides 20% of the ER revenues to social programs. Based on this, the validation team concluded that continuous and real actions were taken to secure the CDM status by the project developer.

In order to assess whether the starting date of the project is appropriate was requested to the PP's evidence about the milestone mentioned in the PDD (signed contract) and a timeline of the project in order to assess whether the selected date is the earliest date at which either implementation or construction or real action of the project begins. Both contract and a timeline have been provided to the validation team.

Considering all above events, the validation team concluded that the date of signing of construction contract (07-05- 2008) is the first commitment of the PP's to proceed with the project implementation and hence the start date of the project activity according to the current definition of the "Starting date" as stated in the "Glossary of the CDM terms" version 5, approved by the EB on its 47th meeting would be 07-05-2008.

All evidence provided to the validation team is credible and reliable, hence in opinion of the ICONTEC validation team the project activity was seriously considered CDM in the decision to implement the project activity.

3.5.2 Additionality analysis

To demonstrate that the project activity is additional and therefore not the baseline scenario, the *tool for the demonstration and assessment of additionality, version 05.2* was used, following the step-wise approach depicted in the respective flow-chart.

Firstly, previous CDM consideration of the Project was checked out by the DOE. In fact, early consideration of CDM is fully demonstrated in the PDD via a detailed chronological table of events

showing CDM actions prior to the project start date, starting at year 2002 with the submission of a Project Idea Note to the World Bank and the subsequent signing of a Letter of Intent (23-09- 2002), to develop the project using the Clean Development Mechanism. After that, other actions were carried out, as referred ahead in the investment and barrier analysis. All the chronology was included in the Section B.5 of the PDD, Version 5. ICONTEC has access to these documentations as evidence along the validation process.

The DOE carefully assessed and verified the reliability and creditability of all data, rationales, assumptions, justifications and documentation provided by project participants to support the demonstration of additionality, as described ahead, where can be seen that some CAR's were raised to justify additionality demonstrations

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

Two alternatives were identified:

1. The proposed project activity, undertaken without being registered as a CDM project activity;
2. The system expansion would occur as defined by UPME; another thermal or big hydro unit would be installed.

Under examination of the Indicative expansion plan for the Colombian electrical grid for the period 2009-2023, as documented by official Planning Unit, the DOE found that project alternatives defined in the PDD are realistic and credible, and they are in compliance with applicable laws and regulation.

STEP 2. Investment analysis.

In this step, the PDD demonstrates that, under two sponsoring approaches, the project activity is not financially feasible without and with the CDM incomes, using IRR analysis.

In a first situation, as mentioned in the PDD, the Project was sponsored by a consortium of companies including "Generadora Unión", CEMEX and ISAGEN. Project sponsors hired Santander Investments, an international banking group with considerable experience in the financial sector, to serve as the financial advisor with responsibility to (i) conduct project financial analysis by focusing on all realistic scenarios and potential local risks; and, (ii) raise investment funds and debt as required by the project. PP demonstrates that, under this approach, it was not possible to find interested investors, because of the IRR calculated by the financial advisor, 9.6%, was not high enough to attract investors. ICONTEC verified the documentation available related to this project financial analysis that include energy price scenarios, investment and capital expenditures, FIRR and sensibility analysis, project cash flow, equity cash flow, project cash flow sensitivity analysis, equity cash flow sensitivity analysis, debt service analysis, cash flow statement, balance sheet, and income statement and confirmed the IRR calculated initially.

Later on, in middle 2005, ISAGEN, the actual project owner, decided to reevaluate the project based on renegotiations of the price of the emissions reductions under an Emissions Reduction Purchase Agreement, and considering its own financial analysis and comparing with the market interest rate charged by FINDETER as a hurdle rate, ISAGEN's Board of Directors approved to go ahead with the project.

Under this second sponsoring approach, an investment analysis for demonstration of additionality was driven applying benchmark analysis.

Firstly, the DOE verified that, according to the *Tool for the demonstration and assessment of additionality (version 5.2)*, the benchmark analysis, using IRR as financial indicator, is an option valid in this case, since the CDM project activity and the alternative identified in Step 1 generate financial or economic benefits other than CDM related income (market energy sales). Besides that, IRR is a suitable financial indicator, used generally to analyze energy investment projects like this one.

As required by paragraph 111 of the VVM, ICONTEC verified the accuracy of financial calculations by a thorough assessment of supporting documentation supplied to the DOE, consisting of a finance analysis model in excel file with the respective calculations and a word document with the description of the parameters used in the analysis and the sources. Details on this verification will be given ahead.

~~The DOE is requested to ensure that all relevant assumptions made in the investment analysis are listed in the PDD, in particular, major input values such as the total investment costs, the annual power export, the power tariff and the O&M costs (See CAR 2).~~

Also the DOE requested the PP to list all relevant assumptions made in the investment analysis in the PDD, in particular, major input values such as the total investment costs, the annual power export, the power tariff and the O&M costs. This was done in the final version of the PDD.

Firstly, as required by paragraph 112 of the VVM, ICONTEC verified that the benchmark used (16.04%) to compare the IRR of the project, is the interest rate charged by FINDETER (Financiera de Desarrollo Territorial S.A.) in June 2005 for electricity generation projects and its suitability for the project. ICONTEC validation team observed that FINDETER is a public development financing institution in Colombia whose focus is to finance projects that help to develop key sectors of the Colombian economy, such as infrastructure, health or education. FINDETER interest rates are composed by a reference interest rate, plus a spread concerning the risk associated to the economic sector and the term of the loan and are widely considered during the investment decisions in Colombia mainly for infrastructure projects like the project activity and especially by the project developer for its investments in the sector. The reference interest rate, Fix Term Deposit - FTD, represents the average money cost in Colombia, and is based on daily rates and total investments in Fix Term Deposit Certificates - CDT´s (Certificados de Depósito a Término Fijo) with a 90 days maturity term.

FINDETER reference interest rate in force by 2005 was 7.18%, annual effective, as retrieved by ICONTEC from the website of the Banco de la República (Central Bank of Colombia) http://www.banrep.gov.co/estad/dsbb/sfin_009.xls. The spread rate applied by FINDETER in 2005 to energy sector projects loans with terms ranking from 8 to 12 years was 2.10%, trimester anticipated, as certified by FINDETER through a formal communication to ISAGEN dated November 1, 2008. This rate is equivalent to 8.86%, annual effective, thus the applicable FINDETER interest rate is 16.04%. Taking into account that FINDETER interest rates, just described, are lower than other commercial banks rates for the eligible sectors, ICONTEC deems that it is suitable to take 16.04% as a benchmark rate for this project.

ICONTEC validation team has assessed the power generation potential and its validity based on engineering studies contracted by ISAGEN S.A. E.S.P. ("ISAGEN") before and during 2005. The validation team observed that ISAGEN hired a firm INGETEC in 1998 to evaluate the hydraulic potential of Amoyá and Ambeima rivers, in order to select the best hydropower project, in terms of generating capacity, environmental impact, and costs. This study evaluated a project with a nominal capacity of 78 MW, with an average flow of 17.2 m3/s. A period of 15 years was simulated and the reported average generation level was 516 GWh/yr. To account for potential losses, the team in charge of assessing the project's economic feasibility applied 99% of 516 GWh, which corresponds to 510.7 GWh. Later in 2005, ISAGEN hired another engineering firm, SEDIC, to update and complement INGETEC's study. Using time series data from hydrological stations, the average flow was now set at 18.4 m3/s, the nominal capacity was increased to 80 MW, and the average generation level was estimated at 513.6 GWh/yr. Based on our local and sectoral expertise and review of above mentioned two reports, ICONTEC confirms that the annual power generation estimated in both the studies is correct. As per the VVM requirements, the generation value used in the financial analysis corresponds to the one available at the time of decision making time, which is 510.7 GWh. ICONTEC also could confirm that the IRR values calculated using generation values based on later study (513.6 GWh) is still well below the benchmark value identified for the Project.

