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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Coruripe Bagasse Cogeneration Project (CBCP)
Version 2.
Date of the document: Octuber 06th, 2005.

A.2. Description of the project activity:

This project activity consists of increasing the efficiency of the bagasse (a renewable fuel source, residue from sugarcane processing) cogeneration facility at **S.A. Usina Coruripe Açúcar e Álcool** (Coruripe), a Brazilian sugar mill. With the implementation of this project, the mill is able to sell electricity to the national grid, avoiding the dispatch of same amount of energy produced by fossil-fuelled thermal plants to that grid. By that, the initiative avoids CO_2 emissions and contributes to the regional and national sustainable development.

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), Coruripe generates surplus steam and uses it exclusively for electricity production (through turbo-generators).

The sponsors of the CBCP are convinced that bagasse cogeneration is a sustainable source of energy that brings not only advantages for mitigating global warming, but also creates a sustainable competitive advantage for the agricultural production in the sugarcane industry in Brazil. Using the available natural resources in a more efficient way, the Coruripe 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. It is worthy to highlight that out of approximately 320 sugar mills in Brazil, the great majority produces energy for on-site use only, and not for grid supply, which is mainly due to the low-efficiency of the cogeneration equipment installed on those sugar mills.

Furthermore, bagasse cogeneration also plays an important role on the country's economic development, as Brazil's sugarcane-based industry provides for approximately 1 million jobs and represents one of the major agribusiness products within the trade balance of the country. The Brazilian heavy industry has developed the technology to supply the sugarcane industry with equipments to provide expansion for the cogeneration, therefore such heavy industry development also helps the country to create jobs and achieve 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 thermal energy 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.

Coruripe also believes that sustainable development will be achieved not only by the implementation of a renewable energy production facility, but also by carrying out activities which corresponds to the company social and environmental responsibilities, as described below:

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Social Contribution

Nowadays, besides generating about 4.300 employments directly and 21.500 indirectly, Usina Coruripe develops a series of relevant social projects benefiting nearby communities:

- Assistance in feeding of 12.400 families
- Literacy of youths and adults: 450 employees have already learnt to write
- Habitational Project, which has already subsidized 743 houses for their employees

Currently, the firm maintains a modern and ample restaurant that serves, daily, food for all its employees from both the industrial and the agricultural sector. Through that, further on having high quality food, the employees receive a balanced and full of nutrients food.

Environmental Contribution

As a decision of the board of directors, Coruripe has decided to convert the 7.544 ha of Atlantic Forest existing in the lands of the company into Private Reservoir of the National Patrimony. The program was initiated after a solicitation asked to the superintendence of the Brasilian Institute of Environment, which has made the first reservoirs official. To keep the area intact, the mill has fought a real battle, mainly against wood thieves and hunters that try to exterminate the local species.

With the intent of growing its forest reservoir, Usina Coruripe has abandoned sugar-cane plantation over 689 ha to let the Atlantic Forest to be reestablished in this area. The intention is to create a corridor (native forest) among the existing blocks of wood to prevent the detachment of the local species.

Thanks to the nearness to the forests and to the existing of large amount of seed spreaders, there is a hurrying in the natural recovery of the forest. Beyond that, in 1998 it was initiated a program of reforesting with exotic essences (eucalyptus), to alleviate the pressure to the forests of the mill.

Recovering the historical river Coruripe – that served as a course for Portuguese navigators more than five thousand years ago – has been a target for Coruripe which, beyond implementing a work in taking wastes from the margin of the river, performs an ostensible plantation of forest along the rivers. Currently, the river that crosses Usina Coruripe properties has been cleaned up due to recovery programs implemented by the company.

With the target of showing to the public the environmental potential that it has, Usina Coruripe make its natural reservoirs of Atlantic Forest available for ecotourism. Across its natural trails, the tourists can keep contact with unique species of Brazilian fauna and flora – many of them threatened of extinction – and advance to know one of the most beautiful post cards of the state: the beach of "Pontal do Coruripe".

As an acknowledgement for the work developed by Usina Coruripe on environment, Unesco (United Nations Educational, Scientific and Cultural Organization) has granted the company with the certification of first Advanced Station of Biosphere of Atlantic Forest in Alagoas. This is the first time in 30 years, since the program MAB (Man and Biosphere), created by Unesco, that a company in Alagoas gets the certification. All over the country, only 19 institutions have the certification, which is internationally recognized.

Having the Environment as one of its worries, Usina Coruripe executes a series of lectures for students at municipal schools in Coruripe. The intention is to make them become multipliers of environment

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preservation. It is possible through some treaties with the Environment Institute of Alagoas and Brazilian Institute of Environment.

Reviews developed by experts of Embrapa (Brazilian Enterprise for Farming Research) have concluded that the forest reservoirs of Usina Coruripe have the greatest concentration of native Pau-Brasil of the country. This is a treasure of inestimable value that is absolutely safe from devastation, thanks to the endeavor of the company. Usina Coruripe has distributed all along the reservoir educative slabs that intent to make the population conscious about the importance of the species.

Usina Coruripe has treaties with a lot of international organizations and researchers. Through that, the biodiversity of the Atlantic Forest can come known.

Aiming at cataloging the more relevant species of its forest reservoir, Usina Coruripe has contracted an agreement technical cooperation with Embrapa, through its Research Center for Farming in the Coast "Tabuleiros" (CPATC). The intention is to determine fenological patterns and to value progenies of the species to serve as reviews that ensure the preservation, beyond facilitating interchanges with national and international foundations.

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)
Brazil (host)	S/A Usina Coruripe Açúcar e Álcool (Brazilian private entity) Econergy Brasil Ltda. (Brazilian 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:

A.4.1.1. Host Party(ies):

