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

CONTENTS

A. General description of project activity

B. Application of a baseline methodology

C. Duration of the project activity / Crediting period

D. Application of a monitoring methodology and plan

E. Estimation of GHG emissions by sources

F. Environmental impacts

G. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

Usina Petribú Renewable Generation with Sugarcane Bagasse, Version 1.3

Date: Monday, April 10, 2006

A.2. Description of the project activity:

The Usina Petribú Renewable Generation Project Activity (hereafter, the Project) developed by Grupo Petribú (hereafter, the Project Developer) is a sugarcane bagasse electricity generation project divided into two components:

1. A **22MWe** expansion of an existing on-site plant. This plant was built under the Brazilian Government Emergency Plan for the production of electricity and is fuelled by fossil fuels. It is under a contract with the government until December 2005. The proposed project activity involves expanding the capacity of this fossil-fuel plant with a **biomass-based turbine**, which will start generating electricity at the end of the contract with the government. In absence of the proposed project activity, the project participant would be expanding the plant based on fossil fuels. The electricity generated by the plant will be sold to the national electricity grid, which is relatively carbon-intensive. To guarantee biomass supply and prevent stoppages due to insufficient sugarcane bagasse, Petribú is in addition planting 300 hectares of bamboo.

2. Another **22MWe** expansion of an existing captive power plant fuelled by biomass with 10 MW generating capacity currently installed. The surplus of electricity produced by the new turbine will be sold to the grid.

The objective of the project is to satisfy the increased demand for energy due to production expansion and the increased demand of electricity in the region, with a clean alternative to the more fossil-fuel-intensive electricity grid. The total size of the proposed project activity is of **44MWe**, consisting of the two above-mentioned components. The project is located at the Petribú sugarcane plant, in the city of Lagoa de Itaenga, in the Brazilian state of Pernambuco.

The project is helping the Host Country fulfil its goals of promoting **sustainable development**.
Specifically, the project:

- Increases employment opportunities in the area where the project is located;
- Diversifies the sources of electricity generation;
- Uses clean and efficient technologies, and conserves natural resources; thus the project will be meeting the Agenda 21 and Sustainable Development Criteria of Brazil.
- Acts as a clean technology demonstration project, encouraging development of modern and more efficient cogeneration of electricity and thermal energy using biomass fuel throughout the country;
- Optimises the use of natural resources, thus reducing the need for new uncontrolled waste disposal sites.

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be in indicated using the following tabular format.		
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)	Grupo Petribú (private)	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.		

Contact details of parties to the project are listed in Annex 1.

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.:

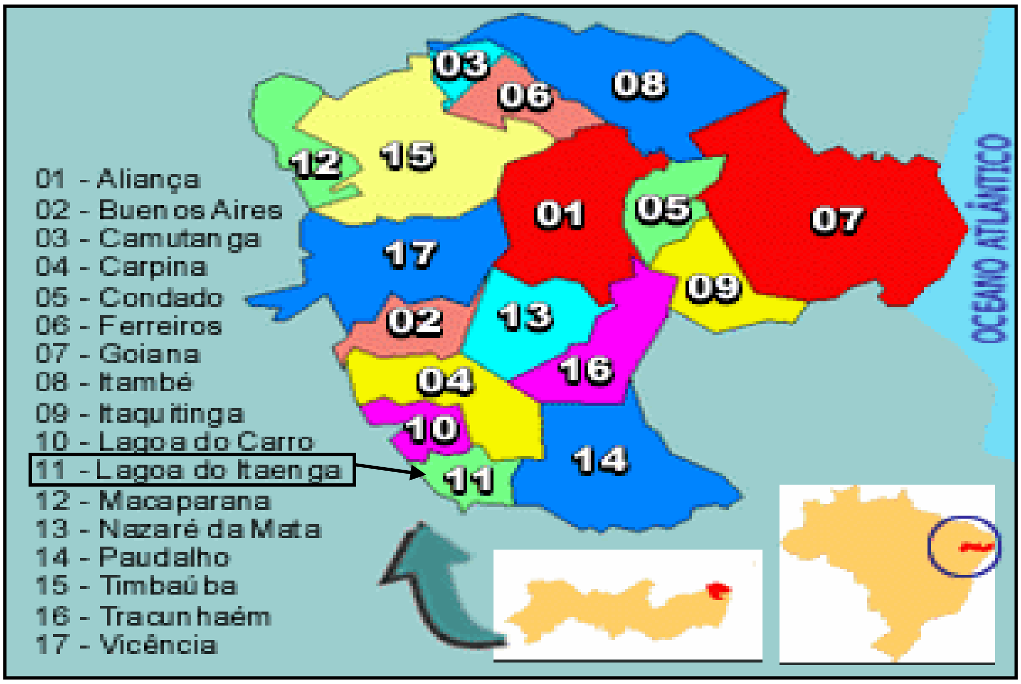
State of Pernambuco – Northeast of Brazil

A.4.1.3. City/Town/Community etc:

City of Lagoa de Itaenga

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

Rodovia PE 53 – Km 05 – Engenho Petribú – Lagoa de Itaenga – Pernambuco – CEP 55819-970



