



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
(Version 02 - in effect as of: 1 July 2004)**

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

San Carlos Bagasse Cogeneration Project (SCBCP).

Version 1.

Date of the document: 03/11/2005.

A.2. Description of the project activity:

This project activity consists of increasing efficiency in the bagasse (a renewable fuel source, residue from sugarcane processing) cogeneration facility of **Sociedad Agrícola e Industrial San Carlos S.A.**, an Ecuadorian sugar mill. With the implementation of this project, the mill has been able to sell electricity to the national grid, avoiding that fossil-fuelled thermal plants dispatch the same amount of energy to that grid. By that, the initiative avoids CO₂ emissions, also contributing to the regional and national sustainable development.

Bagasse cogeneration is important for the energy strategy of the country. Cogeneration is an alternative that allows postponing the installation and/or dispatch of electricity produced by fossil-fuelled generation utilities. The sale of the CER generated by the project will boost the attractiveness of bagasse cogeneration projects, helping to increase the production of this energy and decrease dependency on fossil fuel.

By investing to increase in steam efficiency in the sugar and alcohol production and increase in the efficiency of burning the bagasse (more efficient boilers), San Carlos generates surplus steam and uses it exclusively for electricity production (through turbo-generators).

Moreover, using the available natural resources in a more efficient way, the San Carlos project activity helps to enhance the consumption of renewable energy. Besides that, it is used to demonstrate the feasibility of electricity generation as a side-business source of revenue for the sugar industry.

San Carlos also believes that sustainable development will be achieved not only through the implementation of a renewable energy production facility, but also through carrying out activities which correspond to the company's social and environmental responsibilities, as described below.

Social Contribution

San Carlos considers its employees to be its most valuable and most important resource and therefore stimulates them to be deeply engaged with the results of the company. San Carlos has always supported the development of human resources. The employees' contribution to increase the quality of the products is heavily dependent on their quality of life. In order to achieve a higher quality human resource management, the company focuses special attention on the social responsibility, work safety and health care.

Ingenio San Carlos was established in 1950 the San Carlos Hospital to assist the workers and family for free. The hospital is also opened to the community with the specialties of: pediatrics, cardiology,



gynecology, surgery, dentistry, preventive medicine and others. It is considered the best hospital in the region of Guayas´ Province.

The Collective Contract has been supporting the workers of Ingenio San Carlos since 1950. It regulates earnings, working terms, uniforms, tools, and other social contractual benefits. In 2003 Ingenio San Carlos applied \$1.589.535 in many social benefits.

Since the establishment of Ingenio San Carlos, in 1897, it was necessary to build houses for the workers to live in the surroundings mainly during the harvest season. In 1894 the company started giving to every worker a property for them to build a house. This enabled the urban development of the Marcelino Maridueña region. 1.066 houses were built until December 2003.

San Carlos also invested \$327.376 in 2003, proposing guarantee a good education to 1.104 workers´ children in three educational centers: “Jardín de Infantes Luis Vernaza”, “Escuela Luis Vernaza” and “Colegio Particular Mixto San Carlos”.

Ingenio San Carlos believes that the value of the people is important for the productivity and progress, therefore supports training programs improving personal knowing, abilities and capacities.

Industrial processes are also a matter of care for the company, and quality is on top of that care. The company has defined programs for certification of sugar production process in compliance with ISO norms as a mean to incorporate technology. The result is the company’s conform to the Quality Management System Standard: ISO 9001:2000, since August 2002.

Additionally to the contributions indicated, San Carlos accomplished social donations in 2003 to Marcelino Maridueña and Naranjito municipalities, local police, M. Maridueña church, fire station, and others.

Environmental Contribution

The environmental preservation is a commitment of San Carlos. It disposes of natural resources free of contamination aiming improving the productivity of the project.

Besides reducing the GHG emissions by the implementation of SCBCP, San Carlos has also been developing the reforestation programs since 2002. During 2003, were planted: 507,48 hectare of Teca, 14,49 hectare of Caoba, 16,41 hectare of Amarillo, 15,52 hectare of Cedro, 3,24 hectare of Laurel, 10 hectare of Guayacán and 5,39 hectare of Fremín Sánchez.

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)
Ecuador (host)	• Private entity Sociedad Agrícola e Industrial San Carlos S.A.	No



	<ul style="list-style-type: none"> • Private entity Econergy Brasil Ltda. 	
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(*) 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:

A.4.1.1. Host Party(ies):

Ecuador.

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

Guayas Province.

A.4.1.3. City/Town/Community etc:

Marcelino Maridueña.

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

Marcelino Maridueña is located in the oriental sector of Guayas Province and its total area is 337 km². It is limited north by the Chimbo river and the Naranjito, Milagro and General Elizalde (Bucay) cities; south by Barranco Alto river, with Triunfo city and part of Yaguachi city; east by Chimborazo and Cañar province and west by Yaguachi city, as is shown in Figure 1.

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

Sectorial Scope: 1-Energy industries (renewable - / non-renewable sources)