Brazil

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

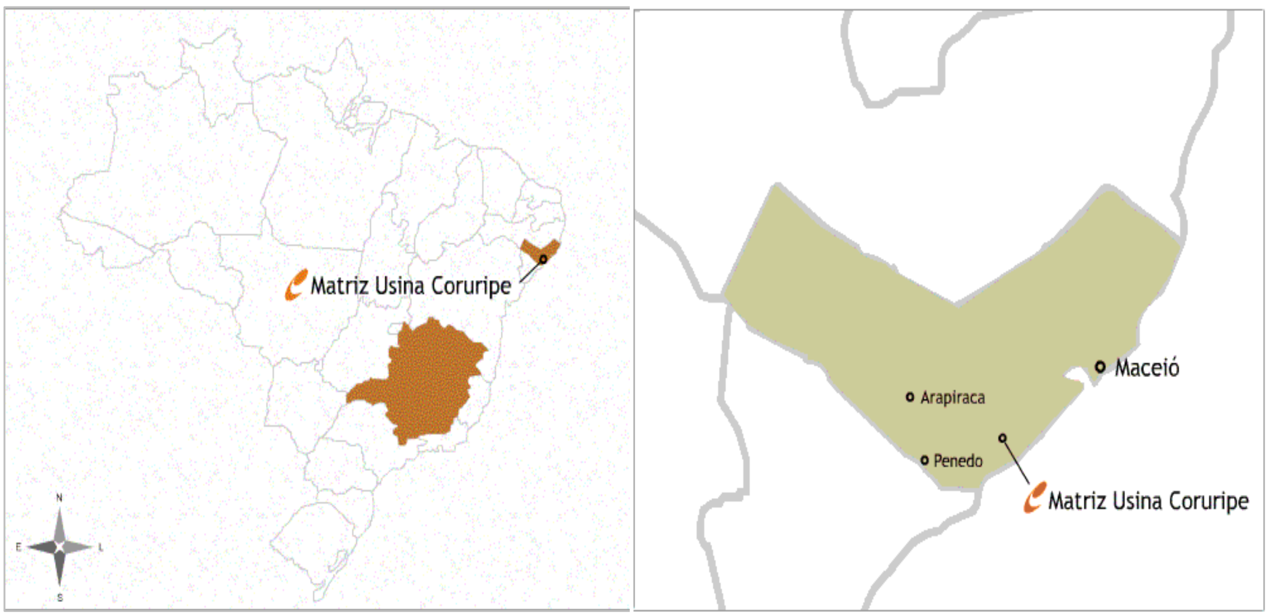
Alagoas

A.4.1.3. City/Town/Community etc:

Coruripe

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

S.A. Usina Coruripe Açúcar e Álcool is located at Fazenda Triunfo, s/n°, Zona Rural (Triunfo Farm, without number, Rural Zone), inside of Coruripe city, located in the south of Alagoas State, about 95 kilometres away from the state capital, Maceió, as can be seen in Figure 1.



Source: Elaborated by Usina Coruripe[1]

Figure 1: Geographical position of the city of Coruripe.

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 raise 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

[1] http://www.usinacoruripe.com.br/empresa/localizacao.asp

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 power only.

The steam-Rankine cycle involves boiling pressurized water, with the resulting steam expanding to drive a turbo-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 (see 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 coolant[2].

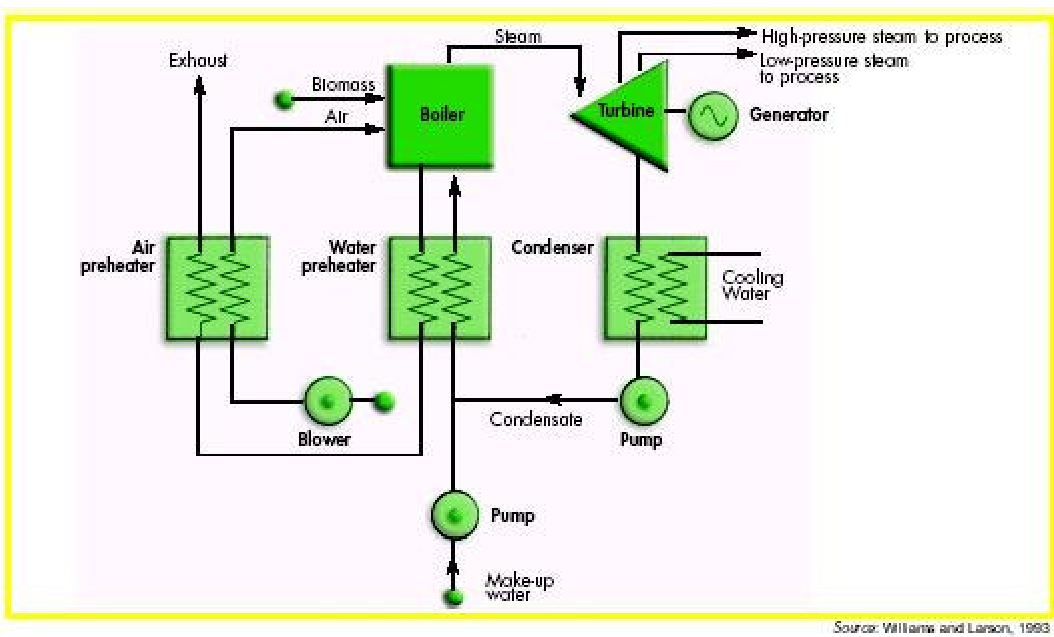


Figure 2: Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extraction steam turbine

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

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[2] Williams & Larson, 1993 and Kartha & Larson, 2000, p.101

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 are, the more efficient, sophisticated, and costly, the cycle is.

Using steam-Rankine cycle as the basic technology of its cogeneration system, for achieving an increasing amount of surplus electricity to be generated, Coruripe began its efforts.

In the year 2006 Coruripe will be refurbishing their six boilers and upgrading them up to a capacity of 450 tons of steam per hour. It will also install a 16 MW condensing-type turbo-generator to be operational in the year 2006.

Table 1 shows how Coruripe's infrastructure will be updated according to CBCP.

Table 1: CBCP's Cogeneration equipment upgrades

	Active / Activating		
Before the expasion 2005	Two 5 MW multistage backpressure turbo-generator	Two 3 MW multistage backpressure turbo-generator	
	Six 21 bar boilers, 350 t/h		
After expansion 2006	One 16 MW condensing-type turbo-generator	Two 3 MW multistage backpressure turbo-generator	Two 5 MW multistage backpressure turbo-generator
	Six refurbished 21 bar boilers, 450 t/h		

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 base load 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).

Bagasse is a fibrous biomass by-product from sugarcane processing, which accounts for about 25 percent on weight of fresh cane and approximately one third of the cane's energy content. In a typical Brazilian sugarcane mill, burning bagasse for generation of process heat and power production is a practice already established. It is estimated that over 700 MW of bagasse-based power capacity is currently installed in the state of São Paulo only[3]. The energy produced from these facilities is almost all consumed for their own purposes. Because of constraints that limit the access of independent power producers to the electric utilities market, there is no incentive for sugarcane mills to operate in a more efficient way. Low-pressure boilers, very little concern with optimal use and control of steam, crushers mechanically activated by steam, energy intensive distillation methods, are a few examples of inefficient methods applied to the sugar industry as normal routine.[4]

The Brazilian electric sector legislation currently recognizes the role of independent power producers, which has triggered interest in improving boiler efficiency and increasing electricity generation at mills, allowing the production of enough electricity not only to satisfy sugar mills' needs but also a surplus amount for selling to the electricity market. Furthermore, the ever increasing electricity demand opens an opportunity for some bagasse cogeneration power plants in Brazil. Additionally, the feature of electricity generation from sugarcane coinciding with dry months of the year, when hydroelectric generation system - the most important electricity source in the country - is under stress, should provide considerable complementary energy and make bagasse cogeneration electricity attractive for any potential purchasers.

