

PERIODIC VERIFICATION REPORT**HIDROABANICO S.A.****PERIODIC VERIFICATION OF THE
PROJECT ACTIVITY ABANICO
HYDROELECTRIC PROJECT****REFERENCE NUMBER:** 2008/024/CDM/01**REPORT NUMBER:** 03

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Client: HIDROABANICO, S.A. Ecuador	

Summary:

The Spanish Association for Standardisation and Certification (AENOR) has performed the verification of the emission reductions of the project "Abanico Hydroelectric Plant" (Registration Ref No. 0141). The monitoring period for this project is from March 1st, 2007-February 29th, 2008 /3/.

The Abanico Hydroelectric Project consists in the construction of a new 37.5 MW run-of river hydroelectric power plant. Abanico is located in the southeastern region of Ecuador, in the Morona Santiago Province; in the coordinates 2° 15-3' y 78° 11-54' northeast of the city of Macas.

The objectives of the Abanico Hydroelectric Project (AHP) are to generate clean power, produce employment in an economically depressed zone, replace the use of polluted energy, presently utilized and improve the efficiency and competitiveness of some Ecuadorian industries. Furthermore Abanico will sell the generated output to Ecuador's Wholesale Power Market (WPM) through both spot market transactions and power purchase agreements (PPAs), using the Transelectric transmission company to wheel the energy.

The activity of the Abanico Project will generate clean electricity displacing thermal energy from fossil fuel power plants, thus reducing Greenhouse Gas (GHG) emissions.

A risk based verification approach was employed to identify key risks to emission reduction estimations.

During the on site visit it was verified the quality assurance of the data concern in the calculation of the emission reduction. The installation of the project was also verified and the proper use of the meters and procedure controls were also tested.

CENACE interviews and calibration evidences allowed the verification team to verify that the main and back up meter worked correctly during the period of the monitoring report. The GHG emission reductions were thus calculated correctly on the basis of the approved methodology ACM0002 ver 3 and the Monitoring plan and formula given in the PDD registered. Therefore, in the audit team opinion, the GHG emission reductions reported for the project in the Monitoring Report of the period March 1, 2007 to February 29, 2008 are correct.

Report title: Abanico hydroelectric project in Ecuador		
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Abbreviations

CONELEC	Consejo Nacional de Electricidad (National Council of Electricity)
AENOR	Spanish Association for Standardisation and Certification
MEM	Wholesale Energy Market
ACM0002- Ver 03	“Consolidated baseline methodology for grid-connected electricity generation from renewable sources”.
CAR	Corrective action request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CENACE	The National Center for Energy Control
CO₂	Carbon Dioxide
FAR	Forwarded Action Requested
DOE	Designated Operational Entity
FAR	Forwarded action request
GHG	Greenhouse Gases
MP	Monitoring Plan
PDD	Project Design Document
SNI	Interconnected National System
tC	Carbon tonnes
tCO₂	Carbon dioxide equivalent tonnes
UNFCCC	United Nations Framework Convention for Climate Change

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1. INTRODUCTION

HIDROABANICO, S.A. has commissioned AENOR to carry out the verification and certification of the emission reductions generated by the “Abanico Hydroelectric Plant” project in Ecuador (the project) for the period March 1st, 2007-February 29th, 2008. This report contains the findings from the verification and a certification statement for the certified emission reductions.

1.1. Objective

According to the Modalities and Procedures for a CDM (Decision 3/CMP1) the purpose of the verification is the periodic independent review and ex-post determination by the DOE of the monitored reductions in anthropogenic emissions by sources of GHG that have occurred as a result of a registered CDM project activity during the verification period.

Certification is the written assurance by the DOE that, during a specified time period, a project activity achieved the reductions in anthropogenic emissions by sources of greenhouse gases as verified.

