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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Água Bonita Bagasse Cogeneration Project.
Version 1.
Date of the document: 09/03/2006

A.2. Description of the project activity:

Água Bonita Bagasse Cogeneration Project (hereinafter ABBCP) consists of replacing the existing equipments by new and more efficient ones in order to increase the efficiency of electricity production in the bagasse (a renewable fuel source, residue from sugarcane processing) cogeneration facility at **Destilaria Água Bonita Ltda. (Água Bonita)**, a Brazilian alcohol distillery. With the implementation of this project, the distillery is able to produce electricity in a more efficient way and sell it 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.

The sponsors of the ABBCP 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 ABBCP 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 the sugar mills.

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 Certified Emission Reductions (CERs) 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.

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 the sustainable development.

Água Bonita 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.

a) Contribution to the local environmental sustainability:

ABBCP installation and certification demands the company to follow even stricter control of the environmental impacts, bringing direct environmental benefits. The sugarcane plantation is made in such a way that the nature is preserved or impacted the least possible, minimizing the effect of herbicides and chemical fertilizers. The effluents or sub products (vinasse, soot) are used carefully and technically so that neither the ground nor the underground water streams are contaminated. Air, water and ground pollution are strictly controlled, according with local environmental legislation.

Moreover, the operation of the project itself improves the environmental conditions, once the use of renewable energy sources lower the use of non-renewable ones.

b) Contribution to the improvement of working conditions and employment creation:
ABBCP is a new business for Água Bonita. Thus, installation, operation and maintenance of the thermoelectric plant demand a specialized and dedicated work force. Hence, ABBCP's operation contributes not only for direct employment generation, but also for indirect employment, being those mainly from the technology field, as in research and development, as in the production and maintenance of equipments.

After the cogeneration facility's expansion, Água Bonita will hire 171 more workers during crop season and 72 more workers during the off-crop season, like shown in Table 1.

Table 1. Employers Post-Project (2006)

Crop Season		Off-crop Season	
Sector	*New Employers*	*Sector*	*New Employers*
Directory	0	Directory	0
Administrative	5	Administrative	5
Industrial	49	Industrial	22
Agricultural	117	Agricultural	45
TOTAL	**171**	**TOTAL**	**72**

c) Contribution to income distribution:
By implementing its bagasse cogeneration project, Água Bonita contributes to a better income distribution for the area's low qualified population. This is due to the fact that the electricity business, along with CER revenues, can contribute to the expansion of the mills' core activities – sugar and ethanol production, which allow for hiring new employees, mainly in the agricultural area. Usually, people hired for such activities are low-income ones, in a way that this new situation is favorable for a better income distribution situation.

Moreover, it is important to highlight that ABBCP's operation, and also maintenance, are carried out by a low-skilled work-force. In this way, the project also contributes to a better income distribution.

d) Contribution to technological development and capacity building:
The sugar and alcohol sector has always explored biomass (bagasse) in an inefficient way, using low pressure boilers, considered as a simple operational technology. The inefficient procedures and the lack of financial incentives for steam generation forbid additional electric energy to be produced for sale. But investments made in a more efficient technology, such as higher pressure boilers, as well as the CERs revenues, have been allowing a few companies in the sugar and alcohol sector to increase their internal installed capacity and then enhance the amount of electricity available for sale.

It's important to mention that all equipments used in ABBCP are made in Brazil (like Weg Automation and Equipálcool), thus having national technical assistance. Therefore, ABBCP contributes to the technical development of the country, once there's a demand for skilled personnel in such service area.

e) Contribution to regional integration and cooperation with other sectors:
The creation of new opportunities for Brazilian sugar industry, through electricity sale and CERs commercialization, promotes a higher interaction between the sugarcane and the Brazilian power sectors, especially when it comes to the PPA negotiation: on the one hand, Água Bonita acquired business' know-how. On the other hand, the energy company acquires knowledge about the sugar and alcohol sector, its work characteristics, intermittence and advantages.

It is also important to note that the implementation and operation of ABBCP requires a number of services provided by local entrepreneurs, such as food supply, medical assistance, technical and maintenance services that allow for the regional integration and cooperation.

Some of the prizes that Água Bonita won for its concern on the sustainable development and some entities supported by Água Bonita are:

- Prêmio Medalha da Ecologia de Qualidade Ambiental *(Ecology Medal for Environmental Quality Prize)*: received by Água Bonita on 2004 for its initiatives on adoption of permanent protection of water, soil, air, fauna, flora and human ecology, contributing permanently to preserve and to defend the planet's life;
- Prêmio Top of Quality *(Top of Quality Prize)*: received by Água Bonita on 2005 for the concern of its products and services qualities and its professional quality concern, contributing with the social and economical development of the State and Nation.
- SEBRAE Tarumã: receives financial support from Água Bonita for local education

The company realises many actions with positive impacts in its influence site. Among this actions are the construction of the local vegetative nursery to reconstitute Tarumã's micro-basin.

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)	❑ Destilaria Água Bonita Ltda. (Brazilian private entity); ❑ Econergy Brasil Ltda. (Brazilian private entity)	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil.

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

São Paulo.

A.4.1.3. City/Town/Community etc:

Tarumã.

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

Destilaria Água Bonita is located in Tarumã in the west of the State of São Paulo, about 400 km away from state capital, São Paulo, as can be seen in Figure 1

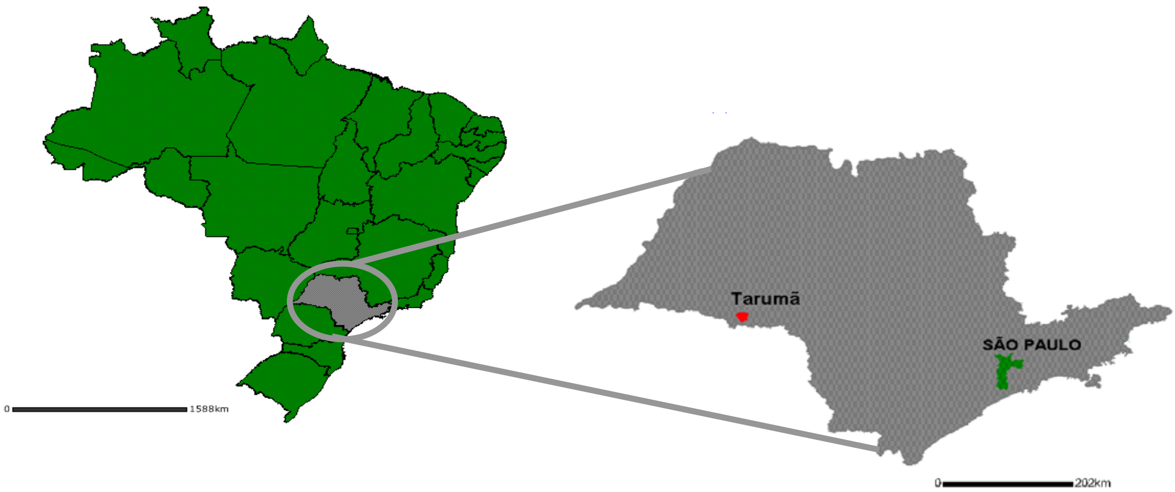

Figure 1. Geographical position of Tarumã (Source: adapted from IBGE[1])

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

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

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

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

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

[1] <http://mapas.igbe.gov.br>

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

Moreover, the technology for expanding the electricity availability from biomass in the sugar industry is, for the local utility companies, an advantage, as the baseload for the utilities in Brazil are supported mainly with hydro-generation and the sugar mill, coincidentally, supplies electricity during the dry season.