During assessment of this project, it has been validated that the average reference electricity price (tariff) used in the investment analysis is based on the information available in the published report from the appropriate national authority in the country. ICONTEC team confirmed through the supporting documents provided that the tariff used in the financial analysis is based on the reference energy sales prices publicized by the Energy Planning Unit, Mine and Energy Ministry in the Reference Expansion Plan Generation – Transmission 2004-2018, plus a premium factor regarding contract type available at the time of investment decision making. This document can be considered as an independent and provides the realistic assessment of the tariff for the projects like the proposed CDM project activity and hence the validation team confirms that the value used in the PDD, 171.08 COP/kWh is valid at the time of investment decision making and is appropriate.

According to the project chronogram and supporting documents, ICONTEC validation confirmed that the total investment costs is 288,691 Million COP, which is approximately US $105 million at 2,749.44 COP/US$, which means investment index cost of 1,350 US/kW. Based on the sector expertise of the team, the DOE considers that this investment index cost is within the usual practice in Colombia for this kind of projects and is appropriate for the project.

The other following main parameters and assumptions used in calculating the IRR were also verified by the DOE, using the evidences as indicated:

- **Macroeconomics assumptions**: projections publicized by the National Planning Department, for the year 2005

- **National grid power and energy projections:** From the Reference Expansion Plan Generation – Transmission 2004-2018, publicized by the Energy Planning Unit, Miner and Energy Ministry.

- **Annual power export:** This parameter has been validated through CLA 1 and its *Project Owner Response,* as registered in Table 3: "Resolution of corrective action and request for clarification", of this Report).

- **O&M costs:** Cost estimated in US$ 24.96/kW installed - year. Based on market conditions and real historic O&M costs for hydro plants running in Colombia.

- **Project grid expenses:** transmission charges and others adequately justified in the supporting documents publicized by the Energy Planning Unit, Mine and Energy Ministry.

- **Taxes**: These values are based on the prevailing tax rates in the country at the time of investment decision making. These were validated using the supporting documents submitted by the developer during the validation visit.

- **Incomes due to firm energy furnished to the system (capacity charge):** Defined according to regulatory resolution CREG 116, 1996 (Comisión de Regulación de Energía y Gas)

- **CDM incomes:** ERC's were calculated according to energy production and emissions reduction factor as presented in the PDD. CDM incomes were calculated using prices as defined in the ERPA subscribed by ISAGEN.

As to IRR calculations, the finance analysis model in excel file utilized by the PP was available to the DOE, so that ICONTEC was able to validate the correctness of the data and formulae utilized, as well as the computations performed and the results obtained. In doing that, ICONTEC verified that the PP followed the *Guidelines on the Assessment of Investment Analysis (version 3.1)* in main aspects concerned in this case, as:

- The period of assessment has not been limited to the proposed crediting period of the Project: 25 years have been considered for IRR calculation.

- Depreciation, which was deducted in the Results State, was added back to IRR evaluation.

- Input values used in all investment analysis are valid and applicable at year 2005, the time of the investment decision.

- In the calculation of project IRR Equity financing costs are not considered.

On these bases, ICONTEC confirms that underlying assumptions and the financial calculations are correct and appropriate for the project.

Results of the financial analysis with and without CDM are shown in table 2 of the PDD. These figures demonstrate that, even with CDM incomes (Based on ER estimates available at the time of decision making), IRR is lower than external benchmark (12.32% and 13.21%, compared with 16.04%). By CAR 2a) the project responsible was requested to correct figures in table 2 of the original version of the PDD. Figures were corrected, as they appear in the final version of the PDD.

Sensitivity analysis on Investments costs, O&M costs and energy prices are shown in table 3 of the PDD, not considering CDM incomes. These figures demonstrate that the project IRR could exceed the relevant benchmark only if energy prices increase further than 6%. Given the economics of the operative rules of the energy market in Colombia, characterized by a competitive merit order dispatch system, and the relatively large share of hydropower, such increments in market prices are considered to be very improbable, as corroborated by ICONTEC, by analyzing the historical behavior of energy market prices. Regarding Investment costs and O&M costs, even with changes of -20%, the IRR is lower than external benchmark.

Based on these rationales, the Project IRR would be similar to benchmark rate only under very extreme conditions, whose likelihood is too low. So ICONTEC confirms that financial analysis and sensitivity analysis results demonstrate that the activity project is additional.

STEP 3. Barrier analysis.

In addition to the investment analysis, barriers that prevent the implementation of the Project and don't prevent the implementation of at least one of the alternatives were identified. Investment barriers regarding financing issues and High risk profile of run-of-river hydropower projects were considered.

As to financing issues, finance analysis model with a normally expected 60/40 share of total investment costs between debt and equity, threw 9.6% to returns on equity, deemed lower than other market investment opportunities, besides that, under these conditions, expected project revenues are not able to produce enough debt-coverage, as required normally by financers visualized in the European and North American capital markets Thus, it was demonstrated that, under the business as usual (BAU) scenario, the Project presents low returns on equity, and low coverage ratios to service debt, thus lacking ability to attract necessary finances to undertake the project. Besides that, it was demonstrated that, in Colombia, as known by the DOE, run-of-river hydropower projects have higher market risk than other comparable sources, like reservoir based hydropower, because of this type of projects do not receive extra remuneration for their full amount of energy supplied, as they cannot supply guaranteed energy output to the national system.

By CAR 2b) the project responsible was requested to make a strong clarification concerning the role of the State in the project financing, given the character of ISAGEN as a mix owned entity. The explanation given in the final version of the PDD is fully satisfactory to the DOE, since it was clarified that the company is managed following commercial principles, and does not receive any government subside.

By CAR 2c) the project responsible was requested to correct a concept concerning the extra remuneration received by renewable energy sources. The final version has clarified that renewable energy sources, such as wind farms and run-of-river plants, do not receive extra remuneration for their full amount of energy supplied, as they cannot supply guaranteed energy output to the national system.

On the other hand, it was demonstrated that other alternatives – like the installation of a thermal unit or an alternative power plant - would find conditions that enable investors and financiers to obtain financial closure under the existing conditions of availability of hydropower potential, coal and natural gas and the market demand for additional capacity to meet the growing demand.

STEP 4. Common practices analysis

As required by VVM, para 121, ICONTEC validation team assessed the common practice analysis taking in to account the geographical scope, existence of similar projects and the essential distinctions from the similar projects. Accordingly, the geographical scope considered for the analysis is entire Colombia as these developmental environment for these kinds of projects are similar all over the country. It was documented by the project owner that the use of run-of-river technology is not part of the business as usual scenario in Colombia, mainly due to the required high up-front investment capital and relatively low energy prices, which make this type of investments only long term return opportunities. ICONTEC could verify based on the investment analysis and project specific capital cost figures the higher up-front investments and lower tariffs though the document published by the Energy Planning Unit, Miner and Energy Ministry in the Reference Expansion Plan Generation – Transmission 2004-2018. ICONTEC also verified that run-of-river investments in the projected power generation expansion plan amount to less than 1% of total generation capacity. Based on the public information available, the validation team also confirmed that most power generation capacity added in the country is through large hydros (52%) or thermal power (46%), while small hydro projects a mere 0.6%.

DOE has verified with the official reference electric expansion plan in Colombia the information shown in Table 1 of the PDD, in which can be seen that run-of-river foreseen investments in a long term view are less than 1% of total generation capacity.

By the CAR 2d) the project Owner was requested to be more realistic as to the contribution of the Project in solving an eventual shortage in the national electricity supply by 2010-2012. This appreciation was corrected in the final version of the PDD.

According to the analyses in the PDD and the definitions of other activities similar to the proposed project activity in the “Tool for the demonstration and assessment of additionality” (Version 05.2) there are essential distinctions with the other potential common practice projects (I.e. large hydro and thermal) in Colombia. Therefore, the project is not common practice.

The above argues and rationales were found correct, so the DOE deems that they provide a fully demonstration of additionality. In conclusion, it has been verified that the project is not the most likely baseline scenario. Hence, the emission reductions occurring from the project are deemed additional to those that would occur in the absence of the project activity.

