CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Annexes

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:

Cucaú Bagasse Cogeneration Project (CBCP).
Version 4
Date of the document: June 12th, 2006.

A.2. Description of the small-scale project activity:

This project activity consists of increasing efficiency in the bagasse (a renewable fuel source, residue from sugarcane processing) cogeneration facility at **Zihuatanejo do Brasil Açúcar e Álcool S.A.** (Cucaú), 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, also contributing 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), Cucaú 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 Cucaú 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 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.

Cucaú 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:

Social Contribution

Cucaú supports several programs aiming to improve social contribution, as shown bellow:

- Causeries: Periodical causeries directed to pregnant for orientation and consciousness-raising (employees and community residents) about the importance of pregnancy attendance, hygiene and health;
- Campaigns: Campaigns about alimentation healthy habits, hygiene, sport practices and diseases prevention directed to employees and community residents;
- School and Education: Cession and maintenance of building structure for school operation of Cocaú Village;
- Sport, Leisure and Education: Cession and maintenance of Recreative Club structure with sportive installations and events directed to employees and community residents;
- Health Station: Cession and maintenance of building structure for the Health Station well functioning to Cocaú Village community assistance;
- Festivity: Financial contribution to development of events directed to children and teenagers of employees and community residents.

The company is socially oriented and very focused on to its surrounding area's children, what can be seen in the annexed "Corporation children friend" seal it has received from the UNICEF supported institution Abrinq[1].

Environmental Contribution

Together with world-wide efforts looking for Environmental Preservation and Sustainable Development, the Cucaú Mill develop the environmental project called "Guardiões da Natureza" (Nature Guardians), having as general objective to construct and develop a collective environmental conscience, involving the managers, the employees and mill surrounding communities, adapting the resources and available knowledge to the implementation of a permanent environmental management policy. The specific objectives are:

- Environmental problems identification;
- Sectorial centre organization to solve the identified problems;
- Acquisition, implementation and maintenance of ISO 14.001;
- Divulgation of all didactic material adopted by the centre;
- Creation of the environmental education centre with training centre to all company sectors and surrounding communities;
- Reforestation of degraded downhill forest;
- Implementations of activities that result in a social and environmental sustainability.

[1] http://www.fundabrinq.org.br/

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)	Zihuatanejo do Brasil Açúcar e Álcool S.A. (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.		

Econergy Brasil Ltda. is the official contact for the CDM project activity.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Brazil