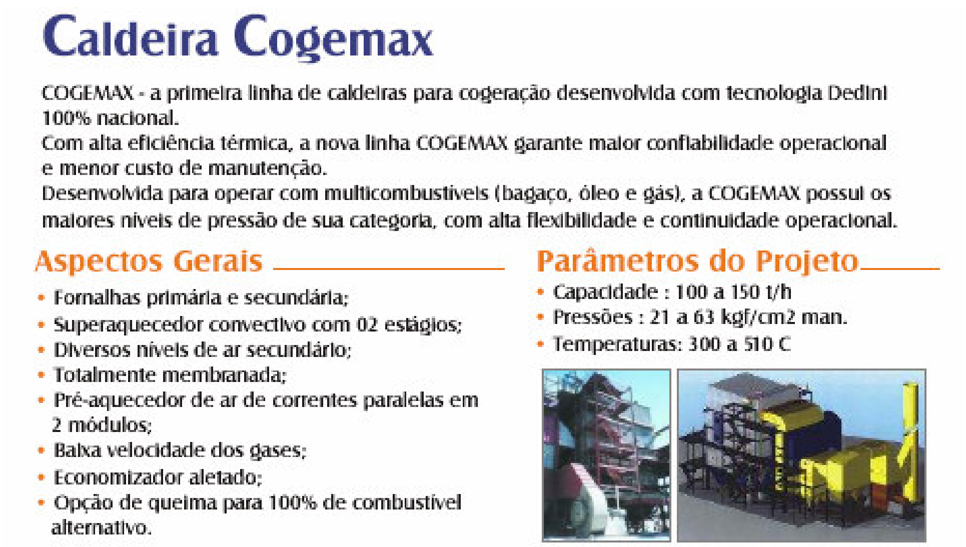
Source: www.citybrazil.com.br

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

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

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

The turbines to be installed are both manufactured by Brazilian companies, with the generators manufactured by Weg, also a Brazilian technology provider. The biomass-fired boiler is a Cogemax 150 MM model that uses high pressure to produce 150 tonnes of steam/hour and is manufactured by a Brazilian company, called Dedini. The technology and know-how being promoted by this project are environmentally safe and contribute to greater efficiency in energy use. The successful completion of this project activity is likely to contribute to the adoption of similar cogeneration technologies by firms in this and other industry sectors in Brazil.



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:

The Petribú plant will reduce GHG emissions by displacing fossil fuel based electricity generation with GHG-neutral biomass electricity generation. The project activity is expected to achieve GHG emission reductions of 76,345 tonnes CO_2equivalent until 2012 and 229,034 tonnes CO_2equivalent until 2026.

In the Baseline Scenario, burning bagasse for generation of process heat and power production is a practice already established by typical Brazilian sugarcane mills. Due to constraints that limit the access of independent power producers to the electricity utilities market, there has been no incentive for sugarcane mills to operate in a more efficient way. The Brazilian electric sector legislation nowadays recognises the role of independent power producers, which has encouraged interest in improving boiler efficiency and increasing electricity generation at mills, allowing the production of enough electricity not only to satisfy sugar mills' need but also a surplus amount that can be sold to the electricity market. Furthermore, the current increasing demand for electricity opens an investment opportunity for some bagasse cogeneration power plants in Brazil.

Additionally, the feature of electricity generation from sugarcane origin during the dry months of winter, when hydroelectric generation system - the most important electricity source in the country - is under stress, provides for a considerable complementary energy and makes the bagasse cogeneration electricity attractive to potential purchasers.

Nevertheless, financial and other 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. 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 enough that it will produce sufficient biomass to supply its cogeneration project. Although it seems easy to predict, the variation of sugarcane productivity ranges from 75 to 95 tonnes of sugarcane per hectare annually depending on the rainfall. 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 in price. So, the revenue from GHG emission reductions and other benefits associated with CDM certification offer a sound investment opportunity for some sugar mills, which might expand its electric power generation capacity and operate in a more rationale way under the new electric power sector circumstances.

The introduction of natural gas as a source for electricity generation is coming at the same time as Brazil is privatising the energy sector. Two 1995 laws restructured the industry and laid the groundwork for private investment. Once thermal plants tend to have lower capital costs and shorter paybacks than new hydropower ones, the private-sector investment criteria has been favouring thermal plants. As a result, an increase in the amount of CO2 emissions in the Brazilian energy sector in the next years is expected.

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

Year	Estimated annual emission reductions in tCO_2e
2006	10,906
2007	10,906
2008	10,906
2009	10,906
2010	10,906
2011	10,906
2012	10,906
2013	10,906
2014	10,906
2015	10,906
2016	10,906
2017	10,906
2018	10,906
2019	10,906
2020	10,906
2021	10,906
2022	10,906
2023	10,906
2024	10,906
2025	10,906
2026	10,906
Total emission reductions 7 years (tCO2e)	**76,345**
Total emission reductions 14 years (tCO2e)	**152,689**
Total emission reductions 21 years (tCO2e)	**229,034**
Renewable Crediting Period	3 x 7 years = 21 years
Mean annual emission reductions (t CO2e)	10,906

In the Project Scenario, Petribú will displace about 84,480 MWh/year of electricity from the Northeast grid with biomass-generated electricity. The estimate of total reductions from the project is 229,034 tonnes of CO_2e over 21 years and 76,345 tonnes of CO_2e over the first 7-year crediting period. The project has the potential to avoid 10,906 tonnes of CO_2 per year.

A.4.5. Public funding of the project activity:

The project will not receive any public funding from Parties listed in Annex I of the UNFCCC.

SECTION B. Application of a baseline methodology

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

ACM0006 – "Consolidated baseline methodology for grid-connected electricity generation from biomass residues."

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

The project is a bagasse-based cogeneration project connected to Brazil's North-Northeast (N-NE) electricity grid as described in ACM0006 and meets all conditions listed in the applicability criteria of methodology ACM0006.

Specifically the project activity involves "the installation of a new biomass power generation unit, which is operated next to existing power generation capacity fired with either fossil fuel or the same type of biomass residue as in the project plant (power capacity expansion project)."

The biomass used here – sugarcane bagasse – is a waste stream from an agricultural industry and no other types of biomass are used. The biomass is not stored for more than one year. The project activity does not result in an increase in the production of the processing capacity of raw sugarcane input.

The project consists of two parts that fall under two different scenarios outlined in the chosen methodology. The first 22Mwe expansion involves the installation of a new biomass power unit, which will be operated next to an existing fossil fuel power plant. The power generated by the project plant is fed into the grid and thus displaces relatively more carbon-intensive electricity from the grid.

The second 22MWe expansion involves the installation of a new biomass power unit next to an existing biomass power generation unit, which is only fired with biomass and continues to operate. The power generated by the project plant is fed into the grid and thus displaces relatively more carbon-intensive electricity from the grid.

These two capacity expansions most closely match **Scenario 10 of Methodology ACM0006**.

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

Methodology "ACM0006 – Consolidated baseline methodology for grid-connected electricity generation from biomass residues" has been applied to the project through the determination of the emissions factor for the North-Northeast (N-NE) subsystem of the Brazilian grid.

The project activity follows the individual steps outlined by the chosen methodology to arrive at a suitable and conservative carbon emission factor for the northern and northeastern electricity grid of Brazil. For the calculation of the Operating Margin, Option b) Simple Adjusted OM was chosen over the more desirable Option c) Dispatch Data Analysis, due to the lack of detailed and publicly available dispatch data in Brazil. The Build Margin (BM) is calculated using Option 1 using publicly available data on the carbon emissions factor of Brazil's electricity grids for the three most recent years available: 2002-2004.