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

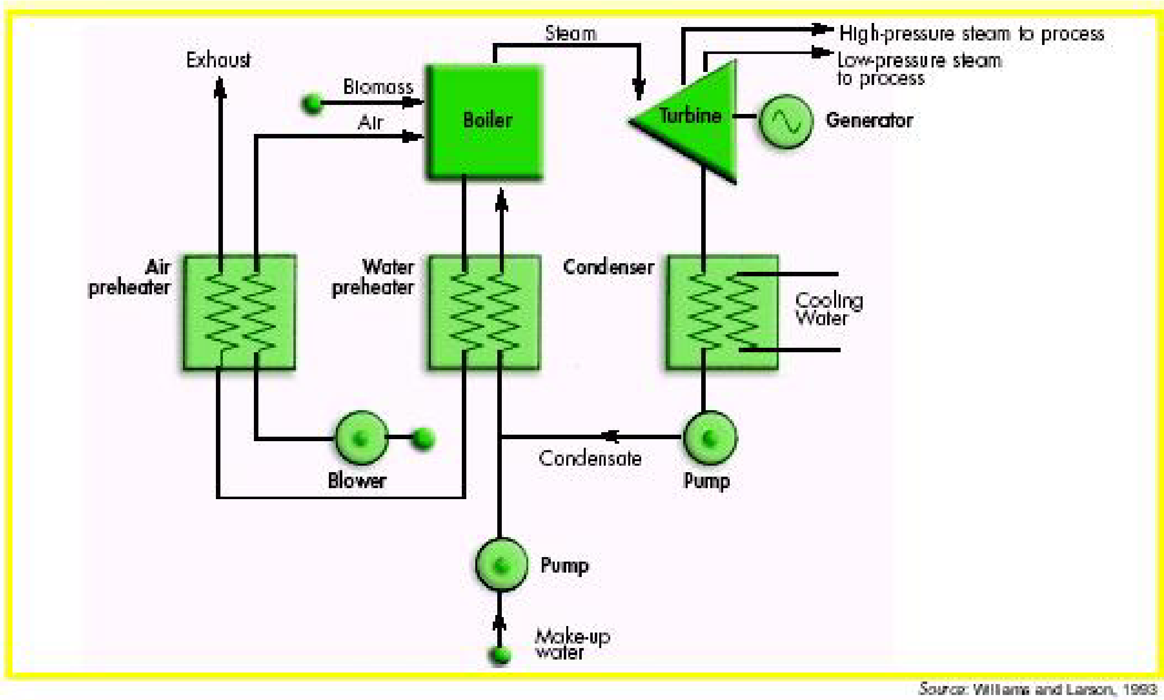

Figure 2. Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extraction steam turbine

Using steam-Rankine cycle as the basic technology of its cogeneration system, for achieving an improvement on the power generation capacity and, consequently, on the amount of surplus electricity to be generated, Água Bonit began its efforts in one phase, which is:

- **Before the expansion plan (until 2006):** the operation of a 1,2 MW backpressure turbo-generator, one 21 bar boiler and one 10 bar boiler. All the electricity produced during this period was only for internal consumption.

- **Phase 1 (2006):** Água Bonita, in order to increase the efficiency of its cogeneration facility, installed one 12 MW backpressure turbo-generator, one 5 MW condensing turbo-generator and one 47 bar boiler and demolished the existing equipment before the expansion plan. With that, Água Bonita will have nearly 12 MW to exploit for commercialisation. This means increasing renewable energy share in the Brazilian matrix.

Table 2 shows how Água Bonita's cogeneration infrastructure will be updated according to ABBCP phases.

Table 2: Cogeneration equipment upgrades

	Active		Demolished	
Before the Expansion Plan	**One 1,2 MW backpressure turbo generator**			
	One 21 bar boiler	**One 15 bar boiler**		
Phase 1 2006	**One 12 MW backpressure turbo generator**	**One 5 MW condensing turbo generator**	**One 1,2 MW backpressure turbo generator**	
	One 47 bar boiler		**One 21 bar boiler**	**One 15 bar boiler**

There is an intention to supply the grid with renewable energy around the amount of 58.326 MWh/year from 2006 to 2026, under the contract with Eletrobras under the PROINFA (Promotion Program for Electricity Generated from Renewable Sources). It is an advantage to buy energy produced by a sugar mill, as the baseload for the utilities in Brazil is supported mainly through hydro generation, and the sugarcane crop season is during the dry period. However, as will be put in more details further in this report, the intermittence of the electricity supply (during harvest season only) is seen as a major issue by the distributors.

Moreover, the technology for expanding the efficiency of electricity availability from biomass in the sugar industry is, for the local utility companies, an advantage, as the baseload for the utilities in Brazil are supported mainly with hydro-generation and the Sugar Mill, coincidentally, supplies electricity during the dry season.

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 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 ABBCP 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.

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

By dispatching renewable electricity to the 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 operated 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 constraints – in case of hydro sources).

Bagasse is a fibrous biomass by-product from sugarcane processing, which accounts for about 30 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 heat generation to both process and power production is a practice already established, but most of this energy is produced for self-consumption in an inefficient way – the low-pressure steam is used to activate crushers, to evaporate molasses, to the distillery process to produce alcohol and to generate electricity for self-consumption (low-pressure steam produces few electricity, which used to activate pumps, lightning, transport mat, and other electric devices).

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 a considerable complementary reliable 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, sponsors 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 and distilleries, like Água Bonita, which is investing to expand its electric power generation capacity and to operate in a more rationale way under the above mentioned new electric sector circumstances.

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

YEARS	ANNUAL ESTIMATION OF EMISSION REDUCTIONS IN TONNES OF CO_2E
2006	18 647
2007	20 548
2008	20 548
2009	20 548
2010	20 548
2011	20 548
2012	20 548
TOTAL ESTIMATED REDUCTIONS (TONNES OF CO_2E)	141 935
TOTAL NUMBER OF CREDITING YEARS	7
ANNUAL AVERAGE OVER THE CREDITING PERIOD OF ESTIMATED REDUCTIONS (TONNES OF CO_2E)	20 276

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline methodology

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

- Approved consolidated baseline methodology ACM0006 / Version 02 *"Consolidated baseline methodology for grid-connected electricity generation from biomass residues"*;

- Approved consolidated baseline methodology ACM0002 / Version 05 *"Consolidated baseline methodology for zero-emissions grid-connected electricity generation from renewable sources"* to calculate the Operating Margin emission factor and the Build Margin emission factor.

