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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Compañía Azucarera Hondureña S.A. cogeneration project (for simplicity hereafter referred to as the "SANTA MATILDE Project").

PDD version 6

Date of completion: 07/03/2007.

A.2. Description of the project activity:

The primary objective of the Santa Matilde Cogeneration Project is to supply Honduras' rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to the environmental, social and economic sustainability by increasing renewable energy's share of total the Honduran electricity consumption. One fundamental goal of the project is the efficient use of resources, particularly indigenous resources, while minimizing impact on the environment.

The project will increase the power generation capacity at the Santa Matilde sugar mill through the installation of highly efficient boilers and turbo-generators for the better use of sugar cane bagasse (a by-product of the sugar cane production process).

The increase in the cogeneration capacity will total 46MW, over the four stages of the project activity, including the equipments in stand-by. The PPA shows an installed capacity of 50 MW in order to take advantage of a Honduran law that gives a 10% benefit off the price of KWh for plants with installed capacity lower than 50 MW. ("*Guía para Desarrolladores de Proyectos de Generación de Energía Eléctrica utilizando Recursos Renovables en Honduras*" (Guide for the Development of Projects of Electrical Energy Generation using Renewable Resources in Honduras) in law number 267-98, of December 1998 (this law replaces law number 85-98, published in April 1998). Phase one was completed in 2005 with the installation of a 900 Psig boiler and two 12MW generators. The second phase of the project is expected to be completed in 2006 and consists of the installation of a 6MW generator. The third stage of the project is to be completed in 2009 with the installation another generator of 12 MW. The fourth stage of the project is to be completed in 2011 with the installation of one generator of 10 MW. The total capacity of the operating equipment after phase four (excluding the equipment in stand by) will be of 46 MW (see section A.4.3 and Annex 3 for more details)

The Santa Matilde project was developed by Compañía Azucarera Hondureña, S.A. de C.V. (CAHSA), a company founded in 1938. Since its foundation, CAHSA has applied the highest standards of quality and productivity into creating a company that has continuously grown and shown innovation. CAHSA has also applied high standards when dealing with the environment, mitigating its environmental impacts and increasing its contribution to sustainable development. Under this optic, CAHSA has decided to contribute into resolving the energy difficulties of Honduras in an environmentally friendly manner.

Santa Matilde will use bagasse, a by product in the production of sugar to produce clean energy that would displace energy that otherwise the Estate would have provided with a strongly fossil dependant generation system. The use of an indigenous and cleaner source of electricity thus contributes

to environmental sustainability by avoiding electricity generation from fossil fuel sources, reducing greenhouse gases (GHG) emissions and reducing the dependency of the country to imported and costly fuels. The cogeneration project also eliminates the bagasse in a controlled way, thus eliminating emissions from the traditional methods of elimination (uncontrolled burning or methane production from decay). In absence of the project, Santa Matilde would have had to supply its energy needs with electricity from the grid, an activity that would have contributed to increased emissions due to Honduras' dependency on fossil fuels.

Honduras has undergone efforts to reduce the country's dependency on fossil fuels. Nevertheless, those initiatives have had a modest result in promoting the development of projects in renewable energies. The Santa Matilde Cogeneration Project thus comes to prove that with the commercialization of CERs, it is viable to develop a generation project in Honduras. This will have a positive effect for the country beyond the evident reductions in GHG.

The revenues obtained from the sale of the CERs will also help CAHSA to continue supporting the community. Throughout its history, Santa Matilde has shown a strong social responsibility providing funds to local institutions and charities. Santa Matilde also provides its employees with numerous benefits, inter alia:

- Tickets for transportation of personnel
- Housing for selected personnel
- Life and medical insurance
- Medical services and medicines
- Aid for labor unions
- Uniforms
- Continuous education
- Organization of sport events

The revenue distribution and social efforts intended to be continued with the contributions of CDM, must be added to the environmental benefits when evaluating the contribution to sustainable development of this project activity.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Honduras (host)	Compañía Azucarera Hondureña S.A. de C.V. (Private Entity)	No
Japan	The Tokyo Electric Power Co., Inc. (Private Entity)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

Figure 1 – Map of Honduras

A.4.1.1. Host Party(ies):

Honduras. The Honduran Designated National Authority is the Secretaria de Estado de Recursos Naturales y Ambiente (SERNA). Please see Annex I for complete contact information.

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

Department of Cortes

A.4.1.3. City/Town/Community etc:

City of Villanueva

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

The coordinates to the Santa Matilde Project are: Longitude 15° 24' 23" North, latitude 87° 59' 59" West.

Villanueva is a city of the Department of Cortes. Current population of Villanueva is around 100,000, most of which is employed at the recently built assembly plants. Besides the manufacturing

business, the production of sugar is also very important for this area, as it employs over 2,000 people; an important share of the sugar in Honduras is produced in Villanueva.

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

Type: Energy and Power.

Sectoral Scope: 1 – Energy industries (renewable - / non-renewable sources).

Category: Renewable electricity generation for a grid (energy generation, supply, transmission and distribution).

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

Biomass power conversion technologies for power production can be classified into three categories: direct combustion technologies, gasification technologies, and pyrolysis. Direct combustion technologies, such as the used in the Santa Matilde Project, are probably the most widely known for simultaneous power and heat generation using biomass. It involves the oxidation of biomass with excess air in a process that yields hot gases that are used to produce steam in boilers. The steam from the boilers is used to produce electricity in a Rankine cycle turbine (diagram below). Rankine cycle turbines could also be divided into two categories: condensing and backpressure depending on the proportion of the steam used for industrial processes and where in the turbine that steam is obtained. Typically, electricity is only produced in a "condensing" steam cycle, while electricity and steam are co-generated in an "extracting" steam cycle.

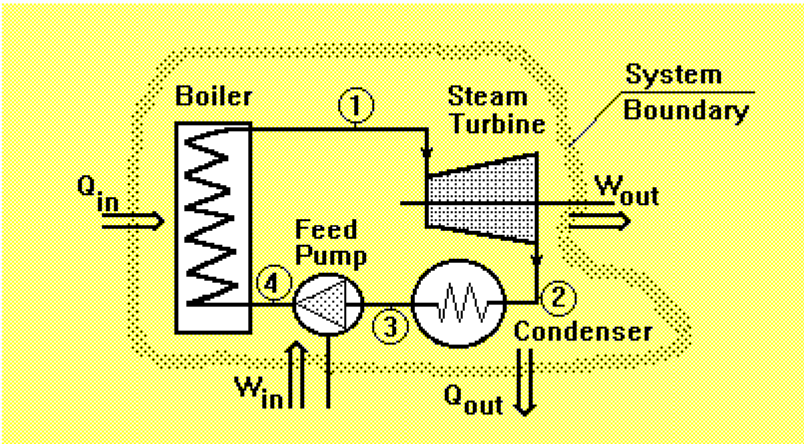

Figure 2 - Rankine Cycle

The Santa Matilde project is divided into four phases: Phase 1 (2005), Phase 2 (2006), Phase 3 (2009) and Phase 4 (2011). The first phase of the project, in 2005, consisted of the installation of one 900 psig boiler and two 12MW turbo-generators. The second phase, in 2006, consisted of the installation of one 6MW turbo-generators,. The third phase that will start in 2009 adds another 900 psig boiler and an additional 12MW turbo generator. The fourth phase that will start in 2011 adds an additional 10MW turbo generator.

Old boilers were replaced for new highly efficient boilers and steam-powered mills were electrified. The objective of these changes was to deliver as much steam as possible to the new highly efficient cogeneration system in order to maximize electricity output.