3.6 MONITORING PLAN

The DOE verified that a Monitoring Plan was included in the PDD, Section B.7 Application of the monitoring methodology and description of the monitoring plan. This MP is based on the “Consolidated Baseline Methodology ACM0002 version 12.1.0”, which is the methodology under the Project has been assessed. Table B.7.1 “Data and parameters monitored” contains all necessary parameters, with adequate descriptions as to: Source of data, Measurements procedures, Monitoring frequency and QA/QC procedures to be applied. A cross checking strategy for verify measurement of $EG_{PJ,y}$ was asked by CAR 5, as defined by the DOE and the Project responsible in the onsite review. Such a strategy, in satisfactory terms, was included in the final version of the PDD.

In Annex 4 of the PDD the Monitoring Plan is further described under four sections, where the

main issues correspond to: Use of the MP by the Project Operator, Measurement and Calculation of Emission Reductions, Calculating Emission Reductions, Operational and Monitoring Obligations, Data Requirements and Project Database, and Description of the Workbook

A new CAR (CAR 7) is raised to ask for the inclusion in Annex 4 of the announced functioning of the MP electronic workbook, implemented as Excel spreadsheets.

Based on these descriptions and on documental verifications, the DOE deems technical and organizational design previsions and circumstances are given to put in practice adequately the Monitoring Plan proposed, such that emission reductions resulting from the Río Amoyá Run-of-River Hydro Project can be reported ex post and verified.

3.7 CALCULATION OF GHG EMISSIONS

Ex-ante estimation of emission reductions over the chosen crediting period was made by the project responsible and presented in literal B.6.4 “Summary of the ex-ante estimation of emission reductions” of the PDD, applying the methodology AMC0002 Version 12.1.0, as:

$$ERy = BEy - PEy$$

Where:

ERy = Emission reductions in year *y* (t CO2e/yr)
BEy = Baseline emissions in year *y* (t CO2/yr)
PEy = Project emissions in year *y* (t CO2e/yr)

As demonstrated in the PDD, for Amoyá River power plant PEy = 0 and BEy was calculated as discussed in section 3.4.

CLA 6, referred to ex-ante calculation of emission reductions, contained three items: CLA 6a) asked for improvements in presentation of *Baseline emissions* section, which was adequately attended; CLA 6b), referred to calculation of the OM emission factor, which was surpassed with the final decision on OM calculation method; and CLA 6c) inquiring an explanation on approach used to calculate the CO_2 emission factor of each power unit. Option A2 was used, since only data on electricity generation and the fuel types used is available, as was confirmed by the DOE.

Excel spreadsheets containing data, parameters, and formulae used for these calculations, as well as results obtained, as presented in Annex 3 of the PDD, were detailed verified by the DOE.

CLA 7 was raised in order to clear the source of data on emission factor (tCO_2/MWh) for power plants operating with natural gas and coal, depicted in Table 1 and table 2 of Annex 3. This clarification was given in the last version of the PDD.

Official data of Colombian Electric System and plant dispatch over the three last years, required for grid emission factor calculations, were reviewed by the DOE during a visit to the National Dispatch Center, located in the same city where the project owner headquarters are located (Medellín city)

Verified results of ex-ante estimation of emission reductions are showed in the following table (Table B.6.4 of the PDD):

Year	Estimation of Project activity emissions (tonnes of CO2e)	Estimation of Baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
01 July 2011 – 31 December 2011	0	88,321	0	88,321
2012	0	176,643	0	176,643
2013	0	176,643	0	176,643
2014	0	176,643	0	176,643
2015	0	176,643	0	176,643
2016	0	176,643	0	176,643
2017	0	176,643	0	176,643
01 January 2018 – 30 June 2018	0	88,321	0	88,321
Total (tonnes of CO2e) of first crediting period	**0**	1,236,499	**0**	1,236,499

CAR 3 was raised because figures concerning emission reductions in table A.4.4 and table B.6.4 did not match themselves and they were based on different estimative on annual generation. Figures were corrected in the final version of the PDD, corresponding to the energy generation defined by CLA 1.

3.8 ENVIRONMENTAL IMPACTS

According with the Colombian legislation, the activity being developed by ISAGEN S.A. E.S.P does not require Environmental License; therefore, it is not necessary to do a study of environmental impact and development an Environmental management Plan (Ministry of Environment, Housing and Territorial Development, Decree 1220, 21-04-2005). Nevertheless, it was necessary to obtain the following permissions: water concession for the water collection and utilization, riverbed occupancy permission for the location of facilities on the riverbanks and forest utilization permission. All these permissions were emitted by the local environmental authority CORTOLIMA.

A detailed environmental impact assessment has been completed. The report concludes that there are no major adverse environmental impacts. The changes in water flow in the Amoyá River over a limited stretch, potential erosion at construction sites and impacts on water quality could be addressed within the Environmental Management Plan during construction and as part of operation and maintenance (O&M) activity.

Likewise, the project developer received other permissions necessary for the construction of the power plant, such as construction license, land movement authorization and land use certification.

In order to assess the impacts during the construction and the operation a detailed socio-economic analysis was carried out. The diagnosis included assessment of infrastructure, water and sanitation, electrification, transport, communication, land use, health, education, administrative and institutional capacity. The socioeconomic impact assessment shows that the adverse impacts are minor while the positive impacts are substantial.

3.9 COMMENTS BY LOCAL STAKEHOLDERS

Comments received from local stakeholders as part of consultation process were compiled in all the phases of the EIA and measures to address them outlined. The project promoters and ISAGEN carried out formal consultations with the local communities and several meetings were held with the government institutions. The consultations with the local community included public hearings and workshops on health and sanitation issues, including the scope of basic agreements for improvements in the access to drinking water and sanitation and health services.

No negative comments or complaints regarding environmental or social impacts of the project were expressed by any of the local stakeholders, hence no corrective measures are considered to be required.

4. GLOBAL STAKEHOLDERS CONSULTATION

The PDD version 01 submitted by ISAGEN S.A. E.S.P. with the name: “Hydroelctric project of the Amoya River” was made publicly available at ICONTEC’s climate change website and UNFCCC website:

Parties, stakeholders and NGOs were invited to provide comments through the CDM website during a 30 days period from 08-11-2009 to 07-12-2009.

No negative comments or complaints regarding environmental or social impacts of the project were expressed by any of the local stakeholders, hence no corrective measures are considered to be required.

During the validation process the name of the project activity was adjusted according with the LoA issued by Colombian DNA.

5. VALIDATION OPINION

ICONTEC has performed a validation of the "Rio Amoyá Run-of-River Hydro Project". The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The review of the Project Design Documentation and the subsequent follow up interviews has provided ICONTEC with sufficient evidence to determine the fulfillment of the stated criteria.

The project activity is being proposed by ISAGEN S.A. E.S.P and Netherlands Clean Development Mechanism Fund (NCDMF). Colombian DNA has provided approval of voluntary participation and meets all requirements to participate in CDM. The Colombia DNA confirmed that the project helps in achieving sustainable development.

The project correctly applies the methodology: Consolidated baseline methodology for grid connected electricity generation projects (ACM0002 – version 12.1.0).

Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.

The total emission reductions from the project are estimated to be on the average of 176,643 tonnes CO_2eq per year over the selected 7 years crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved because the underlying assumptions do not change.

Bogotá, February 2, 2011

Fabio Tobón
Executive Director
ICONTEC

6. REFERENCES

Documents provided by the project proponent that relate directly to the project

/1/ CDM Project Design Document, including Baseline Methodology and the Monitoring Plan. Version 1, 3, 4 and 5.

/2/ Legal applicable requirements of the project activity:
Decree 1220, 2005 – Ministry of Environment, Housing and Territorial Development.
Resolutions of Local Environmental Authority Cortolima
Construction License - Municipality
Land movement authorization – Municipality
Land use certification - Municipality

/3/ Purchase order of equipments, material or goods.

/4/ Letter of Approval, dated 27-04-2004 and 20-10-2008, from the Colombian DNA (Ministry of Environment Housing and Territorial Developing – Climate Change Mitigation Office).
Letter of Approval of The Netherlands (01-03-2010)

/5/ - Emission reductions calculation model
- ISAGEN investment analysis model (summary)

/6/ Records on the meeting to inform local stakeholders about the project activity (invitations, list of stakeholder invited, attendance sheet record)

/7/ - Data of National Energy Commission of Colombia (XM).
- Reference Expansion Plan. Generation -Transmission 2004-2018 – UPME - Colombia

/8/ Administrative Manual of functions' of technical personnel for the operation.