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

ACM0006 is applicable to this project activity due to the following conditions:

i) Bagasse, a biomass residue from the sugar-cane industry, is the only type of biomass used in the project plant.

ii) The project activity will not result in an increase of bagasse production. Bagasse will only increase due to the mill's natural expanding business and could not be attributed to the implementation of the cogeneration project, as show in Figure 3:

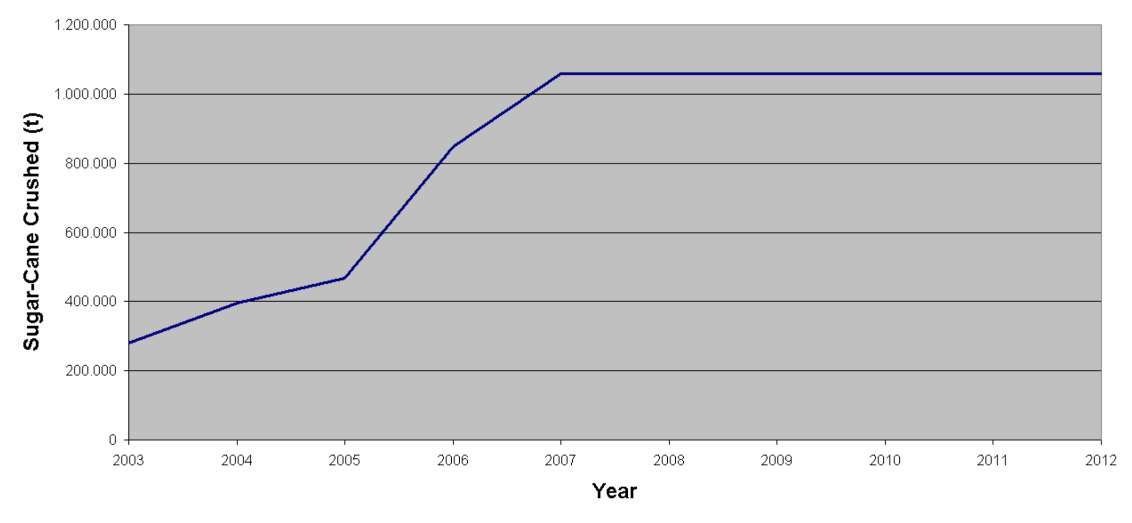

Figure 3. Estimative of Água Bonita's sugar-cane production (Source: Água Bonita)

iii) The bagasse will not be stored for more than one year.

iv) The biomass will not require energy to be prepared or to be transported because the bagasse is produced at the project's boundary.

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

The identification of the baseline scenario will be made through the analysis of the following alternatives:

- how power would be generated in the absence of the CDM project activity;
- what would happen to the biomass in the absence of the CDM project activity; and
- in case of cogeneration projects: how the heat would be generated in the absence of the CDM project activity.

In the absence of ABBCP, power would continue to be produced at the existing low-efficient power plant, fired with the same kind of biomass (bagasse), the same quantity of biomass would continue to be used to produce heat and electricity and the heat would continue to be produced with the same type and amount of biomass.

ABBCP is a cogeneration project that improves the installed capacity of Destilaria Água Bonita Ltda power plant through the acquisition of a high-pressure boiler and two turbo-generators. These equipments increase the power capacity (production of electricity per quantity of fuel fired) while the thermal biomass firing capacity is maintained.

If the project would not be implemented, Água Bonita would continue to operate the existing power plant, producing heat and power for self-consumption, until it would need to be replaced. There will be no increase of biomass fired as in the existing power plant.

The power generated by the existing plant would in the absence of the ABBCP be generated in the same plant (without project implementation) and – since power generation is larger due to the energy efficiency improvements – (b) partly in power plants in the grid.

The heat generated by the existing plant would be generated in the same plant, with the same configuration (the heat generated per biomass input is the same).

This analysis applies for **Scenario 14** as the baseline.

To calculate the emission reductions, an emission factor is applied in order to estimate the amount of CO_2e emitted at the baseline scenario, following steps provided by ACM0002 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", taking into account the (b) Simple Adjusted OM calculation for the STEP 1, since the would be no available data for applying to the preferred option – *(c) Dispatch Data Analysis OM.* For STEP 2, the option 1 was chosen.

The following table presents the key information and data used to determine the baseline scenario.

Variable	Data type	Value	Unit	Data Source
$EG_{project\ plant,\ y}$	Electricity generated in the project plant.	Obtained throughout project activity lifetime.	MWh	Água Bonita

$\varepsilon_{el,\ pre\ project}$	Electrical efficiency of the plant before the replacement of the equipment	4,94	MWh_{el}/TJ_{biomas}	Calculated using data given by Água Bonita
$NCV_{bagasse}$	Net calorific value of bagasse	8	$GJ/t_{bagasse}$	IPCC[3]
$BF_{bagasse,y}$	Quantity of bagasse used during the year y	Obtained through project activity lifetime	$t_{bagasse}$	Água Bonita
$\varepsilon_{el,\ GBCP,y}$	Electrical efficiency of the project in year	Obtained throughout project activity lifetime.	MWh_{el}/TJ_{biomas}	Calculated
EF_y	CO_2 emission factor of the Grid.	0,2677	tCO_2e/MWh	Calculated
$EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	0,4310	tCO_2e/MWh	This value was calculated using data from ONS, the Brazilian electricity system manager.
$EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	0,1256	tCO_2e/MWh	This value was calculated using data from ONS, the Brazilian electricity system manager.
9. λ_y	Fraction of time during which low-cost/ must-run sources are on the margin.	λ_{2002} = 0,5053 λ_{2003} = 0,5312 λ_{2004} = 0,5041	-	This value was calculated using data from ONS, the Brazilian electricity system manager.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

Application of the Tool for the demonstration and assessment of additionality for ABBCP

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

Since ABBCP will start its activities in 2006, the project participants won't have the crediting period starting prior to the registration of their project activity.

Thus Step 0 is not applicable.

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

[3] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual

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

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

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

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

3. Non applicable.

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

Step 2

Not applicable

Step 3. Barrier analysis

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

1. e 2. COELHO *et alii* (2002)[4] stand out that the potential energy surplus from the sugar and alcohol industry "will only become effectively available in its totality if adequate politics are implemented in the country." Such politics should refer to the several barriers that limit the development of the sector, which are:

I. Technological Barriers

According to COELHO (2004)[5], it can be considered that there are no significant technological barriers to the cogeneration of electricity in the Sugar & Alcohol Sector. The country has technologies sufficiently efficient and commercially available.

However, it should be taken into account that the capacity of the transmission lines is insufficient to assist to the supply of energy surpluses in some parts of the country.

It is worth to stand out, still, that the bagasse cogeneration in the country usually works with systems of low thermodynamic efficiency, which generates few surpluses or even limits to the self-sufficiency.

According to the world alliance for the decentralized energy, WADE (2004)[6], as, until recently, the sale of surpluses was not a common practice in the sector, the industry developed units of low efficiency exclusively to guarantee self-sufficiency of energy and steam and to deal with the problem of the bagasse accumulation and elimination. Moreover, at the time the sugar mills' cogeneration facilities are replaced, or when a new cogeneration unit is created, the equipments will have a lifetime of more than 20 years. The decision to go for purchasing low efficiency

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[4] COELHO, S.T., VARKULYA JR, A., PALETTA, C.E.M., SILVA, O.C. – *A importância e o potencial brasileiro da cogeração de energia a partir da biomassa.* CENBIO – Centro Nacional de Referência em Biomassa. Instituto de Eletrotécnica da USP. 2002.

[5] COELHO, S. T. *Barreiras e Propostas de políticas para a implementação da cogeração no Brasil.* In: Curso Internacional: Energia na Industria de Açúcar e Álcool, Núcleo de Estudos em Termodinâmica. 2004.

[6] WADE *Bagasse Cogeneration – Global Review and potential.* 2004. Disponível em http://www.cogensp.com.br

equipments addresses that plant to not take advantage of its potential surpluses of electricity for sale. Therefore, the choice of the equipments is decisive in order the plant to make its electricity surplus potential available. (COELHO, 2004)

The incentives of more efficient technologies is an important factor in that aspect. Still, even in the case of new facilities, the interest rates don't make it possible to make use of more efficient technological options.

II. Institutional and Political Barriers

Political Barriers

From the electric sector point of view, according to COELHO (2004), many utilities still don't demonstrate interest for purchasing the electricity generated by self-producers, independent energy producers and cogenerators, specially when it comes to long-term contracts. In the case of the bagasse cogeneration specifically, the electricity is generated only during the crop season, which, in the utilities' point of view, does not characterize an offer of firm energy.