The exhibit below summarizes the implementation and phase-out of equipment in the project:

Phase	Installed Equipment			Equipment Phased Out
	Boilers	Turbo generators	Mills	
Before Project	3 x 200 Psig	1 x 1.5 MW 1 x 2.5 MW	6 steam powered	
1 (2005)	3 x 200 Psig 1 x 900 Psig	1 x 1.5 MW 1 x 2.5 MW 2 x 12 MW	1 steam powered; 4 electric	
2 (2006)	1 x 200 Psig 1 x 900 Psig	1 X 1.5 MW 1 X 2.5 MW 2 x 12 MW 1 x 6 MW	5 electric	Turbos: 1 X 1.5 MW 1 X 2.5 MW will be kept as stand-by from 2007 on Boiler: 2 X 200 Psig kept as stand-by;
3 (2009)	2 x 900 Psig	3 x 12 MW	5 electric	Turbos: 1 X 1.5 MW 1 X 2.5 MW 1 x 6 MW And Boilers 3 X 200 Psig will be kept as stand-by
4 (2011)	2 x 900 Psig	3 x 12 MW 1 x 10 MW	5 electric	Turbos: 1 X 1.5 MW 1 X 2.5 MW 1 x 6 MW And Boilers 3 X 200 Psig will be kept as stand-by

Equipment to be installed in the cogeneration project:

Technical Description:

Baseline:

Boilers 1 and 2

Brand : Babcok & Wilcox
Capacity : 36.3 ton/h
Operation pressure : 21 KGf/cm2
Temperature : 540 ºF
Steam enthalpy : 704.58 Kcal/Kg steam
Steam specific production: 2.14 kg steam/kg bagasse

Boiler 3

Brand : Bigelow
Model : F-40
Capacity : 45.4 ton/h
Operation pressure : 21 Kgf/cm2
Temperature : 540 ºF
Steam enthalpy : 704.58 Kcal/Kg steam
Steam specific production: 2.14 kg steam/kg bagasse

Turbogenerator 1

Turbine:
Brand : Worthington
Capacity : 1.5 MW
Input pressure : 150 Psig
Output pressure : 25 Psig

Generator:
Brand : Electric Machinery
Capacity : 1.5 MW
RPM : 1,200
P.F : 0.8

Turbogenerator 2

Turbine:
Brand : Ferry GFA
Capacity : 2.8 MW
Input pressure : 188 Psig
Output pressure : 20 Psig

Generator:

Brand: Electric Machinery
Capacity: 2.5 MW
RPM : 1,800
P.F. : 0.8

Project:

PHASE 1 – 2005 (2 x 12 turbo-generators)

TURBINES:

Brand: GEVISA (Brazil)

Steam Pressure (In): 900 Psig

Steam Temperature: 950°F.

Steam Pressure (out): 20 Psig

Rated Speed: 8,000 rpm

GENERATORS:

Brand:	NG/GEVISA (Brazil)
Power:	12 MW and 6 MW, 0.8 P.F.
Voltage:	13.8 KV
Steam Temperature:	950 ºF
Steam Pressure - In:	900 Psig
Turbine Speed:	8000 Rpm
Generator Speed:	1800 Rpm

Type: backpressure

BOILER 4

Type:	Aqua-tubular
Brand:	HPB (Brazil)
Operation Pressure:	63 Kgf/cm2
Steam Temperature:	950 ºF
Capacity:	150,000 ton/h

Steam enthalpy : 704.58 Kcal/Kg steam
Steam specific production: 2.14 kg steam/kg bagasse

Efficiency: 67%

PHASE 2 – 2006 (1 x 6 MW turbo-generator)

This turbo was purchased with the intention of using it as back up after 2009.

Brand: NG/GEVISA (Brazil)

Capacity: 6 MW, 0.8 P.F.

Voltage: 13.8 KV

Steam Temperature - In: 950 ºF

Steam Pressure - In: 900 Psig

Turbine Speed: 8000 Rpm

Generator Speed: 1800 Rpm

PHASE 3 – 2009 (1 x 12 MW turbo-generator)

Brand: NG/GEVISA (Brazil)

Power: 12 MW, 0.8 P.F.

Voltage: 13.8 KV

Steam Temperature: 950 ºF

Steam Pressure - In: 900 Psig

Turbine Speed: 8000 Rpm

Generator Speed: 1800 Rpm

Type: backpressure

BOILER 5

Type: Aqua-tubular

Brand: HPB (Brazil)

Operation Pressure: 63 Kgf/cm2

Steam Temperature: 950 ºF

Capacity: 100,000 ton/h

Steam enthalpy: 808.69 Kcal/Kg steam

Steam specific production: 2.05 kg steam/kg bagasse

PHASE 4 – 2011 (1 x 10 MW turbo-generator)

Brand: NG/GEVISA (Brazil)

Capacity: 10 MW, 0.8 P.F.

Voltage: 13.8 KV

Steam Temperature - In: 950 ºF

Steam Pressure - In: 900 Psig

Turbine Speed: 8000 Rpm

Generator Speed: 1800 Rpm

Type: condensation.

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

The chosen crediting period for this project is the renewable crediting period of 7 years. The estimated amount of emission reductions of the project can be seen at Table 1.

Year	Annual estimation of emission reductions in tones of CO2
2005 (from Feb 11 on)	10,324
2006	24,008
2007 (*)	25,867
2008 (*)	25,867
2009 (*)	42,486
2010 (*)	42,486
2011 (*)	46,069
2012 (until Feb 10) (*)	13,821
Total estimated reductions (tones of CO2e)	**230,927**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tones of CO2e)	**32,990**

Table 1 – Estimated emission reductions of the Santa Matilde Project over the first 7-year crediting period

A.4.5. Public funding of the project activity:

There is no public funding involved on the Santa Matilde Project.

SECTION B. Application of a baseline methodology

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

ACM0006 – "Consolidated baseline methodology for grid-connected electricity generation from biomass residues", version 4, October 2006.
ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 6, dated on 19/05/2006.
Tool for the demonstration and assessment of additionality, Version 2, dated on 28/11/2005.

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

The ACM0006 methodology is applied to the Santa Matilde Project because it complies with all the conditions limiting the applicability of the methodology:

(i) *No other biomass types than biomass residues are used in the project plant and these biomass residues are the predominant fuel used in the project plant. Biomass is defined as a by-product, residue or waste stream from agriculture, forestry and related industries.*

Santa Matilde uses sugar cane bagasse that comes from the production of sugar carried on the same facility where the project is located.

(ii) *The implementation of the project shall not result in an increase of the processing capacity of raw input or other substantial changes in the process:*

Any increase in the bagasse production is due to Santa Matilde's natural expanding business and could not be attributed to the implementation of the cogeneration project. "*Costos y precios para etanol combustible en America Central*" (Costs and prices for ethanol in Central America), a study prepared by CEPAL (*Comisión Económica para América Latina y Caribe*) in May/2006 (copy under request) shows that there has been recently a "notable advance in the consciousness on the potentiality of ethanol in Central America", specially in Honduras, where a law is being discussed regarding the production and use of ethanol as fuel in the country and for export. This shows an unequivocal trend for the expansion of the production of sugar cane in Honduras. The *Asociación de Productores de Azúcar de Honduras* (APAH-Honduras' Sugar Producers Association) estimates an increase of approx.13% in sugar production in Honduras from 2007 to 2011 (see annexed file "Honduras_Estimation Sugar production.jpg". Santa Matilde planned already in 2002 an expansion of their sugar production, as shown in annexed files "Santa Matilde Expansion Study 1.jpg" and "Expansion Study 2.jpg". The graph below shows that the production for the sugar mill has had an incrementing trend for years, long before the implementation of the project activity (period from 1994 to 2005). The increase of production during the implementation of the project is very conservative when compared to the increase in production during the 1990's.