The following table summarizes the most important baseline parameters:

ID Number	Data Type	Value	Data Unit	Source of Data
1. EG_y	Electricity supplied to the grid by the project activity	Obtained during the lifetime of the project activity	MWh	Usina Petribú
2. EF_y	Emission Factor of N-NE Electricity Grid (tCO2e/MWh)	0.1291	tCO_2e/MWh	Calculated
3. $EF_{OM, simple adjusted, y}$	Simple Adjusted Operating Margin	0.1800	tCO_2e/MWh	This value was calculated using date provided by the National System Operator of Brazil (ONS), the regulatory body of the Brazilian grid and has been approved for other CDM projects in Brazil
4. $EF_{BM, y}$	Build Margin	0.0783	tCO_2e/MWh	This value was calculated using date provided by the National System Operator of Brazil (ONS), the regulatory body of the Brazilian grid and has been approved for other CDM projects in Brazil
10. λ_y	Fraction of hours per year that low-cost/must-run sources are on the margin	λ_{2002} = 0. 9390 λ_{2003} = 0. 7192 λ_{2004} = 0.5317		This value was calculated using date provided by the National System Operator of Brazil (ONS), the regulatory body of the Brazilian grid

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:

The proposed project activity will result in the reduction of greenhouse gases that would not occur if the project were not implemented. The numerous barriers and risks associated with the implementation of the proposed project activity that are identified clearly demonstrate that this project activity is not the baseline as usual scenario.

The tool used to demonstrate the additionality is the "Consolidated tool for demonstration of additionality", which is part of the methodology ACM0006. This tool for assessing additionality follows a step-based approach. Explanation on how additionality for the proposed project activity is proven following the consolidated tool for additionality follows.

Step 0 – Preliminary screening of projects started after 1 January 2000 and prior to 31 December 2005

Not applicable

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

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

Alternative 1. A 44MW co-generation plant not undertaken as a CDM project;
Alternative 2. A 44MW fossil-fuelled on-site plant;
Alternative 3. Continuation of the current situation through the addition of 44MW of additional capacity to the national grid

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

Alternatives 1, 2 and 3 are in compliance with all applicable legal and regulatory requirements in Brazil, and this is expected to remain so in the future.

Step 3 – Barrier Analysis

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

- Technology barriers: The low efficiency of cogeneration systems used in the Brazilian sugarcane industry makes this alternative uncompetitive vis-à-vis other generation technologies. COELHO[1] emphasizes the importance of economies of scale. However, these are notoriously difficult to achieve in the sugar industry, as units are usually kept small to avoid unnecessarily high biomass transportation costs.

- Investment barriers: According to Brazilian Ministry of Mines and Energy (2003)[2], Brazil's public sector energy investments are not focussed on biomass cogeneration. In 2002, approximately 80% of installed capacity consisted of hydropower; with the remaining capacity made up of other sources, including coal and oil and increasingly natural gas. However, the primary energy matrix is about to

[1] COELHO, Suani T. Mecanismos para implementacao da cogeracao de eletricidade a partir da biomassa: um modelo para o Estado de Sao Paulo. Soa Paulo: Programa interunidades de pos-graduacao em energia, 1999

[2] Expansion Decennial Plan 2003-2012 – Brazilian Ministry of Mines and Energy

change, especially due to introduction of substantial volumes of natural gas, mainly for use in to electricity generation. Natural gas consumption is projected to rise from a current 20 million m^3/day to around 90 million m^3/day in 2005. Brazil has a modest natural gas resources (220. 8 billion m^3 as of January 2002 the fifth largest in South America), therefore much of this increase is expected to be provided by imports. Brazil recently constructed new natural gas pipeline infrastructure to bring gas from other countries in the region to fuel new gas-fired capacity (Jalles Machado BCP, 2003). Due to the increase in the Brazilian electricity demand, the government is investing in existing technology rather than implementing a new, lower emitting technology. The government expansion plan for the energy sector aims to increase thermal capacity from 9% to 17%.

The current low level of electricity tariffs in Brazil and the relatively high cost of electricity from co-generation plants make this type of generation technology uncompetitive. According to the Expansion Decennial Plan of the Brazilian government, the marginal cost per MWh of electricity from conventional sources is calculated to be US$33. This is considerably less than the price range for co-generated electricity which can be anywhere between US$35 and US$105 per MWh.

- Institutional barriers: According to a recent study developed by the World Alliance for Decentralized Energy (WADE, 2004)[3], despite improvements in the regulatory environment for bagasse cogeneration, there remain some key issues that need to be addressed if the full potential is to be achieved. These include:

    - Detailed rules for interconnection apply only to central power plants, whilst interconnection arrangements for on-site systems in general remain to be clearly defined. Utilities often apply old system rules that do not permit ‘inside-the-fence’ generators to run in parallel with the grid. Open access to the electricity system is thus only facilitated for central power. This is likely to predominantly affect the smallest sugar mills that have less weight than larger players such as the Petribú sugar mill and other Brazilian small producers. Requirements for connection protection and measurement are still strict, causing difficulties and added expense that affect small IPPs in particular.

    - The output of electricity from bagasse cogeneration plants is fundamentally dependent on the prevailing electricity market rules, and inadequate buyback prices paid to mill owners by the utility create a substantial disincentive to size cogeneration plants to meet heat demand. Although the PROINFA Brazilian Government Programme (Program for Incentive of Alternative Electric Energy Sources) promotes renewable energy including biomass, it works by providing guaranteed prices that are higher than the market price for electricity for the next 20 years. However, this project has **not** qualified to receive subsidies under the PROINFA program. In fact, the economic value is the reason that Brazilian utilities do not buy cogeneration electricity energy, while energy sector regulation does not guarantee them the right to pass such cost through the end user tariff. According to the Expansion Plan 2001-2010 from Ministry of Mines and Energy (2001), the cost of cogeneration electricity ranges from US$35 to US$105 per MWh, which is described as higher than the marginal cost for electricity expansion in the system - US$33/MWh. Concerning financial procedures to electricity purchase, the National Social Development Bank (known as BNDES-Banco Nacional de Desenvolvimento Social) responsible for several Brazilian investments, is claiming extra guarantees besides PPAs to approve cogeneration projects.