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

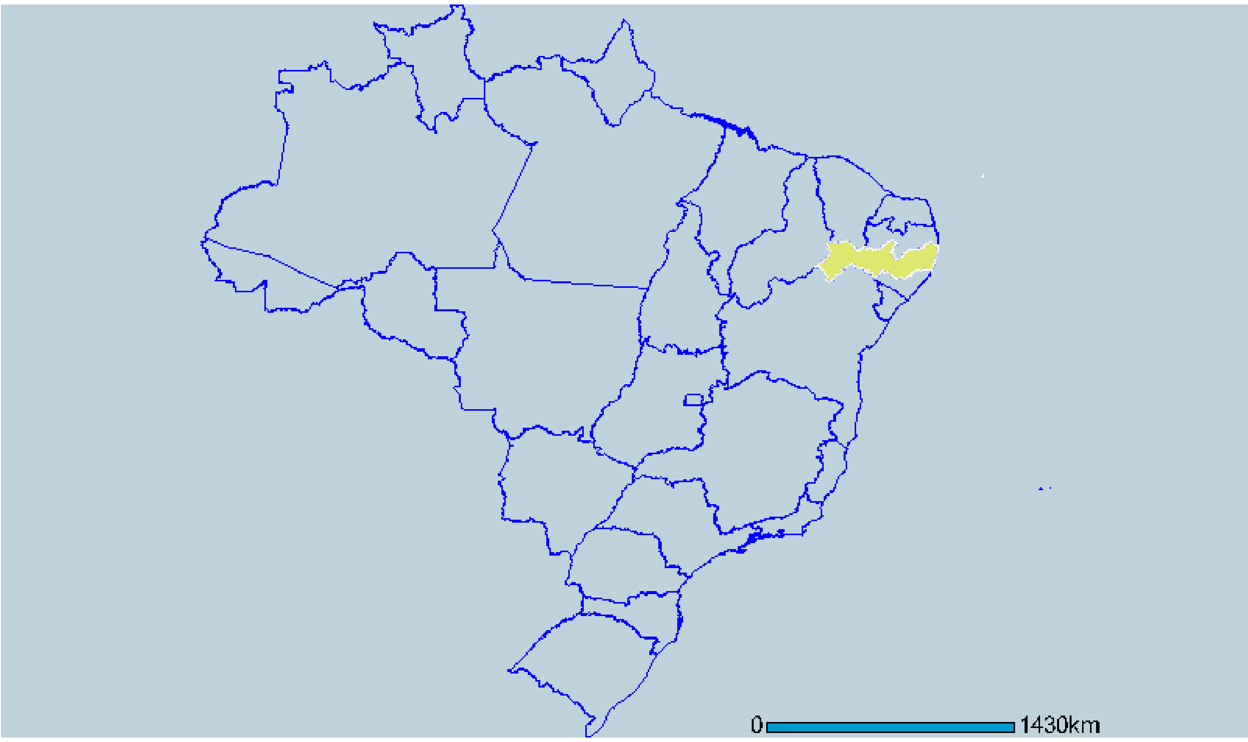
Pernambuco

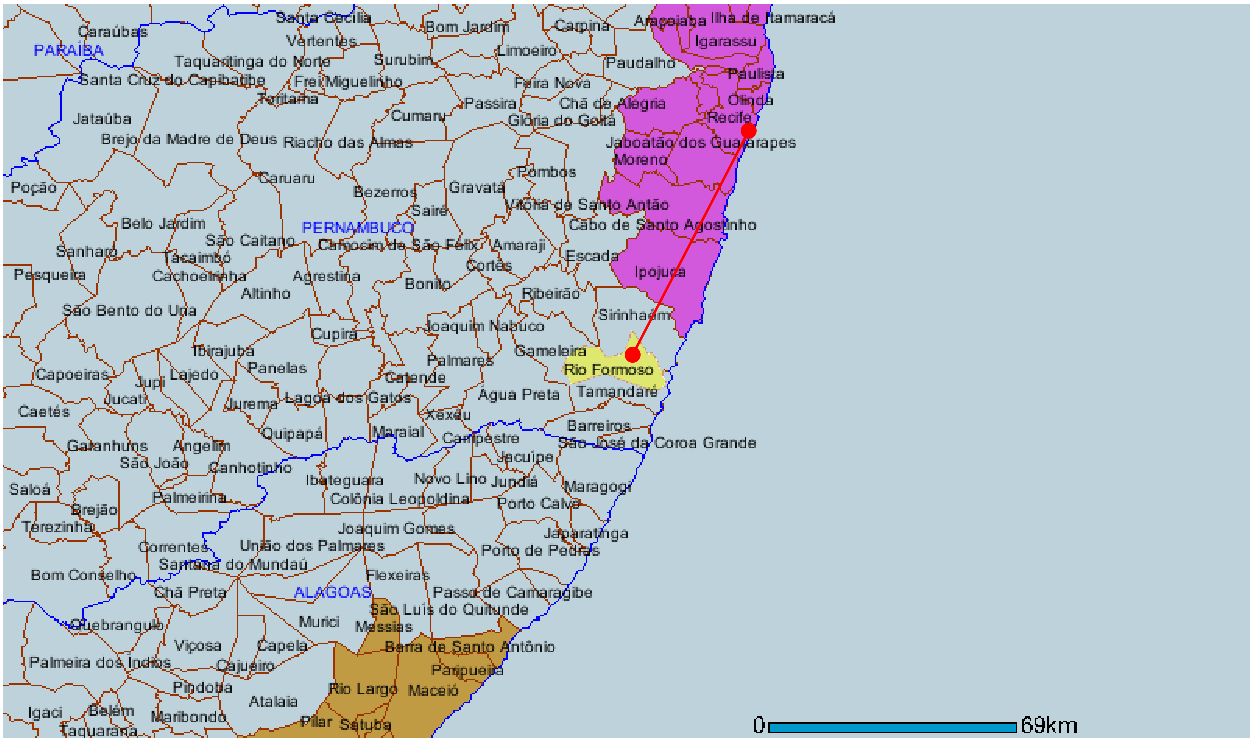
A.4.1.3. City/Town/Community etc:

Rio Formoso

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):

Cucaú Mill is located at Av. Artur Siqueira, S/Nº - Zona Rural - Parque Industrial Engenho Cucaú (Artur Siqueira Highway, without number – Rural Zone), inside of Rio Formoso city, in the Southeast Region of Pernambuco State, about 100 km away from the state capital, Recife, as can be seen in the Figures 1 and 2.





Source: IBGE - Brazilian Geography and Statistics Institute

Figures 1 and 2: Geographical position of Pernambuco State and Rio Formoso city.

A.4.2. Type and category(ies) and technology of the small-scale project activity:

Type (i): Renewable energy projects.
Category D: Renewable electricity generation for a grid.

The project is a small scale project activity and falls under the category I.D according to the Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities. It is a renewable electricity generation for a grid.

The categorization is justified by the following parameters:

1. Electricity generation capacity is lower than 15 MW;
2. Fuel type is biomass: bagasse (a renewable fuel source, residue from sugarcane processing).

The CDM project only includes the electricity generation to the grid system and excludes the generation of electricity and steam for own consumption in the mill.

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 3). 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].

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.

Further, as bagasse cogeneration requires a constant bagasse supply to the sugar mill's boilers, if there is an interruption in bagasse supply, for example due to an interruption in sugarcane supply to the mill, the

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

boilers would not be able to produce the steam required by both the sugar/ethanol production process and the power-generation. Therefore, in order to avoid power-generation interruptions, the cogeneration expansion plan in CBCP includes investments in the sugar/ethanol production process that reduce the steam consumption in the sugar and ethanol production processes. This fine-tune improvement is necessary in order to drive as much steam as possible to the cogeneration project. Consequently, the greater the quantity of electricity production, the higher the investment per MWh produced is sought.