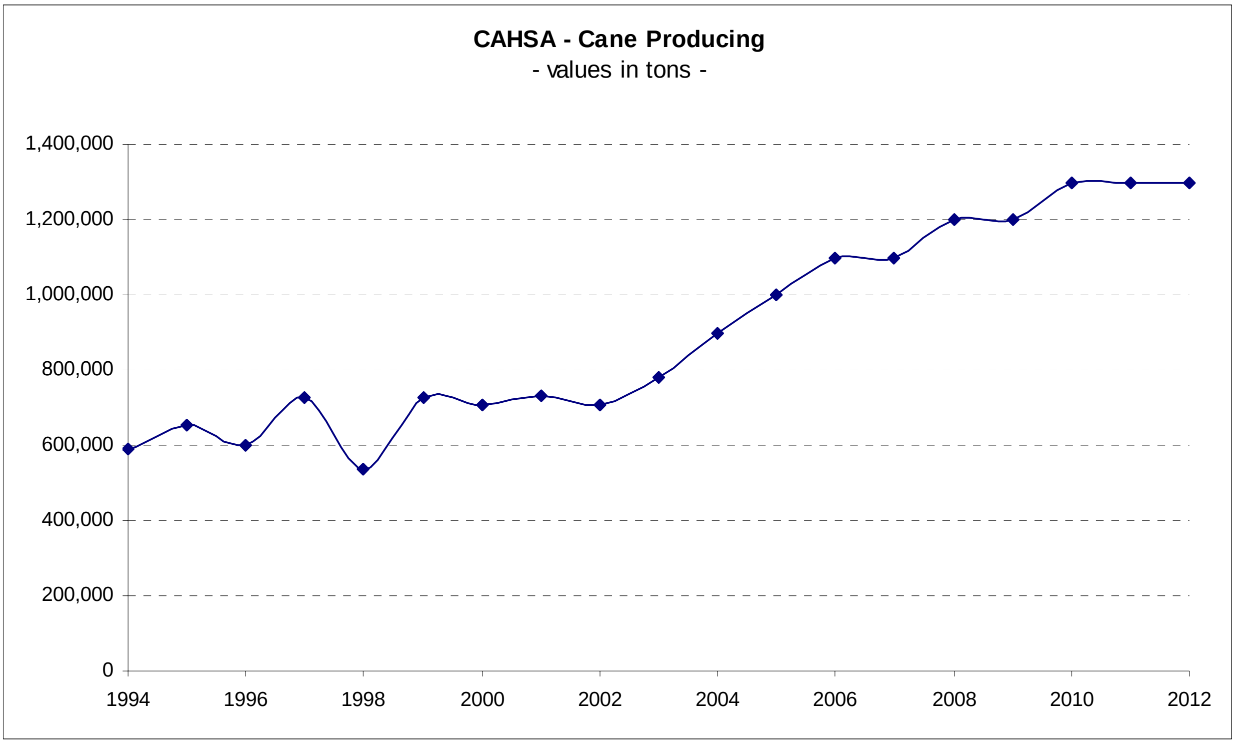

Figure 3 – Sugar cane fluctuation

(iii) The biomass used by the project facility should not be stored for more than one year:

It is of general practice for sugar mills to keep some bagasse until the beginning of the next season to facilitate the start of operation of the cogeneration system. This practice avoids the consumption of fossil fuels. Nevertheless the amount of bagasse stored between seasons is minimal as it accounts for less than 1% of total bagasse generated in a regular season. Most importantly, this bagasse is always stored less than a year, from the end of one crop in mid June until mid January, the start of the next crop.

(iv) No significant energy quantities, except for transportation of the biomass, are required to prepare the biomass residues for fuel consumption:

The biomass used in this project is not transformed in any way before its use as a fuel. The bagasse is taken directly from the mills of the sugar cane production facility and no further processing of this biomass is present.

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

	Source	Gas		Justification/Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Heat generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	Project participants decided to not include this emission source, because cases B1, B2 and B3 of ACM0006 are not the most likely baseline scenarios
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources
Project Activity	On-site fossil fuel consumption	CO_2	Excluded	There are no emissions due to fossil fuel consumption
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Off-site transportation of biomass residues	CO_2	Excluded	Bagasse is produced inside the mills. No off-site transportation of bagasse is necessary
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Combustion of biomass residues for electricity and / or heat generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	This emission source is not included because CH_4 emissions from uncontrolled burning or decay of biomass in the baseline scenario are not included
		N_2O	Excluded	Excluded for simplification. This emissions source is assumed to be very small
	Storage of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	Excluded for simplification. Since bagasse is stored for not longer than one year, this emission source is assumed to be small
		N_2O	Excluded	Excluded for simplification. This emissions source is assumed to be very small

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

Santa Matilde uses bagasse for the generation of heat and electricity. The project activity replaces less efficient equipment that used the biomass to generate electricity to the sugar mill. This corresponds to scenario #14, considering the replacement of equipment for more efficient technology.

The alternatives to the project activity are as follows: a) power generation: in the absence of the project, energy would have been generated partially in existing and new grid-connected power plants (alternative P4) and partially in the existing cogeneration plant using the same biomass until the end of the lifetime of the existing plant. The project activity would have been in that case not implemented as a CDM project activity at the end of the lifetime of the existing plant (alternative P5); b) biomass: in the absence of the project, the biomass would have been used for heat and electricity generation in the project site (alternative B4); c) Heat: in the absence of the project activity, heat would have been generated in boilers using the same type of biomass until the existing plant would have been replaced without the incentives of the CDM (alternative H5). The identified alternatives for the different components of the project activity correspond to scenario 14, an energy efficiency project, obtained by the replacement of the existing biomass power units by new highly efficient ones.

Scenario 14 is valid because the old and less efficient equipment is replaced by the new and more efficient one. This change would have occurred without the incentives of the CDM at the end of the lifetime of the old equipment. For Santa Matilde Cogeneration Project, it was estimated that the replaced equipment at the time of the replacement still had over 20 years of life. This corresponds to typical average technical lifetime of this type of equipment in this industry in Honduras According to the manufacturers, this kind of equipment has a technical lifetime of 30 years, and common practice in Honduras shows that sugar mill equipment can be used, with good maintenance, for over 60 years. *Asociacion de Produtores de Azucar de Honduras* (APAH- Honduras Sugar Producers Association), referring (see annexed document "honduras_lifetime.jpg") to the common practice in the country, assures that sugar mill equipment can be used, with good maintenance, for over 60 years.Technical literature (Babcock & Wilcox Corporation. "Our boilers and enviroment equipment. (catalog); Perez, G. L. "La remodelación de la caldera alemana de 25t/h". Energia, no. 5, pp. 14-27, 1985; Foster Wheeler Corporation. "Heat engineering. CFB technology aids in redevelopment", 1999).
states that boilers with good maintenance can work for periods over 50 years.

It can be added that the equipments are used at most 5 months per year, during the harvest period. Two old boilers and the 1.5 MW turbo were installed in 1968; the third old boiler and the 2.5 MW turbo were installed in 1974. Boilers 1 and 2 were retrofitted in 2002; boiler 3 was retrofitted in 2003. The 2.5 MW turbo was retrofitted in 2005. All the five equipments will continue to be used as stand-by.

Emission reductions from heat are not considered because the heat efficiency of the new plant is greater than the heat efficiency of the pre-project equipment and, for conservativeness reasons, they are excluded, i.e., $ER_{heat,y} = 0$. Heat efficiency for the 3 boilers of the baseline was 1,508 kcal/kg bagasse; for the 2 boilers of the project, heat efficiency is 1,658 kcal/kg bagasse.

Biomass decay was non-existent, nor have biomass been burned in an uncontrolled manner, as biomass was used in the past to generate electricity for internal use. For scenario #14, $BE_{biomass, y}=0$.

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

The "additionality tool" shall be applied in conjunction with ACM0006 to describe how the anthropogenic emissions of GHG are reduced below those that would have occurred in the absence of the Santa Matilde Project. The additionality tool provides a general step-wise framework for demonstrating and assessing additionality. These steps, numbered from 0 to 5, include:

0. Preliminary screening
1. Identification of alternatives to the project activity
2. Investment analysis AND/OR
3. Barrier analysis
4. Common practice analysis
5. Impact of CDM registration

The application of the additionality tool to the Santa Matilde Project follows:

Step 0. Preliminary screening based on the starting date of the project activity

a) Project Start date: The starting date of the CDM project activity, May 12, 2003, falls between 1 January 2000 and the date of the registration of a first CDM project activity, 18 November 2004.

b) Evidence demonstrates that CDM incentives were seriously considered in the development of the Santa Matilde Project.