/9/ Construction contract between ISAGEN S.A. E.S.P. and Consorcio Hidroeléctrica Amoyá 2008, signed May 7th, 2008.

/10/ Engineering study to measure the hydraulic potential of Amoyá and Ambeima rivers, INGETEC, 1998

/11/ Engineering study to measure the hydraulic potential of the Amoyá river, SEDIC, 2005

/12/ Letter of Intent (LOI) between the World Bank and the Project Entity (HIDROGER), 2002

/13/ World Bank Project Appraisal Document of the Amoyá river Project, 2004

/14/ ERPA Signed between the World Bank and the Project Entity (HIDROGER), 2004

/15/ Minutes of the ISAGEN Board approving the Amoya project, 2006

/16/ Novation and ERPA amendment signed with ISAGEN, 2006

/17/ Memo signed between local authorities and ISAGEN on social benefits for the local communities, 2007

Background documents related to the design and/or methodologies employed in the design or other reference document

/18/ Consolidated baseline methodology for grid connected electricity generation projects (ACM0002 – version 12.1.0)

/19/ "Tool to calculate the emission factor for an electricity system version 02".

/20/ "Tool for the demonstration and assessment of additionality version 05.2"

/21/ "Guidelines on the Assessment of Investment Analysis version 3.1"

/22/ Validation and Verification Manual of EB-UNFCCC (Ver. 1.2).

ANNEX A

VALIDATION PROTOCOL

Note: This format is a guide for developing a validation.

However it could change according to type of project

TABLE 1. MANDATORY REQUIREMENTS FOR CLEAN DEVELOPMENT MECHANISM (CDM) PROJECT ACTIVITIES

REQUIREMENT	Reference	CONCLUSION	Cross Reference / Comment
1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3	Kyoto Protocol Art.12.2	OK	The project assists to Annex 1 Party (Netherlands).
2. The project shall assist non-Annex I Parties in achieving sustainable development and the project has obtained confirmation by the host country that the project assists in achieving sustainable development	Kyoto Protocol Art. 12.2, Procedures for Small Scale CDM Project Activities §23a	OK	Table 2, Section A.3 The modification of the letter of the national approval was issued 2008 10 20 (Ministry of Environment, Housing and Territorial Development – Climate Change Mitigation Office).
3. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC	Kyoto Protocol Art.12.2.	OK	Table 2, Section E.4
4. The project shall have the written approval of voluntary participation from the designated national authorities of each party involved	Kyoto Protocol Art. 12.5a, Procedures for Small Scale CDM Project Activities §23a	OK	The project activity already received the Letter of Approval and voluntary participation, dated 20-10-2008, from the Colombian DNA.
5. The emission reductions shall be actual, measurable and give long-term benefits related to the mitigation of climate change.	Kyoto Protocol Art. 12.5b	OK	Table 2, Section E
6. Reduction in GHG emissions shall be additional to any that would occur in absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity	Kyoto Protocol Art. 12.5c, Marrakech Accords, CDM Modalities §43	OK	Table 2, Section B.2
7. In case that public funding from Parties included in Annex I is used for the project activity, these parties shall provide an affirmation that shuch funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations	Decision 17/CP.7, CDM Modalities and Procedures Appendix B, § 2	OK	There is not public funding involvement for the project.

REQUIREMENT	Reference	CONCLUSION	Cross Reference / Comment
of these parties			
8. Parties participating in the CDM shall designate a National Authority for the CDM	CDM Modalities and procedures §29	OK	The Climate Change Team - Ministry of Environment of Colombia is the designated national authority for the Clean Development Mechanism by UNFCCC Secretariat. Netherlands Ministry of Housing, spatial planning and the environment.
9. The host party and the participant Annex I Party shall be a party to the Kyoto protocol	CDM Modalities and Procedures § 30, 31b	OK	Colombia ratified the Kyoto protocol on 2001. Netherlands ratified the Kyoto protocol May 31, 2002.
10. The participant Annex I Party's assigned amount shall have been calculated and recorded	CDM Modalities and Procedures §31b	OK	Netherlands is Annex 1 country.
11. The participating Annex I Party shall have in place a national system for estimating GHG emissions and a national registry in accordance with Kyoto Protocol article 5 and 7.	CDM Modalities and Procedures §31b	OK	Netherlands is Annex 1 country. The LoA of Netherlands DNA was issued March 1, 2010.
12. The proposed project activity shall meet the eligibility criteria for small or large scale CDM project activities set out in § 6 (c) of the Marrakesh Accords	Procedures for CDM Project Activities	OK	Table 2. Section A1.
13. The project design document shall conform with the large Scale CDM Project Design Document format	Procedures for CDM Project Activities	OK	The PDD is in line with the CDM-PDD document.
14. The proposed project activity shall conform to one of the project categories defined for large scale CDM project activities and uses baseline and monitoring methodology for that project category	Procedures for CDM Project	OK	Table 2, Section A.1.3, B and D
15. Comments by local stakeholders are invited, and a summary of these provided	Procedures for CDM Project	OK	Table 2, Section G. Local stakeholders have been consulted by the project proponents
16. If required by the host country, an analysis of the environmental impacts of the project activity is carried out and documented.	Procedures for CDM Project	OK	Table 2, Section F

REQUIREMENT	Reference	CONCLUSION	Cross Reference / Comment
17. Parties, stakeholders and UNFCCC accredited NGOs have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available	Procedures for CDM Project	OK	The PDD version 01 submitted by ISAGEN S.A. E.S.P. was made publicly available at ICONTEC's climate change website and UNFCCC website and Parties, stakeholders and NGOs were invited to provide comments through the CDM website during a 30 days period from 08-11-2009 to 07-12-2009. No comments were received.

TABLE 2 REQUIREMENTS CHECKLIST (ACCORDING VALIDATION AND VERIFICATION MANUAL)