[3] Bagasse Cogeneration: Global Review and Potential. 2004. WADE – World Alliance for Decentralized Energy.

- Despite the creation of PROINFA, investors have not been stimulated to finance bagasse-based cogeneration electricity production. The program was created in April 2002 to increase the share of alternative systems in the Brazilian energy generation mix from Autonomous Independent Producers (PIA). The first phase of PROINFA aims to integrate 3.3GWe of capacity through contracts between Eletrobrás (the State electricity company) and PIAs lasting up to 15 years. However, for this first phase, only 995 MW were achieved due to lower biomass feed-in tariffs, of which only 205 MW is for the Northeast Region, where the Petribú project is located. This is insignificant, considering that the Brazilian cane industry has a potential equal to 12GW (WADE, 2004). Besides, concerning the decree 4541 that has regulated PROINFA, it was not adequately elaborated since is lacking essential data to project developers initiate their financial and economical feasibility studies. Also in this decree, the text is confusing concerning guarantees on government electricity purchase, consequently the developers cannot be sure about biomass-based cogeneration projects.

- The sugar industry has not yet developed the necessary management skills to effectively enter the power generation market. Negotiation skills necessary to implement long-term PPAs and to manage the risk of power generation from variable biomass fuel supplies are still lacking in the industry. There is therefore considerable risk attached to this type of activity from a management perspective.

As for reasons above, it is not expected that the project activity (proposed project activity without CDM) would occur in the absence of the CDM and that the emissions would be reduced below those that would occur in the absence of the project activity. Thus, the proposed project activity passes step 3 of the additionality test.

Step 4 – Common Practice Analysis

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

Although Brazil is a country endowed with large sugarcane plantations, it is still very far from exploiting the resource extensively and efficiently given the barriers outlined in Step 3. There are no similar project activities in the area where the proposed project activity takes place.

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

There are no similar options that are occurring in the sector.

Step 5 – Impact of CDM Registration

This section clearly explains how the approval and registration of the project as a CDM activity, and the attendant benefits and incentives derived from the project activity, will alleviate the investment and institutional hurdles shown in Step 3 and thus enable the project to be undertaken.

For the proposed project activity, the CDM revenue expected for the project has been one of the key issues that encourage the project developer to undertake the proposed project activity. The impact of approval and registration of the project as a CDM activity will bring economic benefits to the host country, helping to insulate the national economy from the fluctuations on price of oil. This will bring prices of electricity down, create a more stable economic environment, and therefore will help to create a more attractive environment for foreign investment in Brazil.

Thus, based on the five-step analysis above, it has been clearly demonstrated that the proposed CDM project activity is not the baseline scenario.

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

The system boundary for the baseline is defined as the North-North East subsystem of Brazilian national grid and will include all the direct emissions related to the electricity produced by the plants displaced by the Project activity.

Emissions from the transport of the biomass to the project site are deemed to be irrelevant as the biomass is already located at the site.

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:

The project is using ACM0006 – "Consolidated baseline methodology for grid-connected electricity generation from biomass residues."

The baseline study was concluded in **December 2005**.

The entity determining the baseline and participating in the project, as the technical consultant is **MaxAmbiental**, Brazil, listed in Annex 1 of this document.

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:

01/01/2005

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

21 years

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:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Application of a monitoring methodology and plan

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

"Approved consolidated monitoring methodology for grid-connected electricity generation from biomass residues." - ACM0006

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

The methodology considers monitoring emissions reductions generated from cogeneration projects fuelled from 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 plants off-grid, which is the case of the proposed project activity.

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 *(Please use numbers to ease cross-referencing to D.3)*	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

Not applicable as the project activity generates electricity from a carbon neutral biomass source.

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

Not applicable as the project activity generates electricity from a carbon neutral biomass source.

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	*Project participant*	*MWh*	*m*	*Monthly*	*100%*	*Electronic and Paper*	*Electricity supplied by the project activity to the grid. Verify against sales receipts.*
2.	EF_y	*ANEEL, ONS, Eletrobrás*	*MWh/yr*	*m*	*Monthly*	*100%*	*Electronic and Paper*	*Energy generated by fossil fuel-fired plants connected to the Brazilian grid. Data to be obtained through ANEEL (the Brazilian electricity agency), ONS (the national system operator), Eletrobrás (the state-owned holding company in charge of managing the largest generators in Brazil)*
3.	*EF_OM*	*ANEEL, ONS, Eletrobrás*	*tCO2e/MWh*	*c*	*Upon validation and again after registration*	*100%*	*Electronic and Paper*	*Energy generated by fossil fuel-fired plants connected to the Brazilian grid. Data to be obtained through ANEEL (the Brazilian electricity agency), ONS (the national system operator), Eletrobrás (the state-owned holding company in charge of managing the largest generators in Brazil)*
4.	*EF_BM*	*ANEEL, ONS, Eletrobrás*	*tCO2e/MWh*	*c*	*Upon validation and again after registration*	*100%*	*Electronic and Paper*	*Energy generated by fossil fuel-fired plants connected to the Brazilian grid. Data to be obtained through ANEEL (the Brazilian electricity agency), ONS (the national system operator), Eletrobrás (the state-owned holding company in charge of managing the largest generators in Brazil)*

10.	λ_y	*ANEEL, ONS, Eletrobrás*	*index*	*c*	*Upon validation and again after registration*	*100%*	*Electronic and Paper*	*Energy generated by fossil fuel-fired plants connected to the Brazilian grid. Data to be obtained through ANEEL (the Brazilian electricity agency), ONS (the national system operator), Eletrobrás (the state-owned holding company in charge of managing the largest generators in Brazil)*

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

Formulae used to calculate **Grid Emission Factor** in accordance with Combined Margin calculation described in ACM0002 (as required in ACM0006).

A. Combined Margin Calculation

Combined Margin (CM) consist of Operating Margin (OM) and Build Margin (BM) multiplied by specific weights **ω**

Step 1, Option b) Simple Adjusted OM: This option has been chosen due to the lack of accurate Dispatch Data required for Option c).