Santa Matilde Project started its cogeneration project May 12, 2003. Prior to this date, the owners of the project were introduced to the Clean Development Mechanism and its incentives for projects that reduce greenhouse gases emissions through seminars held at the Association of Sugar Cane Producers in Honduras. Most particularly, the owners of Santa Matilde project attended a seminar in 2002 sponsored by MGM International where they were introduced to the opportunity of commercializing emission reductions derived from their cogeneration activities. Since that presentation, the owners of the project started considering this incentive as a way to make feasible the construction of new cogeneration facilities within their operation.

Other seminars held in Honduras on CDM prior to the implementation of the project were:

- Regional training course for potential leaders of the carbon program in Latin America, sponsored by BID, SERNA and the Netherlands. October 2001, Tegucigalpa.

- Seminar of CDM Project Formulation, sponsored by World Bank Institute, PCF, OICH. December 2001, Tegucigalpa.

To the initiatives mentioned above, it is noticeable efforts undertaken by the Honduran Government to promote the Clean Development Mechanism and the role of Honduras in the provision of economical emissions reductions. The Government has been very proactive in informing its most important industries (sugar cane among them) on the opportunities that this market has to offer. It is

therefore clear that Santa Matilde Project, as well as other sugar cane producers in Honduras, were aware of the CDM incentives and included them in the planning of the expansion to its cogeneration facilities.

Although the owners of Santa Matilde were fully aware of the incentives of the CDM when developing the cogeneration project, their inclusion in official project documents is rare; a circumstance motivated by the uncertainty of the implementation of the Kyoto Protocol and its flexibility mechanisms. Nevertheless, the minute of the meeting held by CAHSA's Board on April 22, 2003 mentions the incentives of the CDM as a form of financing of the project. This document precedes the start date of the project, thus providing strong evidence of the serous consideration of CDM in the development of the cogeneration project.

Additionally, Jorge A. Arriaga, Manager, José Solano, Chief Operator, and Sergio Solis, Production Manager, attended the workshop "*Aprovechamiento de Residuos Biomásicos en Honduras. Experiencias y Oportunidades*" (The use of biomass residues in Honduras. Experiences and Opportunities), held by MGM Internacional in June 5 and 6, 2003, shortly after the project start. This is also an evidence that CDM was considered in the development of the project.

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

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

To define alternatives to the project activity, we must complete a two-sided analysis, taking into consideration the perspective of the project owner and the perspective of the country.

From the project owner's perspective, the cogeneration project provides the company with electricity and heat for the production of sugar. It also provides excess electricity to be exported to the grid. Without the project, the plant would continue to operate with low energy efficiency. From an investment point of view, the alternative to the project activity for the sponsors is the continuation of the current (previous) situation, i.e., no project activity

From the country's perspective, the alternative for producing a similar amount of energy as the one Santa Matilde is to provide is to use current generation system; a system that continuously increases its dependency on thermal plants (using diesel and bunker).

According to the statistic provided by ENEE, Honduras' electrical company, the interconnected system has shown an increment of the share of thermal electricity in the total installed capacity. In 1985, hydro stations accounted for 76.28% of total installed capacity (424.3MW of the total 556.2MW). Since then, hydro power has shown almost no new developments (hydro plants owned by the State only grew 40.1MW since 1985). Thermal, on the other hand, has shown a tremendous growth, representing today 57.4% of the total 1162.3MW capacity of Honduras (since 1985, thermal plants grew 535.4MW or 306%). Hydro lost its predominant position of the 80's, accounting today for only 41.1% of that installed capacity. [1]

[1] http://www.enee.hn/Estadisticas2005/PDF/GraficoCP3.pdf

All indicates that the observed trend of increased use of thermal plants will continue in the years to come. The present generation expansion plan in Honduras (a plan developed by ENEE with the help of OLADE, Latin American Organization of Energy) shows that thermal energy plays a major role. [2] Between 2006 and 2019, a total of 607.4 MW of thermal plants will be installed, whereas the increase of power from hydro plants will be of 545.3 MW in the same period.

Although there are some incentives in place by the Honduran Government to promote the development of small renewable energy projects (such as a price incentive of 10% above short term marginal cost for small projects below 50MW capacity), the results have been very modest. Since 1967, only 17MW of biomass have been implemented. Today biomass represents only 1.5% of total installed capacity in Honduras. Below, a list of the general practices in Central America:

Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panamá
Executive Decree no. 30480-Minae; Directive no. 22, Promotion of the renewable sources of energy (11-03-2003)		Support for the promotion to the development of new and renewable sources of energy (Decree of law 20-86) and Law of incentives for the development of renewable energy projects (Decree 52-2003, 28-10-2003)	Support to projects of renewable energy (Decree 103-2003, 14-10-2003); Aeolian project Honduras 2000 (decree 9-2001), and Incentives to the renewable energies and their reforms (Decrees 85-98 of 20-4-1998 and 267-98 of 5-12-1998)	Incentives to the renewable sources of energy for electrical generation and for the development of aeolian and hydroelectric resources (Presidential Agreement 279 2002 of the 9-07-2002). Law of incentives for the development of renewable energy projects	Legislative decree establishing regime of incentives and promotion for new and renewable (june-2004)

Source: Cepal (2004)[3]

Considering the actual and foreseen situation of the electric sector in Honduras, and the expansion plan of ENEE, it is accurate to conclude that thermal plants will be the most likely source of power to meet the increasing demand. Thermal energy is therefore the alternative to the proposed CDM project activity.

Sub-step 1b. Enforcement with applicable laws and regulations

The project activity and the alternative scenario are in compliance with the legal and regulatory requirements.

Step 2. Investment Analysis

Sub-step 2a. Determine appropriate analysis method

Additionality is demonstrated through an investment benchmark analysis (option III)

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[2] http://www.enee.hn/PDFS/PlanExpansionGen.pdf (see also annexed Excel spreadsheet Honduras_Plan de Expansion ENEE 2006 - 2020.xls)

[3] *Estrategia para el fomento de las fuentes renovables de energía en América Central. Naciones Unidas – Comisión Económica para América Latina y el Caribe. 2004.*

Sub-step 2b and 2c– Option III - benchmark analysis

The process of funding a project such as the cogeneration project for Santa Matilde is a very challenging task. Honduras suffers from weak local economy and local banks charged high interest rates at the time the investment decision was made (higher than 30% for loans based in Lempiras, see below)

	Annual maximum interest rates in national currency - Honduras (in %)					
Date	Commercial Active rate for loans	Commercial Passive rate (90 days)	Associations Active rate for loans	Associations Passive rate (90 days)	Average Active rate for loans	Average Passive rate (90 days)
2004						
January	32.27	11.61	26.00	11.45	31.75	11.59
February	30.53	11.48	26.00	11.45	30.25	11.48
March	30.93	11.59	26.00	11.45	30.63	11.58
April	32.40	10.89	26.00	11.45	32.00	10.93
May	30.87	11.28	26.00	11.45	30.56	11.30
June	30.57	11.32	26.00	11.45	30.27	11.34
July	31.36	11.74	26.00	12.50	31.00	11.85
August	30.53	11.47	27.00	12.00	30.31	11.53
September	31.40	11.66	27.00	12.00	31.13	11.70
October	32.86	10.95	23.00	11.00	32.20	10.96
November	31.53	11.05	23.00	10.50	31.00	11.00
December	31.33	10.35	23.00	13.00	30.81	10.57

Figure 4 – Honduras' Interest Rate Source: Honduras' Central Bank
(**source: http://www.bch.hn/esteco/monetaria/tasamax.pdf**)

Santa Matilde's cash flow (see annexed spreadsheet "Santa_Matilde_IRR_2007.03.27.xls") shows that the IRR of the project, 13.4%, is lower than the average bank active rates at the time the investment decision was made.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:
• Increase in project revenue
• Reduction in running costs

Those parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 10%, and assessing what the impact on the project IRR would be (see results in the Table below. For the calculation, see annexed spreadsheet

"Santa_Matilde_IRR_2007.03.27.xls"). As it can be seen, the project IRR remains lower than its alternative even in the case where these parameters change in favor of the project.