Nevertheless, some barriers pose a challenge for implementation of this kind of projects. In most cases, the sponsors' culture in the sugar industry is very much influenced by the commodities – sugar and ethanol – market. Therefore, they need an extra incentive to invest in electricity production due to the fact that it is a product that can never be stored in order to speculate with price. The Power Purchase Agreement requires different negotiation skills, which is not the core of the sugar industry. For instance, when signing a long-term electricity contract, the PPA, a given sugar mill has to be confident that it will produce sufficient biomass to supply its cogeneration project. Although it seems easy to predict, the volatility of sugarcane productivity may range from 75 to 95 ton of sugarcane per hectare annually depending on the rainfall. So, the revenue from GHG emission reductions and other benefits associated with CDM certification offer a worthy financial comfort for the sugar mills, like Coruripe, which is investing to expand its electric power generation capacity and to operate in a more rationale way under the above mentioned new electric sector circumstances.

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

Years	Annual estimation of emission reductions in tonnes of CO_2e
2006	5.621
2007	5.621
2008	5.621
2009	5.621
2010	5.621

[3] São Paulo. Secretary of Energy, 2001.

[4] Nastari, 2000.

2011	5.621
2012	5.621
Total estimated reductions (tonnes of CO_2e)	39.345
Total Number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	5.621

A.4.5. Public funding of the project activity:

There is no Annex I public funding involved in CBCP 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 CBCP due to the fact that (i) the bagasse is produced and consumed in the same facility – Coruripe; (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 the 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	Coruripe
2. EF_y	CO_2 emission factor of the Grid.	0,0724	tCO_2e/MWh	Calculated

3. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	0,1178	tCO_2e/MWh	This value was calculated using data information from ONS, the Brazilian electricity system manager.
4. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	0,0270	tCO_2e/MWh	This value was calculated using data information from ONS, the Brazilian electricity system manager.
10. λ_y	Fraction of time during which low-cost/ must-run sources are on the margin.	$\lambda_{2001} = 0,9046$ $\lambda_{2002} = 0,9390$ $\lambda_{2003} = 0,7192$	-	This value was calculated using data information from ONS, the Brazilian electricity system manager.

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 of Coruripe.

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

(a) The starting date of this project falls after 1st January 2000, which is evidenced by the Environmental Implantation License of Usina Coruripe Açúcar e Álcool emitted in 7th April 2004. The starting date of this project falls after 1st January 2000, which is also evidenced by the Purchase Receipt of one 16 MW condensing-type turbo-generator from Gevisa S/A, issued on the 30th of April 2004, to S.A. Usina Coruripe Açúcar e Álcool – Usina Coruripe.

(b) Coruripe would not initiate the project in the absence of CDM. The mechanism was seen as a key player when overcoming technology barriers at the mill, as explained below. It has been considered since 2000, when Mr. André Marques Válio, agronomic engineer of the mill, participated in a workshop organized by Escola de Administração de Empresas de São Paulo (EAESP/FGV), which is the most important business school in the city of São Paulo. In this event, "CDM: the Source of Funding for Projects", there were presentation from Mr. José Domingos Gonzales Miguez, current member of the CDM-EB, Edwin Aalders from SGS, who might evidence that CDM was considered in the decision to proceed with the project activity in CBCP.

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. There were only two possibilities to implement this project activity: one was to continue the current situation of the sugar mill, focusing only on the production of sugar and alcohol and thus investing to enhance the efficiency and increasing the scale of its core business. The other option was the project activity undertaken, which is the investment made to increase steam efficiency and production for electricity sales purposes by acquiring high-efficiency boilers and turbo-generators.

Sub-step 1b: Enforcement of applicable laws and regulations

2. The alternative, which is to continue with the BAU situation before the decision of implementing this CDM project activity is consistent with the applicable laws and regulations.

3. Non applicable.

4. Both the 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**

1. and 2. According to COELHO (1999)[5], "large scale cogeneration program in sugar-alcohol sector has not yet occurred, due to several barriers, mainly economic, political and institutional", such as:

I. Technological Barriers

Technological barriers represent a very important issue for increasing bagasse cogeneration in Brazil, as – despite the fact that Rankine-cycle is a well known technology – the cogeneration units operate with low-efficiency and are not competitive comparing to other generation options. In this way there is a tricky issue about technology and economic value for such technology. Although this technology is well developed, the economic value for its application is not present for projects on the scale similar to the sugar mills in Brazil. COELHO (1999) justifies that by highlighting that the unit costs ($/installed MW) are significantly influenced by the scale-effect. As the bagasse cogeneration unit should have a small scale due to the high cost for transportation of the fuel (bagasse), investments are high. Therefore, as a lower cost of capital is wanted, the result is a simplified installation and lower efficiency.

COELHO (1999) also states that the great majority of the sugar mills still rely on inefficient technology, such as on 22 bar pressure boilers, even in the state of São Paulo, the most industrialized in Brazil. Moreover, when there is a necessity to change equipments it is usual not to consider purchasing high-efficiency boilers due to conservativeness, lack of knowledge or even lack of interest to generate surplus steam for electricity sales purposes.

Finally, SWISHER (1997)[6] considers it difficult to convince the local distributor that the energy to be acquired, generally generated during the harvest season, is sufficiently reliable to be accounted in the distributor's planning.

[5] COELHO, Suani T. *Mecanismos para implementação da cogeração de eletricidade a partir de biomassa*: um modelo para o Estado de São Paulo. São Paulo: Programa interunidades de pós-graduação em energia, 1999.

[6] SWISHER, J. *Using area-specific cost analysis to identify low incremental-cost renewable energy options:* a case study of co-generation using bagasse in the State of São Paulo. Washington DC: Prepared for Global Environment Facility (GEF) Secretariat, 1997.

II. Institutional and Political Barriers

From the electric sector point of view, according to COELHO (1999), acquiring electricity other than hydroelectric would not be a priority, arguing that since bagasse based electricity is generated only during the harvest season, no firm energy could be offered. Suggestions from electricity sector specialists stress this difficulty, pointing to the need to develop a complementary energy source for the part of the year the cogeneration plant cannot operate, such as a small hydro power plant. This is however a very tough task, considering a plant with a similar electricity output would be required. And moreover the economics of both cogeneration and small hydro power are totally different, in a way that the pricing structure for the energy would need to be different, adding therefore another barrier to the negotiation with the electricity distributor. Natural gas cogeneration has been studied as such complementary source as well, though this would be very undesirable in terms of greenhouse gas emissions.

However, the biggest advantage of bagasse based electricity is that it is produced during the period where hydroelectric plants face difficulties due to the low level of rainfall. As a result, COELHO (1999) suggests that there is a significant prejudice and conservativeness of the distributors when deciding whether to purchase bagasse based energy or not.

From the sugar mill point of view, save rare exceptions, COELHO (1999) says that the great majority of sugar mills do not consider investments in cogeneration (for electricity sale) as a priority. The sector "even in the new political context, does not seem to have motivation to invest in a process that it sees with mistrust and no guarantees that the product will have a safe market in the future. Moreover, it is a fact that "the sugar mills are essentially managed by families, which hurdles the association with external financial agents" that would allow the sector to be more competitive and diversifying its investment.