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

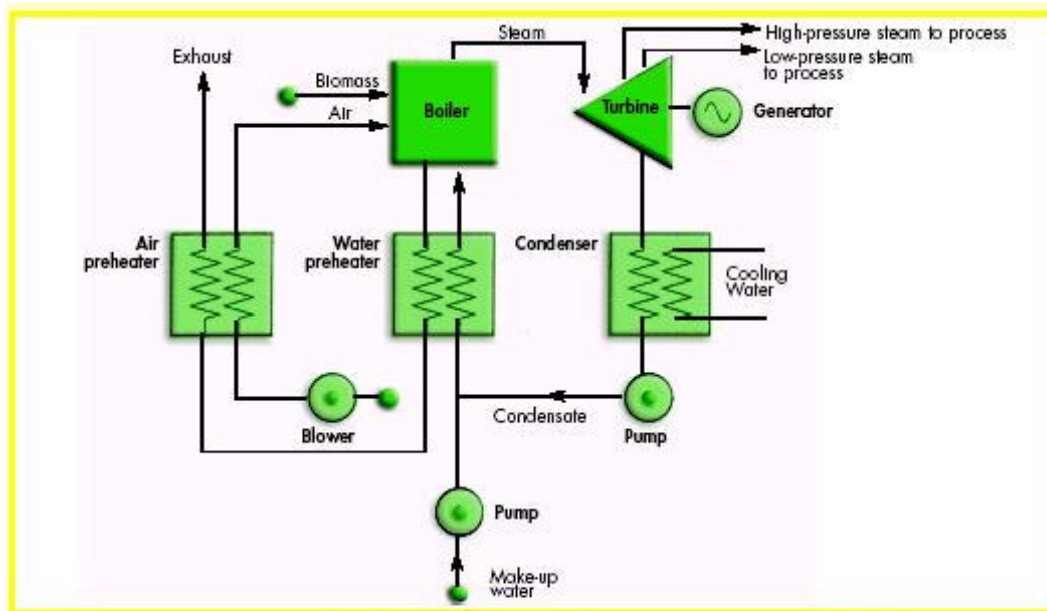
The predominant technology in all parts of the world today for generating megawatt (MW) levels of electricity from biomass is the steam-Rankine cycle, which consists of direct combustion of biomass in a boiler to generate steam, which is then expanded through a turbine. Most steam cycle plants are located at industrial sites, where the waste heat from the steam turbine is recovered and used for meeting industrial process heat needs. Such combined heat and power (CHP), or cogeneration, systems provide greater levels of energy services per unit of biomass consumed than systems that generate electric power only.

The steam-Rankine cycle involves heating pressurized water, with the resulting steam expanding to drive a turbine-generator, and then condensing back to water for partial or full recycling to the boiler. A heat exchanger is used in some cases to recover heat from flue gases to preheat combustion air, and a de-aerator must be used to remove dissolved oxygen from water before it enters the boiler.

Steam turbines are designed as either "backpressure" or "condensing" turbines. CHP applications typically employ backpressure turbines, wherein steam expands to a pressure that is still substantially above ambient pressure. It leaves the turbine still as a vapour and is sent to satisfy industrial heating needs, where it condenses back to water. It is then partially or fully returned to the boiler. Alternatively, if process steam demands can be met using only a portion of the available steam, a condensing-extraction steam turbine (CEST) might be used. This design includes the capability for some steam to be extracted at one or more points along the expansion path for meeting process needs (Figure 2). Steam that is not extracted continues to expand to sub-atmospheric pressures, thereby increasing the amount of electricity generated per unit of steam compared to the backpressure turbine. The non-extracted steam is converted back to liquid water in a condenser that utilizes ambient air and/or a cold water source as the coolant¹.

The steam-Rankine cycle uses different boiler designs, depending on the scale of the facility and the characteristics of the fuel being used. The initial pressure and temperature of the steam, together with the pressure to which it is expanded, determine the amount of electricity that can be generated per kilogram of steam. In general, the higher the peak pressure and temperature of the steam, the more efficient, sophisticated, and costly the cycle is.

¹ Williams & Larson, 1993 and Kartha & Larson, 2000, p.101



Source: Williams and Larson, 1993

Figure 2: Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extraction steam turbine

Using steam-Rankine cycle as the basic technology of its cogeneration system, for achieving an increasing amount of surplus electricity to be generated, San Carlos, in mid-2005, implemented this project activity (SCBCP) consisting of the installation of 16 MW and 12 MW backpressure turbo-generator and refurbishment of one 220 psi to 600 psi boiler. No turbo-generator was deactivated, reaching a total capacity of 35 MW. Table 1 shows project activity implementation schedule for bagasse cogeneration project. Despite the mentioned equipments had been installed in 2004, the new upgraded facility become officially operational only in the middle of 2005.

Table 1: San Carlos Bagasse Cogeneration Project Technical Data

	Active	
Before Expansion Plan Until 2003	One 3 MW and one 4 MW turbo- generators	
	Three 220 psi boilers	
After Expansion Plan Mid-2005	One 16 MW and one 12 MW turbo-generators	One 3 MW and one 4 MW turbo- generators
	One refurbished 600 psi boiler	Two 220 psi boilers



A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

By dispatching renewable electricity to a grid, electricity that would otherwise be produced using fossil fuel is displaced. This electricity displacement will occur at the system's margin, i.e. this CDM project will displace electricity that is produced by marginal sources (mainly fossil fueled thermal plants) which have higher electricity dispatching costs and are solicited only over the hours that baseload sources (low-cost or must-run sources) cannot supply the grid (due to higher marginal dispatching costs or fuel storage – in case of hydro sources – constraints).

Once such fossil fuelled sources are not dispatched, fossil fuel consumption that would happen will no longer be needed, and therefore emission reductions are avoided.

In Ecuador, the electricity system is constituted by around 3,3 GW of installed capacity, fuelled by different sources: around 51,5% are hydropower; the remaining 48,5% are fossil fuels and biomass. It is also significant to consider that nearly 12,5% of the electricity demand in 2004 in the country came from imports generated in neighboring Colombia. From the latest 5 plants added to the national grid, around 94,3% of the capacity were fossil fuelled.

Therefore, it can be seen that fossil fuelled capacity plays a major role in electricity generation in the country. The initiative from San Carlos, using a fuel that's zero cost to the mill as it is a by-product of the sugar milling process, will have privilege in the dispatch order, being dispatched in front of all fossil fuelled sources, i.e., the bagasse plant would constitute baseload. Once the baseload capacity is increased, a fossil fuelled capacity with the same capacity as San Carlos project's would be displaced by the bagasse plant. In that way, greenhouse gases emissions would be avoided, and emission reductions would be achieved.