Table: Sensitivity analysis

Scenario	% change	IRR (%)
Original		13.4%
Increase in project revenue	10%	15.2%
Reduction in project costs	10%	13.7%

We can conclude therefore that Santa Matilde project could not be implemented without the CER revenue.

Step 3. Barrier Analysis

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

Technological and Logistic Barrier

Even though the technology used in the cogeneration project is well known in Honduras, there are barriers of technological and logistical nature associated with its application. Rankine Cycle steam turbines are not produced in Honduras, so they must be imported mostly from Brazil and the US. This represents a problem to the project developer since they must depend on outside know-how to set up and maintain the new facility. The development of cogeneration project also required engineers and technical personnel from abroad, thus making this logistic barrier extensive to manpower as well as equipment.

Besides the Rankine-cycle technology, Santa Matilde also utilizes equipment to deliver electricity to the grid and complex control systems for the new facility. This is not the typical traditional equipment of sugar cane producing and its usage represents also a technological barrier. This control equipment is also imported, thus increasing the importance of the barrier mentioned in the paragraph above.

To ensure the proper function of the project, Santa Matilde had also to acquire new knowledge in electric transmission and the sale of electricity in the spot market. Such knowledge acquisition could not be achieved without important investments. The incentives of the CDM would help to ease the acquisition of this knowledge.

Core Business Barrier

In addition to all those barriers mentioned above, it is important to understand that the sale of electricity from cogeneration represents only a small share of total annual revenues of sugar mills. As a

consequence, sugar mills prefer investing in equipment related to their core business, the production of sugar and molasses. For the Santa Matilde cogeneration project, the sale of electricity represents less than 10% of the total annual revenues of CAHSA.

Regulatory Barrier

According to OLADE, 1997, waste from the wood, paper, and cellulose, and sugar industries are highly appropriate for the cogeneration of electricity and heat for own use and sale to the electric power grid. In Guatemala, Jamaica, Brazil, and other countries of the region, important steps have been taken in the sugar industry. The economic conditions for cogeneration have not improved in the course of the reforms (energy sectors restructurings), owing to the relative depreciation of electricity supplied to the public grid. Thus, the significant potential for cogeneration in sugar mills has taken time to materialize.

In addition to the above exposed, current legislation in Honduras gives thermal plants a series on incentives that includes the exoneration of sales taxes on all fossil fuel bought for electrical generation and a much higher price per KWh than other cleaner alternatives. Thermal plants in Honduras also receive compensation from ENEE for their available installed capacity, regardless of their generation. Renewable energy does not receive this type of compensation as they only receive payment for the electricity they deliver to the grid. This is another clear example of regulatory barriers to the mentioned clean technologies in the country.

Because of the reasons explained, Honduran electric system continuously increases its dependency on thermal plants (using diesel and bunker). According to the statistic provided by ENEE (see sub-step 1a above), Honduras' electrical company, the interconnected system has shown an increment of the share of thermal electricity in the total installed capacity.

Considering the actual and foresee situation of the electric business in Honduras, it is accurate to conclude that thermal plants will be the most likely source of power to meet the increasing demand of the country. Thermal energy is therefore the alternative to the proposed CDM project activity.

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives.

As described above, the main alternative to the project activity is continuing the current situation without the expansion, i.e., no project activity. This alternative would not be prevented by the barriers identified above.

Step 4. Common Practice Analysis

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

Besides hydro, biomass constitutes the only clean energy technology in operation in Honduras. Although cogeneration is a widespread practice among sugar cane producers, it is worth mentioning that only a few of those producers generate excess energy to be sold to the grid. The traditional goal of a cogeneration

project has been first, to produce enough energy to maintain the companies independent from the grid and second, to eliminate (burn) the bagasse, sugar cane's byproduct. There are currently six cogeneration projects in Honduras: La Grecia, Santa Matilde, Tres Valles, Chumbagua, Inversiones Hondureñas and Yojoa. All of them are participating in CDM (at different stages of the process).

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

As mentioned above, six cogeneration projects that will deliver energy to the grid are participating in CDM.

Step 5. Impact of CDM Registration

As described above, the reliability of Honduras on thermal generation has increased dramatically in the past years and it is expected to increase, according to ENEE's generation expansion plans. The usage of this technology to produce electricity has a strong impact on the environment and the economy (fossil fuel has increased in prices dramatically in the last two years).

Honduras has tried to reduce its dependency on fossil fuels but the efforts implemented until now have not proved very useful. The registration of the CDM project activity will contribute to solve this situation, giving incentives to clean energy cogeneration.

The CERs would increase the project's Internal Rate of Return and contribute to it to overcome other barriers, thus making the project a better investment option and a sound option in comparison to national benchmarks.

Moreover, the registration might influence other sugar cane producers in Honduras to set up new cogeneration plants (or expand old ones). The registration of the proposed project activity will have a strong impact in paving the way for similar projects to be implemented in Honduras. This would help promote sustainable development of this Central American country.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

a) ACM0006 - "Consolidated baseline methodology for grid-connected electricity generation from biomass residues", version 4, October 2006, was chosen.

ACM0006 is applicable to biomass-based cogeneration projects connected to the grid. The methodology considers emission reductions generated from cogeneration projects using sugarcane bagasse. This fits perfectly the operation at Santa Matilde, so the choice of methodology is justified.

The equations which will be used in calculating emission reductions are the following:

$ER_y = ER_{thermal,y} + ER_{electricity,y} - PE_y – L_y$	**Equation 1**

Where:

ER_y are the emission reductions of the project activity during year y
$ER_{electricity,y}$ are the emissions reductions due to displacement of electricity in year y
$ER_{thermal,y}$ are the emissions reductions due to displacement of thermal energy in year y
PE_y are project emissions in year y (zero for this project activity)
L_y are the leakage emissions in year y (zero for this project activity)

Estimate of project emissions:

No activities increasing GHG emissions were identified. Therefore, no calculation of estimate of GHG emissions is necessary. The project emissions (PE_y) are zero.

Estimated leakage emissions:

The main source of leakages in the ACM0006 methodology is considered to be the increase of fossil fuel consumption due to the diversion of the biomass. No diversion of biomass occurs, therefore no leakages are present. For the reasons explained, leakages (L_y) are considered to be zero.

Estimated emissions reductions:

The amount of electricity to be considered for the displacement of power from the grid is calculated using the equation below. This equation corresponds to the chosen scenario #14 of the ACM0006 methodology:

$$EG_y = EG_{projectplant,y} * \left(1 - \frac{\varepsilon_{el,preproject}}{\varepsilon_{el,projectplant,y}}\right)$$ **Equation 2**

EG_y is determined based on the average net efficiency of electricity generation in the project plant prior to project implementation, $\varepsilon_{el,pre\ project}$, and the average net efficiency of electricity generation in the project plant after project implementation, $\varepsilon_{el,project\ plant,y}$, shown in Equation 2, where:

EG_y is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year *y* in MWh,
$EG_{project\ plant,y}$ is the net quantity of electricity generated in the project plant during the year *y* in MWh,
$\varepsilon_{el,project\ plant,y}$ is the average net energy efficiency of electricity generation in the project plant, expressed in $MWh_{el}/MWh_{biomass}$. by dividing the electricity generation during the year *y* by the sum of all fuels (biomass residue types *k* and fossil fuel types *i*), expressed in energy units, as follows:

$$\varepsilon_{el,project\ plant,y} = \frac{EG_{project\ plant,y}}{\sum_k NCV_k \cdot BF_{k,y} + \sum_i NCV_i \cdot FF_{project\ plant,i,y}}$$

where:

εel,project plant,y = Average net energy efficiency of electricity generation in the project plant
EGproject plant,y = Net quantity of electricity generated in the project plant during the year *y* (MWh)
BFk,y = Quantity of biomass residue type *k* combusted in the project plant during the year *y* (tons of dry matter or liter)
NCVk = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter or GJ/liter)
NCVi = Net calorific value of fossil fuel type *i* (GJ / mass or volume unit)
FFproject plant,i,y = Quantity of fossil fuel type *i* combusted in the biomass residue fired power plant during the year *y* (mass or volume unit per year)9

For the first crediting period, the emissions reductions due to displacement of electricity ($ERelectricity_y$) will be calculated as follows:

$$ERelectricity_y = 0.668 \times EG_y$$ **Equation 3**

The emission reduction by the project activity (ER_y in tCO_2e) during a given year (y) is the difference between the emissions reductions due to displacement of electricity ($ERelectricity_y$), project emissions (PE_y) and due to leakage (L_y), as follows:

$$ER_y = ERelectricity_{,y} - PE_y - L_y = 0.668 \text{ x } EG_y - PE_y - 0$$ **Equation 4**

b) ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 6, dated on 19/05/2006.