Therefore, the utilities see as a disadvantage what is one of the biggest advantages of the bagasse cogeneration: that the energy is produced during the drought, when the hydroelectric power stations face difficulties due to the low level of rains (COELHO, 1999)[7]. "by not having a legal compulsory nature for the purchase of the electricity generated from renewable sources and/or cogenerators (as in other countries), the utilities can choose other options in the offer of energy".

From the sugar mill's point of view, one can notice an "important change of mentality in the sector's mills, which start to demonstrate a significant interest for the generation of electricity, which didn't happen until some time ago". Even though this change of mentality is already widespread, the reluctance in what regards the sale of spare electric power still persists. According to COELHO (2004), such reluctance can be explained by the "fear as for the involved risks and for the distrust regarding the maintenance, in the medium and long terms, of a solid politics of institutional incentive." The politics of the public section for renewable energy are not considered reliable enough for the executives of the private sector to give support to the expansion of the cogeneration in the sugar mills. This supposition is clearly demonstrated by the following list of rules and/or regulations in the energy sector that have been released in the last 10 years:

- **March 1993**: Law 8.631 sets a tariff regulation for electric energy;
- **February 1995**: Law 8.987 establish public concession for energy;
- **July 1995**: Law 9.074 regulates concession for electric energy sector;
- **December 1996**: Law 9.427 creates National Energy Agency (ANEEL);
- **August 1997**: Law 9.478 sets the National Council for Energy Planning (CNPE);
- **October 1997**: Decree 2.335 regulates the ANEEL task;
- **December 1997**: Implements ANEEL;

[7] 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

- **May 1998**: Law 9.648 establishes the Spot Market for Electric Energy (MAE) and the Operator National System (ONS);

- **July 1998**: Decree 2.655 regulates MAE and ONS tasks;

- **February 2000**: Decree 3.371 regulates the Thermoelectricity Priority Plan (PPT);

- **April 2002**: Law 10.438 sets the Program for Incentive Alternative Energy (PROINFA), stating that contracts shall be signed within 24 months from its date and that there will be different economic values for the acquisition of 3.300MW of electricity capacity from renewable sources by the state owned Eletrobrás, for plants starting operations before December 30, 2006;

- **August 2002**: MP 64 is a presidential act to change the constitution in order to permit the energy sector regulation including the PROINFA;

- **December 2002**: Resolution 4.541 from ANEEL regulates the implementation of PROINFA, stating that economic values would be defined within 90 days;

- **March 2003**: Decree 4.644 postponed for 180 days, from its date, the economic value and operational guidelines announcement;

- **June 2003**: Decree 4.758 indefinitely postponed the date for the economic value and operational guidelines announcement and revoked the above mentioned Decree 4.644.

- **November 2003**: Law 10.762 of 11 November/03 revised Law 10.438 of 26 April 2002 institutes PROINFA.

- **March 2004:** Decree 5.025 regulates the Law 10.438 as of 26 April 2002.

From the economical agents' point of view, the excessive number of warranties requested to finance the projects (COELHO, 2004) is a common barrier to reach the financial viability, as discussed by SWISHER (1997)[8].

Institutional Barriers

There are several institutional barriers to the bagasse cogeneration. According to COGEN (2004)[9], the excessive bureaucracy in the environmental licensing process consists an important restriction to foment the cogeneration.

The inexistence of backup mechanisms leads to the need of raw material storage, generating compulsory nature and obligation for the cogenerator, who starts having to invest resources for the conservation and storage of the bagasse.

Still to be considered is the lack of a direct communication channel between the mills and ANEEL and BNDES, in order to facilitate the explanation of doubts, mainly in what refers to the implantation or expansion of electricity generation plants (COELHO, 2004).

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[8] 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

[9] COGEN SP – Cogeração – A oportunidade de produzir e consumir energia com: maior eficiência energética, menor impacto ambiental, menor risco e maior independência energética. 2004. Disponível em http://www.cogensp.com.br

Even if UNICA and COGEN (2005)[10] mention the gradual removal process of some of those barriers, their consequences are still a known noticed in the whole Sugar and Alcohol sector.

III. Economic and Investment Barriers

COELHO (2004) affirms that, in what concerns the financing process, the amount of warranties demanded by the financing entities consists in a barrier to the implantation of cogeneration projects. Besides, still according to COELHO (2004), "the interest rates don't make the more efficient technological options possible".

It is also worth to stand out that "the financing programs usually have a general approach"(2), not presenting distinction of any sort between the producers, be for load, location, supply quality or for the used technology. So, although the generation of surpluses in more efficient technologies grows more than proportionally to the increase in the installation costs, the not-distinction between the projects in terms of financing ends up forcing the choice of the lower cost alternative, which makes itself possible in a faster way. That decision has a particularly strong impact on the technology to be used in the project activity, leading the producers to use equipments of low thermodynamic efficiency.

In what concerns the energy commercialization, the main barriers are the lack of warranty of purchase from the utilities in long term Power Purchase Agreements; the price not competitive price offered by them; the payment of high transmission and distribution tariffs; and connection difficulties with the local transmission net.

Currently there's no mechanism that guarantees the purchase of the energy surplus produced by the cogenerator in long term contracts, which puts in risk the invested capital return warranty. Another difficulty in this case is the sector's conservative positioning.

PROINFA - Programa de Incentivo a Fontes Alternativas de Energia Elétrica (Alternative Electric power Sources Incentive Program) was created in 2002 by the law No 10.438. It's main objective is to increase the proportion in the electric power net produced by Autonomous Independent Producers. The projects selected in each of the calls will have the warranty of commercializing the energy for the Source's Economical Value, to be defined by the executive power. Projects not included in the PROINFA Program should negotiate their prices with the utilities, which use as reference the value of the Wholesale Market of Energy (MAE) auction. That value is usually insufficient to remunerate the invested capital. "Fathomlessly, even in auctions, the government establishes a high minimum price for the wind energy and low one for the cogenerated energy"[11].

In terms of the access to the transmission and distribution net, the viability of commercializing the energy surplus produced by the cogeneration units sees itself hindered by the high tariffs to be paid by the utilities. Furthermore, the high value of the tariffs is an important factor in what concerns the choice of the capacity to be installed in the cogeneration unit: autonomous producers with installed capacity over 30MWh do not have the right to the 50% discount in the distribution tariff, which leaves them much less competitive.

Still according to UNICA (2004), the tax amount imposed to the cogeneration projects burdens the installation and operation costs, hindering the project's economical viability.

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[10] UNICA e COGEN-SP, Inserção da Bioeletricidade na Matriz Energética – Agregando valor ao terceiro produto da agroindústria canavieira. 2005

[11] UNICA e COGEN-SP, Inserção da Bioeletricidade na Matriz Energética – Agregando valor ao terceiro produto da agroindústria canavieira. 2005

IV. Cultural Barrier

Due to the nature of the sugar industry business, the marketing approach is restricted to the commodity transaction type. Therefore, the commercialization of electricity based on long term contracts (PPA) represents a significant advantage in the business model. In that case, the transaction of electricity should represent an opportunity of safe investment, for both the economical and the social-environmental perspective, in order to convince the sugar mills to invest on it.

However, TEIXEIRA[12] believes in the existence of "rejection and opposition of environmentalists and parts of the population, due to the lack of culture in this kind of systems in Brazil".

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

The alternative for this project activity would be to maintain the current situation and to focus strictly in the main activity, the sugar and alcohol production. Therefore, as the barriers mentioned above are directly related to the entrance in a new business (sale of energy), there is no obstacle for the sugar mills to maintain (or even invest) in their main activity.