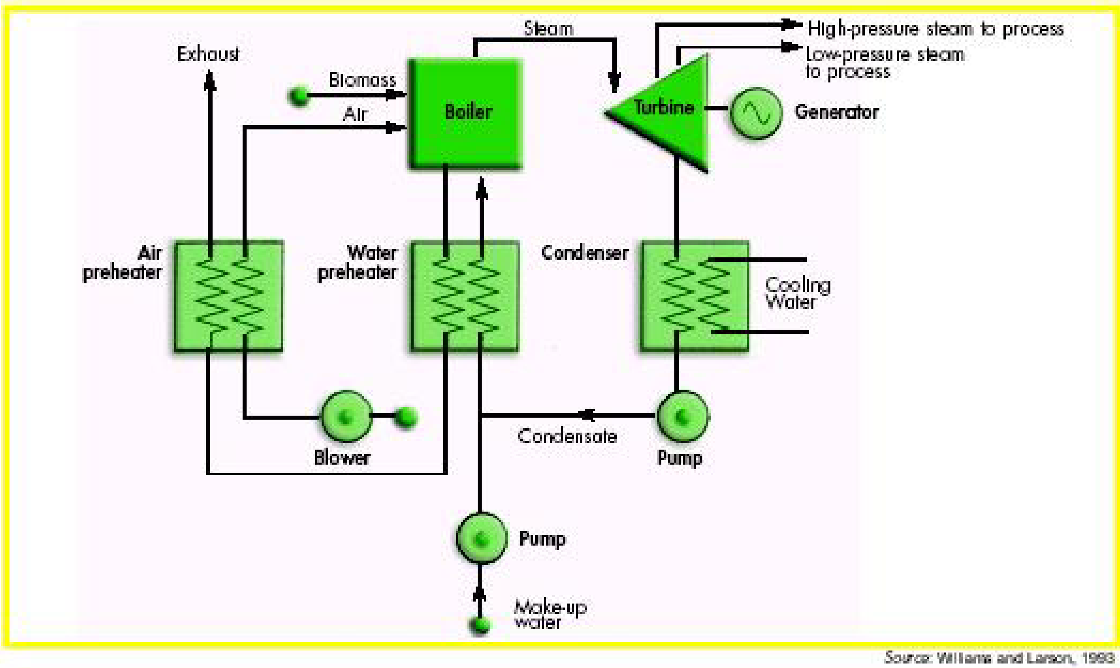


Figure 3: Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extraction steam turbine

Using steam-Rankine cycle as the basic technology of its cogeneration system, for achieving an increasing amount of surplus electricity to be generated, Cucaú, in 2001, had started to implement this project activity (CBCP). The expansion project is divided into five phases: Phase 1 (2001), Phase 2 (2002), Phase 3 (2003), Phase 4 (2004) and Phase 5 (2007). This project consists on installation of additional equipments, refurbishing and upgrading others already installed, during the different phases, as shown bellow:

- Phase 1 (2001):
  - Installation of one additional 3 MW backpressure turbo-generator (NG/Toshiba);
  - Deactivation of one 2 MW backpressure turbo generator (KKK).

- Phase 2 (2002):
  - Refurbishment of one 21 kgf/cm² boiler (Dedini), upgrading it up to a capacity from 60 tsh (tonnes of steam per hour) to 70 tsh.

- Phase 3 (2003):
  - Refurbishment of another one 21 kgf/cm² boiler (Dedini), upgrading it up to a capacity from 40 tsh to 60 tsh.

- Phase 4 (2004):

- Installation of one additional 5,6 MW backpressure turbo generator (TGM/WEG);
- Deactivation of one 1 MW backpressure turbo generator (Texas/AEG).

- Phase 5 (2007):
  - Installation of one additional 2,4 MW condensing turbo generator (GE);
  - Refurbishment of one 21 kgf/cm² boiler (Dedini), the same refurbished in Phase 2 (2002), upgrading it up to a capacity from 70 tsh to 100 tsh.

The Table 1 shows when and with which equipments CBCP took place:

