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# VALIDATION REPORT

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## “Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project in Colombia

REPORT No. 2007-1986

REVISION No. 02



## VALIDATION REPORT

DET NORSKE VERITAS  
CERTIFICATION AS

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Date of first issue: 2007-05-28	Project No.: 61070390
Approved by: Mari Groos Viddal	Organisational unit: Climate Change Services
Client: Corporación Andina de Fomento	Client ref.: Camilo Rojas

**Project Name:** Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project

**Country:** Colombia

**Methodology:** AM0036

**Version:** 01

**GHG reducing Measure/Technology:**

**ER estimate:** 35 140tCO<sub>2</sub>e per annum.

**Size**

☒ Large Scale

☐ Small Scale

**Validation Phases:**

☒ Desk Review

☒ Follow up interviews

☒ Resolution of outstanding issues

**Validation Status**

☐ Corrective Actions Requested

☐ Clarifications Requested

☒ Full Approval and submission for registration

☐ Rejected

In summary, it is Det Norske Veritas Certification AS's opinion that the "Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project" in Colombia, as described in the PDD version 16 dated 27 March 2008, meets all relevant UNFCCC requirements for the CDM and correctly applies the baseline and monitoring methodology AM0036 version 1.1. Det Norske Veritas Certification AS thus requests the registration of the project as a CDM project activity.

Report No.: 2007-1986	Date of this revision: 2008-08-10	Rev. No. 02
Report title: "Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project in Colombia.		
Work carried out by: Alfonso Capuchino; Gustavo Godinez; Hendrik Brinks		
Work verified by: Kakaraparthi Venkata Raman (Applicant), Michael Lehmann		

**Key words:**

Climate Change

Kyoto Protocol

Validation

Clean Development Mechanism

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### Abbreviations

CAF	Corporación Andina de Fomento
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CENICAÑA	Centro de Investigación de la Caña de Azúcar
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CL	Clarification Request
CO <sub>2</sub>	Carbon Dioxide
CO <sub>2eq</sub>	Carbon Dioxide Equivalent
CRC	Corporación Regional del Cauca
DNA	Designed National Authority
DNV	Det Norske Veritas
EIA	Environmental Impact Assessment
GHG	Green House Gases
GWP	Global Warming Potential
INCAUCA	Ingenio del Cauca, S.A.
IPCC	Intergovernmental Panel of Climate Change
MP	Monitoring Plan
ODA	Official Development Assistance
PDD	Project Document Design
UNFCCC	United Nations Framework Convention on Climate Change
VROM	Ministry of Housing, Spatial Planning and the Environment




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Appendix A: Validation Protocol

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### 1 EXECUTIVE SUMMARY – VALIDATION OPINION

*Det Norske Veritas Certification AS (DNV) has performed a validation of the “Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project” in Colombia. The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host Party 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 have provided Det Norske Veritas Certification AS with sufficient evidence to determine the fulfilment of stated criteria.*

*The host Party is Colombia and the Annex I Party is The Netherlands. Both Parties fulfil the participation criteria and have approved the project and authorized the project participants. The DNA from Colombia confirmed that the project assists in achieving sustainable development.*

*The project correctly applies AM0036 “Fuel switch from fossil fuels to biomass residues in boilers for heat generation”, version 1.1.*

*The project results in the displacement of coal consumption by the collection of biomass (discarded sugarcane leaves and stalks) from the fields during harvesting and its use as biomass fuel in the boilers, thereby resulting in reductions of GHG emissions that are real, measurable and give long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. 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 35 140 t CO<sub>2</sub>e per year over the selected 7 year crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.*

*Adequate training and monitoring procedures have been implemented.*

*In summary, it is DNV’s opinion that the “Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project” in Colombia, as described in the PDD version 16 dated 27 March 2008, meets all relevant UNFCCC requirements for the CDM and correctly applies the baseline and monitoring methodology AM0036 version 01.1. Det Norske Veritas Certification AS thus requests the registration of the project as a CDM project activity”.*



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## 2 INTRODUCTION

Corporación Andina de Fomento (CAF) has commissioned Det Norske Veritas Certification AS to perform a validation of the “Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project” in Colombia (hereafter called “the project”). This report summarises the findings of the validation of the project, performed 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.

### 2.1 Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria 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 to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

### 2.2 Scope

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology AM0036. The validation team has, based on the recommendations in the Validation and Verification Manual, employed a risk-based approach, focusing on the identification of significant risks for project implementation and the generation of CERs.

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

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### 3 METHODOLOGY

The validation consisted of the following three phases:

- I a desk review of the project design documents
- II follow-up interviews with project stakeholders
- III the resolution of outstanding issues and the issuance of the final validation report and opinion.

The following sections outline each step in more detail.

#### 3.1 Desk Review of the Project Design Documentation

The following table outlines the documentation reviewed during the validation:

- /1/ Ecoinvest Carbon and CAF, *Project Design Document for the "Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project"*, Version 5 of 17 November, 2005; Version 13 of 23 April, 2007; Version 14 of 13 November 2007; Version 15 dated 07 March 2008 and Version 16 of 27 March 2007.
- /2/ VROM, *Letter of Approval* dated 04 August 2008.
- /3/ Ministry of Environmental, Housing and Territorial Development Republic of Colombia, *Letter of Approval*, English and Spanish version, both dated 29 May 2007
- /4/ Ingenio del Cauca, *Control Reports of use of the biomass residues from 01 January 2006 to 31 March 2008*.
- /5/ International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF), *Validation and Verification Manual*. <http://www.vvmanual.info>
- /6/ CDM Executive Board, AM0036 - *Fuel switch from fossil fuels to biomass residues in boilers for heat generation*, version 1, 29 September 2006
- /7/ CDM Executive Board, *Tool for the demonstration and assessment of additionality*, ver.3
- /8/ CAF, *CERs calculation* 07 March 2008.
- /9/ CORPOICA, *Manage and post harvest of sugar cane* August, 1998
- /10/ GEF - Carlos O. Briceño, James H. Cock and Jorge S. Torres A, *Electric power from green harvesting residues of sugar cane in Colombia a pre feasibility study on its technical and economical viability* February, 1999
- /11/ Cenicaña, *Technical Congress Characteristics of baggase/residues as boiler fuel*, September 2006
- /12/ Cenicaña, *Performance evaluation of the project proposed equipment* March 21, 2002
- /13/ Corporación Autónoma Regional del Cauca, *Resolution No. 0605*, 25 July, 2000
- /14/ Corporación Autónoma Regional del Cauca, *Resolution No. 0609* 21 July, 2004
- /15/ Corporación Autónoma Regional del Cauca, *Resolution No. 0389* 17 July, 2006
- /16/ Government of Colombia, *Environmental License Decree 1753* of 03 August 1994



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- /17/ INCAUCA, *Annual operation reports* for years 2004-2006.
- /18/ SGS Colombia, S.A., *Bagasse laboratory analysis* 13 March, 2006 and October 2006
- /19/ SGS Colombia, S.A., *Steam coal laboratory analysis* 13 March, 2006 and October 2006
- /20/ INCAUCA, *Stakeholders meetings minutes* delivered 20 June, 2007
- /21/ INCAUCA, *Dry leaves and coal internal laboratory analysis* 20 June, 2006
- /22/ Fundación Carvajal, *Cooperative project presentation* provided 09 June, 2007
- /23/ INCAUCA, crushing line several equipments manufacturer manuals.