This project activity is to reduce **320.104 tCO₂e** over 7 years, as determined in section E.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO ₂ e
2005	40.402
2006	46.617
2007	46.617
2008	46.617
2009	46.617
2010	46.617
2011	46.617
Total estimated reductions (tonnes of CO₂e)	320.104



Total Number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO₂e)	45.729

A.4.5. Public funding of the project activity:

There is no public funding from Parties included in Annex I in this project activity.

SECTION B. Application of a baseline methodology

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

AM0015: Bagasse-based cogeneration connected to an electricity grid.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

This methodology is applicable to SCBCP due to the fact that (i) the bagasse is produced and consumed in the same facility – San Carlos; (ii) the project would never be implemented by the public sector, as well as it would not be implemented in the absence of CDM, as shown in the additionality chapter below; (iii) there is no increase on the bagasse production due to the project activity itself and (iv) there will be no bagasse storage for more than one year.

B.2. Description of how the methodology is applied in the context of the project activity:

The project activity follows the steps provided by the methodology taking into account the (b) Simple Adjusted OM calculation for the STEP 1, since there would be no available data for applying to the preferred option – (c) *Dispatch Data Analysis OM*. For STEP 2, the option 1 was chosen. The following table presents the key information and data used to determine the baseline scenario.

ID number	Data type	Value	Unit	Data Source
1. EG _y	Electricity supplied to the grid by the Project.	Obtained throughout project activity lifetime.	MWh	San Carlos
2. EF _y	CO ₂ emission factor of the Grid.	0,7194	tCO ₂ e/MWh	Calculated
3. EF _{OM,y}	CO ₂ Operating Margin emission factor of the Grid.	0,868	tCO ₂ e/MWh	This value uses data from the statistics available on the web-site of CONELEC, the Electricity National Board of Ecuador (Consejo Nacional de Electrificación).



4. $EF_{BM,y}$	CO ₂ Build Margin emission factor of the Grid.	0,571	tCO ₂ e/MWh	This value uses data from the statistics available on the website of CONELEC, the Electricity National Board of Ecuador (Consejo Nacional de Electrificación).
10. λ_y	Fraction of time during which low-cost/ must-run sources are on the margin.	λ_{2002} =0,00171 λ_{2003} =0,00856 λ_{2004} =0,01378	-	This value uses data from the statistics available on the website of CONELEC, the Electricity National Board of Ecuador (Consejo Nacional de Electrificación).

B.3. 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:

Application of the Tool for the demonstration and assessment of additionality for SCBCP.

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

(a) The starting date of this project falls after 1 January 2000, which is evidenced by the Environmental License of SCBCP through the Resolution number 110 emitted on September 23th, 2004, by the Environment Ministry of Ecuador. Previously, the project was presented on 29th March, 2004 to the community of Marcelino Maridueña, with the assistance of the environmental unit members of CONELEC (Consejo Nacional de Electrificación) and Environment Ministry members.

(b) San Carlos would not initiate the project in the absence of CDM. The mill has been eyeing the CDM opportunities since it started considering investing in renewable energy generation, visiting sugar mills in Brazil. In fact, Mr. Amalio Puga, Mr. Herminio Vidal and Ms. Rocío Urquiza, technicians of San Carlos, visited CDM projects, such as Vale do Rosário Bagasse Cogeneration Project and São João Landfill Gas to Energy Project on March 2nd 2003 in Brasil. By the time the visits were done, the Brazilian counterparts were already under validation, and discussions about the CDM were held. Moreover, in a public presentation by the environmental authorities to the sugar mill and the nearby communities on March 29th, 2004, the emission reductions benefits were mentioned as a way to foster renewable energy generation in Ecuador. With all those information, San Carlos decided to move ahead with the bagasse cogeneration project, taking into account the CDM as a feasible opportunity to support the project.

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

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

1. Ingenio San Carlos had only two plausible alternatives when considering the investment in the project: either continuing the business-as-usual situation, using bagasse to generate energy for self-supply purposes only; or investing in the CDM project and start selling electricity to the Ecuadorian grid.

**Sub-step 1b. Enforcement of applicable laws and regulations**

2. Both the above considered alternatives are in line with Ecuadorian laws and regulations. Ingenio San Carlos has existed for several decades, and has always complied with all laws applicable to its core activities. In the case of the CDM project implementation, related laws are nearly the same, exception to the electricity generation and commercialization ones. In fact, there is no regulation in Ecuador that prohibits energy generation and commercialization from sugarcane bagasse, and therefore the CDM project implementation alternative is also in line with laws and regulations in the country.

3. Item 3 does not apply.

4. Both the CDM project activity and the alternative scenario are in compliance with all regulations.

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

San Carlos Bagasse Cogeneration Project faced several barriers to be in place, from technological, institutional, political and cultural barriers.

It is known that Ecuador is going through a political crisis since the middle of last year. The former President Lucio GUTIERREZ was removed from office by congress effective 20 April 2005 after a long period of population's insatisfaction, and the new president Alfredo Palacio, turns to a big challenge. He is trying to implement measures that include a party reformation which is considered to be essential to put the economy and other sectors back in track and wipe away this haze of instability and uncertainty that surrounds the country.

This fact, added to the lack of guarantees of sale in the electric production sector and the doubts about the regulations of this market could already be considered a definitive barrier to investors that think in getting involved with this new activity. In Ecuador, there is no assurance about the term the sales of energy to the National Interconnected System will be recompensed. In fact, there is precedence to the charge, but there are no securities of when it will happen, once the distribution companies have priority on payments of generation contracts above the generators. This occurs because the payments come from a fiduciary account created to correct the low income of the electricity sales to final consumers, due to the very low rates in the electricity sector. This surely discourages investments in projects that, by the supply of electricity to the grid, mitigate the greenhouse gases emission.