Simple Adjusted OM:

$$EF_{OM,simpleadjusted,y} = (1-\lambda_y)\times\frac{\sum_{i,j} F_{i,j,y}\times COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \times \frac{\sum_{i,k} F_{i,k,y}\times COEFk}{\sum_k GEN_{k,y}}$$

Step 2, Option 1)

Build Margin:

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

Step 3

Combined Margin:

$$EF_y = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y}$$

Where:

$F_{i,j,y} =$ Amount of fuel i (mass/volume units) consumed by relevant power sources j (or k) in year y

$j =$ Power sources delivering electricity to the grid NOT including low-operating cost and must-run power plants

$k =$ Low-cost/Must-run power sources

$m =$ Sample of power plants (**either** 5 most recently built power plants **or** power plants capacity additions that comprises 20% of system generation (in MWh) and that have been built most recently)

$COEF_{j,y} =$ CO_2 emission coefficient of fuel i (tCO_2/mass or volume of fuel)

$GEN_{j,y} =$ Electricity (MWh) delivered to the grid by source j or k

$$\lambda_y = \frac{\text{No. of hours k is on margin}}{\text{8760 hours per year}}$$

For y the two following data vintages can be used:

a) A 3-year average, based on the most recent statistics available at the time of PDD submission;
b) The year in which project generation occurs, if $EF_{OM,\ y}$ is updated based on ex-post monitoring

$\omega =$ Weights (0.5 by default)

B. Baseline Emissions Calculation

$$BE_{Electricity,y} = EF_y \times EG_y$$

EG_y corresponds to the lower value between (a) the net quantity of electricity generated in the new power unit that is installed as part of the project activity and (b) the difference between the total net electricity generation by the new power unit and the existing power unit(s) and the historical generation of the existing power unit(s), based on the three most recent years, as follows:

$$EG_y = EG_{total,y} - \frac{EG_{historic,3yr}}{3}$$

EG_y is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh,

$EG_{total,y}$ is the net quantity of electricity generated in all power units fired with the same type of biomass at the project site, including the new power unit installed as part of the project activity and any previously existing units, during the year y in MWh,

$EG_{historic,3yr}$ is the net quantity of electricity generated during the most recent three years in all power plants fired with the same type of biomass at the project in MWh

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

Not applicable

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 *(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

Not applicable

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

Not applicable

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 *(Please use numbers to ease cross-referencing to table D.3)*	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
11.	*Existence of biomass market*	*General market information*	*N/A*	*N/A*	*At the start of every crediting period*	*N/A*	*Electronic and Paper*	*If a market for biomass has arisen since the last period, the relevant leakage formula from ACM0006 will be employed to calculate project Leakage.*

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

The main source of leakage for this type of project activity in accordance with the chosen methodology, ACM0006, is an increase in emissions from fossil fuel combustion due to the diversion of biomass from other sources to the project plant as a result of the project activity. In the case of this project activity the most likely baseline scenario with reference to the sugarcane bagasse is that the biomass is left to decay in an uncontrolled manner without utilizing it for energy purposes.

Nonetheless part of the monitoring plan of the project activity will be the periodic re-assessment of the biomass situation. In doing so Option L1 for Leakage calculation was chosen from the applicable monitoring methodology. Currently biomass residues are left to rot at the project site. The project does not buy biomass from a dedicated biomass market but rather uses biomass residues from the on-site processing of sugar. It is likely that this practice would continue in the absence of the project activity. It is also significant to note that in the immediate region of the project cheap hydroelectricity from the San Francisco River basin covers the energy needs of major electricity users. A biomass market is therefore unlikely to emerge in the foreseeable future.

While leakage is assumed to be zero for the first crediting period, for subsequent periods a reassessment of the biomass situation will occur and to determine whether a market for biomass residues has emerged.

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.)

$$ER_y = BE_{Heat,y} + BE_{Electricity,y} - PE_y - L_y$$

$$BE_{Heat,y} = 0$$

$$PE_y = 0$$

$$L_y = 0$$

$$BE_{Electricity,y} = EF_y \times EG_y$$

Where:

ER_y = Emission reductions of project activity during year y in tonnes of CO_2

$BE_{Electricity,y}$ = Emission reductions due to displacement of electricity during year y in tonnes of CO_2

PE_y = Project emissions during year y in tonnes of CO_2

L_y = Leakage emissions during year y in tonnes 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*	*Directly used in the calculation of the emission reductions. Electricity sales receipts used to assure 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.*
11	*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

To ensure accuracy and consistency of the data, monthly checks will be carried out with calibrated measuring instruments. The only data variable to be measured is the quantity of electricity sold to the grid. This can be accurately established by gauging total operational hours per month of the generating engines and will be crosschecked against the official electricity sales receipts. Hence the operational and management structure will include the following two steps to be carried out by dedicated and trained personnel reporting to the responsible manager:

- Meter readings to determine the exact quantity of electricity sold to the grid (EG_y) and the number of operational hours for each engine.
- Archiving of relevant readings in an electronic spreadsheet and regular printouts for paper archiving.
- In case of data inconsistency the official electricity sales receipts will be used.
- Regular calibrations will be carried out to ensure the accuracy of the monitoring devices.

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

Ben Salm-Reifferscheidt
MaxAmbiental S.A. Brasil (see Annex 1 for contact details)

MaxAmbiental is a project participant and responsible for all carbon-related technical services pertaining to this project.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The project participant has decided to ignore CH_4 emission from both project and baseline emissions.

This project does not generate any additional GHG emissions as it uses renewable biomass as a fuel.

Hence the variable PE_y does not need to be measured.

i.e. $PE_y = 0$

E.2. Estimated leakage:

Usina Petribú has not historically sold any sugarcane bagasse to third parties. Therefore the project activity will not divert sugarcane bagasse from one user to another. Hence the project activity has no leakage.

i.e. $L_y = 0$

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

There are no emissions associated with the project activity.

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

According to the baseline methodology used the main emissions source to be determined are CO_2e emissions from fossil fuel plants in the relevant electricity grid. In the absence of the project activity these fossil fuel plants would continue to generate power and emit GHGs.

To determine the baseline emissions it is first necessary to select the relevant regional electricity grid affected by the project activity. Of the two major Brazilian grids – South/South West/Mid West and North/North East – it is the latter that is of relevance to this project activity.