COELHO (2004) also declares that the great majority of the sugar mills still leans on inefficient technology, as the 22 bar boilers, even in the State of São Paulo, Brazil's most industrialized State. Besides, when there's the need of replacing equipments, it is common not to consider the purchase of high efficiency boilers due to the sector's conservatism.

Step 4. Common practice analysis.

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

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

Similar project activities have been implemented by leading companies in this industry, mainly after Vale do Rosário started to implement its project that clearly served as a sector benchmark. However, these are few examples in a universe of about 334 sugar mills. Currently, other similar project activities under implementation are, for example, Cia Energética Santa Elisa, Moema, Equipav, Nova América. All together similar projects in the sugar industry in Brazil are restricted to a few number of sugar mills, according with MINISTÉRIO DA AGRICULTURA et al (2005)[13]. That clearly shows that just a small part of this sector is willing to invest in cogeneration projects. Moreover, majority of similar projects currently being implemented are carried out as CDM project activities. So far, Econergy Brasil has submitted for registration 21 CDM bagasse cogeneration projects in Brazil.

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

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[12] TEIXEIRA, F.N. – Cogeração. In: Núcleo de Estudos de Sistemas Térmicos.

[13] Ministério da Agricultura, Pecuária e Abastecimento, Ministério da Ciência e Tecnologia, Ministério de Minas e Energia, Ministério do Desenvolvimento, Indústria e Comércio Exterior; *Diretrizes de Política de Agroenergia 2006 – 2011;* November, 2005; Available at http://www.mme.gov.br/download.do?attachmentId=4520&download.

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

Step 5. Impact of CDM registration

The impact of registration of this CDM project activity will contribute to overcoming all the barriers described in this Tool: technological, institutional and political, economic and investment and cultural barriers. The registration will enhance the security of the investment itself and will foster and support the project owners' breakthrough decision to expand their business activities. Along these lines, the project activity is already engaged in a deal to sell its expected CERs.

Notwithstanding, the benefits and incentives mentioned in the text of the Tool for demonstration and assessment of additionality, published by the CDM-EB, will be experienced by the project activities such as: the project will achieve the aim of anthropogenic GHG reductions; financial benefit of the revenue obtained by selling CERs will bring more robustness to the project's financial situation; and its likelihood to attract new players and new technology (currently there are companies developing new type of boilers – extra-efficient – and the purchase of such equipment is to be fostered by the CER sales revenue) and reducing the investor's risk.

Registration will also have an impact on other sugarcane industry players, who will see the feasibility of implementing renewable energy commercialization projects in their facilities with the CDM. Moreover, hard-currency inflows are highly desirable in a fragile and volatile economy as is the Brazilian one.

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

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

Baseline energy grid: For ABBCP, the South-Southeast and Midwest subsystem of the Brazilian grid is considered as a boundary, since it is the system to which Água Bonita 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, including the alcohol distillery, like shown on Figure 4.

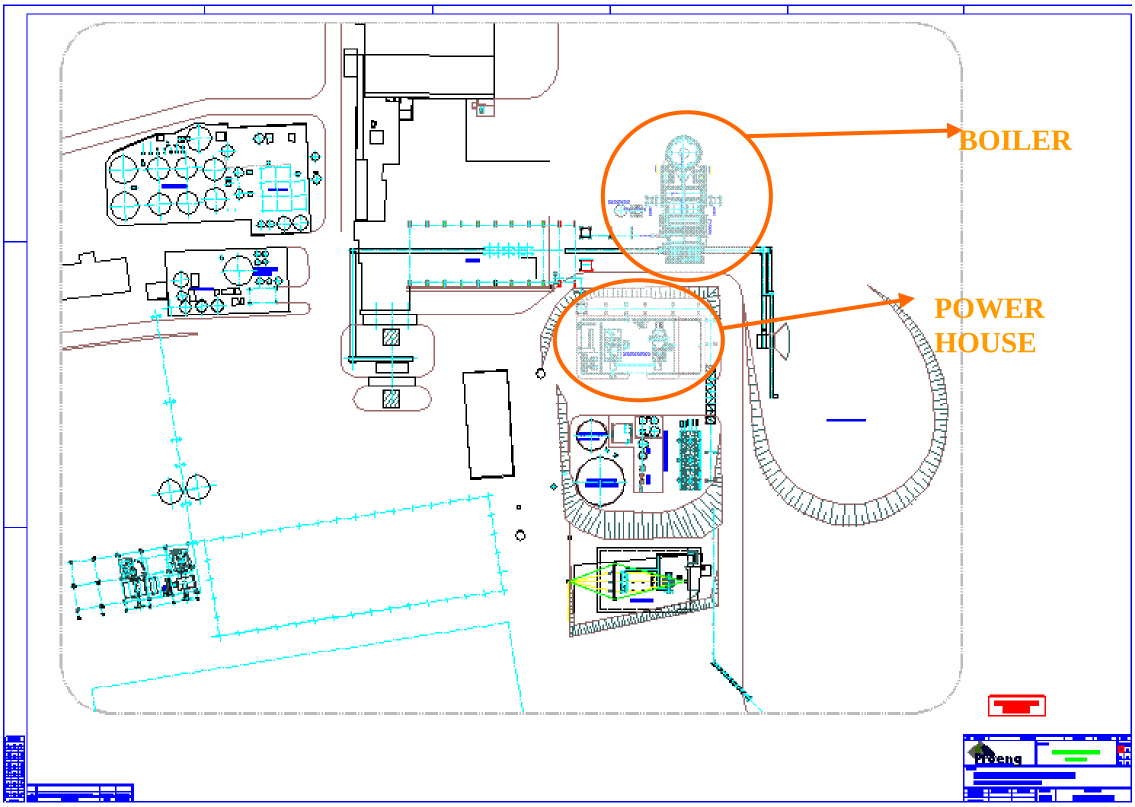

Figure 4. Água Bonita's Lay-out (detailed: cogeneration facility)

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

1. Date of completing the final draft of this baseline section: 09/03/2006.

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 Água Bonita, the developer of this document, and all its contents.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/04/2006.

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

30y-0m[14]

[14] According with a boiler fabricant, the lifetime of a cogeneration unit is estimated in 30 year, if the regular maintenance is made on equipments

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:

01/08/2006.

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Left blank on purpose.

C.2.2.2. Length:

Left blank on purpose.

SECTION D. Application of a monitoring methodology and plan

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

- Approved consolidated monitoring methodology ACM0006 *"Consolidated monitoring methodology for grid-connected electricity generation from biomass residues"*;

- Approved consolidated monitoring methodology ACM0002 *"Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources"* to calculate the EF_{OM} and the EF_{BM}.

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

The chosen monitoring methodology is applicable to biomass-based cogeneration projects connected to the grid. The methodology considers monitoring emission reductions generated from cogeneration projects using sugarcane bagasse which is exactly the case of ABBCP, so the choice of methodology is justified.

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

There is no project emission to be considered in this project activity because the transportation of biomass from the project boundary to the cogeneration facility is made by a mechanical mat.

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

Left blank on purpose.