1.2. Scope

The verification scope is:

- To determine whether the project documentation provided is in accordance with the requirements of the registered project design document and relevant provisions of decision 3/CMP.1 and its annex, and relevant decisions of the COP/MOP;
- To conduct on-site inspections, including a review of performance records, interviews with project participants and local stakeholders, collection of measurements, observation of established practices and testing of the accuracy of monitoring equipment;
- To review monitoring results and to verify that the monitoring plan has been applied correctly and their documentation is complete and transparent;
- To recommend to the project participants appropriate changes to the monitoring plan, if necessary;
- To determine the reductions in anthropogenic emissions by sources of greenhouse gases that would not have occurred in the absence of the CDM project activity, using calculation procedures consistent with those contained in the registered project design document and in the monitoring plan;
- To identify and inform the project participants of any concerns related to the conformity of the actual project activity and its operation with the registered project design document. Project participants shall address the concerns and supply relevant additional information;
- To provide a verification report to the project participants, the Parties involved and the executive board. The report shall be made publicly available.

The verification is not meant to provide any consultancy services to the client. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the monitoring report.

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AENOR, based on the Specific Code for the Processing and Conducting of Validation, Registration, Verification and Certification of Kyoto Protocol CDM Project Activities (IE/DCS/066.07), which is in turn based in the validation and Verification Manual /17/, has used a risk-based approach in the verification, focusing on the identification of significant risks for the generation of CERs and verifying the mitigation measures for these.

1.3. Description of the Project Activity

Project Party:	Ecuador
Title of project activity:	Abanico Hydroelectric plant
UNFCCC registration No:	0141
Project Entity:	HIDROABANICO,S.A. Av. Amazonas N41-56 e Isla Floreana Building: Amazonas Norte, 4th floor e-mail: HIDROABANICO@gne.com.ec
Location of the project activity:	City of Macas. Province of Morona Santiago. Ecuador.
Project's crediting period:	1 st February 2006- 2013. (7 years renewable)
Verification period:	March 1 st , 2007-February 29 th , 2008
Projects starting date:	First phase: 1 st February 2006 (commercial operation) Second phase: 18th July 2007 (commercial operation)

Abanico hydroelectric project began commercial operations in 2006 with the purpose of generating clean electrical energy, free of greenhouse gas emissions, for the SNI.

The Abanico Hydroelectric Plant was built in two phases the first phase included the installation of two turbines in the engine house with an install capacity of 15 MW.

The second phase of the hydropower project had the construction of a pressure pipe, the installation of 3 more turbines with a nominal capacity of 22.5 MW. The complete project including two phases had a nominal capacity of 37.5 MW. The second phase started commercial operations 18th July 2007.

Currently, the Abanico project has 5 turbines: Pelton WKV, with a design flow of 12.5 m³/s, and the load factor of the plant: 86%. These parameters and the construction of the turbines were assessed during the on site visit (22th of April 2008) and all the facilities were subjected to a visual inspection.

The project is a run-of-river hydroelectric plant without a reservoir. It has rubble and sand collecting devices and a cargo tank that is placed at the end of the sand-collecting device connected to tunnel that works under low pressure. This situation was checked during the visit.

The project's emission reductions are determined by multiplying the amount of net electricity generated by the project with a validated ex-ante fixed grid emission coefficient of 0.6165 tCO₂/MWh. According to the registered project design, there are no project emissions and leakage associated with the project.

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Methodology

The verification of the emissions reductions has assessed all factors and issues that constitute the basis for emission reductions from the project, basically these includes following variables:

- The net electricity supplied by the project to the SNI which is multiplied with the fixed grid emission factor, calculated ex ante in the PDD. The emission factor is 0.6165 tCO₂ per MWh;
- The actual installed capacity of the hydroelectric plant to ensure that the project is not a small scale CDM project activity.

The version of the methodology approved in the validation report was not the same that the version of the approved PDD. The first verification report included the version 1 of the methodology, but the CDM Team of the UNFCCC requested to change this issue because the methodology version used for the verification of a project activity should be the same mentioned in the validation report. This issue has been revised, and the correct version of the **ACM 0002 methodology** used is the version **number 3**. The calculations have not been modified because the emission factor of the baseline was fixed ex-ante, only the number of the methodology version.

Verification team

Elena Llorente Pérez	Chief Verifier	AENOR
Gonzalo Canales Ramírez	Verifier	AENOR Chile
Mercedes García Madero	Trainee verifier	AENOR

Duration of verification

Preparations:	From 20 th March 2008 to 18 th April 2008
On-site verification:	22 nd , 23 rd and 25 th April 2008
Reporting:	June 2008

1.4. Review of Documentation

The Monitoring Report from March 1st to February 29th, 2008 /3/, the official reports from the CENACE Corporation, the initial and period verification reports were reviewed /6/ and /7/.