Table 1: Cogeneration equipment upgrades

YEAR	ACTIVE / ACTIVATING						DEACTIVATING
Before the Expansion Plan	One 4 MW backpressure turbo generator (Worthington/Toshiba)	One 2 MW backpressure turbo generator (KKK)	One 1 MW backpressure turbo generator (Texas/AEG)	One 0.8 MW hydro turbo generator (Lindner/ASEA)	One 0.4 MW hydro turbo generator (KMW/AL Eletric)		
(Until 2000)	Two 21 Kg/cm² boilers (70 tsh) (Noraço/Conservite)	One 21 Kg/cm² boiler (60 tsh) (Dedini)	One 21 Kg/cm² boiler (40 tsh) (Dedini)				
After the Expansion Plan	One 4 MW backpressure turbo generator (Worthington/Toshiba)	One 3 MW backpressure turbo generator (NG/Toshiba)	One 1 MW backpressure turbo generator (Texas/AEG)	One 0.8 MW hydro turbo generator (Lindner/ASEA)	One 0.4 MW hydro turbo generator (KMW/AL Eletric)		One 2 MW backpressure turbo generator (KKK)
Phase 1 (2001)	Two 21 Kg/cm² boilers (70 tsh) (Noraço/Conservite)	One 21 Kg/cm² boiler (60 tsh) (Dedini)	One 21 Kg/cm² boiler (40 tsh) (Dedini)				
After the Expansion Plan	One 4 MW backpressure turbo generator (Worthington/Toshiba)	One 3 MW backpressure turbo generator (NG/Toshiba)	One 1 MW backpressure turbo generator (Texas/AEG)	One 0.8 MW hydro turbo generator (Lindner/ASEA)	One 0.4 MW hydro turbo generator (KMW/AL Eletric)		
Phase 2 (2002)	Two 21 Kg/cm² boilers (70 tsh) (Noraço/Conservite)	One 21 Kg/cm² boiler (70 tsh) (Dedini)	One 21 Kg/cm² boiler (40 tsh) (Dedini)				
After the Expansion Plan	One 4 MW backpressure turbo generator (Worthington/Toshiba)	One 3 MW backpressure turbo generator (NG/Toshiba)	One 1 MW backpressure turbo generator (Texas/AEG)	One 0.8 MW hydro turbo generator (Lindner/ASEA)	One 0.4 MW hydro turbo generator (KMW/AL Eletric)		
Phase 3 (2003)	Two 21 Kg/cm² boilers (70 tsh) (Noraço/Conservite)	One 21 Kg/cm² boiler (70 tsh) (Dedini)	One 21 Kg/cm² boiler (60 tsh) (Dedini)				

After the Expansion Plan	One 4 MW backpressure turbo generator (Worthington/Toshiba)	One 3 MW backpressure turbo generator (NG/Toshiba)	One 5,6 MW backpressure turbo generator (TGM/WEG)	One 0.8 MW hydro turbo generator (Lindner/ASEA)	One 0.4 MW hydro turbo generator (KMW/AL Eletric)		One 1 MW backpressure turbo generator (Texas/AEG)
Phase 4 (2004)	Two 21 Kg/cm² boilers (70 tsh) (Noraço/Conservite)	One 21 Kg/cm² boiler (70 tsh) (Dedini)	One 21 Kg/cm² boiler (60 tsh) (Dedini)				
After the Expansion Plan	One 4 MW backpressure turbo generator (Worthington/Toshiba)	One 3 MW backpressure turbo generator (NG/Toshiba)	One 5.6 MW backpressure turbo generator (TGM/WEG)	One 2.4 MW condensing turbo generator (GE)	One 0.8 MW hydro turbo generator (Lindner/ASEA)	One 0.4 MW hydro turbo generator (KMW/AL Eletric)	
Phase 5 (2007)	Two 21 Kg/cm² boilers (70 tsh) (Noraço/Conservite)	One 21 Kg/cm² boiler (100 tsh) (Dedini)	One 21 Kg/cm² boiler (60 tsh) (Dedini)				

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale 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).

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.

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 (PPA) 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 120 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 Cucaú, 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.

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

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO2e
2001	628
2002	815
2003	94
2004	1,810
2005	2,663
2006	3,986
2007	4,584
Total estimated reductions (tonnes of CO_2e)	14,580
Total Number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	2,082

Emission reductions produced until 2005. Data for 2006 and on are estimates.

A.4.4. Public funding of the small-scale project activity:

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

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

CBCP comprises only equipment installation/upgrades in Cucaú's mill, and the situation prevailing prior to such implementations has never been considered as a CDM project activity, which confirms the small-scale project activity is not a debundled component of a larger project activity.

SECTION B. Application of a baseline methodology:

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

Title of baseline methodology: "Renewable Electricity Generation for a Grid", Type I.D in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities.

B.2 Project category applicable to the small-scale project activity:

This category is applicable to CBCP due to the fact that the project produces renewable energy from bagasse co-generation and supplies renewable electricity to a grid.

The project is a renewable energy project that produces electricity for an electricity grid system by combustion of the biomass fuel sources. The project type is therefore a Type I category D that covers renewable energy projects for electricity generation for a system.

The emission reductions are obtained by supplying electricity to the electricity system generated by using renewable resources in the form of bagasse. The electricity export to the grid system will avoid emissions in the electricity system by reducing the emissions from the existing power generation capacities. Renewable biomass electricity generating units are covered by the selected methodology.

The project is a combined steam and power system where steam will be produced for own consumption and for electricity generation. The electricity output does not exceed the threshold of 15 MWe for small scale CDM projects.

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 small-scale CDM project activity:

The proposed project activity qualifies CBCP to use simplified methodologies and is additional using the option (d) of “Attachment A to Appendix B” of the simplified modalities and procedures for small-scale CDM project activities.

a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainly or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led the implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The following explanation provides the reasons that the project activity would not have occurred anyway due to following barriers.

According to COELHO (1999)[4], “large scale cogeneration program in sugar-alcohol sector has not yet occurred, due to several barriers, mainly economic, political and institutional”, such as:

A. Investment barrier

[4] 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.

"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" [5] 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[6].

COELHO (1999) also highlights as one of the major problems of selling surplus energy to the grid as 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.