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

Left blank on purpose.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

1. $EG_{, project plant, y}$	Quantity of electricity generated in the project plant during the year y	Readings of the electricity meter, installed at the turbo-generators.	MWh	*m*	Monthly	*100%*	Electonic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
2. $B_{bagasse, i}$	Quantity of bagasse combusted in the project plant	Readings of the weighing machine	$t_{bagasse}$	*m*	Continuous ly	*100%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
3. EF_y	CO_2 emission factor of the Grid.	Calculated	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
4. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	Factor calculated from ONS, the Brazilian electricity system manager.	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
5. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	Factor calculated from ONS, the Brazilian electricity system manager.	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

6. λ_y	Fraction of time during which low-cost/must-run sources are on the margin.	Factor calculated from ONS, the Brazilian electricity system manager.	index	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

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

$$EG_y = EG_{project-plant} \times \left(1 - \frac{\varepsilon_{el,pre-project}}{\varepsilon_{el,project-plant,y}}\right)$$ $$\varepsilon_{el,project-plant,y} = \frac{EG_{project-plant,y}}{NCV_{bagasse} \times B_{bagasse,y}}$$ $$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} \text{ (tCO}_2\text{e/GWh)}$$ $$EF_{BM} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_m GEN_{m,y}} \text{(tCO}_2\text{e/GWh)}$$ $$EF_{electricity} = \frac{EF_{OM} + EF_{BM}}{2} \text{(tCO}_2\text{e/GWh)}$$ $BE_{electricity,y} = EF_{electricity} \,.\, EG_{,y}$	EG_y is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh $EG_{project\ plant}$ is the net quantity of electricity generated in the project plant during the year y in MWh, $\varepsilon_{el,\ pre\ project}$ is the net efficiency of electricity generation in the project plant prior to project implementation, expressed in $MWh_{el}/TJ_{biomass}$ $\varepsilon_{el,\ project\ plant,\ y}$ is the average net energy efficiency of electricity generation in the project plant, expressed in $MWh_{el}/TJ_{biomass}$ $NCV_{bagasse}$ is the net calorific value of the bagasse ($TJ/t_{bagasse}$) $B_{bagasse,\ y}$ is the quantity of bagasse used in year *y* ($t_{bagasse}$) $F_{i,j(or\ m),y}$ Is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y* *j,m* Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports4 from the grid $COEF_{i,j(or\ m)\ y}$ Is the CO2 emission coefficient of fuel *i* (tCO2 / mass or volume unit of the fuel), taking intoaccount the carbon content of the fuels used by relevant power sources j (or m) and the percent oxidation of the fuel in year(s) y, a $GEN_{j(or\ m),y}$ Is the electricity (MWh) delivered to the grid by source *j (or m)* $BE_{electricity,y}$ Are the baseline emissions due to displacement of electricity during the year y in tons of CO_2 and $EF_{electricity,y}$ Is the CO_2 baseline emission factor for the electricity.

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

Left blank on purpose.

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

ID number *(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

Left blank on purpose.

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

Left blank on purpose.

D.2.3. Treatment of leakage in the monitoring plan

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

ID number *(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

Left blank on purpose.

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

Left blank on purpose.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - L_y - PE_y$ $ER_{heatl,y} = 0$ $BE_{biomass,y} = 0$ $PE_y = 0$ $L_y = 0$ $ER_{electricity,y} = EF_{electricity} . EG_y$	ER_y are the emissions reductions of the project activity during the year y in tons of CO_2 $BE_{biomass,y}$ are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass during the year y in tons of CO_2, $ER_{electricity,y}$ Are the baseline emissions due to displacement of electricity during the year y in tons of CO_2 $ER_{heat,y}$ Are the baseline emissions due to displacement of thermal energy during the year y in tons of CO_2 PE_y Are the project emissions during the year y in tons of CO_2. L_y Are the leakage emissions during the year y in tons of CO_2.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
3.-1.	*Low*	These data will be directly used for calculation of emission reductions.
3.-2.	*Low*	These data will be directly used for calculation of emission reductions.
3.-3.	*Low*	Data does not need to be monitored
3.-4.	*Low*	Data does not need to be monitored
3.-5.	*Low*	Data does not need to be monitored
3.-6.	*Low*	Data does not need to be monitored

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

The structure for monitoring this project activity will basically consist of registering the amount of energy produced by the turbo-generators, through the electricity meter installed at the software that controls the operation, and registering the amount of sugar-cane crushed monthly.

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

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

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

Bagasse will be produced inside the sugar-cane mill's industrial facility and won't need any transportation. Additionally, no fossil-fuel is expected to be burned at the project plant.

Thus, $\mathbf{PE_y = 0}$

E.2. Estimated leakage:

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

Thus, $\mathbf{L_y = 0}$

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

$\mathbf{L_y + PE_y = 0}$

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

The baseline methodology considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario. Emission reductions from heat are simplified assumed as zero because additional heat is generated by biomass boilers fired with the same type of biomass and no fossil fuels are used for power or heat generation at the project site.

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

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

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

The provided information comprised years 2002, 2003 and 2004, and is the most recent information available at this stage.

Simple Adjusted Operating Margin Emission Factor Calculation

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

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_{j} GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_{k} GEN_{k,y}} \quad (tCO_2e/GWh)$$

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

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

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

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

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

Year	Lambda
2002	0,5053
2003	0,5312
2004	0,5041

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	275.402.896
2003	288.493.929
2004	297.879.874

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

$$EF_{OM,simple\_adjusted,2002} = (1-\lambda_{2001})\frac{\sum_{i,j} F_{i,j,2002}.COEF_{i,j}}{\sum_{j} GEN_{j,2002}} \therefore EF_{OM,simple\_adjusted,2002} = 0{,}4207 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2003} = (1-\lambda_{2003})\frac{\sum_{i,j} F_{i,j,2003}.COEF_{i,j}}{\sum_{j} GEN_{j,2003}} \therefore EF_{OM,simple\_adjusted,2003} = 0{,}4397 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2004} = (1-\lambda_{2004})\frac{\sum_{i,j} F_{i,j,2004}.COEF_{i,j}}{\sum_{j} GEN_{j,2004}} \therefore EF_{OM,simple\_adjusted,2004} = 0{,}4327 \text{ tCO}_2\text{/MWh}$$

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

$$EF_{OM,simple\_adjusted\ 2002\_2004} = 0{,}4310 \text{ tCO}_2\text{/MWh}$$

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:

$$EF_{BM,2004} = 0{,}1045 \text{ tCO}_2\text{/MWh}$$

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

$$EF_{electricity,2002-2004} = 0{,}5 * 0{,}4310 + 0{,}5 * 0{,}1045 = 0{,}2677 \text{ tCO}_2\text{/MWh}$$

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

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

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

The electricity delivered to the grid (EG_y) is determined based on the net efficiency of electricity generation in the project plant prior to project implementation $\varepsilon_{el,pre\ project}$ and the net efficiency of electricity generation in the project plant after project implementation $\varepsilon_{el,project\ plant,y}$, as follows:

$$EG_y = EG_{prpject\ plant,y} \times \left(1 - \frac{\varepsilon_{el,pre\ project}}{\varepsilon_{el,project\ plant,y}} \right)$$

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

$BE_{electricity,y}$ = 0,2677 tCO_2/MWh . $EG_{prpject\ plant,y} \times \left(1 - \frac{\varepsilon_{el,pre\ project}}{\varepsilon_{el,project\ plant,y}} \right)$ (in tCO_2e)

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

The emissions reduction of this project activity is:

ER = $BE_{electricity,y}$ – (L_y + PE_y) = 0,2677 tCO_2/MWh . $EG_{prpject\ plant,y} \times \left(1 - \frac{\varepsilon_{el,pre\ project}}{\varepsilon_{el,project\ plant,y}}\right) - 0$

ER = 0,2677 tCO_2/MWh . $EG_{prpject\ plant,y} \times \left(1 - \frac{\varepsilon_{el,pre\ project}}{\varepsilon_{el,project\ plant,y}}\right)$.