Moreover, the PDD /1/, the monitoring plan /2/ and the Validation report /4/ were also reviewed.

The Monitoring Report /3/ was made publicly available on the CDM website on 25th of March 2008.

1.5. Site Visits

From April 22nd, 2007 to April 23rd, 2008, AENOR carried out the second visit to “Abanico Hydroelectric plant”. AENOR verified that the capacity of the hydropower plant continue as described in the PDD, to ensure project’s eligibility as a CDM project activity.

The four meters installed in the HIDROABANICO Substation 2 and calibration records from CENACE /4/ were also reviewed and found to be in order. During the on site visit, shift operators and the plant manager were interviewed. Net generation of electricity data of HIDROABANICO, S.A project stated in

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the Monitoring Report in Annex 1 was verified during the visit carried out the 25th of April, 2008, in the CENACE headquarters in Quito.

During the previous review of the documentation 3 CARs and 1 Clarification were detected.

The lack of documented instructions for monitoring of emission reductions available for the personnel with responsibilities in monitoring was the reason of the first CAR. After the communication of this CAR in the verification checklist, it was solved because a written procedure was sent by HIDROABANICO S.A with the responsibilities established /10/.

The second CAR was related with the internal Procedure of HIDROABANICO, S.A. for reporting generation data of the hydroelectric plant.

HIDROABANICO S.A follows the procedures of CENACE and knows exactly how to proceed for the data trail. This issue was validated during the on site visit through interviews with the operation Manager of the Plant and the operators, but the audit team detected that they did not have an internal documented procedure.

This second CAR was solved, because an internal procedure was sent to the audit team on 30th of May of 2008 /9/. This procedure elaborated on 20th of May 2008 (revision 00) explains the specific actions to calculate the emissions reductions according to the methodology AMC0002 Version 3.

The third CAR was related with the procedures to follow in case of anomalies in data and with the calculation of emission reduction. As stated in the second CAR the official procedure to follow in case of anomalies of data was perfectly known by the company, but a written internal procedure was requested in order to establish an excellent quality control.

This CAR was solved with the internal procedure to manage the information of the data generation /11/

On the other hand, the social activities developed by HIDROABANICO, S.A during the Monitoring period were verified through interviews with the representative of the Community of Macas, local inhabitants and Major of Macas.

The measures taken in the Community support Plan described in the PDD and community agreements were verified.

1.6. Assessment

Following means of verification were used:

- review of project documentation (references).
- on-site inspections, including: review of performance records, interviews with project participants, collection of measurements, observation of established practices and testing of the accuracy of monitoring equipment.
- review of monitoring results and verification of the correct application of monitoring methodologies and
- determination of the GHG emissions reductions.

1.7. Reporting of Findings

Verification findings are described in detail in the Periodic Verification Checklist attached in Annex 1.

2. VERIFICATION FINDINGS

2.1 Project Implementation

In the audit team opinion the project was implemented according to the monitoring plan of the registered PDD, the Monitoring Report and the registered PDD, with the exception of the start of commercial operation of the Second Phase of the project. These issues were assessed with the local interviews and documentation review.

A minor deviation was found with the registered PDD. The implementation of the second phase of the project activity started before than expected. The commercial operation of the Second Phase (3 x 7,5 MW) started 18th July 2007, five months and a half before than estimated in the registered PDD (January 2008).

A request for deviation has been requested to the Execute Board to address this issue.

HIDROABANICO, S.A has been doing a very important social labour with the communities. The company has disbursed since the beginning of the project \$USD 3.000.000 in Macas and bordering communities for local services. Every year, during the concession period, HIDROABANICO, S.A pays \$USD 80.000 to the Municipality of Morona for social investments. The contract was checked during the verification visit. The mayor of Macas, and Proaño Community president were interviewed in order to check the destination of the inversion of HIDROABANICO, S.A. The Community did a treatment water plant (\$USD 150.000) showed during the visit, some bridges to cross the river and some different small social projects. The person in charge of social labour was very involved in the success of the project.