### 3.2 Follow-up Interviews with Project Stakeholders

	Date	Name	Organization	Topic
/24/	2007-06-20	Ruben Uchima Jhon Jairo León Rafael Jiménez Humberto Mondragón Juan Carlos Muñoz Julián Mauricio Aguilera Álvaro Guerrero Pedro Nel López	INCAUCA	<ul style="list-style-type: none"> <li>- Project boundary: which boiler is part of the project and which is not.</li> <li>- Basis for the input figures in the IRR calculation.</li> <li>- Pre feasibility study on its technical and economical viability electric power from green harvesting residues of sugar cane in Colombia</li> <li>- Barrier analysis.</li> <li>- Data regarding turbine installed capacity and historical power generation.</li> <li>- Support that no extra electricity or fossil fuel consumption has been considered for firing the extra amount of biomass.</li> <li>- Demonstrates basis for the truck carrying capacity.</li> <li>- Basis for the mileage of trucks and average distance defined in the PDD.</li> <li>- Basis of the 14000 t coal replacement figure.</li> <li>- Basis for the boiler efficiency considering: coal, barbojo, coal+bagasse and coal+bagasse+barbojo.</li> <li>- Local and national environmental</li> </ul>





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				permits.
				- Actual capacity of the PP to monitor the required data and parameters determined by the methodology (Monitoring plan),
				- Applicability of their current management system to the CDM project.
				- Compliance with environmental management plan.
				- Alternatives to baseline scenario.
				- Sensitivity analysis.
				- Basis for the determination of Cost ton of harvest residue and pre-burning.
/25/	2007-06-20	Gianluca Merlo	CAF	- Documentation to prove consideration of CDM prior to the decision to proceed with the prjoect.
				- Timeframe to obtain LoA's.
/26/	2007-06-20	Edgar Fernando Castillo Adolfo León Gómez Jesús Larrahondo	CENICAÑA	- Business as usual in Harvest operations.
				- Current technology in harvesting.
				- Current boiler technologies in the country.
				- Additionality of the project associated to technology and lack of qualified personnel.
/27/	2007-06-20	José Gregorio Méndez Chávez	Corporación Regional del Cauca	Environmental permits required by INCAUCA.
				- INCAUCA conformity with environmental requirements (environmental management plan).
				- Need to perform EIA.
				- Requirement of local stakeholder consultation.
/28/	2007-06-20	Noralba Zapata. Francisco Javier Zapata Justino Manzano Hidalgo Edward Calvida Francisco Diego	Stakeholders	- Information regarding how the stakeholders were consulted.
				- Comments rose during the process.
				- Comments on the current handling of the biomass residues.
				- Evidence of persons informed of the project.



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Vierdo Fajardo.  
Oscar Donéis.

### 3.3 Resolution of Outstanding Issues

The objective of this phase of the validation was to resolve any outstanding issues which needed be clarified prior to Det Norske Veritas Certification AS's positive conclusion on the project design. In order to ensure transparency a validation protocol was customised for the project. The protocol shows in a transparent manner the criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of three tables. The different columns in these tables are described in the figure below. The completed validation protocol for the "Incauca S. A. Fuel Switch from Coal to Green Harvest Residues CDM Project" is enclosed in Appendix A to this report.

Findings established during the validation can either be seen as a non-fulfilment of CDM criteria or where a risk to the fulfilment of project objectives is identified. Corrective action requests (CAR) are issued, where:

- i) mistakes have been made with a direct influence on project results;
- ii) CDM and/or methodology specific requirements have not been met; or
- iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

A request for clarification (CL) may be used where additional information is needed to fully clarify an issue.

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<b>Validation Protocol Table 1: Mandatory Requirements for CDM Project Activities</b>				
<b>Requirement</b>	<b>Reference</b>	<b>Conclusion</b>		
<i>The requirements the project must meet.</i>	<i>Gives reference to the legislation or agreement where the requirement is found.</i>	<i>This is either acceptable based on evidence provided (<b>OK</b>), a <b>Corrective Action Request (CAR)</b> of risk or non-compliance with stated requirements or a request for <b>Clarification (CL)</b> where further clarifications are needed.</i>		

  

<b>Validation Protocol Table 2: Requirement checklist</b>				
<b>Checklist Question</b>	<b>Reference</b>	<b>Means of verification (MoV)</b>	<b>Comment</b>	<b>Draft and/or Final Conclusion</b>
<i>The various requirements in Table 2 are linked to checklist questions the project should meet. The checklist is organised in different sections, following the logic of the large-scale PDD template, version 03 – in effect as of: 28 July 2006. Each section is then further sub-divided.</i>	<i>Gives reference to documents where the answer to the checklist question or item is found.</i>	<i>Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable.</i>	<i>The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.</i>	<i>This is either acceptable based on evidence provided (<b>OK</b>), or a <b>corrective action request (CAR)</b> due to non-compliance with the checklist question (See below). A request for clarification (CL) is used when the validation team has identified a need for further clarification.</i>

  

<b>Validation Protocol Table 3: Resolution of Corrective Action and Clarification Requests</b>			
<b>Draft report clarifications and corrective action requests</b>	<b>Ref. to checklist question in table 2</b>	<b>Summary of project owner response</b>	<b>Validation conclusion</b>
<i>If the conclusions from the draft Validation are either a CAR or a CL, these should be listed in this section.</i>	<i>Reference to the checklist question number in Table 2 where the CAR or CL is explained.</i>	<i>The responses given by the project participants during the communications with the validation team should be summarised in this section.</i>	<i>This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion".</i>

**Figure 1 Validation protocol tables**




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### 3.4 Internal Quality Control

The draft validation report including the initial validation findings underwent a technical review before being submitted to the project participants. The final validation report underwent another technical review before requesting registration of the project activity. The technical review was performed by a technical reviewer qualified in accordance with Det Norske Veritas Certification AS's qualification scheme for CDM validation and verification.

### 3.5 Validation Team

<i>Role/Qualification</i>	<i>Last Name</i>	<i>First Name</i>	<i>Country</i>
Team Leader/CDM Validator	Capuchino	Alfonso	Mexico
Sector Expert	Godinez	Gustavo	Mexico
Sector Expert	Brinks	Hendrik	Norway
Technical Reviewer (Applicant)	Kakaraparthi	Venkata Raman	India
Technical Reviewer	Lehmann	Michael	Norway

The qualification of each individual validation team member is detailed in Appendix B to this report.



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### 4 VALIDATION FINDINGS

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 Appendix A.

The final validation findings relate to the project design as documented and described in the project design documentation of 27 March 2007.

#### 4.1 Participation Requirements

The project participants are Ingenio del Cauca S. A., Corporación Andina de Fomento (CAF) acting as trustee for the government of The Netherlands and the Netherlands represented by its Ministry of Housing, Spatial Planning and the Environment. The host Party is Colombia and Annex I Party is The Netherlands. Both Parties meet all relevant participation requirements and have provided letters of approvals of voluntary participation in the project /2/ and /3/. The letter of approval from the DNA of Colombia also confirms that the project activity contributes to the sustainable development objectives of the host country.

The validation did not reveal any information that indicates that the project can be seen as a diversion of official development assistance funding towards Guatemala.

#### 4.2 Project Design

The project activity involves the use of green cane harvesting leaves and stalks from the sugar cane fields during the harvesting season as fuel in the bagasse fired boilers. Currently bagasse and coal are used as the primary energy sources for the generation of steam and electricity at the Incauca sugar plant. The project has four boilers. Prior to the implementation of the project, boilers 1 & 2 were operated on bagasse, and the boilers 3 & 4 were operated on bagasse and coal. The steam generated is used for power generation which is used in-house. In the project activity the collected and processed biomass from the fields is fired in the boilers 1 & 2 along with bagasse. The bagasse consumption reduced in the boilers 1 & 2 due to the firing of the biomass residues from the fields is diverted and used in the boilers 3 & 4, thereby displacing/saving about 14000 MT per annum of coal used in the boilers 3 & 4. The coal reduction (saving) leads in reduced GHG emissions to the atmosphere. It has been confirmed that the common practise in Colombia is burning of sugar cane fields to allow simple harvesting operations, a practice which is increasingly being replaced by practice of green cane harvesting, as is stated in the Environmental Guide for the Sugar Cane Sub-sector. It was also confirmed that the shift in the practice in harvesting leads to increased biomass generation in the fields during harvesting season.

The project activity involves investment in facilities for the washing and chopping of the collected biomass residues from the fields, mechanism for the feeding of the prepared biomass to the boilers 1 & 2 and the promotion of new practices for the collection and transportation of the biomass from the fields.

DNV was by assessing the process diagrams and flow charts during the validation site visit able to confirm that the retrofit being carried out in the boiler 1 and 2 for burning the biomass residues from the fields is in line with the requirement of the scenario 1 of the methodology AM0036 Ver 1.1. Although the project activity mainly comprises modifications to the feeding



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system, the project activity also required adaptations of the biomass fuel nozzles to the combustion chamber. This can be considered as a retrofit of the existing boilers.

The pre-feasibility study of the project activity was carried out by an independent third party, GEF in 1999. The project was approved by the management of Incauca in October 2004 based on the revised pre-feasibility report which was updated with respect to the cost by the project proponent. Hence, 1 October 2004 is selected as the project's start date. Subsequent to the approval of the project, biomass collections trials were started in 2004. Three methods for collection of biomass residues from the fields are used: a) collecting machine b) collection by local, previously un-employed personnel through the developing of a social project and the creation of collectors cooperatives and c) use of an adapted tractor with an hydraulic hook and modified sugar cane collection wagons.