The Brazilian government enforced recently law 10.762, from the 11th of November 2003, which is a revision of law 10.438, from the 26th of April 2002. The latter created an incentive program for renewable energy, called PROINFA. According to 10.438/02, the Brazilian government would buy, under favourable conditions, electricity from three main sources of energy: biomass, wind and small hydropower. Total capacity to be contracted was 3.300 MW, divided equally between the three sources.

Power purchase agreements between project developers and Eletrobras happened only recently, after many discussions on the terms of implementation were held. In fact, after two call for projects, the biomass capacity could not be fully contracted. Out of the 1.100 MW, only 685,24 MW were reached. This shows clearly that PROINFA cannot be considered a government incentive towards bagasse-based energy, as only a fraction of projects saw benefits in having a contract with the Brazilian government. Therefore, it can be concluded that institutional barriers for bagasse cogeneration projects persist as for now.

Nevertheless, Coruripe was applied into PROINFA program and a long-term PPA with Eletrobras was signed in December 28th, 2004. However, the Annex 3 of the Report of 16th Meeting of the Executive Board (EB-16), regards about "Clarifications on the treatment of national and/or sectoral policies and regulations (paragraph 45 (e) of the CDM Modalities and Procedures) in determining a baseline scenario". In this case, in accordance with the mentioned document, the PROINFA program specifically should not be considered as a barrier in the baseline of the project.

III. Economic and Investment Barriers

"There are several reasons for the Brazilian utilities' reluctance to offer higher prices for co-generated power. One important reason stems from their assumption that their costs are geographically uniform – i.e., that there is essentially a single value for their avoided cost in the industrial sector. If this cost value does not indicate that sufficient savings are available from buying co-generated power, and then there is little economic motivation, under either a public monopoly or a privatized competitive structure, for a utility to pay enough for co-generation to satisfy potential investors' financial criteria" [7] as stated by SWISHER (1997). In fact, the economic cost is the reason that Brazilian utilities do not buy cogeneration electricity energy, at least, while the energy sector regulation does not guarantee them the right to pass such cost through to the end user tariff. The cost of cogeneration electricity ranges from US$ 35 to US$ 105 per MWh, according to the Expansion Plan 2001-2010 from Brazil Government, which is described as higher than the marginal cost for electricity expansion in the system – US$ 33/MWh[8].

COELHO (1999) also highlights as one of the major problems of selling surplus energy to the grid the economic value paid to the sugar mills which not enough to remunerate the capital invested in the expansion of a cogeneration project. Furthermore, "the fee for accessing the grid does not contribute to making feasible the sale of the surplus energy to the distributors".

Summarizing, SWISHER (1997) considers that the main difficulties are found in: (a) **small sizes of projects and installation costs**: despite the high cost for installation, the fixed cost component is high and cannot be absorbed by the global economic project. (b) **availability of long-term financing:** traditionally, infrastructure projects have had wide access to long-term financing, situation that has changed after the electric sector privatization. (c) **lack of guarantees:** besides technical guarantees, investors require commercial guarantees establishing a paradox: the objective of privatization is to foster a market based economy but banks still require governmental guarantees to ensure long-term investments in the private sector, (d) **lack of local funding**: lack of familiarity with project finance tools and due to the high interest rates in Brazil.

IV. Cultural Barrier

Due to the nature of the business in the sugar industry the marketing approach is narrowly focused on commodity type of transaction. Therefore, the electricity transaction based on long-term contract (Power Purchase Agreement) represents a significant breakthrough in their business model. In this case, the electricity transaction has to represent a safe investment opportunity from both economical and social-environmental perspective for convincing the sugar mills to invest in.

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[7] *Joel Swisher personal communication with Rolls Royce Power Ventures project manage.* Mark Croke, August 26, 1997. Swisher J. 1997 pg. 76.

[8] "As can be seen, the unit costs of the alternative sources of energy are still high compared to the marginal cost of expanding the system, nowadays calculed as US$33/MWh". Translation by Econergy Brasil. IN: BRAZIL, Ministry of Mines and Energy, 2001, pg. 80.

There are also questions regarding the managerial capacity of the companies that comprise the Brazilian sugarcane industry. According to WALTER (1994)[9], they have in many cases demonstrated the will to undertake investments in new technologies, but without sufficient financial and entrepreneurial capacity to complete such projects,.

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 and alcohol. Therefore, as the barriers mentioned above are directly related to entering into a new business (electricity sale), there is no impediment for sugar mills 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

The sugar sector, historically, always exploited its biomass (bagasse) in an inefficient manner by making use of low-pressure boilers. Although they consume almost all of their bagasse for self-energy generation purposes, it is done in such a manner that no surplus electric energy is available for sale, and no sugar company has ventured in the electricity market until the recent years.

Similar project activities have been implemented by leading companies in this industry, mainly after Vale do Rosário started to implement its project that clearly served as a sector benchmark. However, these are few examples in a universe of about 320 sugar mills. Currently, other similar project activities under implementation are, for example, Cia Energética Santa Elisa, Moema, Equipav, Nova América. All together similar projects in the sugar industry in Brazil are restricted to approximately 10% of the sugar industry, since the other 90% are still burning their bagasse for on-site use only in the old-fashioned inefficient way. That clearly shows that just a small part of this sector is willing to invest in cogeneration projects. Moreover, majority of similar projects currently being implemented are carried out as CDM project activities. So far, Econergy Brasil has reported at least 26 CDM bagasse cogeneration projects in Brazil.

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

This project activity type is not considered as a widely spread activity in Brazil as only a small portion of the existing sugar mills in the country actually produce electricity for sale purposes. Also, most of the existing similar activities are being developed as CDM project activities.

Step 5. Impact of CDM registration

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[9] WALTER, A.C.S. *Viabilidade e perspectivas da co-geração e geração termelétrica no setor sucro-alcooleiro*, 1994. Thesis (Doctorate). UNICAMP, Campinas.

The impact of registration of this CDM project activity will contribute to overcoming all the barriers described in this Tool: technological, institutional and political, economic and investment and cultural barriers by bringing more solidity to the investment itself and, therefore, fostering and supporting the project owners' breakthrough decision to expand their business model. In this way, the project activity is already engaged in a deal to sell its expected CERs.

Notwithstanding, the benefits and incentives mentioned in the text of the Tool for demonstration and assessment of additionality, published by the CDM-EB, will be experienced by the project activities 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 its likelihood to attract new players and new technology (there are companies currently developing new type of boilers – extra-efficient – and the purchase of such equipment is to be fostered by the CER sales revenue) and 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 CBCP, the North-Northeast subsystem of the Brazilian grid is considered as a boundary, since it is the system to which Coruripe 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:

   06/10/2005.

2. Name of person/entity determining the baseline:

   ECONERGY BRASIL (Contact Information in Annex 1), which is participant in this project, is responsible for the technical services related to GHG emission reductions, and is therefore, in behalf of Coruripe, 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:

01/01/2006.

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

25y-0m.[10]

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:

01/01/2006.

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Left blank on purpose.

C.2.2.2. Length:

Left blank on purpose.