In relation with Environment Plan, the works detailed in the monitoring report were checked during the verification visit. HIDROABANICO S.A planted 3.700 trees, (82.5% of advance) with a survival ratio of less than 50%, and they are making studies in order to improve it.

Every year, they have to send environmental reports to CONELEC (Environmental Authority), and during the visit, the audit team checked the revegetation area, the rapids made to stabilize the river and the channel of the stream in the area of the tunnel, as well as the following documentation of these works:

- ❑ Developed works Balaquepe River – May 2007 –SIPETROL.
- ❑ Monitoring report of the advance of the construction – July 2007 – SIPETROL /18/.
- ❑ Environment Audit report – 22-23 October 2007. Technical Office Macas (Environmental Ministry) /19/.
- ❑ Environmental Management Plan /20/.

As stated in section 1.3, Description of the project activity, Abanico hydroelectric project was implemented in two phases. The second phase started its commercial operation on 18th July 2007. In the PDD the second phase was estimated to initiate operation in January 2008. The verification team, to assess this issue, checked the following documentation related with the implementation, commissioning and start of commercial operation of the second phase of the project:

- Second phase developed works; progress report issued by SIPETROL /18/

- Letter of CENACE (Corporación Centro Nacional de Control de Energía, the technical and commercial administrator of the wholesale electricity market in Ecuador), dated on 19th July 2008, with the authorization for the commercial operation of the increased capacity of Hidroabanico. / 21/

2.2 Completeness of Monitoring

The main issue of the monitoring of the emission reduction at HIDROABANICO, S.A plant is the meter equipment. All the meters necessary to monitor electricity generated by the plant have been identified and checked by the audit team during the on site visit.

There are 4 measurement electronic equipment, bidirectional type, BRAND MAXSYS 2510 precision 0.2%, that fulfil with the specifications required by the Regulation No. CONELEC-005/06. They were correctly calibrated.

On December 2007 this calibration expired and the General Manager of HIDROABANICO S.A sent a letter to CENACE to request a technician to recalibrate the meters (the letter is attached in the Monitoring Report). The recalibration of the equipment consists of an on site visit of the technician from CENACE that calibrates it at the substation.

On February 20th 2008 these meters were calibrated and they were within the accuracy range. Since the electricity generation of the months January and February 2008 were checked with CENACE by the verification team, the data stated in the Monitoring Report /3/ is considered correct.

These calibration certificates were checked during the visit to CENACE office, and calibration registries are included in the Monitoring Report Period: March 1st, 2007-February 29th, 2008. Furthermore, during the on site visit the serial numbers of the meters and safety seals were checked in the substation No. 2 of HIDROABANICO, S.A and they corresponded with the serial numbers of the Calibration Certificates. During the visit to CENACE, the certificates were checked again and they were in accordance with the official ones.

The second main issue according to the monitoring plan is the energy delivered to the grid measure. The project measures the net electrical energy in the substation HIDROABANICO No.2 located in Macas using electronic equipment that stores data of active energy, reactive energy, apparent energy, current, voltage and frequency in integration periods of 15 minutes.

The Monitoring Report period: March 1st, 2007-February 29th, 2008 of Abanico Hydroelectric Plant /3/ shows the net generation value of electricity delivered to the grid. The Annex 1 of the Monitoring Report shows a summary of the HIDROABANICO generation from March 2007 to February 2008. This net generation was assessed during the visit in the CENACE offices and the official documentation of CENACE, and the official values of energy delivered to the grid used in the calculation of the CERs were checked.

2.3 Accuracy of Emission Reduction Calculations

In line to guarantee the accuracy of emission reduction calculation, HIDROABANICO, S.A uses an application of the software (TPL) that CENACE gives to every electricity agent in order to unload data.

According to the regulation No.CONELEC 005/06 “Commercial measurement of the Electric Market” (MEM) the Manager of the Plant has to unload the data and send them to CENACE through the website. The information is recorded every 15 minutes by the meters in the HIDROABANICO Substation 2 everyday.

The maximum hour to send this information is 9 a.m of the next day of the operation. The files sent to CENACE can not be modified, so the precision of the data is assured.