B. Technological barrier

Technological barriers represent a very important issue for increasing bagasse cogeneration in Brazil, as – despite of 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-

---

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

[6] "As may 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.

efficiency boilers due to conservativeness, lack of knowledge or even lack of interest to generate surplus steam for electricity sales purposes.

Finally, SWISHER (1997)[7] 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.

C. Barrier due to prevailing practice:

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.

There are also questions regarding the managerial capacity of the companies that comprise the Brazilian sugarcane industry. According to WALTER (1994)[8], 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.

D. Other 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.

---

[7] 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.

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

From the point of view of the economic agents, the excessive level of guarantees required to finance the projects is a common barrier to achieving a financial feasibility stage, deeply discussed in SWISHER (1997).

Other barriers have more to do with the lack of adequate commercial contractual agreements from the energy buyers (i.e. bankable long-term contracts and payment guarantee mechanisms for non-creditworthy local public-sector and private customers) making it much more difficult to obtain long-term financing from a commercial bank and/or a development bank. Some other financing barriers occur simply due to prohibitively high transaction costs, which include the bureaucracy to secure the environmental license.

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 PROINFA, the Brazilian program for renewable energy. 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.

For this CDM project analysis purposes, at the time the project started, in 2001, there were no institutional incentive like PROINFA to be considered, because PROINFA entered into force only in the year 2004. Therefore, the company's decision to sign a long-term PPA with the local distributor undoubtedly represented a significant risk that the mill was willing to take partially thanks to the expected CDM revenue.

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.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale 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 Cucaú 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 the baseline and its development:

The baseline methodology has followed the one specified in the Project Category I.D.

The baseline is the MWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh or in ton CO_2equ/MWh) calculated in a transparent and conservative manner as:

(a) The average of the "approximate operating margin" and the "build margin", where:

(i) The "approximate operating margin" is the weighted average emissions (in kg CO_2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

(ii) The "build margin" is the weighted average emissions (in kg CO_2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants.";

OR,

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

The method that will be chosen to calculate the Operating Margin (OM) for the electricity baseline emission factor is the option (a) *The average of the "approximate operating margin" and the "build margin"*.

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)[9]:

"… 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

---

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

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.

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 methodology ACM0002 asks 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, plant's daily dispatch information was made available for years 2002, 2003 and 2004..

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, 2003 and 2004) 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 (2002 to 2004). For that reason project participants find the application of such numbers to be not only reasonable but the best available option.

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 tables, a summary of the analysis is provided. On the first one, the 21 plants dispatched by the ONS are provided. Then, a table with the summarized conclusions of the analysis, with the emission factor calculation displayed.

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	P. do Cavalo	2004	160	1,00	0,00	0,0	0,0
2	N-NE	G	Termopernambuco	2004	533	0,32	15,30	0,995	0,67
3	N-NE	H	Itapebi	2003	450	1,00	0,00	0,0	0,0
4	N-NE	G	UT Fortaleza	2003	346,63	0,32	15,30	0,995	0,67
5	N-NE	G	C. Jereissati (Termoceará)	2002	220	0,32	15,30	0,995	0,67
6	N-NE	G	Fafen (Camaçari)	2002	151,2	0,32	15,30	0,995	0,67
7	N-NE	G	Termobahia	2002	185,891	0,32	15,30	0,995	0,67
8	N-NE	H	Prod. Adicional NE	2001	-	1,00	0,00	0,0	0,0
9	N-NE	H	Lajeado	2000	902,5	1,00	0,00	0,0	0,0
10	N-NE	H	Curuá-Uma	1998	30,3	1,00	0,00	0,0	0,0
11	N-NE	H	Xingó	1994	3162	1,00	0,00	0,0	0,0
12	N-NE	H	Luiz Gonzaga	1988	1479,6	1,00	0,00	0,0	0,0
13	N-NE	H	Tucuruí	1984	7960	1,00	0,00	0,0	0,0
14	N-NE	H	P.Afonso 4	1979	2462,4	1,00	0,00	0,0	0,0
15	N-NE	H	Sobradinho	1979	1050,3	1,00	0,00	0,0	0,0
16	N-NE	H	PCH Chesf	1978	57,5	1,00	0,00	0,0	0,0
17	N-NE	D	Camaçari	1977	350	0,33	20,20	0,99	0,88
18	N-NE	H	P.Afonso 3	1971	794,2	1,00	0,00	0,0	0,0
19	N-NE	H	Boa Esperança	1970	237,3	1,00	0,00	0,0	0,0
20	N-NE	H	P.Afonso 2	1961	443	1,00	0,00	0,0	0,0
21	N-NE	H	Paulo Afonso 1	1955	180	1,00	0,00	0,0	0,0
				Total (MW) =	**21.155,82**				

(*) 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

SSC Emission factors for the Brazilian North-Northeast interconnected grid

Small-scale baseline (without imports)	OM (tCO2e/MWh)	Total generation (MWh)
2002	0.7869	68,779,390
2003	0.7549	68,630,265
2004	0.5979	77,553,416
	Weighted average OM (2002-2004, tCO2e/MWh)	Total = 214,963,071
	0.7133	**BM 2004 (tCO2e/MWh)**
	OM*0.5+BM*0.5 (tCO2e/MWh)	0.0568
	0.3850	

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	Cucaú
2. EF_y	CO_2 emission factor of the Grid.	0.3850	tCO_2e/MWh	Calculated

3. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	0.7133	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.	0.0568	tCO_2e/MWh	This value was calculated using data information from ONS, the Brazilian electricity system manager.