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
A. General Description of Project Activity The project design is assessed.					
A.1 Project activity It is assessed whether the project qualifies as CDM project activity					
A.1.1 Does the project qualify as a CDM project activity as defined in paragraph 6 (c) of decision 17/CP.7 on the modalities and procedures for the CDM (Decision-/CMP.2 (Further guidance relating to the clean development mechanism) revises the definitions CDM project activities referred to in paragraph 6 (c) of decision 17/CP.7.)?	/1/	DR, I Onsite	The project qualifies as a large scale project activity because it has less than 80 MW.	CLA 1 CAR 1	OK
A.1.2 The project activity is not a debundled component of a larger project activity?	/1/	DR, I	According to the PDD, the project activity is not a de-bundled component of a larger project activity. It is a large scale project activity. No other similar Project Activities have been registered or implemented by any company within 1 km from the project boundary.	OK	OK
A.1.3 Does the proposed project activity conform to one of the project categories defined for CDM project activities?	/1/	DR, I	Yes, the project falls under Consolidated baseline methodology for grid connected electricity generation projects (ACM0002 – version 12.1.0).	OK	OK
A.2 Project Design Validation of project design focuses on the choice of technology and the design documentation of the project.					
A.2.1. Are the project's spatial (geographical) boundaries clearly defined?	/1/	DR, I		OK	OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
			Yes, the project activity will be located in the Municipality of Chaparral, Department of Tolima, Colombia.		
A.2.2. Are the project's system (components and facilities used to mitigate GHG's) boundaries clearly defined?	/1/	DR, I	Yes, the project boundaries are defined with precision.	OK	OK
A.2.3. Does the project design engineering reflect current good practices?	/1/	DR, I	Yes, the project engineering design reflects current good practices through the technology used.	OK	OK
A.2.4. Will the project results in technology transfer to the host country?	/1/	DR	Yes, there is a technology transfer process that produces positive results to the country.	OK	OK
A.2.5. Does the project require extensive initial training and maintenance efforts in order to work as intended during the project period? Does the project make provisions for meeting training and maintenance needs?	/1/	DR	During the installation process and the initial operation periods there will be necessary support from technology providers. Regarding training issues, the personnel receipt the necessary training.	OK	OK
A.3 Contribution to Sustainable Development The project's contribution to sustainable development is assessed.					
A.3.1 Will the project create other environmental or social benefits than GHG emission reductions?	/2/	DR, I	The project created employments during operation as well as during construction.	OK	OK
A.3.2 Will the project create any adverse environmental or social effects?	/2/	DR, I	No, it does not.	OK	OK
A.3.3 Is the project in line with sustainable development policies of the host country?	/1/,/2/	DR, I	Yes, it is.	OK	OK
A.3.4 Is the project in line with relevant legislation and plans in the host country?	/1/, /2/	DR, I	Yes, it is.	CLA 3	OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
B. Project Baseline The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.					
B.1 Baseline Methodology It is assessed whether the project applies an appropriate baseline methodology.					
B.1.1 Is the selected baseline methodology in line with the baseline methodologies provided for the relevant project category?	/1/	DR	The project applies the methodology Consolidated baseline methodology for grid connected electricity generation projects (ACM0002 – version 12.1.0).	OK	OK
B.1.2 Is the baseline methodology applicable to the project being considered?	/1/ /11/	DR	The project comply the applicability conditions of the chosen approved baseline methodology.	CLA 1, CLA 2	OK
B.2 Baseline Determination It is assessed whether the project activity itself is not a likely baseline scenario, and whether the selected baseline represents a likely baseline scenario.					
B.2.1 Is it demonstrated that the project activity itself is not a likely baseline scenario due to the existence of one or more of the following barriers: investment barriers, technology barriers, barriers due to prevailing practice or other barriers	/1/, /10/	DR, I	Additionally analyses were made to demonstrate that the project face investment, technological, prevailing practice with the clarify justifications given to investment and prevailing practice barriers. The CDM prior consideration was verified by DOE and the pertinent documentation confidential and public was verified.	CAR 2 CLA 5	OK
B.2.2 Is the application of the methodology and the discussion and determination of the chosen baseline transparent and conservative?	/1/,	DR, I	Yes, the application of the methodology and the discussion and determination of the chosen baseline is	CLA 4	OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
	/11/		transparent and conservative.		
B.2.3 Are relevant national and/or sectorial policies and circumstances taken into account?	/1/, /11/	DR, I	Yes, Special circumstances on Colombian electricity market were taken into account	OK	OK
B.2.4 Is the baseline selection compatible with the available data?	/1/, /11/	DR, I	Yes. Most data necessary to apply the baseline methodology are public opened.	CAR 4	OK
B.2.5 Does the selected baseline represent the most likely scenario among other possible and/or discussed scenarios?	/1/, /11/	DR, I	Yes, The baseline is according to the selected methodology.	OK	OK
C. Duration of the Project/ Crediting Period It is assessed whether the temporary boundaries of the project are clearly defined.					
C.1.1 Are the project's starting date and operational lifetime clearly defined and reasonable?	/1/	DR	Yes, the starting date of the project activity is July 1st, 2011 and the operational lifetime of the project is 50 years.	OK	OK
C.1.2 Is the assumed crediting time clearly defined and reasonable (renewable crediting period of seven years with two possible renewals or fixed crediting period of 10 years with no renewal)?	/1/	DR	Yes. The length of the first crediting period is 7 year.	OK	OK
D. Monitoring Plan The monitoring plan review aims to establish whether all relevant project aspects deemed necessary to monitor and report reliable emission reductions are properly addressed.					
D.1 Monitoring Methodology It is assessed whether the project applies an appropriate monitoring methodology.					
D.1.1 Is the selected monitoring methodology in line with the monitoring methodologies provided for relevant project category?	/1/	DR	The project activity applies the monitoring methodology Consolidated baseline methodology for grid connected electricity generation projects (ACM0002 – version 12.1.0)	CAR 5	OK
D.1.2 Is the monitoring methodology applicable for this project and is the appropriateness justified?	/1/	DR	Yes, it is.	CAR 7	OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
D.1.3 Is the application of the monitoring methodology transparent?	/1/	DR OS	Yes, it is.	OK	OK
D.1.4 Will the monitoring methodology give opportunity for real measurements of achieved emission reductions?	/1/	DR, OS	Yes, it does. Achieved emission reductions will be direct function of energy generation measurements	OK	OK
D.2 Monitoring of Project Emissions It is established whether the monitoring plan provides for reliable and complete project emission data over time.					
D.2.1 Does the monitoring plan provide for the collection and filing of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period?	/1/	DR	NA	OK	OK
D.3 Monitoring of Leakage It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.					
D.3.1 Does the monitoring plan provide for the collection and filing of all relevant data necessary for determining leakage?	/1/	DR	No leakage is identified.	OK	OK
D.3.2 Are the choices of leakage indicators reasonable?	/1/	DR	NA	OK	OK
D.3.3 Will it be possible to monitor the specified GHG leakage indicators?	/1/	DR	NA	OK	OK
D.3.4 Will the indicators give opportunity for real measurement of leakage effects?	/1/	DR	NA	OK	OK
D.4 Monitoring of Baseline Emissions It is established whether the monitoring plan provides for reliable and complete project emission data over time.					
D.4.1 Does the monitoring plan provide for the collection and filing of all relevant data necessary for determining baseline emissions during the crediting period?	/1/	DR	Yes, It does. All relevant data necessary for determining baseline emissions during the crediting period are managed by the project owner and the grid operator.		OK
D.4.2 Is the choice of baseline indicators, in particular for baseline emissions, reasonable?	/1/	DR	The baseline indicators have been chosen in line with		OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
			the chosen methodology approved by the CDM EB.		
D.4.3 Will it be possible to monitor the specified baseline indicators?	/1/	DR	Yes, it will be		OK
D.4.4 Will the indicators give opportunity for real measurements of baseline emissions?	/1/	DR	Yes, it does.		OK
D.5 Project Management Planning It is checked that project implementation is properly prepared for and that critical arrangements are addressed.					
D.5.1 Is the authority and responsibility of project management clearly described?	/1/	DR	The authority and management responsibilities have been defined for the personnel in charge. There is formally documented.	CAR 6	OK
D.5.2 Is the authority and responsibility for registration, monitoring, measurement and reporting clearly described?	/1/	DR	This information is summarized in the PDD, and in the Procedure for the operational control.	CAR 6	OK
D.5.3 Are procedures for training of monitoring personnel identified?	/1/	DR	The procedures include the training of monitoring personnel.	OK	OK
D.5.4 Are procedures for emergency preparedness for cases where emergencies can cause unintended emissions identified?	/1/	DR	Yes, they are implemented	OK	OK
D.5.5 Are procedures for calibration of monitoring equipment identified?	/1/	DR	Yes, there are procedures of calibration of meters in the frontier identified	CLA 9	OK
D.5.6 Are procedures for maintenance of monitoring equipment and installations identified?	/1/	DR	Yes, they are implemented	CLA 9	OK
D.5.7 Are procedures for monitoring, measurements and reporting identified?	/1/	DR	Yes, they are implemented		OK
D.5.8 Are procedures for day-to-day records handling identified (including what records to keep, storage area of records and how to process performance documentation)?	/1/	DR	Yes, they are implemented		OK
D.5.9 Are procedures for dealing with possible monitoring data adjustments and uncertainties identified?	/1/	DR	Yes, they are implemented		OK
D.5.10 Are procedures for internal audits of GHG project compliance with operational requirements where applicable identified?	/1/	DR	Yes, they are implemented		OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
D.5.11 Are procedures for project performance review identified?	/1/	DR	Yes, they are implemented		OK
D.5.12 Are procedures for corrective actions identified?	/1/	DR	Yes, they are implemented		OK
E. Calculation of GHG Emissions by Source It is assessed whether all material GHG emission sources are addressed and how sensitivities and data uncertainties have been addressed to arrive at conservative estimates of projected emission reductions.					
E.1 Project GHG Emissions The validation of ex-ante estimated project GHG emissions focuses on transparency and completeness of calculations.					
E.1.1 Are all aspects related to direct and indirect GHG emissions captured in the project design?	/1/	DR	NA		OK
E.1.2 Have all relevant GHG and sources been evaluated?	/1/	DR	NA		OK
E.1.3 Do the methodologies for calculating project emissions comply with existing good practices?	/1/	DR	NA		OK
E.1.4 Are the calculations documented in a complete manner?	/1/	DR	NA		OK
E.1.5 Have conservative assumptions been used?	/1/	DR	NA		OK
E.1.6 Are uncertainties in the project emissions estimates properly addressed?	/1/	DR	NA		OK
E.2 Leakage It is assessed whether there are leakage effects, i.e. change of emissions which occurs outside the project boundary and which are measurable and attributable to the project, have been properly assessed.					
E.2.1 Are leakage calculation required for the selected project category and if yes, are the relevant leakage effects assessed?	/1/	DR	No leakage was identified		OK
E.2.2 Have these leakage effects been properly accounted for in calculations (If applicable)?			NA		OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
E.2.3 Does the methodology for calculating leakage comply with existing good practice (If applicable)?			NA		OK
E.2.4 Are the calculations documented in a complete and transparent manner (If applicable)?			N/A		OK
E.2.5 Have conservative assumptions been used when calculating leakage (If applicable)?			N/A		OK
E.2.6 Are uncertainties in the leakage estimates properly addressed (If applicable)?			N/A		OK
E.3 Baseline GHG Emissions The validation of ex-ante estimated GHG emissions focuses on transparency and completeness of calculations.					
E.3.1 Are the baseline emission boundaries clearly defined and do they sufficiently cover sources and sinks for baseline emissions?	/1/	DR	Yes, The point of the grid where the project will be connected is clearly defined.	CLA 6 CLA 8	OK
E.3.2 Are all aspects related to direct and indirect baseline emissions captured in the project design?	/1/	DR	Yes, They are	OK	OK
E.3.3 Have all relevant GHG and sources been evaluated?	/1/	DR	Yes, all relevant GHG and sources, according to the methodology have been evaluated,	CLA 7	OK
E.3.4 Do the methodologies for calculating baseline emissions comply with existing good practices?	/1/, /11/	DR	Yes, it does.		OK
E.3.5 Are the calculation documented in a complete and transparent manner?	/1/	DR	Yes, they are documented.	OK	OK
E.3.6 Have conservative assumptions been used	/1/	DR	Yes, It does. Assumptions, when made, have been conservatives.	OK	OK
E.3.7 Are uncertainties in the baseline emissions estimates properly addressed?	/1/	DR	Yes, they are.	OK	OK
E.4 Emission Reductions Validation of ex-ante estimated emissions.					
E.4.1 Will the project result in fewer GHG emissions than the baseline scenario?	/1/	DR	Yes, It will have fewer ER that the Baseline.	CAR 3	OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
F. Environmental Impacts It is assessed whether environmental impacts of the project are sufficiently addressed.					
F.1.1 Does the host country legislation require analysis of the environmental impacts of the project activity?	/1/	DR, I	The environmental impacts are controlled during the construction activities and these have the supervision of the local environmental authorities.	OK	OK
F.1.2 Does the project comply with environmental legislation in the host country?	/1/	I	Yes, it does.	OK	OK
F.1.3 Will the project create any adverse environmental effects?	/1/	I	The environmental impacts are controlled during the construction activities and these have the supervision of the local environmental authorities.	OK	OK
F.1.4 Have environmental impacts been identified and addressed in the PDD?	/1/	DR, I	Yes, they do. Section D.2 of the PDD	OK	OK
G. Stakeholder Comments Validation of the local stakeholder consultation process.					
G.1.1 Have relevant stakeholders been consulted?	/1/	DR	An informational meeting was carried out at the municipality of Chaparral with local stakeholders about the project activity. The local stakeholders who attended the meeting were: - Regional Environmental Authority, - Community Action Boards, - Regional communities, No negative comments were received.	OK	OK
G.1.2 Have appropriate media been used to invite comments by local stakeholders?	/1/	DR	Information about the event was spread through information boards and leaders of the community	OK	OK
G.1.3 If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	/1/	DR	It is carried out with the community around the project activity.	OK	OK
G.1.4 Is a summary of the stakeholder comments received /provided?	/1/	DR	Yes, the comments received from the stakeholders are summarized in the PDD.	OK	OK