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Several times, the accuracy of the generation data is guaranteed in three ways:

1. CENACE makes telemetry to unload the information of the meters at the Substation so no human error can be produced
2. HIDROABANICO, S.A sends generation readings data to CENACE to be validated against to the telemetry data.
3. And, the General Manager of HIDROABANICO, S.A reviews the net daily generation of the Central and compares it with the daily liquidation of CENACE. This procedure correctly is described in the procedures PCRDE 03-08 and PDRMR 01-08.

Besides this daily internal validation, with monthly recurrence the net energy generation is checked with the information posted in CENACE.

As stated above, CENACE access by remote way to the energy delivered to the Interconnected National System and provides monthly several versions of the national energetic balance (electricity generation and payments in \$USD) to be checked by all the Agents in the Ecuadorean Electrical Market. After this process, CENACE certifies the quantity of energy delivered monthly by issuing an official report.

Data used to calculate emissions reduction by HIDROABANICO, S.A is the official data included in the monthly Report issued by CENACE. These monthly reports were showed to the verification team during the on site visit and they were in accordance with the official information obtained from CENACE.

All the details of this procedure are explained in the Internal procedure of HIDROABANICO "Internal Procedure to calculate the emission reduction of CO₂ " version 0 PCRDE03-08 /9/.

The calculation of the emission reduction is according to the AMC0002 version 3. As it is above established, the General Manager is responsible of the calculation of these reductions. Monthly he is in charge of downloading the final version of CENACE net generation. In case of absence of the General Manager, the President of the company is responsible of the calculation of the emission reductions.

The Emission factor is a combined Margin of the Operation Margin and the Built Margin. This emission factor is fixed and calculated ex-ante as stated in the registered PDD of Abanico Project 0141.

The emission factor is the following: 0.6165 tCO₂/MWh.

A spreadsheet has been submitted to the audit team including the calculation of the CERs for the corresponding period, and it has been checked as support documentation. This spreadsheet will be submitted to the CDM Executive Board as support of the Monitoring Report.

The verification team is able to assure that calculations of emission reductions in the monitoring report are accurate, reliable and in accordance with the registered PDD and CDM requirements.

2.4 Quality of Evidence to Determine Emission Reductions

The Monitoring Report /3/ claimed emission reductions of 148,920 tCO₂e for the period 01st March 2007 to 29th February 2008. In order to check these data, AENOR reviewed following documentation:

- Procedure to calculate the emission reductions /9/.
- Internal procedure to manage the information of data generation /11/.

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- Monitoring Report /3/.

After the on site visit, AENOR was able to verify that the net amount of electricity for the period 01st March 2007 to 29th February 2008 was 241,556.52 MWh which corresponds to emission reductions of 148,920 tCO_{2e}.

The net amount of electricity was verified with the official documents in the headquarters of CENACE and with the spreadsheet sent by HIDROABANICO, S.A to AENOR.

As it was mentioned before, Abanico Hydroelectric Power was developed in two phases. As the second phase (22,5 MW of installed capacity) started its commercial operation on 18th July 2007, there is an increase of the electricity generated from July 2007 due to the performance of the new installed capacity.

Since the start of the commercial operation of the second phase, approximately 40% of the total electricity production is generated by the Pelton turbines (2 x 7,5 MW) installed and commissioned at the first phase, and 60% is generated by the new installed capacity (3 x 7,5 MW)

The quality to determine Emission Reductions is accurate since it is established the following procedure to avoid uncertainties.

In case a meter would not be working, the Manager of the Plant will inform the CENACE immediately. On the contrary, CENACE shall inform the Manager of the Plant if a failure in the equipment is detected. Once it is detected, the Manager of the Plant will proceed to correct the meters with the authorization of CENACE. 48 hours is the maximum period to solve this issue.

On the other hand, the below procedure is usually followed:

- Daily liquidation: Until 24:00h of the following day of operation, CENACE posted the information of the measure. The following day CENACE will receive punctual observations of the generation agents. The third day CENACE posted the liquidation. During the following days CENACE will receive the comments from the agents.
- Monthly liquidation: the sixth day of the following month of the operation of the plant, CENACE published the monthly liquidation. During the seventh and eighth day CENACE will receive observation of the monthly report.

This procedure was checked at all in CENACE and it's stated in detail in the procedure PIMIDG 02-08 /11/.