1. Date of completing the final draft of this baseline section: 12/06/2006

2. Name of person/entity determining the baseline:
   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, in behalf of Cucaú, the developer of this document, and all its contents.

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

05/09/2001.

C.1.2. Expected operational lifetime of the small-scale project activity:

25y-0m.[10]

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

C.2.1. Renewable crediting period:

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

05/09/2001.

C.2.1.2. Length of the first crediting period:

7y-0m.

C.2.2. Fixed crediting period:

[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.

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:

The monitoring will occur as follows:

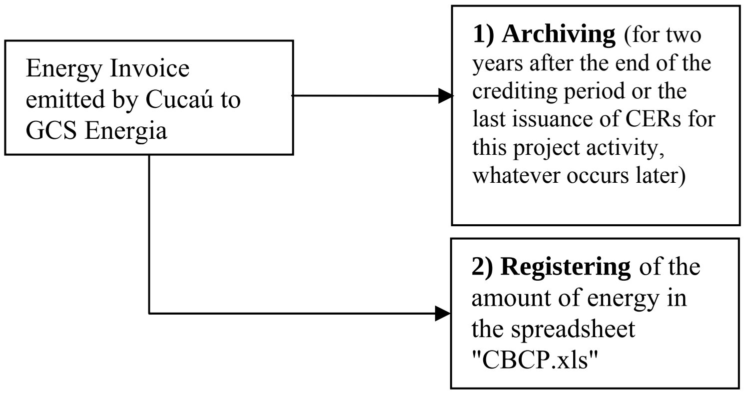


Figure 4: Monitoring procedures for Cucaú

The quantity of energy exported to the grid will be monitored through the energy invoice emitted by Cucaú to GCS Energia, the energy distributor. 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.

The calibration of energy measurement instruments are made by CELP – Companhia Energética de Pernambuco, which is the local concessionaire. The calibration procedures shall be made annually.

As informed by the Brazilian Energy Spot Market (from Portuguese: “CCEE – Câmara Comercializadora de Energia Elétrica”), the calibration of the energy meters occurs annually before the beginning of each crop season, probably during August of each year.

D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:

Approved monitoring methodology: “Renewable Electricity Generation for a Grid”, Type I.D in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities.

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

According to the methodology, monitoring shall consist of metering the electricity generated by the renewable technology. In the case of co-fired plants, the amount of biomass and fossil fuel input shall be monitored.

And that is exactly the case with 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.

D.3 Data to be monitored:

ID number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
1.	Electricity supplied to the grid by the Project.	EGy	MWh	m	Monthly	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.	Double check by receipt of sales.
2.	CO_2 emission factor of the Grid.	EFy	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.	These values are to be recalculated at the time of each baseline renovation
3.	CO_2 Operating Margin emission factor of the grid.	$EF_{OM,y}$	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.	These values are to be recalculated at the time of each baseline renovation
4.	CO_2 Build Margin emission factor of the Grid.	$EF_{BM,y}$	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.	These values are to be recalculated at the time of each baseline renovation

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

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

D.5. Please describe briefly the operational and management structure that the project participant(s) 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 quantity of energy exported to the grid (EG_y), from year 2001 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. 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.6. 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 Cucaú, the developer of this document, and all its content.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Appendix B does not indicate a specific formula to calculate the GHG emission reductions by sources.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

This project activity does not burn any additional quantity of fossil fuel due to the project implementation. Therefore, there is no GHG emission due to project activity.

Thus, $\mathbf{PE_y = 0}$

PE_y are the project emissions during the year y in tons of CO_2e.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

According to the leakage paragraph of Approved Monitoring Methodology "Renewable Electricity Generation for a Grid", Type I.D in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities, the following applicability is shown:

"**Leakage**
8. If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered."

Since none of the conditions above is applicable for CBCP, there is no leakage to be considered in this project activity.

Thus, $\mathbf{L_y = 0}$
L_y are the leakage emissions during the year y in tons of CO_2e.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

$\mathbf{L_y + PE_y = 0}$

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

According to the baseline methodology I.D., the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh or in ton CO_2equ/MWh) calculated in a transparent and conservative manner as:

(a) The average of the “approximate operating margin” and the “build margin”, where:

(i) The “approximate operating margin” is the weighted average emissions (in kg CO_2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

(ii) The “build margin” is the weighted average emissions (in kg CO_2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants.”;

OR,

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

The method that will be chosen to calculate the Operating Margin (OM) for the electricity baseline emission factor is the option (a) *The average of the “approximate operating margin” and the “build margin”*.

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.

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 2002, 2003 and 2004, and is the most recent information available at this stage. At the end of 2005 ONS supplied raw dispatch data for the whole interconnected grid in the form of daily reports[11] from Jan. 1, 2002 to Dec. 31, 2004, the most recent information available at this stage.