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 similarity of the project, the same methodology was chosen in order to monitor the emissions reduction due to CBCP.

The methodology considers monitoring emissions reductions generated from cogeneration projects with sugarcane bagasse. The energy produced by the project could be electricity exported to a grid-connected system and/or energy used to substitute fossil fuel off-grid connected. And that is exactly the case with

[10] Specialists from the Brazilian National Agency of Electric Power (ANEEL - *Agência Nacional de Energia Elétrica*) suggest using 25 years of lifetime for steam turbines, combustion turbines, combined cycle turbines and nuclear power plants, according to Bosi, 2000, p. 29.

CBCP: the project exploits a by-product from the sugarcane milling process (bagasse) to produce and commercialize renewable electricity connected to a regional Brazilian grid. The methodology is therefore fully applicable to CBCP.

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

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

Left blank on purpose.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Left blank on purpose.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	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. EG_y	Electricity supplied to the grid by the Project.	Readings of the energy metering connected to the grid and Receipt of Sales.	MWh	*M*	Data will be instantly collected (on-line) and monthly archived .	*100%*	Electronic and paper	Double check by receipt of sales. Will be archived according to internal procedures, until 2 years after the end of the crediting period. The quantity of energy to be sold to Eletrobras will be on-line monitored and the information will be monthly recorded.
2. EF_y	CO_2 emission factor of the Grid.	Calculated	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
3. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	Factor calculated from ONS, the Brazilian electricity system manager.	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
4. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	Factor calculated from ONS, the Brazilian electricity system manager.	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 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.	Factor calculated from ONS, the Brazilian electricity system manager.	index	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}}$$ (tCO2e/GWh) $$EF_{BM} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_m GEN_{m,y}}$$ (tCO2e/GWh) $$EF_{electricity} = \frac{EF_{OM} + EF_{BM}}{2}$$ (tCO2e/GWh)	$F_{i,j(or\ m),y}$ Is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y* *j,m* Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid $COEF_{i,j(or\ m)\ y}$ Is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j (or m) and the percent oxidation of the fuel in year(s) y, a $GEN_{j(or\ m),y}$ Is the electricity (MWh) delivered to the grid by source *j (or m)* $BE_{electricity,y}$ Are the baseline emissions due to displacement of electricity

$BE_{electricity,y} = EF_{electricity} \cdot EG_y$	during the year y in tons of CO_2 EG_y Is the net quantity of electricity generated in the bagasse-based cogeneration plant due to the project activity during the year y in MWh, and $EF_{electricity,y}$ Is the CO_2 baseline emission factor for the electricity.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Left blank on purpose.

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

Left blank on purpose.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Left blank on purpose.

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

Left blank on purpose.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 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 CO_2 equ.)

$ER_y = BE_{thermal, y} + BE_{electricity, y} – PE_y - L_y$ $\mathbf{BE_{thermal, y} = 0}$ $\mathbf{PE_y=0}$ $\mathbf{L_y=0}$ $\mathbf{BE_{electricity, y} = EF_{electricity} . EG_y}$	ER_y: are the emissions reductions of the project activity during the year y in tons of CO_2 $BE_{electricity,y}$: Are the baseline emissions due to displacement of electricity during the year y in tons of CO_2 $BE_{thermal,y}$: Are the baseline emissions due to displacement of thermal energy during the year y in tons of CO_2 PE_y: Are the project emissions during the year y in tons of CO_2. L_y: Are the leakage emissions during the year y in tons of CO_2.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	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.

Moreover, according to the law, the metering equipment shall be periodically calibrated to comply with the regulations for independent power producers connected to the regional grid.

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

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, on behalf of Coruripe, the developer of this document, and all its contents.

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.

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 PEy, presented in the methodology, does not need to be monitored.

Thus, $\mathbf{PE_y = 0}$

E.2. Estimated leakage:

Coruripe did not used to sell sugarcane bagasse before the implementation of the project.

Thus, $\mathbf{L_y = 0}$

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

$\mathbf{L_y + PE_y = 0}$

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. In Brazil, there are two main grids, South-Southeast-Midwest and North-Northeast, therefore the North-Northeast Grid is the relevant one for this project.

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 Brazil.

In order to calculate the Operating Margin, daily dispatch data from the Brazilian electricity system manager (ONS) needed to be gathered. ONS does not regularly provide such information, which implied in getting it through communicating directly with the entity.

The provided information comprised years 2001, 2002 and 2003, and is the most recent information available at this stage (At the end of 2004 ONS supplied raw dispatch data for the whole interconnected grid in the form of daily reports[11] from Jan. 1, 2001 to Dec. 31, 2003, the most recent information available at this stage).

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[11] *Acompanhamento Diário da Operação do Sistema Iterligado Nacional*. ONS-CNOS, Centro Nacional de Operação do Sistema. Daily reports on the whole interconnected electricity system from Jan. 1, 2001 to Dec. 31, 2003.

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:

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

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

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

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

The ONS data as well as the spreadsheet data with the calculation of emission factors have been provided to 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 2001, 2002 and 2003.

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

Year	Lambda
2001	0,9046
2002	0,9390
2003	0,7192

Electricity generation for each year needs also to be taken into account. This information is provided in the table below.

Year	Electricity Load (MWh)
2001	66.224.504
2002	70.885.724
2003	76.163.515

Using therefore appropriate information for $F_{i,j,y}$ and $COEF_{i,j}$, OM emission factors for each year can be determined, as follows.

$$EF_{OM,simple\_adjusted,2001} = (1-\lambda_{2001})\frac{\sum_{i,j} F_{i,j,2001}.COEF_{i,j}}{\sum_{j} GEN_{j,2001}} \therefore EF_{OM,simple\_adjusted,2001} = 0{,}0933 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2002} = (1-\lambda_{2002})\frac{\sum_{i,j} F_{i,j,2002}.COEF_{i,j}}{\sum_{j} GEN_{j,2002}} \therefore EF_{OM,simple\_adjusted,2002} = 0{,}0480 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2003} = (1-\lambda_{2003})\frac{\sum_{i,j} F_{i,j,2003}.COEF_{i,j}}{\sum_{j} GEN_{j,2003}} \therefore EF_{OM,simple\_adjusted,2003} = 0{,}2120 \text{ tCO}_2\text{/MWh}$$

Finally, to determine the baseline *ex-ante*, the mean average among the three years is calculated, finally determining the $EF_{OM,simple\_adjusted}$.

$$EF_{OM,simple\_adjusted\ 2001\_2003} = 0{,}1178 \text{ tCO}_2\text{/MWh}$$

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

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

Electricity generation in this case means 20% of total generation in the most recent year (2003), as the 5 most recent plants built generate less than such 20%. Calculating such factor one reaches:

$$EF_{BM,2003} = 0{,}0270 \text{ tCO}_2\text{/MWh}$$

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:

$$EF_{electricity,2001-2003} = 0{,}5 * 0{,}1178 + 0{,}5 * 0{,}0270 = 0{,}0724 \text{ tCO}_2\text{/MWh}$$

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 ($EF_{electricity,2001\text{-}2003}$) with the electricity generation of the project activity.