After the development of the biomass processing line in the plant, the firing of the new type of biomass residues was started in 2006, as evidenced by control reports of use of biomass residues.

The project applies a renewable crediting period of 7 years starting on 01 July 2008 or the date of registration, whichever is later.

### 4.3 Baseline Determination

The "Incauca S. A. Sugarcane Bagasse Cogeneration and Displacement of Thermal Energy Generation by Coal" applies the approved methodology AM0036 "*Fuel switch from fossil fuels to biomass residues in boilers for heat generation*", version 1.1.

AM0036 is applicable to project activity which considers the switch from use of fossil fuels to biomass residues, in existing four boilers and full fills the following applicability conditions:

- The heat generated in the boiler(s) is used for power generation but power generation capacity installed remains unchanged due to the project implementation as verified during site visit.
- The use of biomass residues is more that the biomass residues used in the historical levels and it is technically not possible at the project site without a significant capital investment in
  - a) The retrofit of the existing boilers 1 & 2 for burning the biomass from the fields by the reduction of particle size and modification on the burner nozzles. The retrofits required for the boilers were identified and assessed in a CENICAÑA study which was done as a part of the project support data /11/ and which was verified during the site visit and also verifying the pre feasibility study of the project /10/.
  - b) In a new dedicated biomass supply chain (e.g collecting and cleaning contaminated new sources of biomass residues). This was verified during the site visit.
- The boilers 3 & 4 used bagasse and coal /26/ and the boilers 1 & 2 used bagasse only, prior to the project activity for power generation during the most recent three years prior to the implementation of the project activity.
- No biomass types other than biomass residues, as defined above, will be used in the boiler(s) during the crediting period (some fossil fuels may be co-fired).

**The implementation of the project does not result in an increase of the processing capacity of raw input (e.g. sugar)**



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- The biomass residues used at the project site, where the project activity is implemented, is not stored for more than one year.
- No significant energy quantities are required to prepare the biomass residues for fuel combustion. The biomass is washed and chopped in to smaller particles for combustion, and emissions associated from this process are considered as project emissions
- The biomass residues are sourced from the project proponent's captive sugar fields.
- The boilers have more than fifty years of service life as per the boiler constructors COLAMQUINAS. DNV assessed this through the document provided by the boiler manufacturer COLAMQUINAS on 13 September 2008.

The baseline for the project activity has been determined as per the methodology by the selection of the possible scenario for the generation of heat (H2), alternative uses of biomass (B1 and B3) and the baseline was determined to be the continuation of the present practice of using bagasse and coal.

The normal practice for green cane harvesting is to leave the residues to decay in the field, and some of the residue may eventually be burned in an uncontrolled manner. Hence, the selection of biomass baseline scenarios B1 and B3 is justified.

Selecting the heat generation baseline scenario H2 is appropriate. Incauca has a an agreement with a paper factory (Propal) to trade coal in exchange for bagasse and continuing using coal is thus the most likely baseline scenario as there is no indication that Incauca would switch to another fuel and retrofit the existing boilers in absence of the project.

The spatial extent of the project boundaries have been clearly defined and include a) All the boilers and related equipment at the project site, b) The means for transportation of biomass residues to the project site (e.g. vehicles, animal carts etc) and c) Sugar cane fields from where the biomass is collected and which in the absence of the project activity would have been left to decay.

### 4.4 Additionality

The additionality of the project has been demonstrated using the latest *Tool for the demonstration and assessment of additionality*, version 4 /7/.

DNV observes that, while the pre-feasibility study of the project was carried out by GEF already in 1999 (GEF Study: Electric Power from Green Harvesting Residues of Sugar Cane in Colombia - A Pre Feasibility Study on its Technical and Economical Viability-1999), the decision to proceed with the project was based on the updated report of 2004, with updated project costs using the GEF financial model, prepared by Incauca's Electric Power and Financial Departments. The start date of the project activity of 1 October 2004 was confirmed by the memorandums presented to DNV during the validation. These memorandums document that the manager of the plant requested a meeting in order to finalize details about the construction, installation and starting of the project.

It was also evidenced that the project proponent decided not to proceed with the project activity without CDM revenues. This was assessed during the site visit through a detailed review of the financial model applied for making investment decisions and interviews with project participant representatives.

Incauca decided to update the financial analysis done in the pre-feasibility study done in 1999. This update financial model in 2004 represents evidence that the CDM was seriously considered because this model showed that without the CDM the project is not feasible. The





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pre-feasibility study made by GEF (third party) was available for DNV during validation process as well as the financial model updated in 2004.

Finally, by means of reviewing an internal letter of Incauca, dated 1 October 2004 and several analyses previously carried out by Incauca's Electrical Department, DNV was able to confirm that the Superintendent of the mill accepted to go a head with the project as a CDM project and initiated the construction.

**Step 1.** Two alternatives of a) Continuation of the current situation and b) The implementation of the project without incentives from the CDM consistent with current laws and regulations have been identified for the project activity.

In the case of the option a) Continuation of the current situation, it was assessed during validation process that the sector of green cane harvesting produces 4 million tons of bagasse per year and an amount of 10 million tons per year of biomass / sugar cane residues, which are currently left in the fields and burnt because there are no cost – effective means to capture the potential energy in the residues at present, this was assessed considering the document United Nations Development programme (UNPD) Global Environment facility (GEF) Full size project brief, this document was made available to DNV during validation process.

Also in this document is stated that biomass energy sources are available from the cane crushing and sugar production process (bagacillo and bagasse) as well as from the residues that are currently being left in the field after cane harvesting and collection.

### **Step 2. Investment Analysis**

Since the project activity results in savings of coal consumption, an investment analysis was conducted. The investment analysis /4/ considered the IRR and payback period, based on a financial model prepared as part of the pre feasibility study /10/. The cost analysis was based on a cash flow model and included Incauca's *Earnings Before Interest and Taxes, Depreciation and Amortization* (EBITDA). The model considers variables of (i) cost of biomass collection, transportation, and fuel preparation costs (at US\$ 10.8-17.8 per ton); (ii) price of coal (at US\$ 22.11 per ton), which is considered as savings; and (iii) for the burning of sugarcane even though a cost of 0.3 US\$/Mt is estimated, no cost has been considered in order to be conservatives.

The analysis indicates a negative payback and return on investment. The sensitivity analysis on the model by varying the parameters of coal price, pre-burning cost and transportation cost also indicate a negative return on investment. The calculations have been verified and the supporting documents like the coal invoices and local review of applied costs have been evidenced during the site visit.

It has also been demonstrated that the IRR of the project activity improves to 13 % when considering CDM revenues for the lifetime of the project.

It was also evidenced that the feasibility study report executive summary states “If the costs of these systems can be reduced to less than approximately US\$8 per ton, with 35% moisture content, electricity generation from green residues could be an excellent investment opportunity for the sugar industry in Colombia, and would provide important benefits to the regional economy”. Considering that labour prices always increase, the possibilities of the cost of systems coming down is not likely.





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During the validation process DNV also in particular assessed the following values used in the financial model:

\* 10.8-17.8 USD / Te of biomass collection: (data stated in the GEF study Table 2. Preliminary estimated costs of operations in field, per ton trash and Table 3 Preliminary estimated costs of operations in factory, per ton trash; sum values on total cost (10.8-17.5 and 8.7-13.7 USD /ton). The most conservative figure of 10.8 US\$/TE, in the range was used in the financial model.

\* 22.11 USD / Te coal: This was assessed through the review of invoices.

\* 0.0 USD / Te of biomass burnt in the fields: During validation process, DNV could confirm by interviews with sector experts and authorities that the cost of burning sugarcane biomass in the fields is 0.3 US\$/Te. However the cost has been considered to be 0 USD/Te in order to be conservative.

The calculations have been verified to be correct. All the values provided in the FSR have been validated as appropriate for the time of the investment decision through several documents such as invoices and internal communication from INCAUCA and external companies.

### ***Step 3. Barrier Analysis***

#### Local investment in innovation:

DNV could verify during the site visit that the project faces barriers in the application of new technology/processes for the biomass collection. Though the biomass is collected by three methods, i.e. a) collecting machine b) collection by local, previously un-employed personnel through the developing of a social project and the creation of collectors cooperatives and c) use of an adapted tractor with an hydraulic hook and modified sugar cane collection wagons. The most efficient and economical method is the option c). The upkeep and operation of the mechanized machinery for collection of biomass is critical for the operation of the project. Since the trials for collection were conducted by the project proponent, it can be deemed that this is the first of its kind in Colombia.