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

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_{j} GEN_{j,y}} + \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_{k} GEN_{k,y}} \quad (tCO_2e/GWh)$$

[11] *Acompanhamento Diário da Operação do Sistema Interligado Nacional*. ONS-CNOS, Centro Nacional de Operação do Sistema. Daily reports on the whole interconnected electricity system from Jan. 1, 2002 to Dec. 31, 2004.

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

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

Where;

$F_{i,j(or\ m),y}$ 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 excluding 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;

$GEN_{j(or\ m),y}$ 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 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.

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.

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

Year	Electricity Load (MWh)
2002	68,779,390
2003	68,630,241
2004	77,553,416

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

$$EF_{OM,2002} = \frac{\sum_{i,j} F_{i,j,2002}.COEF_{i,j}}{\sum_{j} GEN_{j,2002}} \therefore EF_{OM,2002} = 0.7869 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,2003} = \frac{\sum_{i,j} F_{i,j,2003}.COEF_{i,j}}{\sum_{j} GEN_{j,2003}} \therefore EF_{OM,2003} = 0.7549 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,2004} = \frac{\sum_{i,j} F_{i,j,2004}.COEF_{i,j}}{\sum_{j} GEN_{j,2004}} \therefore EF_{OM,2004} = 0.5979 \text{ tCO}_2\text{/MWh}$$

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

$$EF_{OM,2002-2004} = 0.7133 \text{ tCO}_2\text{/MWh}$$

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 (2004), as the 5 most recent plants built generate less than such 20%. Calculating such factor one reaches:

$$EF_{BM,2003} = 0.0568 \text{ tCO}_2\text{/MWh}$$

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:

$$EF_{electricity,2002-2004} = \frac{EF_{OM} + EF_{BM}}{2} = \frac{0.7133 + 0.0568}{2} = 0.3850 \text{ tCO}_2\text{/MWh}$$

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.

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

Where;

$BE_{electricity,y}$ are the baseline emissions due to displacement of electricity during the year y in tons of CO_2;

$EF_{electricity,y}$ is the CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh;

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.

Therefore, for the first crediting period, the baseline emissions will be calculated as follows:
$\mathbf{BE_{electricity,y} = 0{,}3850\ tCO_2/MWh\ .\ EG_y}$ (in tCO_2e)

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

The total net emission reductions due to the project activity result during a given year y as:

$\mathbf{ER = BE_{electricity,y} - (L_y + PE_y)} = 0{,}3850\ tCO_2/MWh\ .\ EG_y - 0 \rightarrow \mathbf{ER = 0{,}3850\ tCO_2/MWh\ .\ EG_y}$

E.2 Table providing values obtained when applying formulae above:

Cucaú Bagasse Cogeneration Project

Grid-Connected Emission Reduction	Item	Before CBCP 2000	2001	2002	2003	2004	2005	2006	2007	Total CERs
	Total installed capacity (MW)	7	8	8	8	12,6	12,6	12,6	15	
	Internal consumption (MW)	5,8	5,8	6,5	7,2	8	8	8	8	
	Capacity available for sale (MW)	1,2	2,2	1,5	0,8	4,6	4,6	4,6	7	
	Estimated energy to be sold to the grid (MWh)*	0	1.632	2.119	244	4.703	6.919	10.354	11.907	
	Baseline emision factor (tCO2/MWh)	0,385	0,385	0,385	0,385	0,385	0,385	0,385	0,385	
	Emission Reduction (tCO_2e)	-	628	815	94	1.810	2.663	3.986	4.584	**14.580**

*** Electricity sold until 2004. Data for 2005 and on are estimates.**

Total emission reductions for the first crediting period are estimated to be 14.580 tCO_2e.

SECTION F.: Environmental impacts:

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The possible environmental impacts were analyzed by the Science, Technology and Environmental Secretary of Government State through CPRH – Agência Estadual de Meio Ambiente e Recursos Hídricos (Environmental and Hydrous Resources State Agency). Cucaú is in compliance with the environmental legislation and has been issued an Implanting License for the extension of its electric system generation from biomass.

The latest official Operating License was issued in 19th January 2005, however, Cucaú must comply with some demands from the CPRH – Agência Estadual de Meio Ambiente e Recursos Hídricos (Environmental and Hydrous Resources State Agency), in order to proceed with the operation of the project, being:

- When the entrepreneurship is operating in full charge, it will be necessary to realize chimney samples, by isokinetic process, whose results must be reported to CPRH.

Zihuatanejo do Brasil Açúcar e Álcool S.A. (Cucaú) already requested, by formal means, on the 06th of December 2005, the Operation License renovation to the CPRH – Agência Estadual de Meio Ambiente e Recursos Hídricos (Environmental and Hydrous Resources State Agency).

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.