$BE_{electricity,y} = EF_{electricity,2001\text{-}2003} \ . \ EG_y$

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

$\mathbf{BE_{electricity,y} = 0{,}0724\ tCO_2/MWh\ .\ EG_y}$ (in tCO_2e)

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

$\mathbf{ER = BE_{electricity,y} - (L_y + PE_y)} = 0{,}0724\ tCO_2/MWh\ .\ EG_y - 0 \rightarrow \mathbf{ER = 0{,}0724\ tCO_2/MWh\ .\ EG_y}$

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

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of the baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2006	5.621	0	0	5.621
2007	5.621	0	0	5.621
2008	5.621	0	0	5.621
2009	5.621	0	0	5.621
2010	5.621	0	0	5.621
2011	5.621	0	0	5.621
2012	5.621	0	0	5.621
Total (tonnes of CO_2e)	39.345	0	0	39.345

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 Environmental Institute of Alagoas State (*IMA – Instituto de Meio Ambiente do Estado de Alagoas*) through CEPRAM (*Conselho Estadual de Proteção Ambiental*) – state of Alagoas environmental agency. Coruripe is in compliance with the environmental legislation and has been issued an Installation License for the extension of its electric system generation from biomass.

S/A Usina Coruripe Açúcar e Álcool already requested, by formal means, on the 05th of April 2005, the Operation License renovation to the Environmental Institute of Alagoas State (*IMA – Instituto de Meio Ambiente do Estado de Alagoas*). The newest Operation Licence is expected to be received by S/A Usina Coruripe Açúcar e Álcool from IMA, until the end of September, 2005.

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

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:

The impacts from CBCP are not considered significant. They arise from activities (cane crushing and bagasse burning) that were already in place before the project. Nevertheless, all the impacts from the project need to be mitigated and the demands made in the installation license must be complied with, so the operation license for the project can be issued and CBCP can be finally issued.

SECTION G. Stakeholders' comments

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

Also, as a requirement of the Brazilian Interministerial Commission on Global Climate Change, the Brazilian DNA, Coruripe invited several organizations and institutions to comment the CDM project being developed. Letters[12] were sent to the following recipients:

- *Câmara Municipal de Coruripe – AL /* Municipal Legislation Chamber of Coruripe – AL;
- *Ministério Público da Comarca de Coruripe - AL /* Public Ministry of Coruripe County – AL;
- *Fórum Brasileiro de ONGs /* Brazilian NGO Forum;
- *Instituto do Meio Ambiente – IMA /* Environmental Institute;
- *Prefeitura Municipal de Coruripe – AL /* Municipal Administration of Coruripe – AL;
- *Secretaria de Meio Ambiente, Turismo e Pesca /* Environmental, Tourism and Fishing Secretary;
- *Associação das Artesãs do Pontal de Coruripe /* Pontal's Craftsman Association of Coruripe.

G.2. Summary of the comments received:

Until the date of completing the final draft of this document, one comment was received from Municipal Administration of Coruripe (*Prefeitura Municipal de Coruripe)* about the CBCP project. A letter was sent by Mr. José Edson dos Santos (Environmental, Tourism and Fishing Municipal Secretary). This

[12] The copies of these invitations are available in hold of Project participants.

letter contains several positive comments about the CBCP Project. Also, a full copy of the final version of the Project Design Document was requested, for the Secretary Library, when available.

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

Coruripe will send a copy of the requested document after the Validation procedures.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

1.1 Project Developer Responsible for the CDM Project Activity

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1.2 Project Activity Host Company

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was requested.

Annex 3

BASELINE INFORMATION

The Brazilian electricity system has been historically divided into two subsystems: the North-Northeast (N-NE) and the South-Southeast-Midwest (S-SE-CO). This is due mainly to the historical evolution of the physical system, which was naturally developed nearby the biggest consuming centers of the country.

The natural evolution of both systems is increasingly showing that integration is to happen in the future. In 1998, the Brazilian government was announcing the first leg of the interconnection line between S-SE-CO and N-NE. With investments of around US$700 million, the connection had the main purpose, in the government's view, at least, to help solve energy imbalances in the country: the S-SE-CO region could supply the N-NE in case it was necessary and vice-versa.

Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000)[13]:

"… where the Brazilian Electricity System is divided into three separate subsystems:

(i) The South/Southeast/Midwest Interconnected System;
(ii) The North/Northeast Interconnected System; and
(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

Moreover, Bosi (2000) gives a strong argumentation in favor of having so-called *multi-project baselines*:

"For large countries with different circumstances within their borders and different power grids based in these different regions, multi-project baselines in the electricity sector may need to be disaggregated below the country-level in order to provide a credible representation of 'what would have happened otherwise'".

Finally, one has to take into account that even though the systems today are connected, the energy flow between N-NE and S-SE-CO is heavily limited by the transmission lines capacity. Therefore, only a fraction of the total energy generated in both subsystems is sent one way or another. It is natural that this fraction may change its direction and magnitude (up to the transmission line's capacity) depending on the hydrological patterns, climate and other uncontrolled factors. But it is not supposed to represent a significant amount of each subsystem's electricity demand. It has also to be considered that only in 2004 the interconnection between SE and NE was concluded, i.e., if project proponents are to be coherent with the generation database they have available as of the time of the PDD submission for validation, a situation where the electricity flow between the subsystems was even more restricted is to be considered.

[13] Bosi, M. *An Initial View on Methodologies for Emission Baselines: Electricity Generation Case Study*. International Energy Agency. Paris, 2000.

The Brazilian electricity system nowadays comprises of around 91,3 GW of installed capacity, in a total of 1.420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5,3% are diesel and fuel oil plants, 3,1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1,4% are coal plants, and there are also 8,1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6,3 GW of the Paraguayan part of *Itaipu Binacional*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

Approved methodologies AM0015 and ACM0002 ask project proponents to account for “all generating sources serving the system”. In that way, when applying one of these methodologies, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

In fact, information on such generating sources is not publicly available in Brazil. The national dispatch center, ONS – *Operador Nacional do Sistema* – argues that dispatching information is strategic to the power agents and therefore cannot be made available. On the other hand, ANEEL, the electricity agency, provides information on power capacity and other legal matters on the electricity sector, but no dispatch information can be got through this entity.

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was contacted, in order to let participants know until which degree of detail information could be provided. After several months of talks, plants’ daily dispatch information was made available for years 2001, 2002 and 2003.

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75.547 MW of installed capacity by 31/12/2004, out of the total 98.848,5 MW installed in Brazil by the same date (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Such capacity in fact is constituted by plants with 30 MW installed capacity or above, connected to the system through 138kV power lines, or at higher voltages. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76,4% of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23,6% are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

Therefore, considering all the rationale explained, project developers decided for the database considering ONS information only, as it was capable of properly addressing the issue of determining the emission factor and doing it in the most conservative way.