To arrive at the relevant emissions factor for this particular grid, the Combined Margin (CM) needs to be calculated from the "Simple Adjusted Margin" and the "Build Margin" using publicly available electricity grid data. The more desirable "Dispatch Data Analysis" cannot be carried out due to the lack of available data. The relevant Combined Margin for this project activity is based on several similar Brazilian sugarcane bagasse-based power generation projects within the CDM that have already been validated and approved by the DNA. This step has been opted for due to the lack of readily available data from the relevant electricity sector regulatory bodies.

The formula used to calculate the simple, adjusted operating margin is as follows:

$$EF_{OM,simpleadjusted,y} = (1-\lambda_y)\times\frac{\sum_{i,j} F_{i,j,y}\times COEF_{i,j}}{\sum_{j} GEN_{j,y}} + \lambda_y \times \frac{\sum_{i,k} F_{i,k,y}\times COEFk}{\sum_{k} GEN_{k,y}}$$

Where:

$\frac{\sum_{i,k} F_{i,k,y}\times COEFk}{\sum_{k} GEN_{k,y}} = 0$ as k refers to must-run/low-cost zero emission resources such as hydroelectric plants.

According to the ONS data supplied, the lambdas for the years 2002, 2003, and 2004 are as follows:

$$\lambda_{2002} = 0.9390$$
$$\lambda_{2003} = 0.7192$$
$$\lambda_{2004} = 0.5317$$

Total energy generation for the relevant grid was:

Year	Electricity Generation (MWh)
2002	68,779,390
2003	68,630,265
2004	77,553,416

From this and additional information one arrives at the following **annual simple, adjusted operating margins**:

$$EF_{OM,simpleadjusted,2002} = (1-0.9390)\times\frac{\sum_{i,j} F_{i,j,2002}\times COEF_{i,j}}{\sum_{j} GEN_{j,2002}} = 0.0480\ tCO_2e/MWh$$

$$EF_{OM,simpleadjusted,2003} = (1-0.7192)\times\frac{\sum_{i,j} F_{i,j,2003}\times COEF_{i,j}}{\sum_{j} GEN_{j,2003}} = 0.2120\ tCO_2e/MWh$$

$$EF_{OM,simpleadjusted,2004} = (1-0.5317)\times\frac{\sum_{i,j} F_{i,j,2004}\times COEF_{i,j}}{\sum_{j} GEN_{j,2004}} = 0.2780\ tCO_2e/MWh$$

$$EF_{OM,simpleadjusted,2002-2004} = \frac{0.0480+0.2120+0.2780}{3} = 0.1800\ tCO_2e/MWh$$

And the **Build Margin** (for the Year 2004, the most recent for which information is available):

$$EF_{BM,2004} = \frac{\sum_{i,m} F_{i,m,2004}\times COEF_{i,m}}{\sum_{m} GEN_{2004}} = 0.0783\ tCO_2e$$

Which leads to a Combined Margin of:

$$EF_y = \omega_{OM}\times EF_{OM,y} + \omega_{BM}\times EF_{BM,y} = 0.5\times 0.1800 + 0.5\times 0.0783 = 0.1291\ tCO_2e$$

And Total Baseline Emissions of:

$$BE_{Electricity,y} = EF_y \times EG_y = 0.1291\times EG_y$$

Where:

$F_{i,j,y} =$ Amount of fuel i (mass/volume units) consumed by relevant power sources j (or k) in year y

$j =$ Power sources delivering electricity to the grid NOT including low-operating cost and must-run power plants

$k =$ Low-cost/Must-run power sources

$m =$ Sample of power plants (**either** 5 most recently built power plants **or** power plants capacity additions that comprises 20% of system generation (in MWh) and that have been built most recently)

$COEF_{j,y} =$ CO_2 emission coefficient of fuel i (tCO_2/mass or volume of fuel)

$GEN_{j,y} =$ Electricity (MWh) delivered to the grid by source j or k

$$\lambda_y = \frac{\text{No. of hours k is on margin}}{\text{8760 hours per year}}$$

For y the two following data vintages can be used:

c) A 3-year average, based on the most recent statistics available at the time of PDD submission;
d) The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex-post monitoring
ω = Weights (0.5 by default)

Electricity delivered to the grid ($GEN_{j,y}$) by the project activity is estimated to be **84,480 MWh annually** for the lifetime of the project or a total of 1,774,080 MWh over 21 years.

Year	EF_y (tCO_2e/MWh)	EG_y	$BE_{electricity,y}$ (tCO_2e)
2006	0.1291	84,480	10,906
2007	0.1291	84,480	10,906
2008	0.1291	84,480	10,906
2009	0.1291	84,480	10,906
2010	0.1291	84,480	10,906
2011	0.1291	84,480	10,906
2012	0.1291	84,480	10,906
Total	**0.1291**	**591,360**	**76,345**

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

The total emission reductions ER_y of the project activity during any given year y is the difference between the baseline emissions (BE_y in tCO_2) and leakage:

$$ER_y = BE_y - Leakage - PE_y = 0.0724\, tCO_2e / MWh \times EG_y - 0 - 0$$

As mentioned above (E.2.) leakage and project emissions are assumed to be nil.

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2006	0	10,906	0	10,906
2007	0	10,906	0	10,906
2008	0	10,906	0	10,906
2009	0	10,906	0	10,906
2010	0	10,906	0	10,906
2011	0	10,906	0	10,906
2012	0	10,906	0	10,906
2013	0	10,906	0	10,906
2014	0	10,906	0	10,906
2015	0	10,906	0	10,906
2016	0	10,906	0	10,906
2017	0	10,906	0	10,906
2018	0	10,906	0	10,906

2019	0	10,906	0	10,906
2020	0	10,906	0	10,906
2021	0	10,906	0	10,906
2022	0	10,906	0	10,906
2023	0	10,906	0	10,906
2024	0	10,906	0	10,906
2025	0	10,906	0	10,906
2026	0	10,906	0	10,906
Total (tonnes of CO_2e)	**0**	**229,034**	**0**	**229,034**

SECTION F. Environmental impacts

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

Concerning environmental legislation, CPRH is the local agency responsible for evaluating the impacts assessment reports and also for issuing environmental licenses related to thermoelectric operations. In this case, CPRH has not required from Petribú this type of report because the company's existence is prior to EIA legislation. The only demand related to the proposed project activity is that every year, Petribú has to renew its operational license, conceded by CPRH. Nevertheless, it is not expected that the proposed project activity lead to significant environmental impacts. They might arise from activities (like cane crushing and bagasse burning) that were already in place before the project, though in different conditions and circumstances. Transboundary impacts beyond the borders of country are not envisaged.