Besides that, the carbon credit market in Ecuador is very incipient and SCBCP is the first sugarcane bagasse cogeneration project launched in the country. Due to this, there is still a sort of suspicion on this kind of activity and a limitation on the credit dedicated to the projects, which diminishes substantially the opportunities of its development.

Further on, there is the fact that in Ecuador there is a confuse red tape for processes of license acceptance and dubious regulations that demand doubled work. One example of this is the double approval requested by the Environment Ministry for impact assessments studies and environment management plans.



There are also other contrary aspects like the fact that is safer to use the same low-efficient, but well-known and business-as-usual technology that have been in place in the sugarcane industry in Ecuador. Deciding to develop the project, Ingenio San Carlos took the risk of the implementation of more efficient measures and procedures which are not disseminated in the country. This initiative of the mill, because of its innovative attributes, meets also obstacles with the new equipment to be used in the cogeneration process, since there is no such apparel currently in Ecuador. Their operators had to go under training sessions to learn the techniques for their use and maintenance, and therefore the operational risk in the first years of the project is obviously high.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

The alternative to this project activity was to keep the current situation and focus strictly in its core business which is the production of sugar. Therefore, as the barriers mentioned above are directly related to entering into a new business (electricity sale), there was no impediment for San Carlos to maintain (or even invest in) its core business.

Step 4. Common practice analysis

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

There are no other cogeneration project activities implemented in Ecuador.

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

Non applicable.

Step 5. Impact of CDM registration

The impact of registration of this CDM project activity will be an incentive to overcoming all the barriers described, by bringing more solidity to the investment itself and, therefore, fostering and supporting the project owners' breakthrough decision to expand their business model.

Moreover, other benefits and incentives will be experienced, such as: the project will achieve the aim of anthropogenic GHG reductions; financial benefit of the revenue obtained by selling CERs will bring more robustness to the project's financial situation; and it's likely to attract new players and new technology, with the CDM reducing the investor's risk.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The definition of the project boundary related to the baseline methodology is applied to the project activity in the following way:

Baseline energy grid: For SCBCP, the Ecuadorian grid is considered as a boundary, since it is the system to which San Carlos is connected and therefore receives all the bagasse-based produced electricity.



Bagasse cogeneration plant: the bagasse cogeneration plant considered as boundary comprises the whole site where the cogeneration facility is located.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

1. Date of completing the final draft of this baseline section: 03/11/2005.
2. Name of person/entity determining the baseline:

ECONERGY BRASIL (Contact information in Annex 1), which is a participant in this project, is responsible for the technical services related to GHG emission reductions, and is therefore, in behalf of San Carlos, the developer of this document, and all its contents.

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:

06/07/2005.

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:

06/07/2005.

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

NA

C.2.2.2. Length:



NA

SECTION D. Application of a monitoring methodology and plan**D.1. Name and reference of approved monitoring methodology applied to the project activity:**

Approved monitoring methodology AM0015: “Bagasse-based cogeneration connected to an electricity grid”

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

The monitoring methodology was designed to be applied to the Vale do Rosario CDM Project. Due to the great project similarity of the project, the same methodology was chosen in order to monitor the emissions reduction of this project activity.

The methodology considers monitoring emissions reductions generated from a cogeneration project using sugarcane bagasse. The energy produced by the project will be exported to a grid and will substitute fossil fuel capacity connected to the same grid. And that is exactly the case with SCBCP: the project exploits a by-product from the sugarcane milling process (bagasse) to produce and commercialize renewable electricity connected to Ecuadorian grid. The methodology is therefore fully applicable to SCBCP.

Therefore, besides being a methodology to be used in conjunction with the approved baseline methodology AM0015 (“Bagasse-based cogeneration connected to an electricity grid”), the same applicability conditions are described and justified in item B1.1 of this document.



D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

There is no project emission to be considered in this project activity.

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

Project generates no net emissions.



D.2.1.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. E _{Gy}	Electricity supplied to the grid by the Project.	Readings of the energy metering connected to the grid and Receipt of Sales.	MWh	m	Monthly	100%	Electronic and paper	Double check by receipt of sales. Data will be kept for 2 years after the end of the crediting period.
2. E _{Fy}	CO ₂ emission factor of the Grid.	Calculated	tCO ₂ e/MWh	c	At the validation and baseline renewal	0%	Electronic and paper	These values are to be recalculated at the time of each baseline renovation. Data will be kept for 2 years after the end of the crediting period.
3. E _{FOM,y}	CO ₂ Operating Margin emission factor of the grid.	This value uses data obtained from CONELEC (Consejo Nacional de Electricidad)	tCO ₂ e/MWh	c	At the validation and baseline renewal	0%	Electronic and paper	These values are to be recalculated at the time of each baseline renovation. Data will be kept for 2 years after the end of the crediting period.
4. E _{FBM,y}	CO ₂ Build Margin emission factor of the Grid.	This value uses data obtained from CONELEC (Consejo Nacional de Electricidad)	tCO ₂ e/MWh	c	At the validation and baseline renewal	0%	Electronic and paper	These values are to be recalculated at the time of each baseline renovation. Data will be kept for 2 years after the end of the crediting period.
10. λ _y	Fraction of time during which low-cost/ must-run sources are on the margin.	This value uses data obtained from CONELEC (Consejo Nacional de Electricidad)	index	C	At the validation and baseline renewal	0%	Electronic and paper	Will be archived according to internal procedures, and kept for two years after the end of the crediting period.