The site visit and provided documents /9/-/12/ demonstrates that this is a new technology and also demonstrates all past developments which were not successful. CENICAÑA /26/ also confirms the existence of all of this investments and the risk of using the technology.

#### Utilization of new energy source:

The harvest cane green residue is a new proposed renewable energy source in Colombia. The nature and characteristics of this kind of energy are unknown and depend on climate and rainfall patterns. These uncertainties increase the risk of the utilization of this source. The barriers of logistics and storage at plant also exist for the project. While DNV does confirm that the biomass is a new source of energy, the barriers stated are more generic in nature.



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### Availability of skill labour:

There is not enough skilled manpower (in terms of numbers as well as expertise) at CENICAÑA and within the individual sugar mills the required research and development needed for designing the systems, process and machinery to collect, transport and use the harvested cane residue. This was verified in an interview with CENICAÑA /26/, which also supports the existence of the Lack of access to modern equipment and resources barrier.

### Managerial technological views:

DNV could through interviews with CENICAÑA personnel /26/ and Incauca production area responsible /24/ confirms that the management of Incauca S A (in operation since 1963) is very conservative in its approach to adopt new technology.

The above barriers do not affect the selected baseline scenario, i.e. the continuation of the present practice of using bagasse and coal.

### ***Step 4. Common practice analysis***

DNV could through direct interviews with local and federal authorities and sugar sector experts assess that the project activity is the first commercial-scale project where coal is substituted by harvest cane residues for co-generation. The national sugar cane investigation centre are not aware of any similar projects in the Colombian sugar sector.

Hence, it is DNVs opinion that financial analysis, the assessment of barriers and the common practise analysis demonstrated that the implementation of the project activity without the incentive from the CDM is very unlikely.

## **4.5 Monitoring**

### **4.5.1 Parameters determined ex-ante**

The following parameters were determined ex-ante and verified as part of the validation:

- Quantity of bagasse residue type *k* fired in all boiler(s) at the project site during the historical year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to implementation of the project activity: 2004=767.841; 2005=726.046; 2006=775.554
- Average net efficiency of heat generation in the boiler(s) when fired with fossil fuels.= 68.9%
- Historical annual heat generation from firing biomass residues in boilers at the project site during the year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to the implementation of the project activity (GJ/yr): 2004=6,965,417; 2005=6,586,277; 2006=7,035,385
- Quantity of coal fired in all boiler(s) at the project site during the historical year 2004, 2005 and 2006 prior to implementation of the project activity. 2004=150.360; 2005=161.275; 2006=161.982



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- CO<sub>2</sub> emission factor for coal combination used at Incauca. (Derived from IPCC default emission factors) .0946 t CO<sub>2</sub>/GJ.
- IPCC default emission factor for coal (25.8 t C/TJ).

The above parameters were assessed against local operational reports /17/ to verify the selected values.

### 4.5.2 Parameters monitored ex-post

The following parameters as required by the methodology will be monitored ex-post:

- CO<sub>2</sub> emission factor of the coal displaced by biomass residues for the year y.
- Total heat generated in all boilers at the project site, firing both biomass residues and coal, during the year (y).
- Tonnes of dry matter (Barbojo).
- Moisture content of the biomass residue.
- Tonnes of dry matter (Bagasse).
- Moisture content of the bagasse.
- Quantity of coal fired in all boiler during the year y
- On-site electricity consumption attributable to the project during the year y.
- Emission Factor for electricity used from the grid.
- Quantity of fossil fuel type i combusted at the project site for other purposes than heat generation as a result of project activity during the year y. basically for barbojo collection processes.
- Average truck load of the trucks used.
- Average return trip distance (from and to) between the biomass fuel supply sites and the site of the project plant during the year y.
- Net calorific value of biomass residue type k.
- Net calorific value of coal.
- Average CO<sub>2</sub> emission factor per km for the trucks during the year y
- CH<sub>4</sub> emission factor for the combustion of the biomass residues in the boilers
- CH<sub>4</sub> emission factor for uncontrolled burning of the biomass residue type k during the year y
- Demonstration that the biomass residue type k from a specific source would continue not to be collected or utilized, e.g. by an assessment whether a market has emerged for that type of biomass residue (if yes, leakage is assumed not be ruled out) or by showing that it would still not be feasible to utilize the biomass residues for any purposes.

### 4.5.3 Management system and quality assurance

The project proponent (INCAUCA) has ISO 14 000 certified environmental management systems in place, and all activities of the project will be incorporated into this system. Management system include description of authorities and responsibilities; operational and management procedures, identification of environmental requirements and actions to ensure compliance.

The monitoring plan was assessed and found to be according to methodology requirements, Monitored parameters have when required measurement procedure, defined monitoring frequency and QA/QC procedures and all of them are feasible to be monitored with high accuracy. The competency of the CDM involved employees was also assessed.

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### 4.6 Estimate of GHG Emissions.

The estimate of the GHG emissions has been done as per the formulae provided in the approved methodology AM0036.

#### Baseline emissions

Baseline emissions during the year  $y$  ( $\text{tCO}_2\text{e/yr}$ ) is calculated as the sum of baseline emissions from fossil fuel combustion for heat generation in the boiler(s) ( $\text{tCO}_2/\text{yr}$ ) plus baseline emissions due to uncontrolled burning or decay of the biomass residues ( $\text{tCO}_2\text{e/yr}$ ).

The heat generation from incremental biomass during the year ( $\text{HGPI}_{\text{biomass},y}$ ) was determined as per the option B as some biomass (bagasse) was being used for heat generation in the baseline scenario.

This was calculated as stated by the methodology as the minimum value among the two options:

- The difference between the total quantity of heat generated from biomass residues in all boilers at the project site in the year  $y$  ( $\text{HGPI}_{\text{biomass},\text{total},y}$ ) and the highest annual historical heat generation with biomass residues among the most recent three years prior to the implementation of the project activity
- The difference between the total quantity of heat generated from biomass residues in all boilers in the year  $y$  ( $\text{HGPI}_{\text{biomass},\text{total},y}$ ) and the total heat generation during the year  $y$  ( $\text{HGPI}_{\text{total},y}$ ) multiplied with the highest historical fraction of heat generation with biomass residues from the most recent three years.

Baseline emissions due to uncontrolled burning or decay of the biomass residues was determined for each biomass residue type  $k$  the quantity of biomass residue used for heat generation as a result of the project activity ( $\text{BFPJ}_{k,y}$ ) applying: **other cases** (use of more than one type of biomass residue) considering *Uncontrolled burning or aerobic decay of the biomass residues (cases B1 and B3)* as the most likely baseline scenario for the use of the biomass residues is either that the biomass residues would be dumped or left to decay under mainly aerobic conditions (B1) or burnt in an uncontrolled manner without utilizing them for energy purposes (B3) considering:

- $EF_{\text{burning, CH}_4, k, y}$  of 0.0027 t  $\text{CH}_4$  per ton.
- Conservativeness factor of 0.73
- $EF_{\text{burning, CH}_4, k, y}$  of 0.001971 t $\text{CH}_4$ /tbiomass

**Project emissions** have been estimated using the formulae provided in the methodology and considering the following sources:

- $\text{CO}_2$  emissions from transportation of biomass residues to the project site ( $\text{PE}_{\text{TR}, \text{CO}_2, y}$ ) are determined applying Option 1: Emissions are calculated on the basis of distance and the number of trips the average truck load and by considering  $\text{BFPJ}_{k,y}$  = Quantity of biomass residue type  $k$  used for heat generation as a result of the project activity during the year  $y$  (tons of dry matter or liter).
- $\text{CH}_4$  emissions from combustion of biomass residues in the boiler(s) ( $\text{PE}_{\text{CH}_4, \text{BF}, y}$ ) considering  $\text{CH}_4$  emission factor for the combustion of the biomass residues in the boilers at 41.1 Kg/TJ as per the methodology.
- $\text{CH}_4$  emission factor: 41.1 kg/TJ.