The fossil fueled plants efficiencies were also taken from the IEA paper. This was done considering the lack of more detailed information on such efficiencies from public, reliable and credible sources.

From the mentioned reference:

> *The fossil fuel conversion efficiency (%) for the thermal power plants was calculated based on the installed capacity of each plant and the electricity actually produced. For most of the fossil fuel power plants under construction, a constant value of 30% was used as an estimate for their fossil fuel conversion efficiencies. This assumption was based on data available in the literature and based on the observation of the actual situation of those kinds of plants currently in operation in Brazil. The only 2 natural gas plants in combined cycle (totaling 648 MW) were assumed to have a higher efficiency rate, i.e. 45%.*

Therefore only data for plants under construction in 2002 (with operation start in 2002 and 2003) was estimated. All others efficiencies were calculated. To the best of our knowledge there was no retrofit/modernization of the older fossil-fuelled power plants in the analyzed period (2001 to 2003). For that reason project participants find the application of such numbers to be not only reasonable but the best available option.

The aggregated hourly dispatch data got from ONS was used to determine the lambda factor for each of the years with data available (2001, 2002 and 2003). The Low-cost/Must-run generation was determined as the total generation minus fossil-fuelled thermal plants generation, this one determined through daily dispatch data provided by ONS. All this information has been provided to the validators, and extensively discussed with them, in order to make all points crystal clear.

On the following pages, a summary of the analysis is provided. First, the table with the 19 plants dispatched by the ONS are provided. Then, a table with the summarized conclusions of the analysis, with the emission factor calculation displayed. Finally, the load duration curves for the N-NE system are presented.

ONS Dispatched Plants

N	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capcity (MW) [1]	Fossil fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
1	N-NE	H	Itapebi	2003	450	1,00	0,00	0,0	0,0
2	N-NE	G	UT Fortaleza	2003	346,63	0,30	15,30	0,995	0,67
3	N-NE	G	C. Jereissati (Termoceará)	2002	220	0,30	15,30	0,995	0,67
4	N-NE	G	Fafen (Camaçari)	2002	151,2	0,30	15,30	0,995	0,67
5	N-NE	G	Termobahia	2002	185,891	0,30	15,30	0,995	0,67
6	N-NE	H	Prod. Adicional NE	2001	-	1,00	0,00	0,0	0,0
7	N-NE	H	Lajeado	2000	902,5	1,00	0,00	0,0	0,0
8	N-NE	H	Curuá-Uma	1998	30,3	1,00	0,00	0,0	0,0
9	N-NE	H	Xingó	1994	3162	1,00	0,00	0,0	0,0
10	N-NE	H	Luiz Gonzaga	1988	1479,6	1,00	0,00	0,0	0,0
11	N-NE	H	Tucuruí	1984	7960	1,00	0,00	0,0	0,0
12	N-NE	H	P.Afonso 4	1979	2462,4	1,00	0,00	0,0	0,0
13	N-NE	H	Sobradinho	1979	1050,3	1,00	0,00	0,0	0,0
14	N-NE	H	PCH Chesf	1978	57,5	1,00	0,00	0,0	0,0
15	N-NE	D	Camaçari	1977	350	0,27	20,20	0,99	0,88
16	N-NE	H	P.Afonso 3	1971	794,2	1,00	0,00	0,0	0,0
17	N-NE	H	Boa Esperança	1970	237,3	1,00	0,00	0,0	0,0
18	N-NE	H	P.Afonso 2	1961	443	1,00	0,00	0,0	0,0
19	N-NE	H	Paulo Afonso 1	1955	180	1,00	0,00	0,0	0,0
				Total (MW) =	**20.462,82**				

(*) Subsystem: N - north, NE - Northeast.
(**) Fuel source (C, bituminous coal; D, diesel oil; G, natural gas; H, hydro; N, nuclear; O, residual fuel oil).

[1] Agência Nacional de Energia Elétrica. *Banco de Informações da Geração* (http://www.aneel.gov.br/, data collected in november 2004).
[2] Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A. F. Simoes, H. Winkler and J.-M. Lukamba. *Road testing baselines for greenhouse gas mitigation projects in the electric power sector.* OECD and IEA information paper, October 2002.
[3] Intergovernamental Panel on Climate Change. *Revised 1996 Guidelines for National Greenhouse Gas Inventories.*
[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. *Acompanhamento Diário da Operação do SIN* (daily reports from Jan. 1, 2001 to Dec. 31, 2003).
[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. *Resumo Geral dos Novos Empreendimentos de Geração* (http://www.aneel.gov.br/, data collected in november 2004).

Summary table

Baseline (including imports)	Emission factors (tCO_2/MWh)	
	OM	**Yearly generation (MWh)**
2001	0,9777	66.224.504
2002	0,7869	70.885.724
2003	0,7549	76.163.515
	Total (2001-2003) =	**213.273.743**
from ONS-Lambda N-NE 2001-2003.xls	**Adjusted OM**	**BM 2003**
lambda (2001)	0,1178	0,0270
0,9046	**Weights**	**Default weights**
lambda (2002)	w_{OM} = 1,00	w_{OM} = 0,5
0,9390	w_{BM} = 0,00	w_{BM} = 0,5
lambda (2003)	**Baseline**	**Default baseline**
0,7192	0,1178	0,0724