The utilization of sugarcane bagasse as fuel has clear positive environmental impacts. Bagasse has traditionally been viewed as a waste product and can cause substantial local environmental pollution in the form of leachate. Its use for fuel is therefore going to reduce such environmental impacts. Additional positive impacts concern the reduction of GHG emissions to the atmosphere as well as the elimination of local pollutants such as SO_2 and N_2O from the combustion of fossil fuels for the generation of electricity.

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:

Not applicable.

SECTION G. Stakeholders' comments

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

A stakeholder meeting has been set for 2PM on 24th of April 2006. Invitations have been sent to all parties involved explaining the project and outlining some of the possible impacts. The rules set out by the Brazilian DNA and the CDM EB have been followed in calling this stakeholder meeting.

G.2. Summary of the comments received:

This will be included after the meeting on 24th of April 2006.

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

This will be included after the meeting on 24th of April 2006.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	
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Salutation:	
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Middle Name:	Cavalcanti
First Name:	Jorge
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project will not receive any public funding from Parties listed in Annex I of the UNFCCC.

Annex 3

BASELINE INFORMATION

Data relevant to the calculation of the N-NE grid carbon emission factor obtained from previously validated and host country approved Brazilian sugarcane bagasse CDM projects.

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.

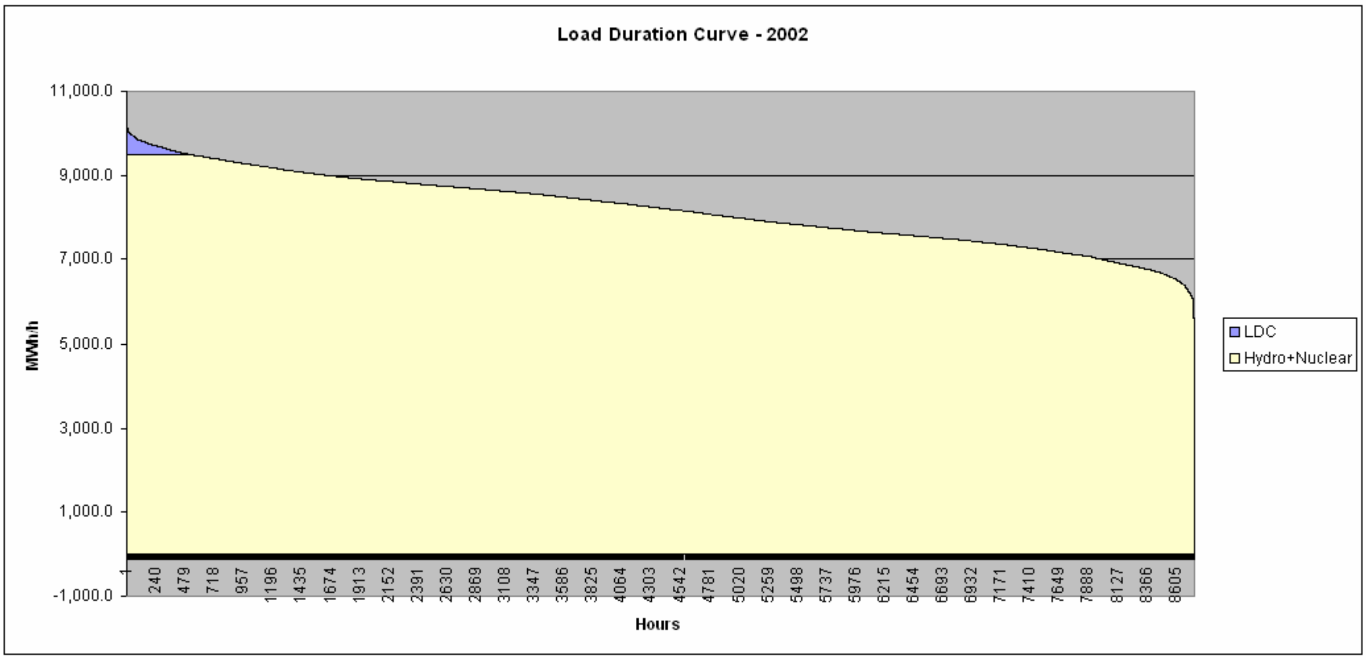
[3] Intergovernamental Panel on Climate Change. *Revised 1996 Guidelines for National Greenhouse Gas Inventories.*

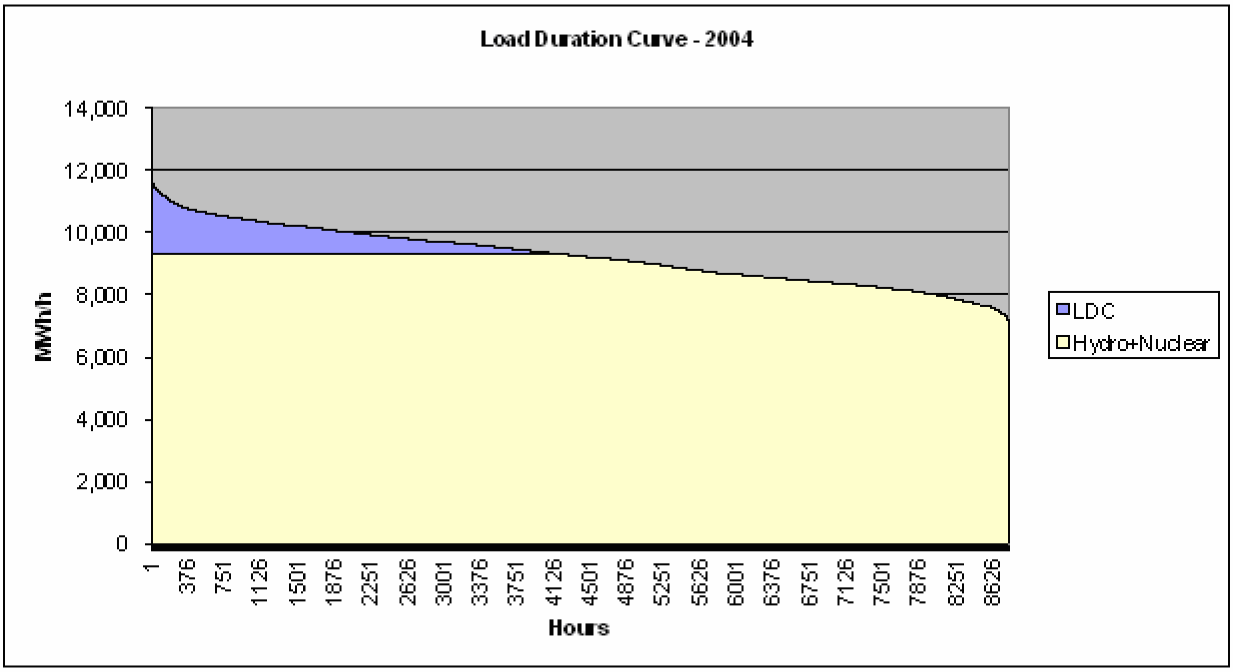
[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. *Acompanhamento Diário da Operação do SIN* (daily reports from Jan. 1, 2001 to Dec. 31, 2003).