SECTION G. Stakeholders' comments:

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

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

- *Prefeitura Municipal de Rio Formoso – PE /* Municipal Administration of Rio Formoso – PE;
- *Câmara dos Vereadores de Rio Formoso – PE /* Municipality Chamber of Rio Formoso – PE;
- *Agência Estadual de Meio Ambiente e Recursos Hídricos – CPRH /* Environment and Hydro Resources State Agency;
- *Secretaria da Agricultura, Indústria, Comércio e Meio Ambiente* / Agriculture, Industry, Commerce and Environmet Secretary;
- *Fórum Brasileiro de ONGs /* Brazilian NGO Fórum;
- *Ministério Público de Pernambuco /* Public Ministry of Pernambuco;
- *Associação Comunitária Unidos Por Rio Formoso – UCURF /* Communitariam Association United by Rio Formoso;
- *Associação dos Moradores da Rua da Lama /* Residents Association of Lama Street;
- *Associação dos Deficientes Físicos do Rio Formoso* / Physically Handicapped Associantion of Rio Formoso;
- *Associação dos Moradores do Alto do Campo /* Residents Association of Alto do Campo;
- *Sindicato da Indústria do Açúcar e do Álcool no Estado de Pernambuco - Sindaçúcar* / Sugar and Alcohol Industry Syndicate of Pernambuco State;
- *Sociedade dos Técnicos Açucareiros e Alcooleiros do Brasil* / Brazilian Sugar and Alcohol Technician Society;
- *Associação dos Moradores da Cohab de Rio Formoso /* Residents Association of Cohab from Rio Formoso;

[12] The copies of these invitations are available from the Project participants.

- *Associação de Desenvolvimento do Distrito de Cucaú /* Development Association District of Cucaú;

- *Centro de Pesquisas Ambientais do Nordeste – CEPAN /* Northeast Environment Research Centre;

- *Instituto para Preservação da Mata Atlântica – IPMA /* Atlantic Forest Preservation Institute.

G.2. Summary of the comments received:

Until the date of completing the final draft of this document, six comments were received by the listed local stakeholders, as showed below:

- *Sindicato da Indústria do Açúcar e do Álcool no Estado de Pernambuco* - *Sindaçúcar* / Sugar and Alcohol Industry Syndicate of Pernambuco State;

- *Centro de Pesquisas Ambientais do Nordeste – CEPAN /* Northeast Environment Research Centre;

- *Prefeitura Municipal de Rio Formoso – PE /* Municipal Administration of Rio Formoso – PE;

- *Secretaria da Agricultura, Indústria, Comércio e Meio Ambiente* / Agriculture, Industry, Commerce and Environmet Secretary;

- *Câmara dos Vereadores de Rio Formoso – PE /* Municipality Chamber of Rio Formoso – PE;

- *Associação Comunitária Unidos Por Rio Formoso – UCURF /* Communitariam Association United by Rio Formoso.

In the first case, a letter was sent by Mr. Renato Augusto Pontes Cunha (Sindaçúcar President).

In the second case, a letter was sent by Ms. Sônia Aline Roda (CEPAN Project Director).

In the third case, a letter was sent by Ms. Graça Hacker (Rio Formoso Mayor).

In the fourth case, a letter was sent by Mr. Robson Jerônimo Lins de Oliveira (Agriculture, Industry, Commerce and Environmet Secretary).

In the fifth case, a letter was sent by Mr. Cláudio Marcos da Silva, Mr. Marcondes Alves de Figueredo and Mr. José Pereira do N. Filho (President, Vice-President and Secretary of Municipality Chamber of Rio Formoso).

In the sixth case, a letter was sent by Mr. José Fernando Barreto Lins (ACURF President).

All the mentioned letters contains several positive comments about CBCP. They enhance the importance of the Global Climate Change associated with the Global Warming Potential and the contribution, by the Cucaú Bagasse Cogeneration Project, for the mitigation of Greenhouse Gases effects.

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

Since the comments provided required no further explanation nor feedback, the consultation process was ended.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project participant – 1:

Organization:	Zihuatanejo do Brasil Açúcar e Álcool S.A.
Street/P.O.Box:	Av. Artur Siqueira, S/Nº - Zona Rural - Parque Industrial Engenho Cucaú
Building:	
City:	Rio Formoso
State/Region:	PE
Postfix/ZIP:	55575-000
Country:	Brazil
Telephone:	+55 (81) 3224-0506
FAX:	+55 (81) 3224-0672
E-Mail:	
URL:	
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Silva
Middle Name:	Tavares da
First Name:	Afrânio
Department:	Project Manager
Mobile:	-
Direct FAX:	-
Direct tel:	+55 (81) 3224-0665
Personal E-Mail:	afranio@usinacucau.com.br

Project participant – 2:

Organization:	Econergy Brasil Ltda.
Street/P.O.Box:	Rua Pará, 76 cj 41
Building:	Higienópolis Office Center
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	01243-020
Country:	Brazil
Telephone:	+ 55 (11) 3219-0068
FAX:	+55 (11) 3219-0693
E-Mail:	-
URL:	http://www.econergy.com.br
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Diniz Junqueira
Middle Name:	Schunn
First Name:	Marcelo
Department:	-
Mobile:	+55 (11) 8263-3017
Direct FAX:	Same above
Direct tel:	+ 55 (11) 3219-0068 ext 25 and/or mobile
Personal E-Mail:	junqueira@econergy.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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