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D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

$EF_{OM, simple_adjusted, y} = (1 - \lambda_y) \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}}$ <p>(tCO₂e/GWh)</p> $EF_{BM} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_m GEN_{m,y}} \text{ (tCO}_2\text{e/GWh)}$ $EF_{electricity} = \frac{EF_{OM} + EF_{BM}}{2} \text{ (tCO}_2\text{e/GWh)}$ $BE_{electricity,y} = EF_{electricity} \cdot EG_y$	<p><i>F_{i,j(or m),y}</i> Is the amount of fuel <i>i</i> (in a mass or volume unit) consumed by relevant power sources <i>j</i> in year(s) <i>y</i></p> <p><i>j,m</i> Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports⁴ from the grid</p> <p><i>COEF_{i,j(or m),y}</i> Is the CO₂ emission coefficient of fuel <i>i</i> (tCO₂ / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources <i>j</i> (or <i>m</i>) and the percent oxidation of the fuel in year(s) <i>y</i>, a</p> <p><i>GEN_{j(or m),y}</i> Is the electricity (MWh) delivered to the grid by source <i>j</i> (or <i>m</i>)</p> <p><i>BE_{electricity,y}</i> Are the baseline emissions due to displacement of electricity during the year <i>y</i> in tons of CO₂</p> <p><i>EG_y</i> Is the net quantity of electricity generated in the bagasse-based cogeneration plant due to the project activity during the year <i>y</i> in MWh, and</p> <p><i>EF_{electricity,y}</i> Is the CO₂ baseline emission factor for the electricity.</p>
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D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

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D.2.3. Treatment of leakage in the monitoring plan
D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment

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D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

Left blank on purpose.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

$ER_y = BE_{thermal,y} + BE_{electricity,y} - PE_y - L_y$ $BE_{thermal,y} = 0$ $PE_y = 0$ $L_y = 0$	<p>ER_y Are the emissions reductions of the project activity during the year y in tons of CO₂</p> <p>$BE_{electricity,y}$ Are the baseline emissions due to displacement of electricity during the year y in tons of CO₂</p> <p>$BE_{thermal,y}$ Are the baseline emissions due to displacement of thermal energy during the year y in tons of CO₂</p>
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$BE_{\text{electricity}, y} = EF_{\text{electricity}} \cdot EG_y$	<p>PE_y Are the project emissions during the year y in tons of CO₂</p> <p>L_y Are the leakage emissions during the year y in tons of CO₂.</p>
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D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	Low	These data will be directly used for calculation of emission reductions. Sales record and other records are used to ensure the consistency.
2	Low	Data does not need to be monitored
3	Low	Data does not need to be monitored
4	Low	Data does not need to be monitored
10	Low	Data does not need to be monitored

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

The structure for monitoring this project activity will basically consist of registering the amount of energy sold to the grid (EG_y). There are two operations that the project operators must perform in order to ensure data consistency, despite the fact that this will actually consist of the monitoring of one single variable.

1. The monthly readings of the calibrated meter equipment must be recorded in an electronic spreadsheet
2. Sales receipt must be archived for double checking the data. In case of inconsistency, these are the data to be used.

D.5 Name of person/entity determining the monitoring methodology:

ECONERGY BRASIL, which is a project participant (Contact information in Annex 1), is responsible for the technical services related to GHG emission reductions and is therefore, on behalf of San Carlos, the developer of this document and all its contents.

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**SECTION E. Estimation of GHG emissions by sources****E.1. Estimate of GHG emissions by sources:**

This project activity does not burn any additional quantity of fossil fuel due to the project implementation. Therefore, variable PE_y , presented in the methodology, does not need to be monitored.

Thus, $PE_y = 0$

E.2. Estimated leakage:

San Carlos did not sell sugarcane bagasse before the implementation of SCBCP.

Thus, $L_y = 0$

E.3. The sum of E.1 and E.2 representing the project activity emissions:

$L_y + PE_y = 0$

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

The baseline methodology considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario. The considered grid is the Interconnected National System (Sistema Nacional Interconectado - S.N.I.) of Ecuador.

The method that will be chosen to calculate the Operating Margin (OM) for the electricity baseline emission factor is the option (b) *Simple Adjusted OM*, since the preferable choice (c) *Dispatch Data Analysis OM* would face the barrier of data availability in Ecuador.

In order to calculate the Operating Margin, daily dispatch data from the Ecuadorian electricity system manager (CONELEC) needed to be gathered. The provided information comprised years 2002, 2003 and 2004, and is the most recent information available at this stage.

Calculation of electricity baseline emission factor**STEP 1. Simple Adjusted Operating Margin Emission Factor Calculation**

According to the methodology, the project is to determine the Simple Adjusted OM Emission Factor ($EF_{OM, simple\ adjusted, y}$). Therefore, the following equation is to be solved:

$$EF_{OM, simple_adjusted, y} = (1 - \lambda_y) \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}} \quad (\text{tCO}_2\text{e/GWh})$$

It is assumed here that all the low-cost/must-run plants produce zero net emissions.



$$\frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}} = 0 \text{ (tCO}_2\text{e/GWh)}$$

Please refer to the methodology text or the explanations on the variables mentioned above.

The CONELEC data as well as the spreadsheet data with the calculation of emission factors are available for the validator (DOE). In the spreadsheet, the dispatch data is treated as to allow calculation of the emission factor for the most three recent years with available information, which are 2002, 2003 and 2004.

Using therefore appropriate information for $F_{i,j,y}$ and $COEF_{i,j}$, OM emission factors, for the mean average among the three years, can be determined, as follows.

$$EF_{OM, simple_adjusted, 2002_2004} = (1 - \lambda_{2002_2004}) \frac{\sum_{i,j} F_{i,j,2002_2004} \cdot COEF_{i,j}}{\sum_j GEN_{j,2002_2004}} \text{ tCO}_2\text{/MWh}$$

Where,

$$\frac{\sum_{i,j} F_{i,j,2002_2004} \cdot COEF_{i,j}}{\sum_j GEN_{j,2002_2004}} = 0,8749$$

$$\lambda_{2002_2004} = 0,0080$$

The Lambda factors for each year were calculated in accordance with methodology requests. More detailed information is provided in Annex 3. The table below presents such factors.