Since the power generation capacity of the project plant is of more than 15 MW, *EFgrid,y* should be calculated as a combined margin (CM), following the guidance in the section "Baselines" in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002, version 6, May 19, 2006).

The calculation of emissions reductions from the displacement of electricity form the grid includes a calculation for baseline emission factor (EF_y) that is equal to a combined margin (CM) consisting of a weighted average of the operating margin (*OM*) and build margin (*BM*) factors. The methodology thus starts with the calculation of the OM and BM emission factors and concludes with the calculation of the electricity baseline emission factor. ACM0002 follows a three-step approach, namely:

- **STEP 1** - Calculation of the operating margin emission factor(s), based on one of the following methods:
    - (a) Simple operating margin
    - (b) Simple adjusted operating margin
    - (c) Dispatch data analysis operating margin
    - (d) Average operating margin.

Although the methodology calls for giving priority to the Dispatch data analysis method, lack of data for Honduras prevented the application of this option. Additionally, Honduras is a country where less than 50% of total grid generation comes from low-cost/ must-run resources. For these reasons, the Simple OM method (a) was chosen.

The simple operating margin emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (in tCO_2/MWh) of all generating sources except low-cost/ must-run power plants over the past three years:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$ (Equation 5)

Where:

- $F_{i,j,y}$ is the amount of fuel i (in mass or volume unit) consumed by relevant power sources j in year(s) y,
- $COEF_{i,j}$ is the CO_2e coefficient of fuel i (tCO_{2e}/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y and,
- $GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j in year(s) y

- **STEP 2** – Calculation of the build margin mission factor ($EF_{BM,y}$) as the generation weighted average emission factor (tCO_{2e}/MWh) of a sample of power plants m, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$ (Equation 6)

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the Simple OM method (ACM0002) for plants m, based on the most recent information available on plants already built . The sample group m consists of either:

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

For Santa Matilde cogeneration project, m consisted on the five most recently built plants as they comprises the larger annual generation.

STEP 3 – Calculate the baseline emission factor EF_y, as the weighted average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$ (Equation 7)

Where the weights are w_{OM} and w_{BM}, by default are 50% (i.e., w_{OM} = w_{OM} = 0.5). Alternative weights can be used, as long as $w_{OM} + w_{BM} = 1$, and appropriate evidence justifying the alternative weights is presented.

The OM emission factor is calculated as the generation-weighted average emissions per electricity unit (in tCO_2/MWh) of all generating sources except low-cost/ must-run power plants:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

Where:

- $\sum_{i,j} F_{i,j,y}$ is the amount of fuel i (in mass or volume unit) consumed by relevant power sources j in year(s) y,
- $COEF_{i,j}$ is the CO_2e coefficient of fuel i (tCO_{2e}/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y and,
- $\sum_{j} GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j,

The calculation of the Simple OM was done using the most recent numbers for Honduras' national interconnected system obtained from the national dispatch center. Data from 38 power plants, comprising 1.375 GW of installed capacity and over 14.564 TWh of electricity generation for the 3-year period comprised between 2003 and 2005 were considered.

Non-low-cost/must-run resources in Honduras' national interconnected system are thermo power plants diesel and fuel oil.

The product $\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}$ for each one of the plants was obtained from the following formulae:

$$F_{i,j,y} = GEN_{i,j,y} \cdot \eta_{i,j,y} \qquad \text{(Equation 8)}$$

Where,

$$\eta_{i,j,y} = \frac{DEN_i \cdot NCV_i \cdot 1000}{TE_{i,j}} \qquad \text{(Equation 9)}$$

$$COEF_{i,j} = EF_{CO2,i} \cdot 44/12 \cdot OXID_i \qquad \text{(Equation 10)}$$

Hence,

$$F_{i,j,y} \cdot COEF_{i,j} = GEN_{i,j,y} \cdot EF_{CO2,i} \cdot 44/12 \cdot OXID_i \cdot \eta_{i,j,y} \qquad \text{(Equation 11)}$$

Where variable and parameters used are:

- $\sum_{i,j} F_{i,j,y}$ is given in TJ, $COEF_{i,j}$ in tCO_2e/TJ and $F_{i,j,y} \cdot COEF_{i,j}$ in tCO_2e
- $GEN_{i,j,y}$ is the electricity generation for plant *j*, with fuel *i*, in year *y*, obtained from the National Dispatch Center, in MWh.
- $\eta_{i,j}$ is the fuel consumption factor of plant *j*, operating with fuel *i*, in TJ/MWh.
- DEN_i is the density of fuel *i* in tonnes/Gallon.
- NCV_i is the net calorific value of fuel *i,* obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, in TJ/10^3 tonnes.
- 1,000 is the conversion factor from MWh to KWh.
- $TE_{i,i}$ is the thermal efficiency of plant *j*, operating with fuel *i*, obtained from the National Dispatch Center in KWh/Gallon.
- $EF_{CO2,i}$ is the emission factor for fuel *i*, obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, in tC/TJ.
- 44/12 is the carbon conversion factor from tC to tCO_2.
- $OXID_i$ is the oxidization factor for fuel *i*, obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, in %.

$\sum_{j,y} GEN_{j,y}$ is obtained from the National Dispatch Center, as the sum of non-low-cost/must-run resources electricity generation, in MWh.

See results of this calculation in Annex 3.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	***EF***
Data unit:	tCO_2/MWh
Description:	Emission factor for Honduras interconnected grid
Source of data used:	ENEE
Value applied:	0.668, at the start of the project activity. For the first crediting period, the emission factor $EF_{OM,y}$ will be calculated *ex-ante.*
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to ACM0002, version 6, May 19, 2006, the calculation of emissions reductions from the displacement of electricity form the grid included a calculation for baseline emission factor (*EF_y)* that is equal to a combined margin (CM) consisting of a weighted average of the operating margin (*OM*) and build margin (*BM*) factors. The methodology thus starts with the calculation of the OM and BM emission factors and concludes with the calculation of the electricity baseline emission factor.
Any comment:	*EF* is the value used for $CEF_{electricity,y}$

Data / Parameter:	$EF_{BM grid,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 build margin emission factor for grid electricity during the year *y*
Source of data used:	The latest approved version of ACM0002 to calculate the grid emission factor: version 6, May 19, 2006.
Value applied:	0.667
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{OM grid,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 operating margin emission factor for grid electricity during the year *y*
Source of data used:	The latest approved version of ACM0002 to calculate the grid emission factor: version 6, May 19, 2006.
Value applied:	0.670
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**εel, pre project**
Data unit:	MWh_{el} / $MWh_{biomass}$
Description:	Average net efficiency of electricity generation in the project plant prior to project implementation.
Source of data used:	On-site measurements conducted prior to the implementation of the project activity.
Value applied:	0.023
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measure the quantity of fuels fired and the electricity generation during a representative time period and divide the quantity of electricity generated by the energy quantity of the fuels fired. The three most recent historical years should preferably be used to determine the average efficiency, where such data is available and where this time period is reasonably representative.
Any comment:	Applicable to scenario 14

Data / Parameter:	$BF_{Bagasse, pre project}$
Data unit:	Metric tones
Description:	Quantity of bagasse that has been fired in boilers for heat generation during the most recent three years at the project site

Source of data used:	On-site measurements
Value applied:	See annexed spreadsheet "SantaMatilde_CERs_calculation_scenario14_2007.03.06.xls"
Justification of the choice of data or description of measurement methods and procedures actually applied :	Use weight or volume meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be crosschecked with the quantity of electricity (and heat) generated and any fuel purchase receipts (if available).
Any comment	

B.6.3 Ex-ante calculation of emission reductions:

The Tables below show data on energy export, energy internally consumed and bagasse consumption of the Project since year 2002. The values for 2005 were obtained considering the energy and bagasse production data proportionally to the number of harvest days left (107 days) after the project started. The harvest in 2005 had 137 days.