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Conclusion.	Final Concl.
G.1.5 Has due account been taken of any stakeholder comments received?	/1/	DR	No adverse comments were received from local stakeholders	OK	OK

MoV : Means of verification DR: Document review I: interview

TABLE 3: RESOLUTION OF CORRECTIVE ACTION AND REQUEST FOR CLARIFICATION

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
CLA 1: In the following item of the version 1 (26-10-2009) of the PDD: "A.2 Description of the project activity. *The Hydroelectric Project of the Amoyá River (the project), consists of a greenfield run-of-river power plant with a nominal capacity of 80 MW and an anticipated generation of approximately 510 GWh/year."* The project responsible must explain the models and criteria under which nominal capacity of 80 MW and the anticipated generation of 510 GWH/year were obtained. And the name of the project activity was adjusted	A.1.1 B.1.2	Project Owner Response: Back in 1998, INGETEC was hired to evaluate the hydraulic potential of Amoya and Ambeima rivers, in order to select the best hydropower project, in terms of generating capacity, environmental impact, and costs. This study evaluated a project with a nominal capacity of 78 MW, with an average flow of 17.2 m3/s. A period of 15 years was simulated and the reported average generation level was 516 GWh/yr. To account for potential losses, the team in charge of assessing the project's economic feasibility applied 99% of 516 GWh, which corresponds to 510 GWh.	Validation Team Response: The explanation is deemed satisfactory PDD modification is accepted. Validation Team Conclusion: Closed

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
according with the LoA of the Colombian DNA.		Later in 2005, ISAGEN hired another engineering firm, SEDIC, to update and complement INGETEC's study. Using time series data from hydrological stations, the average flow was now set at 18.4 m3/s, the nominal capacity was increased to 80 MW, and the average generation level was estimated at 513.6 GWh/yr. The latter will be used for the ex-ante estimation of the project emission reductions.	
CLA 2. Into the text of version 1 (26-10-2009) of the PDD the version of the Tool to calculate the emission factor for an electricity system should be modified (version 1.1 for 02).	B.1.2	Project Owner Response: PDD has been updated in p.7 and p.19 changing the number of the version from 1.1 to 02	Validation Team Response: PDD modification is accepted. Validation Team Conclusion: Closed
CLA 3 The information included in the section D.2. should be updated with the last decisions of the local environmental authorities.	A.3.4	Project Owner Response: Section D.2 already includes the reference to the administrative acts issued by the regional environmental authority. In addition, Section D.2 has included the two last requests for clarifications that ISAGEN has sent to CORTOLIMA (the local environmental	Validation Team Response: PDD modification is not completed with the last decisions of environmental authority about the project activity. Validation Team Conclusion: Closed

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
		authority).	
CLA 4 In B.6.1. Explanation of methodological choices: The following affirmation must be clarified. "It applies the preferential dispatch to the Amoyá River Hydroelectric Project".	B.2.2	Project Owner Response: The methodological choice has been modified for calculating both the Operation Margin and the Build Margin. In the first case, the project will use the Simple Adjusted Method, using the ex-ante data vintage. In the case of the Build Margin, option 1 with ex-ante vintage data will be used. In p.16 of the PDD, it was included the following footnote to clarify the referred statement: "In Colombia, the Centrally Dispatch System, as defined by Resolution 024/95, gives preference to the low cost generators. Run-of-river hydropower plants have the lowest cost in the system, operate based on available water flows, and since there is no reservoir, the water opportunity cost is zero. Therefore, it is expected that these power plants are always dispatched."	Validation Team Response: CLA 4 raised by the DOE refers to an specific aspect of dispatching Amoyá River Hydroelectric Project. Project Owner Response, however, refers to changes in the choices of the methodological options to calculate baseline emissions. According to the tool to calculate the emission factor for the system, options of data vintage chosen should be documented in the CDM-PDD. Therefore a new CLA 8 is raised to ask for such documentation. In respect to CLA 4 itself, the request of clarification remains, because the new sentence "CND preferentially dispatches the Amoyá River Hydroelectric Plant" must be clarified. In the last version of PDD, the CLA 4 was conveniently responded. Validation Team Conclusion: Project Owner Response, and