Year	Lambda
2002	0,00171
2003	0,00856
2004	0,01378

Finally, determining the $EF_{OM, simple_adjusted}$.

$$EF_{OM, simple_adjusted 2002_2004} = 0,8679 \text{ tCO}_2\text{/MWh}$$

According to the methodology used, a Build Margin emission factor also needs to be determined.

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



Electricity generation in this case means 20% of total generation in the most recent year (2004), as the 5 most recent plants built generate less than such 20%. Calculating such factor one reaches:

$$EF_{BM,2004} = 0,5709 \text{ tCO}_2/\text{MWh}$$

Finally, the electricity baseline emission factor is calculated through a weighted-average formula, considering both the OM and the BM, being the weights 50% and 50% by default. That gives:

$$EF_{electricity,2002-2004} = 0,5 * 0,8679 + 0,5 * 0,5709 = 0,7194 \text{ tCO}_2/\text{MWh}$$

It is important to note that adequate considerations on the above weights are currently under study by the Meth Panel, and there is a possibility that such weighing changes in the methodology applied here.

The baseline emissions would be then proportional to the electricity delivered to the grid throughout the project's lifetime. Baseline emissions due to displacement of electricity are calculated by multiplying the electricity baseline emissions factor ($EF_{electricity,2002-2004}$) with the electricity generation of the project activity.

$$BE_{electricity,y} = EF_{electricity,2002-2004} \cdot EG_y$$

Therefore, for the first crediting period, the baseline emissions will be calculated as follows:

$$BE_{electricity,y} = 0,7194 \text{ tCO}_2/\text{MWh} \cdot EG_y \quad (\text{in tCO}_2\text{e})$$

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The emissions reduction of this project activity is:

$$BE_{electricity,y} - (L_y + PE_y) = 0,7194 \text{ tCO}_2/\text{MWh} \cdot EG_y - 0 \rightarrow BE_{electricity,y} = 0,7194 \text{ tCO}_2/\text{MWh} \cdot EG_y$$

E.6. Table providing values obtained when applying formulae above:

Year	Estimation of project activity emission reductions (tonnes of CO ₂ e)	Estimation of the baseline emission reductions (tonnes of CO ₂ e)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of emission reductions (tonnes of CO ₂ e)
2005	40.402	0	0	40.402
2006	46.617	0	0	46.617
2007	46.617	0	0	46.617



2008	46.617	0	0	46.617
2009	46.617	0	0	46.617
2010	46.617	0	0	46.617
2011	46.617	0	0	46.617
Total (tonnes of CO ₂ e)	320.104	0	0	320.104

SECTION F. Environmental impacts

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

The possible environmental impacts were analyzed by the Environment Ministry of Ecuador (*Ministerio del Ambiente de Ecuador*), who approved the Operation License of SCBCP on September 23th, 2004, through the Resolution number 110.

The delivery of the Environmental License was carried out by Mr. Fabián Valdivieso, the Environment Minister in a public act on October 12th, 2004.

There will be no transboundary impacts resulting from SCBCP. All the relevant impacts occur within Ecuadorian borders and have been mitigated to comply with the environmental requirements for project's implementation. Therefore SCBCP will not affect by any means any country surrounding Ecuador.

F.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:

San Carlos developed an Environmental Assessment which was necessary for the issue of the Operation License by the Environment Ministry of Ecuador and the operation of the cogeneration project and selling of surplus energy.

According to the Operation License, San Carlos must comply with:

1. the Environmental Management Plan (EMP) approved, with the actual environmental requirements;
2. the issue of detailed schedule of the activities developed before the beginning of operation;
3. the requirements established by CONELEC;
4. the utilization of methods that minimize the negative environmental impacts;
5. presenting information every semester about the water, air and soil quality during the operation of the project, according to the Environmental Management Plan;
6. issuing all complementary documentation and information to the Environment Ministry and CONELEC;



7. presenting in the year of the issue of the Environmental License and every two year of the Environment Auditory, the actualization and annual schedules of the EMP;
8. the implementation of the Environmental Auditory previously to the end of the enlargement of the project in comply with the Environmental Management Law;
9. promoting meetings with the community, informing about the environmental monitoring of the project;
10. issuing after the issue of the Environmental License, actual documentation of the EMP compliance guarantee, annually;
11. the Environmental Ministry technical time support to facilitate the monitoring and controlling proceedings of the approved EMP.

San Carlos, however, complied with all these requirements.

SECTION G. Stakeholders' comments

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

The public has been invited to take part in the presentation of the project in Marcelino Maridueña's municipality on March 29th, 2004. Attending such presentation were representatives from governmental authorities, such as CONELEC – Consejo Nacional de Electrificación and the ministry of environment, who were available to clarify any issues that could be raised. Other entities attending the meeting were the local Red Cross, the civil council, sugarcane workers' association, plus many others.²

Later, on October 12th, 2004, another meeting was held to communicate the issuance of the environmental license of the project. As already mentioned, it was held personally by the minister of environment, with participation from municipal authorities, neighbourhood and workers representatives, as well as some of the mill's executives and other local politicians. This was therefore a second opportunity to raise questions about the project.

G.2. Summary of the comments received:

The local population and its representatives formally agreed to support the project as presented.

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

Ingenio San Carlos proceeded with the project implementation as originally planned.

² The Minute of the Public Presentation is available in hold of project participants.

Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY.****Project Participant 1:**

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Represented by:	
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Annex 2**INFORMATION REGARDING PUBLIC FUNDING**

There is no Annex I public funding involved in SCBCP project activity.