$\text{CO}_2$  emissions from on-site electricity consumption attributable to the project activity ( $\text{tCO}_2/\text{yr}$ ) can be considered as non significant due to the following reasons: a) Incauca actually generates its own electricity from mainly biomass and b) a rather small electricity



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consumption of the equipment (the ex-ante estimate considers rated capacities of the equipments and the operation time in the barbojo crushing line of 12 hours per day these assumptions verified by reviewing the manufacturer manuals /23/. These emissions will be considered and the project proponent will ex-post monitor the electricity consumption of the project. Although an emission factor of zero tons CO<sub>2</sub> per MWh could be applied due the project's electricity being generated on-site from biomass, the project participant will use an electricity grid emission factor of 0.661 tons CO<sub>2</sub>/MWh, determined based on data of 2004. The electricity grid emission factor will be calculated ex -post.

### **Leakage**

No leakage is anticipated as a result of the project activity. Since the baseline alternatives for biomass are B1 or B3, the leakage approach L1 is selected. DNV was able to confirm that biomass residues have not been collected or utilized through site visit interviews with CENICAÑA /26/; visit to the sugar fields and the review of technical background documents /9/ and /11/. It was also confirmed that a) biomass residues were not collected prior to the project (verified with stakeholders /28/) b) external business is being promoted on the basis of social cooperatives to stimulate the barbojo's harvesting which in the baseline scenario did not have economic value and c) surplus of biomass residue would exist even after implementation of the project activity.

Yearly survey will be conducted to assess the leakage and if during any year it cannot be demonstrate that the use of the biomass does result in leakage, a leakage penalty to the quantity of biomass will be included in line with AM0036.

## **4.7 Environmental Impacts**

During the site visit all the environmental permits of the project activity were reviewed and DNV found that the project activity meets the requirements established by the CRC /13/-/15/.

No EIA assessment for the project is required because the potential environmental impacts of the project activity are negligible. It was also confirmed that the biomass in the absence of the project activity would decay in the field. It was also confirmed that transportation of biomass to the mill (short distances) in trucks or traditional vehicles of human traction (carretillas) does not require an EIA as stated by Colombian laws /16/.

## **4.8 Comments by Local Stakeholders**

Different stakeholders meeting were held to inform about the project objectives. Participants were INCAUCA employees, Fundación Carvajal who is expected to create the cooperatives responsible of biomass collection and transportation to INCAUCA processing facilities, people from communities near the project and Union responsible from the near communities.

Meetings were held in INCAUCA facilities as well as in different community areas as El Ortigal community school; open hall in Puerto Tejada community; Juan Ignacio community school; formal health center of Padilla. The meeting dates were 16 January, 2007; 08 February, 2007; 16 March, 2007; 17 May, 2007; 31 May, 2007; 07 June, 2007 and 09 June, 2007.

Relevant issues from the meetings were primary cooperative establishment /22/, benefits and associated risks which took mostly all the meetings time and the presentation of the CDM project, were no negative comments were issued as demonstrated in the meeting minutes /20/



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provided during site visit and also verified during interviews with selected stakeholders during the site visit /28/.

### **4.9 Comments by Parties, Stakeholders and NGOs**

PDD was made publicly available twice on Det Norske Veritas Certification AS's climate change website<sup>1</sup> and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days as follow: Version 5 from 19 November, 2005 to 18 December, 2005 using the methodology AM0015 and Version 13 from 06 May, 2007 to 04 June, 2007 using the present methodology AM0036 version 01.1.

No comments were received.

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<sup>1</sup> [http://www.dnv.com/focus/climate\\_change/projects/projectlist.asp?](http://www.dnv.com/focus/climate_change/projects/projectlist.asp?)

## **APPENDIX A**

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### **CDM VALIDATION PROTOCOL**

**Table 1 Mandatory Requirements for Clean Development Mechanism (CDM) Project Activities**

Requirement	Reference	Conclusion
<b>About Parties</b>		
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
2. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC.	Kyoto Protocol Art.12.2.	OK
3. The project shall have the written approval of voluntary participation from the designated national authority of each Party involved.	Kyoto Protocol Art. 12.5a, CDM Modalities and Procedures §40a	OK
4. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof.	Kyoto Protocol Art. 12.2, CDM Modalities and Procedures §40a	OK
5. In case public funding from Parties included in Annex I is used for the project activity, these Parties shall provide an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of these Parties.	Decision 17/CP.7, CDM Modalities and Procedures Appendix B, § 2	OK  Public funding from the Netherlands is included, but the DNA confirmed that this funding is not a diversion of ODA.



Requirement	Reference	Conclusion
6. Parties participating in the CDM shall designate a national authority for the CDM.	CDM Modalities and Procedures §29	OK
7. The host Party and the participating Annex I Party shall be a Party to the Kyoto Protocol.	CDM Modalities §30/31a	OK
8. The participating Annex I Party's assigned amount shall have been calculated and recorded.	CDM Modalities and Procedures §31b	OK
9. 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
<b>About additionality</b>		
10. Reduction in GHG emissions shall be additional to any that would occur in the 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, CDM Modalities and Procedures §43	OK
<b>About forecast emission reductions and environmental impacts</b>		
11. The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change.	Kyoto Protocol Art. 12.5b	OK
12. Documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, shall be submitted, and, if those impacts are considered significant by the project participants or the Host Party, an environmental impact assessment in accordance with procedures as required by the Host Party shall be carried out.	CDM Modalities and Procedures §37c	OK
<b>About stakeholder involvement</b>		
13. Comments by local stakeholders shall be invited, a summary of these provided and how due account was taken of any comments received.	CDM Modalities and Procedures §37b	OK

Requirement	Reference	Conclusion
14. Parties, stakeholders and UNFCCC accredited NGOs shall 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.	CDM Modalities and Procedures §40	OK
<b>Other</b>		
15. The baseline and monitoring methodology shall be previously approved by the CDM Executive Board.	CDM Modalities and Procedures §37e	OK
16. A baseline shall be established on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances.	CDM Modalities and Procedures §45c,d	OK
17. The baseline methodology shall exclude to earn CERs for decreases in activity levels outside the project activity or due to force majeure.	CDM Modalities and Procedures §47	OK
18. The project design document shall be in conformance with the UNFCCC CDM-PDD format.	CDM Modalities and Procedures Appendix B, EB Decision	OK
19. Provisions for monitoring, verification and reporting shall be in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP.	CDM Modalities and Procedures §37f	OK

**Table 2 Requirements Checklist**

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
<b>A. General Description of Project Activity</b> <i>The project design is assessed.</i>					
<b>A.1. Project Boundaries</b> <i>Project Boundaries are the limits and borders defining the GHG emission reduction project.</i>					
A.1.1. Are the project's spatial boundaries (geographical) clearly defined?	/1/	DR	Geographical coordinates: latitude 3 15 ° North, longitude 76 ° 15' West (50 km to the southeast of the City of Santiago de Cali Colombia).		OK
A.1.2. Are the project's system boundaries (components and facilities used to mitigate GHGs) clearly defined?	/1/	DR	No clear described in the PDD this must be clarified.  - All the boilers and related equipment at the project site. - The means for transportation of biomass residues to the project site (e.g. vehicles). - The sugar cane fields	<del>CL1</del>	OK
<b>A.2. Participation Requirements</b> <i>Referring to Part A, Annex 1 and 2 of the PDD as well as the CDM glossary with respect to the terms Party, Letter of Approval, Authorization and Project Participant.</i>					
A.2.1. Which Parties and project participants are participating in the project?	/1/	DR	Host Pary is Colombia represented by Ingenio del Cauca S. A. And The Netherlands represented by Corporación Andina de Fomento (CAF) acting as		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			trustee for the government of The Netherlands represented by its Ministry of Housing, Spatial Planning and the Environment		
A.2.2. Have all involved Parties provided a valid and complete letter of approval and have all private/public project participants been authorized by an involved Party?	/1/	DR	LoA have been issued.		OK
A.2.3. Do all participating Parties fulfil the participation requirements as follows: - Ratification of the Kyoto Protocol - Voluntary participation - Designated a National Authority	/1/	DR	The DNA for Colombia is the Ministry of Environmental, Housing & Territorial Development, and the DNA for Netherlands is the Ministry of Housing, Spatial Planning and the Environment (VROM).  Colombia ratified the Kyoto Protocol on November 30 <sup>th</sup> , 2001. Netherlands ratified the Kyoto Protocol on May 31 <sup>st</sup> , 2002.		OK
A.2.4. Potential public funding for the project from Parties in Annex I shall not be a diversion of official development assistance.	/1/	DR	DNA of Netherlands confirm that purchase of CERs of the project does not result in a diversion of ODA and is separate from and not counted as a part of the financial obligations of the Netherlands towards Colombia.		OK
<b>A.3. Technology to be employed</b> <i>Validation of project technology focuses on the project engineering, choice of technology and competence/ maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is</i>					