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
		PDD has been updated accordingly.	respective changes in the PDD, concerning others CLA's and CAR's are analyzed by the DOE in the view of new approaches presented by the project responsible, when necessary Closed
CLA 5 In the B.6.2. Data and parameters that are available at validation of the version 1 (26-10-2009) of the PDD: "Source of data used", "Value applied", and "Justification of the choice of data.." to calculate the Net electricity supplied to the Grid by the Project activity must be clarified	B.2.1	Project Owner Response: The information contained in rows "Source of data used", "Value applied", and "Justification of the choice of data..." of tables from section B.6.2. of the PDD has been updated according with the methodological choices for calculating the emission reductions. As discussed during the validation visit, the ex-ante adjusted simple method was selected to calculate the OM emission factor. On the BM EF, the ex-ante vintage data option was also selected.	Validation Team Response: Tables in B.6.2. "Data and parameters that are available at validation" were adapted to the new methodological options. Validation Team Conclusion: Closed
CLA 6 B.6.3 Ex-ante calculation of emission reductions: a) Baseline emissions		Project Owner Response:	Validation Team Response: Formulation of Ex-ante calculation of Emission reduction has been adapted to the new methodological options.

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
This section must be completely revised in order to obtain coherence in the reading. b) Calculation of the combined margin CO_2 emission factor for grid connected power generation Step 3. Calculation of the OM emission factor according to selected method Descriptions in this section must be revised in order to clarify why different methods are used to baseline and to emission reduction calculations. Also, in "Option A for OM calculations is used" it must be explained which Option A is referred to. c) Calculation of the combined margin CO2 emission factor for grid connected power generation Sub-step 3.2 It must be explained why fuel efficiency method was selected to calculate the CO2 emission factor EFEL,n,y, instead of fuel consumption method (Option A), as preferred by the tool.	E.2.1	Section B.6.3 has been revised in the PDD, including the selected method to calculate the EF. Option A2 was used, as data on electricity generation and the fuel types and the efficiency of the power unit are available. Data on fuel consumption per power units are not available. Note has been added to PDD	Nevertheless, excel data sheet with real data and calculations must be submitted to the DOE in order to be verified In response, the Project Participant submitted to the DOE, the file "Combined OM BM EF Lambda method dec 17 2009" containing detailed data and calculations of emissions reduction. On these bases ICONTEC concluded this part of the Validation process. Validation Team Conclusion: The CLA 6b was surpassed because the project participant changes the methodology option. Closed
CLA 7 Annex 3 BASELINE INFORMATION	E.3.3	Project Owner Response: PDD was revised to include the specific	Validation Team Response: PDD modification is accepted.

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
Table 1 and Table 2 Emissions Factor for power plants (natural gas and coal). Specific source of data must be specified, showing the application of formulae in sub step 3.2 of "Calculation of the combined margin CO2 emission factor for grid connected power generation"		source of the information (the Mining and Energy Planning Unit at the Ministry of Energy (UPME)) for the information contained in tables 1 and 2 of Annex 3 of the PDD.	Validation Team Conclusion: Closed
CLA 8 Options of data vintage chosen to calculate Operating Margin and Build Margin should be documented in the CDM-PDD.	E.3.1	Project Owner Response: Step 3 and 5 of section B.6.3. of the PDD has been modified to document the data vintage option chosen for both the OM and BM, including details of the years chosen as well as the data source. In addition, the project owner sent the spreadsheet for the calculation of the emission factor to the DOE on January 14, 2010, which documents the data vintage used in the calculation of both margins	Validation Team Response: Project Owner Response satisfies the requirements of the tool on documentation of data vintage options chosen Validation Team Conclusion: Closed
CLA 9 The QA/QC defined in Monitoring plan (Annex 4 of the PDD) only referred to the CREG regulations but it is not defined for the project owner into the project	D.5.5 D.5.6	Project Owner Response: The QA/QC section of the Monitoring Plan has been modified to mention the ISO certified QMS of the project	Validation Team Response: The version 5 of the PDD have clarified modification.

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
activity.		sponsor and the commitment of the project sponsor to include the project activity in the same QMS and get the ISO certification.	Validation Team Conclusion: Closed
CAR 1 PDD, page 4: The announced representation of the institutional arrangements for the implementation of the project is missed. It must be corrected.	A.1.1	Project Owner Response: Section A3 on Project Participants has been revised to abide by the methodology. Only the table with the description of project participants is required.	Validation Team Response: Suppressed information is not deemed necessary. Validation Team Conclusion: Closed
CAR 2 In the following items of the version 1 (26-10-2009) of the PDD, related to 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): a) Step 2: Investment analysis, table 2. Project internal rates of return with and without CDM: Figure for scenario 1 (14.08%) does not correspond to 13.21% from the Financial Analysis spreadsheets. Corrective action must be undertaken. b) Step 3, Barrier analysis in the section of Investment barriers (paragraph 4): Taken into	B.2.1	Project Owner Response: a) Table 2 of the PDD was revised, modifying the figure for scenario 1 from 14.08% to 13.21% to make it coherent with the Financial Analysis spreadsheet b) Paragraph 4 of the investment barriers section of sub step 3a of the barrier analysis of the PDD has been revised to clarify that no special subsidy or public funds have been committed to the project and that ISAGEN is managed following commercial principles.	Validation Team Response: a) Clarification is adequate b) Clarification is deemed adequate c) Clarification is deemed adequate d) Solution is deemed adequate Validation Team Conclusion: a) Closed b) Closed

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
account that the property of ISAGEN (the project owner) shares public and private capital, use of public funds in the project investment should be clarified. c) Step 3, Barrier analysis in the section of High risk profile of run-of-river hydropower projects: The following affirmation is questioned by the DOE: "On the other hand, renewable energy sources, such as wind farms and run-of-river plants, do not receive extra remuneration as they cannot supply guaranteed energy output to the national system". As it is known by the DOE, this issue is not correct. Corrective action must be undertaken. d) In the summary, literal f): It must be clarified that the anticipated shortage in the electricity supply by 2010-2012 should not be solved by the project commissioning.		c) The mentioned paragraph of PDD has been clarified to read as follows: "Renewable energy sources, such as wind farms and run-of-river plants, do not receive extra remuneration for their full amount of energy supplied, as they cannot supply guaranteed energy output to the national system". Therefore it is clarified that they receive extra remuneration, but not for their full amount of energy supplied. d) For the avoidances of any doubt, and given that it is not correct that the electricity supply by 2010-2012 will not be solved by adding the 80 MW of this project, literal f has been removed from the PDD.	c) Closed d) Closed
CAR 3 Figures in table A.4.4 Estimated amount of emission reductions over the chosen crediting period, and figures in table B.6.4 Summary of the ex-ante estimation of emission reductions do not match themselves.	E.4.1	Project Owner Response: Both tables of the PDD have been corrected to have the same values and to reflect the change of the methodology to calculate the Emission	Validation Team Response: Tables A.4.4 and B.6.4 were corrected. New figures correspond to annual generation of 513.6 Gwh and grid emission factor of 0.3439