Annex 3**BASELINE INFORMATION**

An agreement between Deuman Internacional, Econergy and Cordelim (Corporación para la Promoción del Mecanismo de Desarrollo Limpio), the Ecuadorian CDM office, resulted in the calculation of the electricity baseline emission factor. On the other hand, CONELEC, the electricity legislation authority contributed with information on generation sources, load data, and fuel consumption (years 2002, 2003 and 2004) of power plants in Ecuador.

CENACE (Centro Nacional de Control de Energia) is the electricity dispatch center in Ecuador. It is responsible for managing the dispatch of all generating plants connected to the Ecuadorian grid and transactions of power purchase between MEM (Mercado Eléctrico Mayorista) and power plants contributing to the Ecuadorian Electrical System.

Project developers decided for the database considering CONELEC information (publicly available on websit www.conelec.gov.ec), as it was capable of properly addressing the issue of determining the emission factor and doing it in the most conservative way. The “Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook” provided all the instructions and factors for calculating emissions of fuel products consumed by Ecuadorian fossil fuel plants.

The aggregated hourly dispatch data got from CENACE was used to determine the load duration curve and consequently the lambda factor for each of the years with data available (2002, 2003 and 2004).

The Low-cost/Must-run generation was determined as the total generation of hydroelectric plants, this one determined through annual dispatch data provided by CONELEC. Moreover, the electricity importation from Colombia was considered for calculating low-cost/must-run generation.

On the following pages, a summary of the analysis is provided. The load duration curves for the electricity system of Ecuador and the emission reductions calculation data for the first crediting period of SCBCP are presented.