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CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
<i>used.</i>						
A.3.1. Does the project design engineering reflect current good practices?		/1/ /9/- /12//	DR I	The process for collecting, transporting, chopping, and feeding the additional residues to the boilers is being developed at Incauca and will be a novelty in the sector. The existing boiler will be adapted (retrofitted) with the chopping and feeding equipments suited for the additional biomass residues (mainly tops and leaves of the sugarcane plant).		OK
A.3.2. Does the project use state of the art technology or would the technology result in a significantly better performance than any commonly used technologies in the host country?		/1/ /26/	DR I	Yes it was assessed on site and verified with CENICAÑA sector specialist in Colombia		OK
A.3.3. Does the project make provisions for meeting training and maintenance needs?		/1/	DR I	Not described in PDD. But verified on site. INCAUCA have an environmental management system implemented and project activities as part of general operations will be included in the certification scope.		OK
<b>A.4. Contribution to Sustainable Development</b> <i>The project's contribution to sustainable development is assessed.</i>						
A.4.1. Has the host country confirmed that the project assists it in achieving sustainable development?		/1/	DR	DNA of Colombia submits LoA for the project stating that the project assist in achieving sustainable development..		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
A.4.2. Will the project create other environmental or social benefits than GHG emission reductions?	/1/	DR	The collection of sugarcane residues will reduce the need of burning biomass in the fields improving the local quality of air.		OK
<b>B. Project Baseline</b> <i>The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.</i>					
<b>B.1. Baseline Methodology</b> <i>It is assessed whether the project applies an appropriate baseline methodology.</i>					
B.1.1. Does the project apply an approved methodology and the correct version thereof?	/1/	DR	Yes. Project applies the approved methodology AM0036 - “Fuel switch from fossil fuels to biomass residues in boilers for heat generation” (version 01, 29 September 2006).		OK
B.1.2. Are the applicability criteria in the baseline methodology all fulfilled?	/1/ /7/	DR	PDD must apply the last version of the tool for demonstration and assessment of additionality  Last version of the PDD includes last version of the tool and baseline criteria is well described in PDD or in the Baseline excel sheet.	<del>CL-2</del>	OK
<b>B.2. Baseline Scenario Determination</b> <i>The choice of the baseline scenario will be validated with focus on whether the baseline is a likely scenario, and whether the methodology to define the baseline scenario has been followed in a complete and transparent manner.</i>					

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
B.2.1. What is the baseline scenario?	/1/	DR	STEP 1 of the procedure for the selection of the most plausible baseline scenario requires the identification of alternative scenarios to the proposed CDM project activity, and this should be separately determined for the two components of the project activity <ul style="list-style-type: none"><li>- Heat generation in the absence of the project activity</li><li>- What would happen to the biomass residues in the absence of the project activity.</li></ul> This need to be included in the PDD.	<del>CL-3</del>	OK
B.2.2. What other alternative scenarios have been considered and why is the selected scenario the most likely one?	/1/ /24/ /26//	DR I	<b>Alternatives for heat generation:</b> For Incauca, if this additional amount of biomass was not collected, the boilers will continue the operation using the same fuel mix, in order to respect the supply to propel ( <u>scenario H2</u> ). <b>Alternatives for biomass residues:</b> For Incauca, without the financial stimulus of carbon credits input, the idea of recovering the barbojo will not make sense. If this additional amount of biomass was not collected, it will be dumped at fields (mainly under anaerobic - aerobic conditions due to the barbojo pile heath) or eventually be burned at the same field, but never to use it as		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			fuel for energy generation. The most alternative scenarios for the biomass will be the combination of: <b>scenario B1 and B3.</b> The scenario of use the barbojo as fertilizer is really improbable, because Incauca have developed already an extended compost program based on other residues (cahaza and vinaza).		
B.2.3. Has the baseline scenario been determined according to the methodology?	/1/	DR	Yes.		OK
B.2.4. Has the baseline scenario been determined using conservative assumptions where possible?	/1/	DR I	Were determined considering feasible conditions applicable to the sugar cane sector.		OK
B.2.5. Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations?	/1/ /26/	DR I	Yes. Interview with CENICAÑA sectorial investigation center corroborate it.		OK
B.2.6. Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced?	/1/ /9/ /11/	DR I	Yes. Sufficient literature of the sector were delivered to ensure baseline conditions and alternatives identified.		OK
B.2.7. Have the major risks to the baseline been identified?	/1/	DR	Changes in environmental requirements respect to coal usage as fuel.		OK
<b>B.3. Additionality Determination</b> <i>The assessment of additionality will be validated with</i>					

\* MoV = Means of Verification, DR= Document Review, I= Interview



CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
<i>focus on whether the project itself is not a likely baseline scenario.</i>						
B.3.1. Is the project <b>additionality</b> assessed according to the methodology?		/1/	DR	PDD must apply the last version of the tool for demonstration and assessment of additionality Version 4 were applied in last version of PDD.	<del>CL2</del>	OK
B.3.2. Are all assumptions stated in a transparent and conservative manner?		/1/ /10/ /24/ /27/	DR	Sensitivity analysis had been done using 2004 as base year. These needs to be clarify. As well is required to support of the basis for the determination of Cost ton of harvest residue and pre-burning.  Additionality was determined in a transparent manner and correct supported by interview with sector authorities; sugar mill management and technical literature.	<del>CL4</del>	OK
B.3.3. Is sufficient evidence provided to support the relevance of the arguments made?		/1/ /27/	DR I	PDD Barrier analysis appears to be sufficiently documented, and on site visit and interview with National authorities were confirm it.		OK
B.3.4. If the starting date of the project activity is before the date of validation, has sufficient evidence been provided that the incentive from the CDM was seriously considered in the decision to proceed with the project activity?		/1/ /25/	DR I	Project start preparations and equipment design and development time after. CAF demonstrates interest in CDM time before. Evidence could be demonstrated as first attempt to register with another methodology time after correct scope preparations start.		OK
<b>B.4. Calculation of GHG Emission Reductions – Project emissions</b> <i>It is assessed whether the project emissions are stated</i>						

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
<i>according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.</i>						
B.4.1.	Are the <b>calculations documented</b> according to the approved methodology and in a complete and transparent manner?	/1/	DR	Calculations are according to methodology in a complete and transparent manner. Project Participants need to provide basis applied for the calculations (equipment specifications, coal and bagasse historical consumptions, etc.).		OK
B.4.2.	Have conservative assumptions been used when calculating the project emissions?	/1/	DR	Yes as stated in methodology respect to: <i>CH<sub>4</sub> emissions from combustion of biomass residues in the boiler(s) (<math>PE_{CH_4,BF,y}</math>) applying Default CH<sub>4</sub> emission factors for combustion of biomass residues.</i>		OK
B.4.3.	Are uncertainties in the project emission estimates properly addressed?	/1/	DR I	Uncertainties have been estimated using conservativeness factors as required by the methodology.		OK
<b>B.5. Calculation of GHG Emission Reductions – Baseline emissions</b> <i>It is assessed whether the baseline emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.</i>						
B.5.1.	Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/ /8/	DR I	Yes. Spreadsheet calculations are presented in a transparent and complete manner and project participants provide evidence of the data applied.		OK
B.5.2.	Have conservative assumptions been used when	/1/	DR	Yes. This assumptions were applied as		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
calculating the baseline emissions?			I	determined in the methodology and are related to conservativeness factors in <i>Uncontrolled burning or aerobic decay of the biomass residues (cases B1 and B3)</i>		
B.5.3. Are uncertainties in the baseline emission estimates properly addressed?		/1/	DR	Uncertainties have been estimated using conservativeness factors as required by the methodology.		OK
<b>B.6. Calculation of GHG Emission Reductions – Leakage</b> <i>It is assessed whether leakage emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.</i>						
B.6.1. Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner?		/1/ /24/ /25/	DR I	PDD does not state clearly why leakage is zero in the project. This need to be clarified.  PDD version 14 includes a clear description of leakage and considerations taken.	<del>CL-5</del>	OK
B.6.2. Have conservative assumptions been used when calculating the leakage emissions?		/1/	DR I	See B.6.1	<del>CL-5</del>	OK
B.6.3. Are uncertainties in the leakage emission estimates properly addressed?		/1/	DR I	See B.6.1	<del>CL-5</del>	OK
<b>B.7. Emission Reductions</b> <i>The emission reductions shall be real, measurable and give long-term benefits related to the mitigation</i>						