2.5 Management System and Quality Assurance

According to the Monitoring Plan, readings are checked by the person in charge of it, in order to avoid any anomaly before being provided to CENACE. Monitoring and reporting of electricity generation is part of power plant normal operations and the quality of the meter readings is assured through calibration

During the on-site audit, the verification team could validate that the quality assurance routine of the readings includes a double criteria: existence of data and validation with qualification controls. All the process is under supervision by the Responsible of Monitoring. See procedure of definition of responsibilities PDRMR-01-08 /10/.

Data obtained by meters reading is double checked by receipts of sales. Electricity generation data is compared monthly with official certificate of sales issued by CENACE that includes the amount of electricity generated by the Abanico River Hydroelectric Plant.

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The internal validation procedures carried out by HIDROABANICO, S.A were confirmed during the audit and afterwards the written procedures were sent to the audit team.

3. VERIFICATION STATEMENT

Reporting period: From March 1st, 2007-February 29th, 2008

Verified emission in the above reporting period:

Emission reductions 148,920 t CO₂ equivalents

AENOR has been engaged by HIDROABANICO, S.A to examine the greenhouse gas (GHG) emission reductions reported from the Abanico Hydroelectric Power Plant Project for the reporting period, equating to 148,920 tonnes of CO₂ equivalents.

Our verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakech accords ratified in Montreal MOP1 as well as those defined by the CDM Executive board.

We planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that the amount of GHG emission reductions for the reporting period, prepared on the basis of the Monitoring Plan and the Monitoring Report /2/ & /3/, are fairly stated.

We conducted our verification having regard to the Project Design Document /1/, the Project's Monitoring Plan /2/ and the applied baseline as registered for the project. This assessment included:

- collection of evidence supporting the reported data
- checking whether the provisions of the Monitoring Plan, were consistently and appropriately applied

According to calibrations evidences, the operational performance of the Commercial meter is considered adequate during year 2007 and part of 2008. Therefore, electricity generation data in the Monitoring Report /3/ are considered reliable and accurate. The GHG emission reductions were thus calculated correctly on the basis of the approved methodology ACM0002, version 3, the Monitoring Report /3/ and formula given in the PDD registered /1/. Therefore, in our opinion, the GHG emission reductions reported for the project in the Monitoring Report of March 1st, 2007-February 29th, 2008 /3/ are correct.

AENOR is able to certify that the emission reductions from the "Abanico Hydroelectric Plant" project during the period March 1st, 2007 – February 29th, 2008, amount to 148,920 tonnes of CO₂ equivalent.

Madrid, **September 2nd, 2008**

Elena Llorente Pérez
Team Leader and Chief verifier
AENOR

Luis Robles Olmos
Technology Coordinator
AENOR

4. REFERENCES

- /1/ PDD registered. v.3/ 18-11-2005
- /2/ Monitoring plan v.3/18-11-2005
- /3/ Annual report of the Monitoring Plan “Period: March 1,2007-February 29, 2008”, 29th August 2008.
- /4/ Validation Report Version 3 2004-26-11
- /5/ Consolidated Methodology AMC0002 version 3
- /6/ Initial verification Report version 1 2007-04-23
- /7/ Periodic verification report version 2 2007-04-23
- /8/ Monitoring report Abanico period: 4 February-28 February 2007
- /9/ Internal procedure to Calculate the Emission reduction of CO2 version 0 PCRDE 03-08
- /10/ Internal procedure of Responsibilities of Monitoring PDRMR 01-08
- /11/ Internal procedure to manage the data generation PIMIDG 02-08
- /12/ No. CONELEC 005/06
- /13/ No. CONELEC 002/04
- /14/ Updated Environmental Management Plan 2007
- /15/ Environmental Monitoring –HIDROABANICO Project 2007
- /16/ Developed works Balaquepe River – May 2007 –SIPETROL.
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- /18/ Monitoring report of the advance of the construction – July 2007 – SIPETROL.
- /19/ Environment Audit report – 22-23 October 2007. Technical Office Macas (Environmental Ministry)
- /20/ Environmental Management Plan
- /21/ Letter of CENACE (Corporación Centro Nacional de Control de Energía, the technical and commercial administrator of the wholesale electricity market in Ecuador).