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
Neither corresponds to Emission Reduction Factor EF2008 = 0.2547 tCO2/MWh (calculated in Annex 3), applied over annual generation estimation of 510 GWh/year. Corrective action must be undertaken.		Factor.	Validation Team Conclusion: Closed
CAR 4: In the Table 2 “Project Internal Rates of Return with and without CDM” of the version 1 (26-10-2009) of the PDD: The value of the item “1. With Carbon credits and tax exemption” should be modifying according with the projection and assumption for this calculation.	B.2.4 E.4.1	Project Owner Response: Table 2 of the PDD was revised, modifying the figure for scenario 1 from 14.08% to 13.21% to make it coherent with the Financial Analysis spreadsheet	Validation Team Response: PDD modification is accepted. Validation Team Conclusion: Closed
CAR 5 B.7.1 Data and parameters monitored A cross-checking strategy for verify measurement of EGPJ,h must be presented.	D.1.1	Project Owner Response: Section B.7.1. and Annex 4 of the PDD have been modified to include the following methodology to cross-check the measurement of EGPJ,y: To cross check the metering, the electricity generated will be also measured at the plant substation at 13.8 kV, correcting the measure taking	Validation Team Response: Cross checking strategy defined with ISAGEN in the close meeting must be included in B.7.1 Data and parameters monitored, and in Annex 4 Monitoring Plan Project Owner Response in last version of PDD fully satisfies the requirements Validation Team Conclusion:

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
		into account the transmission losses, estimated based on the technical specifications of the transmission line. The monitoring frequency and the precision of the meter located at the plant substation are the same as the ones located in Tuluní substation.	Closed
CAR 6: In the section B.7.2 Description of the monitoring plan the project participant should be describe which will be the structure of the roles and responsibilities and management for the monitoring plan. And detailed description of specific measurements methods to be applied to meter data and parameters in table B.7.1 must be included.	D.5.1 D.5.2	Project Owner Response: Section B.7.2 of the PDD has been modified to include the following details of the Operational and Management Structure of the Monitoring System: The CDM responsibility, including monitoring, will be under the control of the Production Management Unit (Gerencia de Producción). ISAGEN will incorporate explicitly into its internal procedures a detailed description of the activities related with the adequate management of the CDM monitoring system, including the roles and responsibilities associated with those activities. Since the project will be using an Ex-Ante option for the grid emission factor,	Validation Team Response: The personnel responsible for carry out activities in relation with the monitoring plan have to have a description role or into the procedures or into the functions and responsibilities manual. Validation Team Conclusion: Closed

Report clarifications and corrective action requests	Ref. to checklist question in Table 2	Summary of project owner response	Validation conclusion
		the only number to monitor for upcoming verifications is the actual electricity dispatched to the grid. This is relatively simple process, as the Colombian interconnected system relies on a highly regulated metering setup, which is required to make payments for electricity possible. This means that for the CDM project the only role for monitoring data is keeping copies of the hourly generation records that the Dispatch Center maintains on file.	
CAR 7 The functioning of the MP electronic workbook must be included in Annex 4, as announced in the Monitoring Plan section of the PDD	D.1.2	Project Owner Response: Annex 4 of the PDD has been modified to include section 4 of the Monitoring Plan, which describes the functioning of the Workbook	Validation Team Response: Functioning of the MP electronic workbook has been included in Annex 4, as announced in the Monitoring Plan section of the PDD Validation Team Conclusion: Closed

CLA: Clarification request, CAR: Corrective Action Request, FAR: Forward Action Request

ANNEX B

CV´S OF VALIDATION TEAM MEMBERS

Lead Auditor
Eng. Juan Alberto Gracia

Chemical Engineer. National University of Colombia (1991)
Environmental Management Specialist – Libre University (Colombia)
DQS and EOQ Register of Environmental Auditor (Germany)

1992 – 1998

Responsible for Standardization Technical Committees in the areas of chemical products, paint products, food products (fresh and processed); Quality air test, quality water test, quality soil test, solid waste management, hazard material, Environmental Management systems (ISO 14000 series).

1998 - 2006

Administrative and technical management of Certification Staff for supporting the Department Director, especially in Environmental Certification ISO 14001 services.

Qualified as a Quality Lead auditor and Environmental Lead auditor; besides, ISO 9001 and ISO 14001 audits as lead auditor.

Performing of more than 200 audits of ISO 9001 and 150 audits of ISO 14001 in chemical, food, oil, petrochemical industrial sectors and waste disposal in landfill.

2003 - 2006

Coordination, structuring, implementation and criteria definition related to the service of validation and verification of CDM project activities.

Fellowship in Prototype Carbon Fund of World Bank about CDM procedures and methodologies (Washington and Geneva).

Conduction of validation and verification audits, being part of the DNV audit team, of the CDM Project Activities for: Río Amoya, La Vuelta y La Herradura, and Jepirachi.

2006 - 2009

Conduction as a GHG Lead auditor of:

- Verification of three verification periods of Santa Ana hydroelectric project
- Verification of two verification periods of Agua Fresca Multipurpose and Environmental Services Project
- Verification of one verification period of RIMA Fuel switch in Bocaiúva plant project
- Verification of one verification period of La Venta II project
- Verification of Río Azul landfill gas project

- Verification of two verification periods of La Vuelta y la Herradura Hydroelectric Project
- Verification of Rio Amazon Woods residues power plant
- Verification of Cristalino small hydroelectric power plant project
- Verification of Faxinal small hydro project in Faxinal dos Guedes
- Validation of El Bote small hydroelectric plant project
- Verification of Monomeros Nitrous Oxide Abatement Project
- Validation of Cueva Maria Hydroelectric Project
- Validation of Methane Gas Capture and Fuel Switching at Compañía Argentina de Levaduras S.A.I.C. Plant Project
- Validation of Installation of a high-pressure/high-efficiency bagasse boiler to cogenerate heat and power
- Validation of Paysandú Clean Energy project

Sectoral Specialist
Eng. Fernando Gómez Gómez

Electrical Engineer. Universidad Nacional of Colombia (1967)
Master of Power Systems - Instituto Tecnológico de Monterrey (Mexico) (1970)
EAFIT Financial Specialist (Colombia) (1984)

ECONOMETRÍA S.S. - Technical Advisory
Technical Advisory to Unidad de Planeación Minero Energética to incorporate international electrical interconnections into the Colombian electrical planning carried by UPME, October 2002 - March 2003 (including use of SUPEROLADE, MPODE, NEPLAN and REAL models).

ECOENERGIA S.S. ESP - Founding Member and Manager
Management of private projects of generation, distribution and commercialization of power.

Unidad de Planeación Minero Energética - UPME-: Elaboration of Catalog of Generation Projects for National Energy Plan, October 1996 - October 1997.

AUDITORES ENERGÉTICOS - AENE LTDA
Advisory to the company in the application of the new regulatory scheme of Colombian electrical sector to private and public entrepreneurial management through the following studies:

Development of competent rate models, October 1994 - March 1995

CORELCA: Determination of marginal costs and development of innovative rate structures for power generation companies and big industrial customers, October 1994 - March 1995.

CORELCA: Development and application of rate models to prepare proposal on power sale in the wholesale market, July 1995 - September 1995.

EMPRESA DE ENERGIA DE BOGOTÁ - EEB

Positions:

Chief of the Department of generation planning, interconnection and sub-transmission, 1978 - 1979.
Chief of Electric Planning Division, 1979 - 1986.
Assistant for Technical Sub-management, 1986 - 1987
Chief of Special Projects Division, 1987
Chief of expansion and Development Division, 1987 - 1994
Management Advisor, 1994

INTERCONEXIÓN ELÉCTRICA S.A - ISA
1976 - 1978
Engineer Specialist in electric planning Research and development of models for planning and operation of electric systems.

National Coordinator of Colombian electric system planning in the project " Study of Electric Power Sector (Estudio del Sector de Energía Eléctrica), ESEE" winner of the National Award of Engineering.

Experience in CDM activities:

2006 – 2010

Participation as an Energy expert in:

- Verification of three verification periods of Santa Ana Hydroelectric plant project
- Verification of two verification periods of Agua Fresca Multipurpose and Environmental Services Project
- Verification of two verification of La Vuelta and la Herradura Hydroelectric Project
- Verification of one verification period of La Venta II project
- Verification of Rio Amazon Woods residues power plant
- Verification of Cristalino small hydroelectric power plant project
- Verification of Faxinal small hydro project in Faxinal dos Guedes
- Validation of El Bote small hydroelectric plant project
- Validation of Cueva Maria Hydroelectric Project
- Validation of Installation of a high-pressure/high-efficiency bagasse boiler to cogenerate heat and power
- Validation of La Calera Biodigesters Project