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

Year	**Estimation of project activity emission reductions (tonnes of CO_2e)**	**Estimation of the baseline emission reductions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of emission reductions (tonnes of CO_2e)**
2006	18 647	0	0	18 647
2007	20 548	0	0	20 548
2008	20 548	0	0	20 548
2009	20 548	0	0	20 548
2010	20 548	0	0	20 548
2011	20 548	0	0	20 548
2012	20 548	0	0	20 548
Total (tonnes of CO_2e)	141 935	0	0	141 935

SECTION F. Environmental impacts

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

The possible environmental impacts were analyzed by the State Secretary of Environment (*Secretaria de Estado do Meio Ambiente*) through CETESB (*Companhia de Tecnologia de Saneamento Ambiental*) – state of São Paulo environmental agency. Água Bonita is in compliance with the environmental legislation and has been issued a Preliminary Working License for the current installed facilities. On March 29th, 2004. Later, on April 5th, 2004, Água Bonita received the Installation Licence and requested the Operation Licence on July 14th, 2005 with an inspection date after 02/12/2006 (beginning of boiler's test).

Água Bonita complied with all these requirements, either through direct measures or with planned activities. There will be no transboundary impacts resulting from ABBCP.

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

The impacts from ABBCP are not considered significant. They arise from activities (cane crushing and bagasse burning) that were already in place before the project, though in different conditions and circumstances.

The secretary of environment and CETESB already analyzed the most relevant impacts from the project activity through the Preliminary Environmental Report (RAP), and issuance of the environmental licenses is conditioned to the compliance with the technical demands for the installation of the project.

SECTION G. Stakeholders' comments

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

Invitations for comments by local stakeholders are required by the Brazilian Designated National Authority as part of the procedures for analyzing CDM projects and issuing letters of approval. This procedure will be followed by Água Bonita to take its GHG mitigation initiative to the public. Letters and the Executive Summary of the project will be sent to the following recipients:

- Prefeitura Municipal de Tarumã – SP / *Municipal Administration of Tarumã - SP*
- Câmara dos Vereadores de Tarumã – SP / *Municipal Legislation Chamber of Tarumã – SP*
- Ministério Público do Estado de São Paulo / *Public Ministry of São Paulo State*
- Fórum Brasileiro de ONGs / *Brazilian NGO Forum*
- Secretaria do Meio Ambiente do Estado de São Paulo / *Environment Secretary of São Paulo State*
- CETESB – Companhia de Tecnologia e Saneamento Ambiental / *State of São Paulo Environmental Agency*
- ASSOCANA – Associação Rural dos Fornecedores e Plantadores de Cana da Média Sorocabana / *Mid-Sorocabana Sugar-cane Workers Rural Association*

G.2. Summary of the comments received:

No comments were received yet.

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

No comments were received yet.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Participant – 1:

Organization:	Econergy Brasil Ltda.
Street/P.O.Box:	Rua Pará, 76 cj 41
Building:	Higienópolis Office Center
City:	São Paulo
State/Region:	São Paulo
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:	
Salutation:	Mr.
Last Name:	Diniz Junqueira
Middle Name:	Schunn
First Name:	Marcelo
Department:	-
Mobile:	+55 (11) 8263-3017
Direct FAX:	+55 (11) 3219-0693
Direct tel:	+55 (11) 3219-0068 ext 25
Personal E-Mail:	junqueira@econergy.com.br

Project Participant - 2:

Organization:	Destilaria Água Bonita Ltda.
Street/P.O.Box:	Rodovia SP 33, km 26,7
Building:	Fazenda Tarumã
City:	Tarumã
State/Region:	São Paulo
Postfix/ZIP:	19820-000
Country:	Brasil
Telephone:	+55 (13) 3373 4400
FAX:	+55 (18) 3373 4401
E-Mail:	
URL:	www.aguabonita.com.br
Represented by:	
Title:	Commercial Director
Salutation:	Mr.
Last Name:	Neto
Middle Name:	Holzhausen
First Name:	Gerhardt
Department:	
Mobile:	+55 (18) 8118 9746
Direct FAX:	+55 (18) 3373 4400
Direct tel:	+55 (18) 3373 4401
Personal E-Mail:	administrativo@aguabonita.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was requested.

Annex 3

BASELINE INFORMATION

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

The natural evolution of both systems continues to demonstrate that integration will happen in the future. In 1998, the Brazilian government announced 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 was established, technical papers continue to divide the Brazilian system in two (Bosi, 2000)[15]:

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

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

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

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

Finally, one has to take into account that even though the systems today are connected, the energy flow between N-NE and S-SE-CO is heavily limited by the transmission lines capacity. Therefore, only a fraction of the total energy generated in both subsystems is sent one way or another. It is natural that this fraction may change its direction and magnitude (up to the transmission line's capacity) depending on the hydrological patterns, climate and other uncontrolled factors. But it is not supposed to represent a significant amount of each subsystem's electricity demand. It should also be noted 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.

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

The Brazilian electricity system nowadays comprises of around 101,3 GW of installed capacity, in a total of 1.482 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 4,5% are diesel and fuel oil plants, 3,2% 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 8,17 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid[16]. This latter capacity is in fact comprised by mainly 5,65 GW of the Paraguayan part of *Itaipu Bi-national*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

The approved methodology ACM0002 asks project proponents to account for “all generating sources serving the system”. In that way, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

However, information on such generating sources is not publicly available in Brazil. The national dispatch center, ONS – National System Operator – 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 specifically contacted and the reason for data collection was explained. After several months of talks, plants’ daily dispatch information was made available for years 2002, 2003 and 2004 by ONS.

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[17], 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.

In an attempt to include all generating sources, project developers considered the option to research for available, but non-official data, to supply the existing gap. The solution found was the International Energy Agency database built when carrying out the study “Road-Testing Baselines For Greenhouse Gas Mitigation Projects in the Electric Power Sector”, published in October 2002. Merging ONS data with the IEA data in a spreadsheet, project proponents have been able to consider all generating sources connected to the relevant grids in order to determine the emission factor. The emission factor calculated was found

[16] www.aneel.gov.br
[17] www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf

more conservative when considering ONS data only, as the table below shows the build margin in both cases.

IEA/ONS Merged Data Build Margin (tCO_2/MWh)	ONS Data Build Margin (tCO_2/MWh)
0,205	0,0937

Therefore, considering all the rationale explained, the project developers selected to use 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 (2001 to 2004). For that reason project participants find the application of such numbers to be not only reasonable but the best available option.

The aggregated hourly dispatch data received from ONS was used to determine the lambda factor for each of the years with available data (2002, 2003 and 2004). The Low-cost/Must-run generation was determined as the total generation minus the generation from fossil-fuelled thermal plants generation, this one determined through daily dispatch data provided by ONS. All this information has been provided to the validators, and extensively discussed with them, in order to make all points crystal clear.

On the following pages, a summary of the analysis is provided. First, the Tables 3 and 4 with the 126 plants dispatched by ONS are provided. Then, a table with the summarized conclusions of the analysis of the emission factor calculation and the load duration curves for the S-SE-CO sub system are presented.