[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).

Baseline Calculations	Simple Adjusted Operating Margin (tCO_2e/MWh)	Build Margin (tCO_2e/MWh)	Lambda	Annual Electricity Generation (MWh)	Combined Margin (tCO_2e/MWh)
2002	0.0480	NA	09390	68,779,390	0.1291
2003	0.2120	NA	0.7192	68,630,265	
2004	0.2780	0.0783	0.5317	77,553,416	
Average	0.1800	NA			
Weights					
ω_{OM}	0.5				
ω_{BM}	0.5				

Load Duration Curves

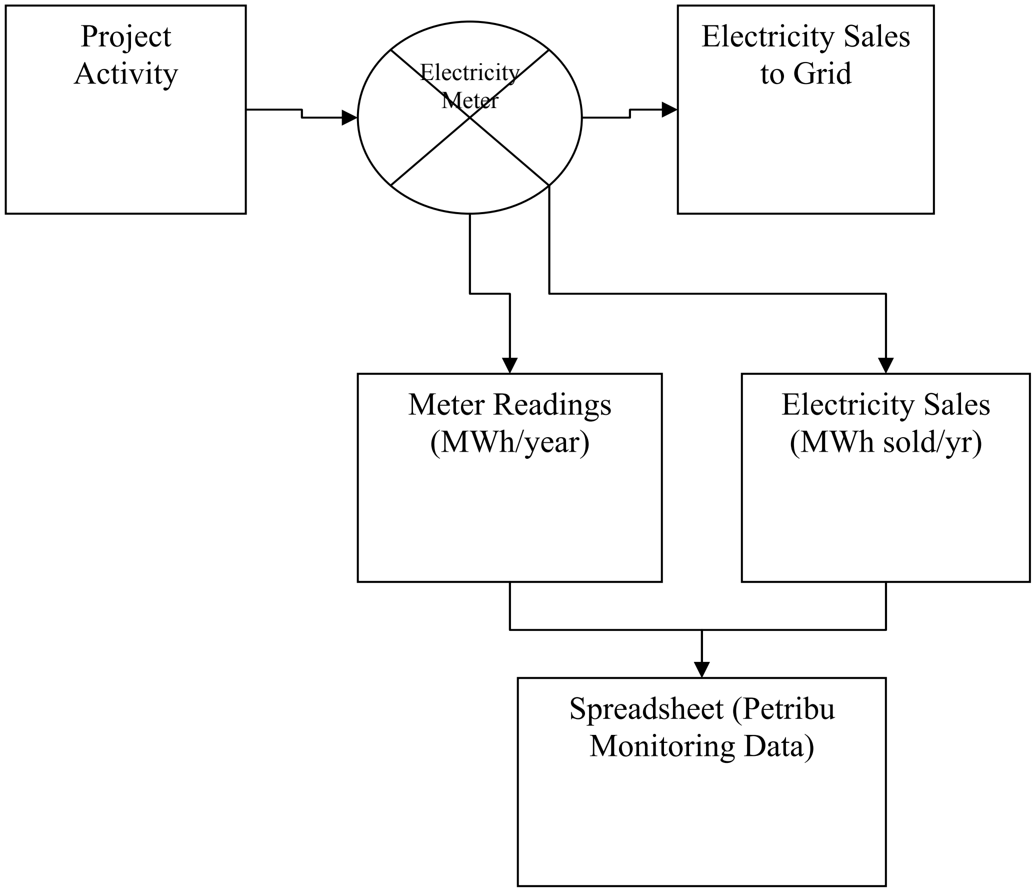

Load Duration Curve - 2002
11,000.0
9,000.0
7,000.0
5,000.0
3,000.0
1,000.0
-1,000.0
MWh
1
240
479
718
957
1196
1435
1674
1913
2152
2391
2630
2869
3108
3347
3586
3825
4064
4303
4542
4781
5020
5259
5498
5737
5976
6215
6454
6693
6932
7171
7410
7649
7888
8127
8366
8605
Hours
LDC
Hydro+Nuclear


Load Duration Curve - 2004
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
MWh
1
376
751
1126
1501
1876
2251
2626
3001
3376
3751
4126
4501
4876
5251
5626
6001
6376
6751
7126
7501
7876
8251
8626
Hours
LDC
Hydro+Nuclear

Annex 4

MONITORING PLAN

The monitoring plan for the Usina Petribú Renewable Generation with Sugarcane Bagasse project activity is relatively simple, as only one variable needs to be regularly monitored which is the quantity of electricity delivered to the grid. No other data is expected to change within the seven-year crediting period. Using on-site electricity meters as well as sales receipts electricity sales will be measured and then archived in a dedicated spreadsheet, which will be kept at least until two years after the last CERs have been certified and issued. At the start of each new crediting period the remaining data as described in Table D.3 will be re-assessed and updated if necessary.


Project Activity
Electricity Meter
Electricity Sales to Grid
Meter Readings (MWh/year)
Electricity Sales (MWh sold/yr)
Spreadsheet (Petribu Monitoring Data)