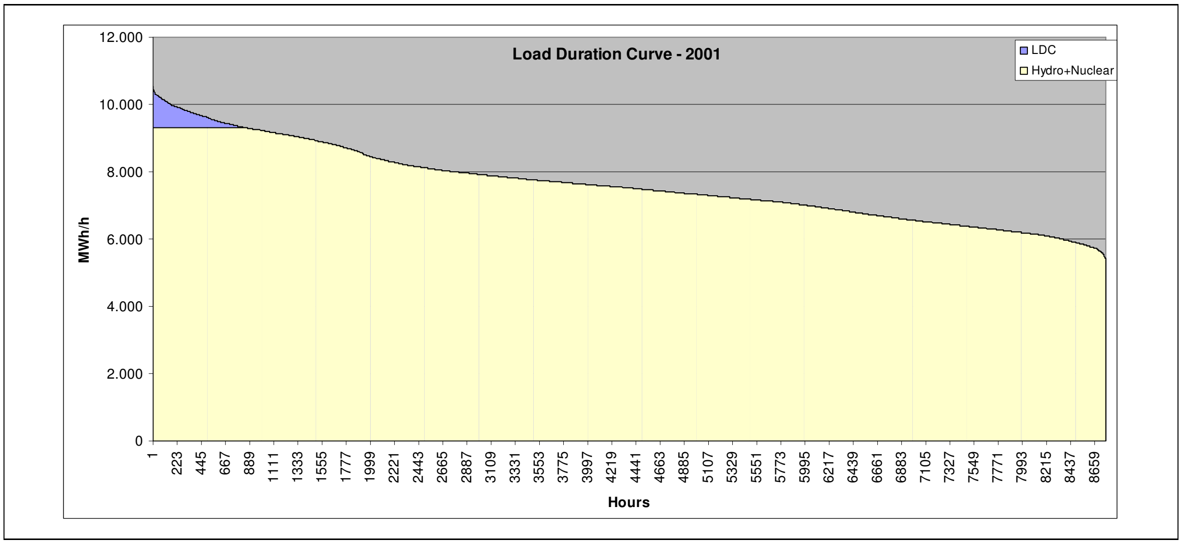

Figure 3: Load duration curve for the N-NE system, 2001

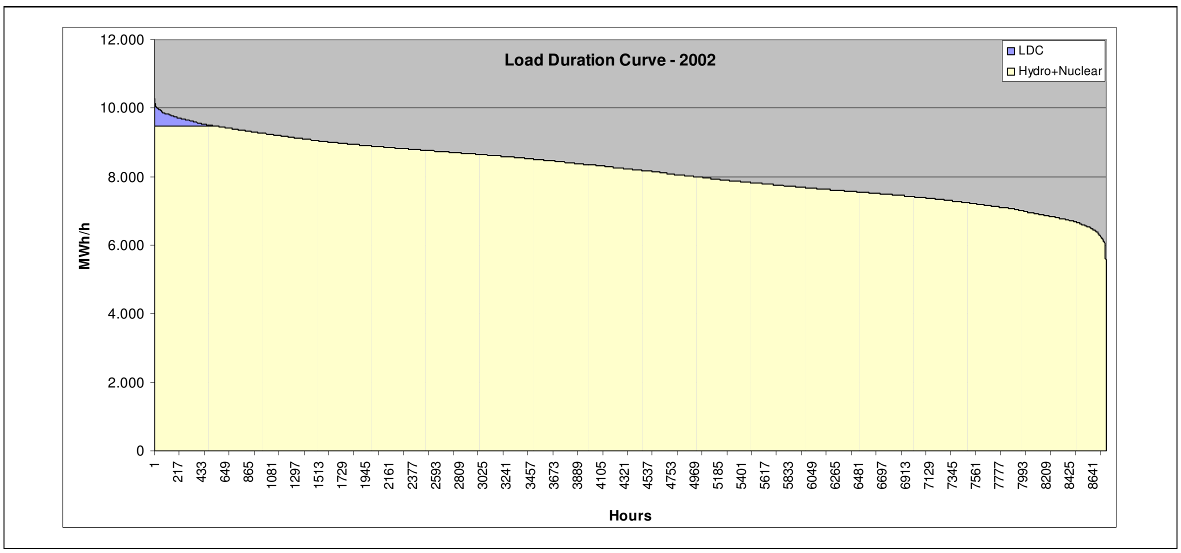

Figure 4: Load duration curve for the N-NE system, 2002

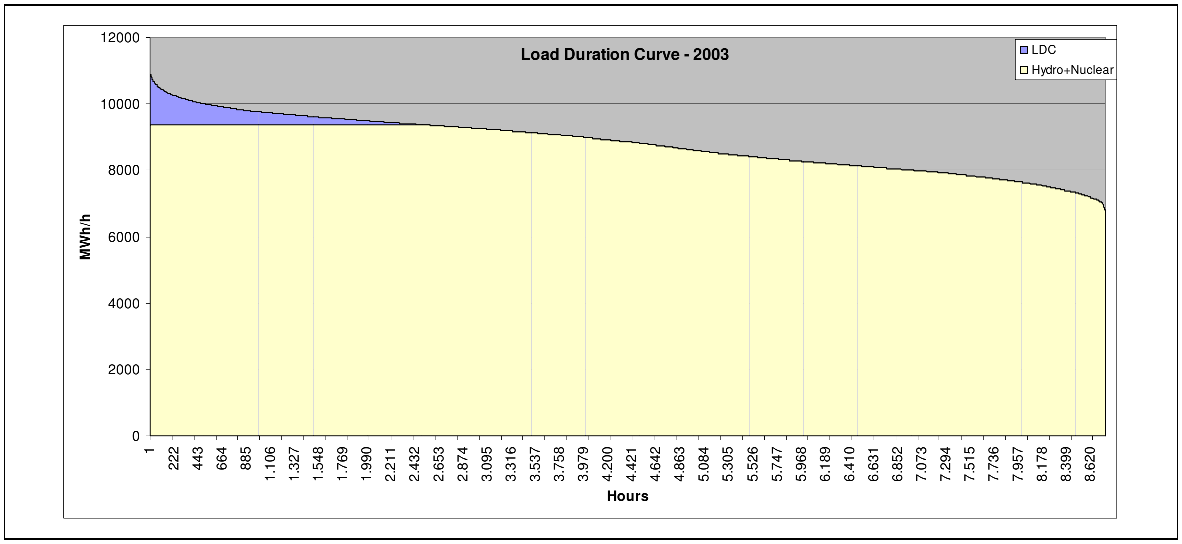

Figure 5: Load duration curve for the N-NE system, 2003

Coruripe Cogeneration Project									
Grid-Connected Emission Reduction	**Item**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total CERs**
	Total installed capacity (MW)	32	32	32	32	32	32	32	
	Stand by capacity (MW)	0	0	0	0	0	0	0	
	Internal consumption (MW)	16	16	16	16	16	16	16	
	Capacity available for sale (MW)	16	16	16	16	16	16	16	
	Operating hours (h)	5.000	5.000	5.000	5.000	5.000	5.000	5.000	
	Estimated energy to be sold to the grid (MWh)*	77.635	77.635	77.635	77.635	77.635	77.635	77.635	
	Baseline emision factor (tCO2/MWh)	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	
	Emission Reduction (tCO_2e)	5.621	5.621	5.621	5.621	5.621	5.621	5.621	**39.345**

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 year 2006 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:

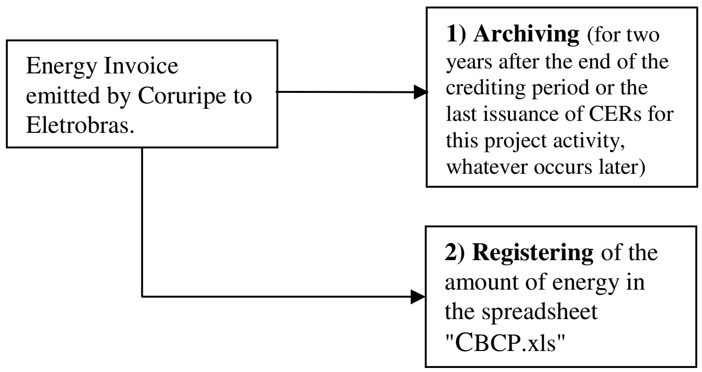

Figure 7: Monitoring procedures for Coruripe

The quantity of energy exported to the grid will be monitored through the energy invoice emitted to Eletrobras the energy distributor, by Coruripe. The quantity of energy to be sold to Eletrobras will be on-line monitored and the information will be monthly recorded. 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 "CBCP.xls", which shall be the instrument for the further Verification.