Year	Energy exported (MWh)
2002	0
2003	0
2004	0
2005 (from Feb 11 on)	14,258
2006	30,288
2007 (*)	34,656
2008 (*)	34,656
2009 (*)	57,396
2010 (*)	57,396
2011 (*)	61,800
2012 (until Feb 10) (*)	18,540
Year	Energy consumed (MWh)
2002	14,281
2003	13,149
2004	14,135
2005 (from Feb 11 on)	18,510

2006	24,837
2007 (*)	22,810
2008 (*)	22,810
2009 (*)	28,800
2010 (*)	28,800
2011 (*)	29,760
2012 (until Feb 10) (*)	8,928

Year	Bagasse consumption (tones)
2002	190,487
2003	184,379
2004	203,075
2005 (from Feb 11 on)	218,785
2006	249,776
2007 (*)	242,440
2008 (*)	242,440
2009 (*)	306,240
2010 (*)	306,240
2011 (*)	306,240
2012 (until Feb 10) (*)	91,872

Year	Bagasse NCV (MWh/tones)
2002	2.57
2003	2.57
2004	2.57
2005	2.57
2006	2.57
2007 (*)	2.57
2008 (*)	2.57
2009 (*)	2.57
2010 (*)	2.57
2011 (*)	2.57
2012 (*)	2.57

From these values, EGy is calculated as shown below:

Year	EG projectplant, y (MWh)	$\varepsilon_{el, project, y}$ (non dimensional)	EGy (MWh)
2005 (from Feb 11 on)	28,667	0.051	15,455
2006	51,023	0.079	35,940

2007 (*)	53,364	0.086	38,723
2008 (*)	53,364	0.086	38,723
2009 (*)	82,095	0.104	63,601
2010 (*)	82,095	0.104	63,601
2011 (*)	87,459	0.111	68,965
2012 (until Feb 10) (*)	26,238	0.111	20,690

εel, project = 0.023

Emissions reductions will be as follows:

Year	EGy (MWh)	ERy (t CO2)
2005 (from Feb 11 on)	15,455	10,324
2006	35,940	24,008
2007 (*)	38,723	25,867
2008 (*)	38,723	25,867
2009 (*)	63,601	42,486
2010 (*)	63,601	42,486
2011 (*)	68,965	46,069
2012 (until Feb 10) (*)	20,690	13,821
Total		**230,927**

(*) estimated

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

The full implementation of the Santa Matilde project connected to the Honduran grid will avoid an average estimated yearly emission of around 32,990 tCO2e, and a total reduction of about 230,927 tCO2e over the first 7 years crediting period (up to and including 2012, see Table 2 below). Note: the calculation of the baseline emissions is not required, as per methodology ACM0006, version 4.

Year	**Estimation of project activity emissions**	**Estimation of baseline emissions**	**Estimation of leakage**	**Estimation of overall emissions reductions**
	(tonnes of CO2e)	**(tonnes of CO2e)**	**(tonnes of CO2e)**	**(tonnes of CO2e)**
2005 (from Feb 11 on)	0	0	0	10,324
2006	0	0	0	24,008
2007	0	0	0	25,867
2008	0	0	0	25,867
2009	0	0	0	42,486
2010	0	0	0	42,486
2011	0	0	0	46,069
2012 (until Feb 10)		0		13,821
Total (tonnes of CO2e)	0	**0**	0	**230,927**

Table 2 - Summary of the ex-ante estimation of emission reductions

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**EGproject plant$_y$**
Data unit:	MWh
Description:	Net quantity of electricity generated in the project plant during the year y
Source of data to be used:	Readings of the energy metering connected to the project plant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	87,459 MWh at the end of the first crediting period
Description of measurement methods and procedures to be applied:	Meter should be calibrated regularly according to ENEE's norms. Measurement results for the energy exported should be cross-checked with the quantity of invoices from the grid operator. Data is being archived and administered by Santa Matilde. Data will be archived during the crediting period and two years after.
QA/QC procedures to be applied:	Data on the energy exported to the grid is being monitored by Santa Matilde and the utility company (ENEE). This duplicity of counting will ensure the accuracy of the amount of electricity delivered to the grid. The utility company will also perform audits to the measurement equipments of the plant to assure correct monitoring.
Any comment:	

Data / Parameter:	**EG$_y$**
Data unit:	MWh
Description:	Net quantity of increased electricity generation as a result of the project activity during the year y
Source of data to be used:	Calculated according to equation 2, in section B.6.1
Value of data applied for the purpose of calculating expected emission reductions in section B.5	68,965 MWh at the end of the first crediting period
Description of measurement methods and procedures to be applied:	Calculated quarterly. Data will be archived during the crediting period and two years after.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**$\varepsilon_{el,project\ plant,y}$**
Data unit:	Non dimensional
Description:	Electric energy efficiency
Source of data to be used:	Net energy efficiency of electricity generation in the project plant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.111 at the end of the crediting period
Description of measurement methods and procedures to be applied:	Calculated quarterly. Data will be archived during the crediting period and two years after.
QA/QC procedures to be applied:	Data is being calculated by Santa Matilde, as in annexed spreadsheet “SantaMatilde_CERs_calculation_scenario14_2007.03.06.xls”
Any comment:	

Data / Parameter:	**$FC_{bagasse}$**
Data unit:	Metric tones
Description:	Quantity of bagasse combusted in the project plant during the year *y*
Source of data to be used:	Weight on-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table in section B.6.3
Description of measurement methods and procedures to be applied:	Monitored continuously, with an annual energy balance. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be crosschecked with the quantity of electricity (and heat) generated and any fuel purchase receipts (if available). Data will be archived during the crediting period and two years after.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	

Data / Parameter:	**$NCV_{bagasse}$**
Data unit:	MWh/tones
Description:	Net calorific value of bagasse
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2.57

Description of measurement methods and procedures to be applied:	Data will be measured every six months by Santa Matilde. The net calorific value should be determined separately for all types of biomass. Measurements shall be carried out at reputed laboratories and according to relevant international standards. Data will be archived during the crediting period and two years after.
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
Any comment:	

B.7.2 Description of the monitoring plan:

Data that has to be monitored during the life of the contract are the net quantity of electricity generated in the project plant ($EG_{project\ plant,y}$) and the quantity of bagasse (and its NCV) used yearly. The project owner will continuously measure these values.

The electricity data will be monitored by two Santa Matilde's meters and one ENEE meter installed at the substation of the cogeneration system and compiled in a spreadsheet. The amount of electricity will be corroborated with the invoices to be electrical company and in case of discrepancies, the latter will prevail. Two days after the measurement, ENEE will send a receipt detailing the amount of energy it purchased. The payment will be done at most within 11 days after the measurement takes place.

The project sponsor will proceed with the necessary measures for the power control and monitoring, according to the information produced by ENEE.

Santa Matilde are responsible for the project monitoring and reporting.

The calibration of the monitoring instruments will be done according to the regulations of ENEE, once a year.

In case of failure of any of the energy meters, Santa Matilde have stand-by meters both at the high voltage side and one meter at the low voltage side to collect the measurements. Reading of the values measures is always done in the presence of Santa Matilde's and ENEE's personnel.