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
<i>of climate change.</i>						
B.7.1. Are the emission reductions real, measurable and give long-term benefits related to the mitigation of climate change.		/1/ /8/	DR	Yes. Supplied documentation demonstrates emission reductions in a clear manner.  During site visit calculations were assessed against local document support to finally verify emissions reductions.		OK
<b>B.8. Monitoring Methodology</b> <i>It is assessed whether the project applies an appropriate monitoring methodology.</i>						
B.8.1. Is the monitoring plan documented according to the approved methodology and in a complete and transparent manner?		/1/	DR	Some of the data/parameters required to be monitored are not included in the PDD and no reference of why were excluded ( $FC_{on-site,i,y}$ ; $EC_{pJ,y}$ ; $N_y$ ;among others. This must be clarified on site.	<del>CL-6</del>	OK
B.8.2. Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later?		/1/	DR	PDD states that All data will be electronically archived at least during the whole lifetime of the project.		OK
<b>B.9. Monitoring of Project Emissions</b> <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>						
B.9.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the		/1/	DR	See B.8.1 Yes as stated in methodology and according to options applied.	<del>CL-6</del>	OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
greenhouse gas emissions within the project boundary during the crediting period?					
B.9.2. Are the choices of project GHG indicators reasonable and conservative?	/1/	DR	Yes and described according to methodology requirements.		OK
B.9.3. Is the measurement method clearly stated for each GHG value to be monitored and deemed appropriate?	/1/	DR	Parameters when required describe measurement method to be applied.		OK
B.9.4. Is the measurement equipment described and deemed appropriate?	/1/ /24/ /25/	DR I	Parameters to be monitored not in all cases requires specific measurement equipment instead a laboratory method will be applied in the rest of the parameters were verified the method to be applied during site visit verifying that measurements will be correctly measured.		OK
B.9.5. Is the measurement accuracy addressed and deemed appropriate? Are procedures in place on how to deal with erroneous measurements?	/1/	DR	Yes as described in B.9.4		OK
B.9.6. Is the measurement <i>interval</i> identified and deemed appropriate?	/1/	DR	Yes as described in B.9.4		
B.9.7. Is the <i>registration, monitoring, measurement and reporting</i> procedure defined?	/1/	DR	Incauca had implemented an environmental management system based on ISO 14000. which includes clear description of management system procedures which will be applied to the CDM		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview  
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<b>CHECKLIST QUESTION</b> * MoV = Means of Verification, DR= Document Review, I= Interview		<b>Ref.</b>	<b>MoV*</b>	<b>COMMENTS</b>	<b>Draft Concl.</b>	<b>Final Concl.</b>
				project basically because day by day activities does not differ.		
B.9.8. Are procedures identified for <i>maintenance</i> of monitoring equipment and installations? Are the calibration intervals being observed?		/1/	DR	See B.9.7		OK
B.9.9. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)		/1/	DR	See B.9.7		OK
<b>B.10. Monitoring of Baseline Emissions</b> <i>It is established whether the monitoring plan provides for reliable and complete baseline emission data over time.</i>						
B.10.1.Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period?		/1/	DR	Methodology AM0036 does not include requirements to monitor baseline emissions.		OK
<b>B.11. Monitoring of Leakage</b> <i>It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.</i>						
B.11.1.Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining leakage?		/1/	DR	Methodology requires the demonstration that the biomass residue type k from a specific source would continue not to be collected or utilized, e.g. by an assessment whether a market has emerged for that type of biomass residue (if yes, leakage is assumed not be ruled out) or by		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
				showing that it would still not be feasible to utilize the biomass residues for any purposes. For this purpose PP would require that CENICAÑA performs annual surveillance to demonstrate it.		
B.11.2. Are the choices of project leakage indicators reasonable and conservative?	/1/	DR		As determined by the methodology.		OK
B.11.3. Is the measurement method clearly stated for each leakage value to be monitored and deemed appropriate?	/1/ /24/ /25/	DR I		Not method determined by the methodology but PP select annual surveillance.		OK
<b>B.12. Monitoring of Sustainable Development Indicators/ Environmental Impacts</b> <i>It is assessed whether choices of indicators are reasonable and complete to monitor sustainable performance over time.</i>						
B.12.1. Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host country?	/1/	DR		The monitoring of sustainable development indicators is not required by the Colombian DNA or AM0031.		OK
<b>B.13. Project Management Planning</b> <i>It is checked that project implementation is properly prepared for and that critical arrangements are addressed.</i>						
B.13.1. Is the authority and responsibility of overall project management clearly described?	/1/	DR		Incauca had implemented an environmental management system based on ISO 14000. which		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			includes clear description of management system procedures which will be applied to the CDM project basically because day by day activities does not differ.		
B.13.2. Are procedures identified for training of monitoring personnel?	/1/	DR	See B.13.1		OK
B.13.3. Are procedures identified for emergency preparedness for cases where emergencies can cause unintended emissions?	/1/	DR	See B.13.1		OK
B.13.4. Are procedures identified for review of reported results/data?	/1/	DR	See B.13.1		OK
B.13.5. Are procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting?	/1/	DR	See B.13.1		OK
<b>C. Duration of the Project/ Crediting Period</b> <i>It is assessed whether the temporary boundaries of the project are clearly defined.</i>					
C.1.1. Are the project's starting date and operational lifetime clearly defined and evidenced?	/1/	DR	Starting date of project activity is stated as the date of the feasibility study (financial model) on 01 October 2004. Operational lifetime of 30 years		OK



CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
C.1.2. Is the start of the crediting period clearly defined and reasonable?		/1/	DR	PDD Final version 16 dated 27 march 2008, determines initial of crediting period as 01 July 2008.	<del>CL-7</del>	OK
<b>D. Environmental Impacts</b> <i>Documentation on the analysis of the environmental impacts will be assessed, and if deemed significant, an EIA should be provided to the validator.</i>						
D.1.1. Has an analysis of the environmental impacts of the project activity been sufficiently described?		/1/	DR	Yes. Section D of the PDD is well described.		OK
D.1.2. Are there any Host Party requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved?		/1/	DR I	Conditions and scope of project activities does not require EIA and some of the activities (harvesting against burning) are actions that improve environmental impacts.		OK
D.1.3. Will the project create any adverse environmental effects?		/1/ /27/	DR I	PDD states that the potential environmental impacts of the project activity are negligible or null. This was assessed on site and with the Environmental Authorities of Colombia		OK
D.1.4. Are transboundary environmental impacts considered in the analysis?		/1/	DR	Not identified.		OK
D.1.5. Have identified environmental impacts been addressed in the project design?		/1/ /27/	DR I	PDD states that the potential environmental impacts of the project activity are negligible or null. This was assessed on site and with the Environmental Authorities of Colombia		OK
D.1.6. Does the project comply with environmental legislation in the host country?		/1/	DR I	During site visit and interview with local authorities was verified. Environmental permits		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
		/27/		were delivered to ensure compliance		
<b>E. Stakeholder Comments</b> <i>The validator should ensure that stakeholder comments have been invited with appropriate media and that due account has been taken of any comments received.</i>						
E.1.1. Have relevant stakeholders been consulted?		/1/ /20/ /28/	DR I	Yes. Project activity was presented to the communities of the surroundings and to the mills gremial meetings.		OK
E.1.2. Have appropriate media been used to invite comments by local stakeholders?		/1/ /20/ /28/	DR I	Local foundation called Fundación Carvajal was the mean to ensure relevant stakeholder be invited which was ensured as all the ones that assist were interested in be part of the project.		OK
E.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/ /20/ /28/	DR I	PDD states that Stakeholder meeting is not required by the law, because the impact is negligible. But the project activity was presented to the communities of the surroundings and to the mills gremial meetings.		OK
E.1.4. Is a summary of the stakeholder comments received provided?		/1/ /20/ /28/	DR I	Yes presented as part of meetings evidences.		OK
E.1.5. Has due account been taken of any stakeholder comments received?		/1/ /20/ /28/	DR I	As a result of implementing the project, the majority of the community concerns would be solved.  The project will facilitate the creation of collectors' cooperatives in Tarragona and El		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			Ortital. In this way, the project will permit a sustainable employment within the involved communities improving social wellbeing as a result of it implementation.		