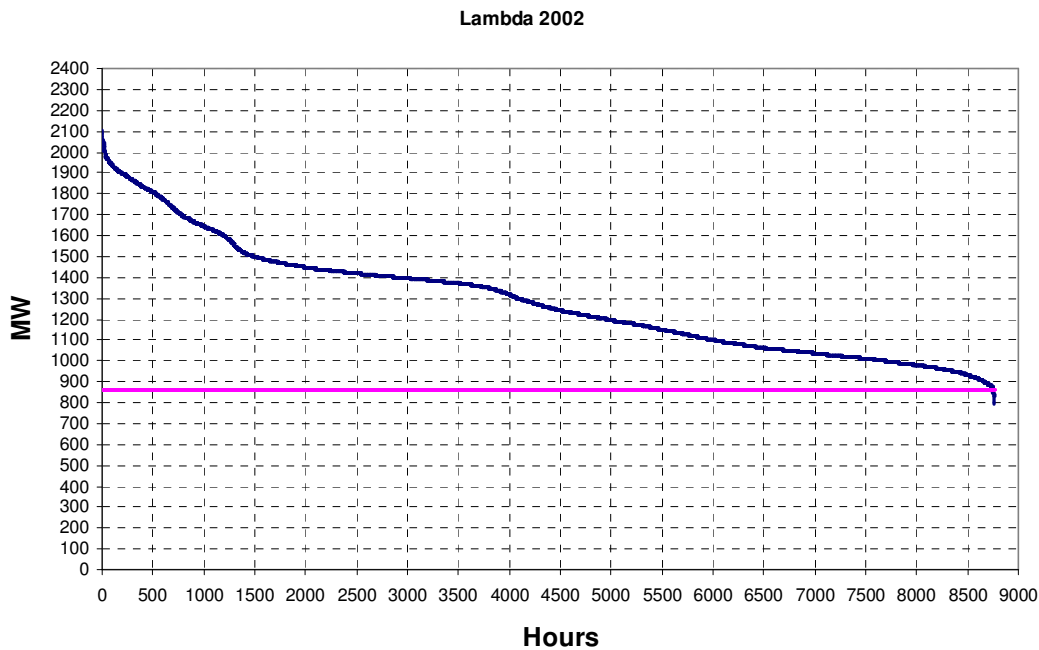


Figure 3: Load duration curve for the electricity system of Ecuador, 2002

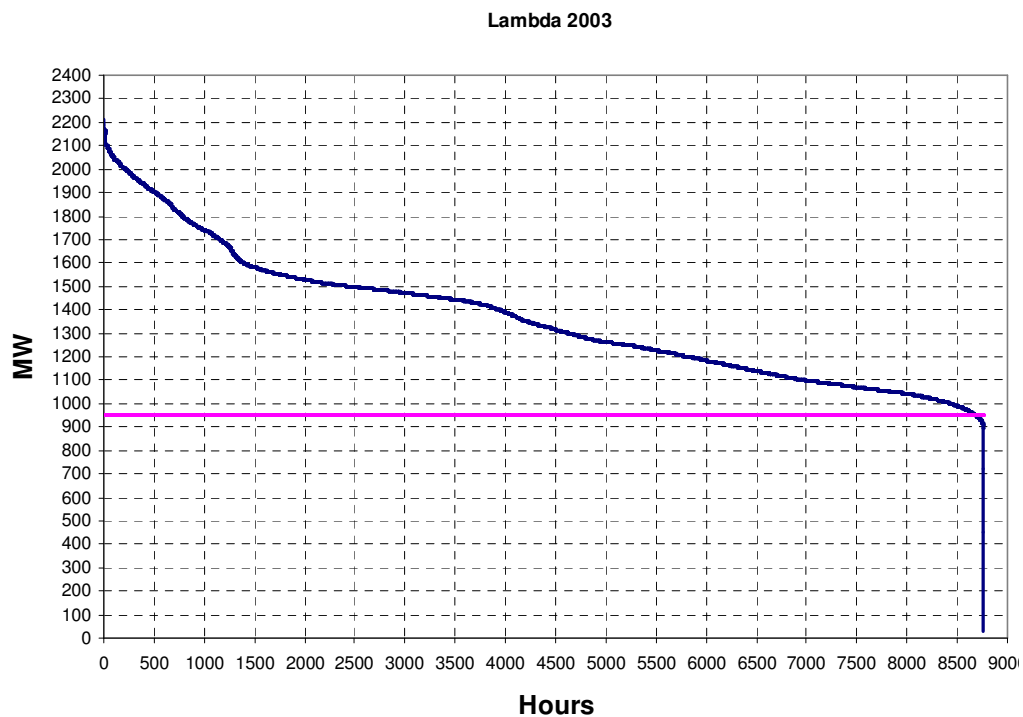


Figure 4: Load duration curve for the electricity system of Ecuador, 2003

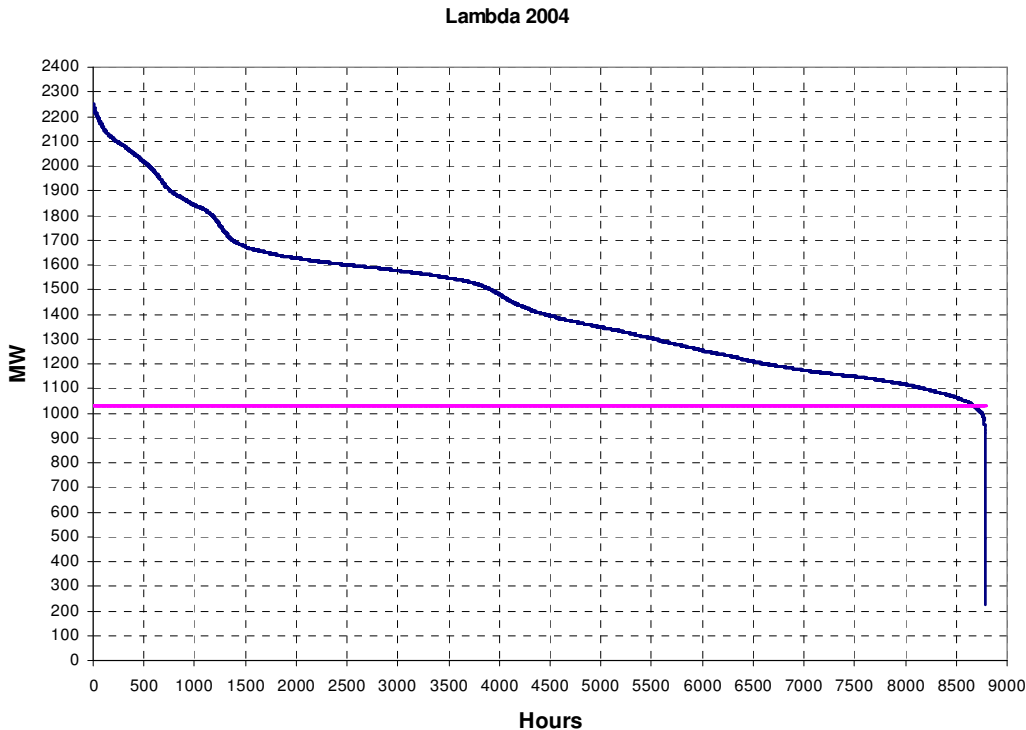


Figure 5: Load duration curve for the electricity system of Ecuador, 2004

San Carlos Bagasse Cogeneration Project								
Item	First Crediting Period							Total CERs
	2005	2006	2007	2008	2009	2010	2011	
Total Installed Capacity (MW)	35	35	35	35	35	35	35	
Internal Consumption (MW)	6,5	6,5	6,5	6,5	6,5	6,5	6,5	
Standby (MW)	12,0	7,0	7,0	7,0	7,0	7,0	7,0	
Installed Capacity Available for Sale (MW)	16,5	21,5	21,5	21,5	21,5	21,5	21,5	
Hours of Operation (h)	4.320	4.320	4.320	4.320	4.320	4.320	4.320	
Energy to be sold to CONELEC, Applying for CERs (MWh)	56.160	64.800	64.800	64.800	64.800	64.800	64.800	
Baseline Carbon Intensity (tCO ₂ e/MWh)	0,7194	0,7194	0,7194	0,7194	0,7194	0,7194	0,7194	
Total CO ₂ emissions reductions (tCO ₂ e)	40.402	46.617	46.617	46.617	46.617	46.617	46.617	

Figure 6: Emission reductions calculation data for the first crediting period

Annex 4

MONITORING PLAN

According to the section D of this document, the only variable that will be monitored in this project activity is the quantity of energy exported to the grid, from mid-2005 up to the end of the last crediting period. Since no leakage nor any off-grid emissions change were identified in this project activity, there will be no need to monitor the variables for these cases. The monitoring will occur as follows:

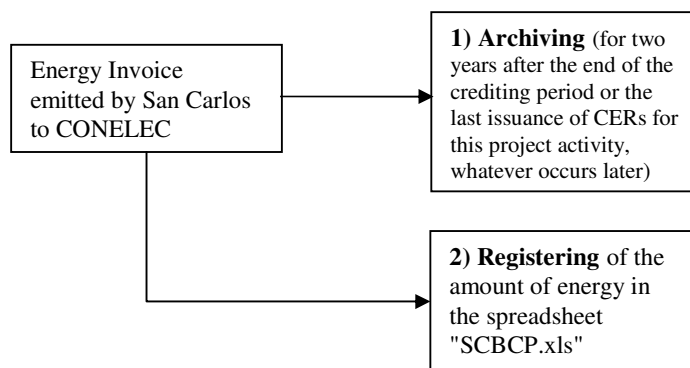


Figure 7: Monitoring procedures for San Carlos

The quantity of energy exported to the grid will be monitored by CENACE (Centro Nacional de Control de la Energía). The energy will be exported to the National Grid, through the energy invoice emitted by San Carlos to CONELEC (Consejo Nacional de Electrificación). The archiving will occur up to two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later. The amount of energy will be registered in the spreadsheet "SCBCP.xls", which shall be the instrument for the further Verification.