The plant has a DCS (Distributed Control System) that monitors, reports and records all relevant process variables and manages corrective actions.

There is full training of the plant personnel.

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

The baseline and monitoring studies were conducted according to approved methodology ACM0006 – "Consolidated baseline methodology for grid-connected electricity generation from biomass residues". They were completed on February 5st, 2007 by Ricardo Besen of Ecoinvest Carbon S.A.

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SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date of the CDM project is 12/05/2003

C.1.2. Expected operational lifetime of the project activity:

25y-0m

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

C.2.1. Renewable crediting period

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

11/02/2005

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

This section is left blank on purpose.

C.2.2.2. Length:

This section is left blank on purpose.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

Although Honduras recognizes the evident positive impact of the Santa Matilde cogeneration project (the reduction of GHG in Honduras), Santa Matilde had to undergo an environmental impact assessment customary for all constructions and energy projects in Honduras. Such analysis was completed successfully in regards to the fact that Santa Matilde obtained from the National Environmental Ministry (Secretaria de Recursos Naturales y Ambiente), the necessary environmental licences for operation (the environmental license Nº 269-2003 was granted in Tegucigalpa on December 8th, 2003).

The environmental impact assessment of SANTA MATILDE cogeneration project included:

- Usage of Resources
- Legislation to be observed
- Impacts to climate and air quality
- Geological and soil impacts
- Hydrological impacts (surface and groundwater)
- Impacts to the flora and animal life
- Socio-economic (necessary infra-structure, legal and institutional, etc.)
- Mitigation measures
- Monitoring plan

Santa Matilde cogeneration project has signed a power purchase agreement that is contingent to the compliance of all environmental regulations. This provides additional evidence that the environmental impact of this project has been properly assessed and deemed insignificant.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

No significant environmental issues aroused from the Environmental Impact Assessment undergone by Santa Matilde. This process concluded successfully leading to the granting of Environmental License Nº 269-2003 by the National Environmental Ministry (Secretaria de Recursos Naturales y Ambiente).

Sugar production has some environmental impact such as bagasse burning. Nevertheless, those activities were conducted prior to the implementation of the project and thus could not be attributed to the CDM project activity.

SECTION E. Stakeholders' comments

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

The process for obtaining the Environmental Licence includes two site visits to the project by the so-called National System of Evaluation of Environmental Impact (SINEIA for its initials in Spanish). SINEAI is composed by representatives of the following Government agencies:

- Secretariat of National Resources and Environment (SERNA, in Spanish).
- General Commission of Evaluation and Environment Control (DECA).
- Water Resources Comission (DRH).
- Honduran Association of Sugar Producers (APAH).

- Center for Pollution Studies and Control.
- Municipal Environmental Unit (UMA).
- National Electric Company (ENEE).
- Secretariat for Agricultural Sanitation (SENASA).
- Secretariat for Agriculture and Cattle Rising (SAG).
- Independent Service for Aqueducts and Sewer Systems (SANAA).

The first site visit from the SINEIA occurs after the request for the Environmental License is rendered together with the technical report and the feasibility study. After this first visit, the project sponsor hired the independent consultant for the development of the environmental impact assessment.

Once the environmental impact assessment is delivered, the SINEAI does the second site visit to corroborate the information mentioned in the study in hand. During this visit, SINEIA will deliver its final recommendations and comments. The compliance to these comments is mandatory for the issuance of the Mitigation Contract, a preliminary step for obtaining the Environmental License.

On July 18th, 2003, there was also a public notice from the Ministry of Environment on the process for the issuance of the Environmental License.

Local stakeholders from Municipal Environment Units in towns around the sugar mill and from the regional office of the National Electric Company (ENEE) were invited to make comments on the project.

E.2. Summary of the comments received:

The SINEAI issued some comments regarding the operation of the cogeneration facility. Those comments were all included in the Mitigation Contract and its compliance is mandatory for the issuance of the Environmental License. Some of the remarks included in the Mitigation Contract are related to:

1) The proper handling and disposal of construction material.
2) The separation of construction waste for proper recycling.
3) The accounting of the dust produced from the combustion of bagasse
4) The use of hearing protection for areas were noise is above 85 decibels
5) The control of particles and emissions at boilers, according to World Bank guidelines
6) The correct demarcation of dangerous areas

No comments were received from other stakeholder besides the SINEAI.

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

All comments received were incorporated into the project. It is important to remember that the issuance of those licenses is contingent to the compliance with all comments from the SINEIA. Santa Matilde obtained both the Environmental and the Operational License on December 8th, 2003 and signed

a PPA with the National Electric Company (ENEE), thus providing enough evidence that due account of stakeholders comment was taken.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Compañía Azucarera Hondureña S.A.
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Represented by:	
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Salutation:	Mr.
Last Name:	Hirano
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Annex 2 – Information regarding public Funding

There is no public funding involved in this project.

Annex 3 – Baseline Information

Year	Installed Capacity (MW)	Energy Consumed (MWh/ year)	Energy Sold (MWh/ year)	Energy purchased (MWh/ year)
2002	4 MW	14,281	--	2,637
2003	4 MW	13,149	-	715
2004	4 MW	14,135	-	2,522
2005	28 MW	23,700	18,256	
2006	34 MW	24,837	30,288	
2007*	30 MW	22,810	34,656	
2008*	30 MW	22,810	34,656	
2009*	36 MW	28,800	57,396	
2010*	36MW	28,800	57,396	
2011*	46 MW	29,760	61,800	

The resulting operating margin using the Simple OM method was:

- $EF_{OM,simple,2003\text{-}2005} = 0.670\ tCO_2e/MWh.$

- **STEP 2** – Calculate the build margin mission factor ($EF_{BM,y}$) as the generation weighted average emission factor (tCO_{2e}/MWh) of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the Simple OM method (ACM-0002) for plants *m*, based on the most recent information available on plants already built . The sample group m consists of either

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

Project participants should use from these two options that sample group that comprises the larger annual generation. For Santa Matilde project, the 20% option was chosen.

From the obtained data, the build margin emission factor for Honduras is:

- $EF_{BM,2005} = 0.667\ tCO_{2e}/MWh.$

- **STEP 3** – Calculate the baseline emission factor EF_y, as the weighted average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$

For the weights w_{OM} and w_{BM} the default values of 50% (each) were used.

- EF_{2005} = *0.668 tCO_{2e}/MWh.*

Summary of the results:

Baseline Emission Factor - Honduras		
According to Approved Methodology ACM0002		
Year 2003		
EF_{OM} (tCO_2/MWh)	0.6790	
Annual generation[1] (MWh)	4,850,200	
Year 2004		
EF_{OM} (tCO_2/MWh)	0.6537	
Annual generation[1] (MWh)	5,178,630	
Year 2005		
EF_{OM} (tCO_2/MWh)	0.6766	
EF_{BM} (tCO_2/MWh)	0.6670	
Annual generation[1] (MWh)	5,483,300	
Generation weighted $EF_{OM,2003-2005}$	0.670	(tCO_2/MWh)
EF_{CM} = 0.5*$EF_{OM,2003-2005}$ + 0.5*$EF_{BM,2005}$ =	**0.668**	**(tCO_2/MWh)**

Annex 4 – Monitoring Plan

As per the procedures set by the Approved monitoring methodology ACM0006 - Monitoring methodology for emissions reductions from grid connected biomass cogeneration projects. The project sponsor will proceed with the necessary measures for the power control and monitoring. Together with the information produced by ENEE, it will be possible to monitor the power generation of the project and the grid power mix. Santa Matilde is responsible for the project monitoring and reporting. The measurement of the energy generated to the grid will be done by two electronic redundant meters which will make data available both to the buyer and to the seller of the energy. For invoicing, the measurements of these two meters are averaged. In case of a discrepancy greater than 3% in measurements, the smaller of the measurements is taken and calibration procedures will take place according to the law.

See more details in section B.7.2.