**Table 3 Resolution of Corrective Action and Clarification Requests**

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CL 1: The project's system boundaries (components and facilities used to mitigate GHGs) is not clear defined in the PDD.	A.1.2	New version of PDD will clearly described	<p>PDD Version 14 Dated 13 November 2007 clearly includes project boundaries.</p> <p>Clarification considered close.</p>
CL 2 PDD must apply the last version of the tool for demonstration and assessment of additionality	B.1.2 B.3.1	New version of PDD will include tool version 3.	<p>PDD Version 14 Dated 13 November 2007 clearly includes additionality tool version 4 and were correctly applied.</p> <p>Clarification considered close.</p>
<p>CL 3 STEP 1 of the procedure for the selection of the most plausible baseline scenario requires the identification of alternative scenarios to the proposed CDM project activity, and this should be separately determined for the two components of the project activity</p> <ul style="list-style-type: none"> <li>- Heat generation in the absence of the project activity</li> <li>- What would happen to the biomass residues in the absence of the project activity.</li> </ul> <p>This need to be included in the PDD.</p>	B.2.1	New version of PDD will include an identification of alternative scenarios for Heat Generation and for Biomass residues in absence of the project activity.	<p>PDD Version 14 Dated 13 November 2007 clearly includes alternatives:</p> <p><b>Alternatives for heat generation:</b></p> <p>For Incauca, if this additional amount of biomass was not collected, the boilers will continue the operation using the same fuel mix, in order to respect the supply to propel (<u>scenario H2</u>).</p> <p><b>Alternatives for biomass residues:</b></p> <p>If this additional amount of biomass was not collected, it will be dumped at fields (mainly under anaerobic - aerobic conditions due to the barbojo pile heath) or eventually be burned at the same field, but never to use it as fuel for</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
			<p>energy generation. <b><u>scenario B1 and B3.</u></b> The scenario of use the barbojo as fertilizer is really improbable, because Incauca have developed already an extended compost program based on other residues (cahaza and vinaza).</p> <p>Clarification considered close.</p>
<p>CL 4 Sensitivity analysis had been done using 2004 as base year. These needs to be clarify. As well is required to support of the basis for the determination of Cost ton of harvest residue and pre-burning.</p>	<p>B.3.2</p>	<p>Sensibility study was part of the pre feasibility study which were considered as part of project consideration in 2004. Pre feasibility study delivered to validator during site visit includes description of the values included as part of the calculation.</p>	<p>Pre feasibility study were supplied during site visit and values included were discussed with sugar mill managers and verified against historical and current costs involved in the operations.</p> <p>Clarification considered close.</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CL 5 PDD does not state clearly why leakage is zero in the project. This need to be clarified.	B.6.1 B.6.2 B.6.3	A clearly description will be included in PDD to ensure correct description.	<p>PDD Version 14 Dated 13 November 2007 clearly includes Leakage description as follow:</p> <p>No leakage is anticipated as a result of the project activity. The project does not quantify any leakage effect related to biomass availability or due to any potential market for these kind of agricultural discard (barbojo). The amount of biomass available could surpass the initial expectations but Incauca will need all of them to substitute progressively the actual coal consumption. It is guaranteed by the provision of Incaucas's own biomass, and harvesting operations developed for barbojo, that the purposed amount of coal will be displaced and eventually surpassed.</p> <p>Also approach for the leakage assumption, based on scenarios B1 and B3, leakage consideration L1 described.</p> <p>Clarification considered close.</p>
CL 6 Some of the data/parameters required to be monitored as baseline and project activities are not included in the PDD and no reference	B.8.1 B.9.1	Methodology review will be done and ensure that monitoring parameters	PDD Version 14 Dated 13 November 2007 includes all parameters to be monitored according to methodology

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
of why were excluded: $\eta_{\text{boiler,FF}}$ ; $\text{FCi,n}/\text{FCi,n-1}/\text{FCi,n-2}$ and $\text{FC}_{\text{on-site,i,y}}$ .		required be correctly addressed.	requirements and options applied as described within the methodology.  Clarification considered close.
CL 7 The start of the crediting period clearly defined is not reasonable and need to be updated based on that was established at 01 June 2007, but commenting period end until 04 June 2007.	C.1.2	Once that a clear time scale is determined and clarifications are demonstrated Last Version of PDD will include it.	PDD Version 16 Dated 27 March 2008 states starting date of crediting period at 01 June 2008.  Clarification considered close.

## **APPENDIX B**

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### **CERTIFICATES OF COMPETENCE**





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## CERTIFICATE OF COMPETENCE

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***Alfonso Capuchino***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1

<b><i>GHG Auditor:</i></b>	Yes		
<b><i>CDM Validator:</i></b>	Yes	<b><i>JI Validator:</i></b>	--
<b><i>CDM Verifier:</i></b>	Yes	<b><i>JI Verifier:</i></b>	--
<b><i>Industry Sector Expert for Sectoral Scope(s):</i></b>	--		

Høvik, 30 October 2007

*Michael Lehmann*

Michael Lehmann

*Technical Director, International Climate Change Services*



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## CERTIFICATE OF COMPETENCE

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***Gustavo Godinez-Martinez***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b><i>GHG Auditor:</i></b>	Yes		
<b><i>CDM Validator:</i></b>	Yes	<b><i>JI Validator:</i></b>	--
<b><i>CDM Verifier:</i></b>	Yes	<b><i>JI Verifier:</i></b>	--
<b><i>Industry Sector Expert for Sectoral Scope(s):</i></b>	Sectoral scope 4 & 6		

Høvik, 6 November 2006

Einar Telnes  
*Director, International Climate Change Services*

Michael Lehmann  
*Technical Director*



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## CERTIFICATE OF COMPETENCE

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***Hendrik Brinks***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	--
<b>CDM Verifier:</b>	--	<b>JI Verifier:</b>	--
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 1, 2, 3 & 12		
<b>Technical Reviewer for (group of) methodologies:</b>			
ACM0001, AM0002, AM0003, AM0010, AM0011, AM0012, AMS-III.G	Yes	AM0013, AM0022, AM0025, AM00379, AMS-III.H, AMS-III.I	Yes
ACM002, AMS-IA-D, AM0019, AM0026, AM0029, AM0045	Yes	ACM0006, AM0007, AM0015, AM0036, AM0042	Yes
ACM0004, ACM0012	Yes		

Høvik, 30 October 2007

*Michael Lehmann*

Michael Lehmann

*Technical Director, International Climate Change Services*



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## CERTIFICATE OF COMPETENCE

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***Raman Venkata Kakaraparthi***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	--
<b>CDM Verifier:</b>	Yes	<b>JI Verifier:</b>	--
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 5		
<b>Technical Reviewer for (group of) methodologies:</b>			
ACM002, AMS-IA-D, AM0019, AM0026, AM0029, AM0045	Yes		

Høvik, 30 October 2007

*Michael Lehmann*

Michael Lehmann

*Technical Director, International Climate Change Services*



# CERTIFICATE OF COMPETENCE

***Michael Lehmann***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	Yes
<b>CDM Verifier:</b>	Yes	<b>JI Verifier:</b>	Yes
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 1, 2, 3		
<b>Technical Reviewer for (group of) methodologies:</b>			
ACM0001, AM0002, AM0003, AM0010, AM0011, AM0012, AMS-III.G	Yes	AM0027	Yes
ACM002, AMS-I.A-D, AM0019, AM0026, AM0029, AM0045	Yes	AM0030	Yes
ACM003, ACM0005, AM0033, AM0040	Yes	AM0031	Yes
ACM0004, ACM0012	Yes	AM0032	Yes
ACM0006, AM0007, AM0015, AM0036, AM0042	Yes	AM0035	Yes
ACM0007	Yes	AM0038	Yes
ACM0008	Yes	AM0041	Yes
ACM0009, AM0008, AMS-III.B	Yes	AM0034	Yes
AM0006, AM0016, AMS-III.D, ACM0010	Yes	AM0043	
AM0009, AM0037	Yes	AM0046	
AM0013, AM0022, AM0025, AM0039, AMS-III.H, AMS-III.I	Yes	AM0047	
AM0014	Yes	AMS-II.A-F, AM0044	Yes
AM0017	Yes	AMS-III.A	Yes
AM0018	Yes	AMS-III.E, AMS-III.F	Yes
AM0020	Yes		
AM0021, AM0028, AM0034, AM0051	Yes		
AM0023	Yes		
AM0024	Yes		

Høvik, 5 February 2007

**Einar Telnes**  
Director, International Climate Change Services

**Michael Lehmann**  
Technical Director