Table 3. ONS Dispatched Plants -1/2

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
1	S-SE-CO	G	Termo Rio	Nov-2004	423,3	0,30	15,3	99,5%	0,670
2	S-SE-CO	H	Candonga	Sep-2004	140,0	1,00	0,0	0,0%	0,000
3	S-SE-CO	H	Queimado	May-2004	105,0	1,00	0,0	0,0%	0,000
4	S-SE-CO	G	Norte Fluminense	Feb-2004	860,2	0,30	15,3	99,5%	0,670
5	S-SE-CO	H	Jauru	Sep-2003	121,5	1,00	0,0	0,0%	0,000
6	S-SE-CO	H	Gauporé	Sep-2003	120,0	1,00	0,0	0,0%	0,000
7	S-SE-CO	G	Três Lagoas	Aug-2003	306,0	0,30	15,3	99,5%	0,670
8	S-SE-CO	H	Funil (MG)	Jan-2003	180,0	1,00	0,0	0,0%	0,000
9	S-SE-CO	H	Itiquira I	Sep-2002	156,1	1,00	0,0	0,0%	0,000
10	S-SE-CO	G	Araucária	Sep-2002	484,5	0,30	15,3	99,5%	0,670
11	S-SE-CO	G	Canoas	Sep-2002	160,6	0,30	15,3	99,5%	0,670
12	S-SE-CO	H	Piraju	Sep-2002	81,0	1,00	0,0	0,0%	0,000
13	S-SE-CO	G	Nova Piratininga	Jun-2002	384,9	0,30	15,3	99,5%	0,670
14	S-SE-CO	O	PCT CGTEE	Jun-2002	5,0	0,30	20,7	99,0%	0,902
15	S-SE-CO	H	Rosal	Jun-2002	55,0	1,00	0,0	0,0%	0,000
16	S-SE-CO	G	Ibirité	May-2002	226,0	0,30	15,3	99,5%	0,670
17	S-SE-CO	H	Cana Brava	May-2002	465,9	1,00	0,0	0,0%	0,000
18	S-SE-CO	H	Sta. Clara	Jan-2002	60,0	1,00	0,0	0,0%	0,000
19	S-SE-CO	H	Machadinho	Jan-2002	1.140,0	1,00	0,0	0,0%	0,000
20	S-SE-CO	G	Juiz de Fora	Nov-2001	87,0	0,28	15,3	99,5%	0,718
21	S-SE-CO	G	Macaé Merchant	Nov-2001	922,6	0,24	15,3	99,5%	0,837
22	S-SE-CO	H	Lajeado (ANEEL res. 402/2001)	Nov-2001	902,5	1,00	0,0	0,0%	0,000
23	S-SE-CO	G	Eletrobolt	Oct-2001	379,0	0,24	15,3	99,5%	0,837
24	S-SE-CO	H	Porto Estrela	Sep-2001	112,0	1,00	0,0	0,0%	0,000
25	S-SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	529,2	0,30	15,3	99,5%	0,670
26	S-SE-CO	G	W. Arjona	Jan-2001	194,0	0,25	15,3	99,5%	0,804
27	S-SE-CO	G	Uruguaiana	Jan-2000	639,9	0,45	15,3	99,5%	0,447
28	S-SE-CO	H	S. Caxias	Jan-1999	1.240,0	1,00	0,0	0,0%	0,000
29	S-SE-CO	H	Canoas I	Jan-1999	82,5	1,00	0,0	0,0%	0,000
30	S-SE-CO	H	Canoas II	Jan-1999	72,0	1,00	0,0	0,0%	0,000
31	S-SE-CO	H	Igarapava	Jan-1999	210,0	1,00	0,0	0,0%	0,000
32	S-SE-CO	H	Porto Primavera	Jan-1999	1.540,0	1,00	0,0	0,0%	0,000
33	S-SE-CO	D	Cuiaba (Mario Covas)	Oct-1998	529,2	0,27	20,2	99,0%	0,978
34	S-SE-CO	H	Sobragi	Sep-1998	60,0	1,00	0,0	0,0%	0,000
35	S-SE-CO	H	PCH EMAE	Jan-1998	26,0	1,00	0,0	0,0%	0,000
36	S-SE-CO	H	PCH CEEE	Jan-1998	25,0	1,00	0,0	0,0%	0,000
37	S-SE-CO	H	PCH ENERSUL	Jan-1998	43,0	1,00	0,0	0,0%	0,000
38	S-SE-CO	H	PCH CEB	Jan-1998	15,0	1,00	0,0	0,0%	0,000
39	S-SE-CO	H	PCH ESCELSA	Jan-1998	62,0	1,00	0,0	0,0%	0,000
40	S-SE-CO	H	PCH CELESC	Jan-1998	50,0	1,00	0,0	0,0%	0,000
41	S-SE-CO	H	PCH CEMAT	Jan-1998	145,0	1,00	0,0	0,0%	0,000
42	S-SE-CO	H	PCH CELG	Jan-1998	15,0	1,00	0,0	0,0%	0,000
43	S-SE-CO	H	PCH CERJ	Jan-1998	59,0	1,00	0,0	0,0%	0,000
44	S-SE-CO	H	PCH COPEL	Jan-1998	70,0	1,00	0,0	0,0%	0,000
45	S-SE-CO	H	PCH CEMIG	Jan-1998	84,0	1,00	0,0	0,0%	0,000
46	S-SE-CO	H	PCH CPFL	Jan-1998	55,0	1,00	0,0	0,0%	0,000
47	S-SE-CO	H	S. Mesa	Jan-1998	1.275,0	1,00	0,0	0,0%	0,000
48	S-SE-CO	H	PCH EPAULO	Jan-1998	26,0	1,00	0,0	0,0%	0,000
49	S-SE-CO	H	Guilmam Amorim	Jan-1997	140,0	1,00	0,0	0,0%	0,000
50	S-SE-CO	H	Corumbá	Jan-1997	375,0	1,00	0,0	0,0%	0,000
51	S-SE-CO	H	Miranda	Jan-1997	408,0	1,00	0,0	0,0%	0,000
52	S-SE-CO	H	Noav Ponte	Jan-1994	510,0	1,00	0,0	0,0%	0,000
53	S-SE-CO	H	Segredo (Gov. Ney Braga)	Jan-1992	1.260,0	1,00	0,0	0,0%	0,000
54	S-SE-CO	H	Taquaruçu	Jan-1989	554,0	1,00	0,0	0,0%	0,000
55	S-SE-CO	H	Manso	Jan-1988	210,0	1,00	0,0	0,0%	0,000
56	S-SE-CO	H	D. Francisca	Jan-1987	125,0	1,00	0,0	0,0%	0,000
57	S-SE-CO	H	Itá	Jan-1987	1.450,0	1,00	0,0	0,0%	0,000
58	S-SE-CO	H	Rosana	Jan-1987	369,2	1,00	0,0	0,0%	0,000
59	S-SE-CO	N	Angra	Jan-1985	1.874,0	1,00	0,0	0,0%	0,000
60	S-SE-CO	H	T. Irmãos	Jan-1985	807,5	1,00	0,0	0,0%	0,000
61	S-SE-CO	H	Itaipu 60 Hz	Jan-1983	6.300,0	1,00	0,0	0,0%	0,000
62	S-SE-CO	H	Itaipu 50 Hz	Jan-1983	5.375,0	1,00	0,0	0,0%	0,000
63	S-SE-CO	H	Emborcação	Jan-1982	1.192,0	1,00	0,0	0,0%	0,000
64	S-SE-CO	H	Nova Avanhandava	Jan-1982	347,4	1,00	0,0	0,0%	0,000
65	S-SE-CO	H	Gov. Bento Munhoz - GBM	Jan-1980	1.676,0	1,00	0,0	0,0%	0,000

* Subsystem: S - south, SE-CO - Southeast-Midwest

** 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 GHG mitigation projects in the electric power sector.* OECD/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).

Table 4. ONS Dispatched Plants -2/2

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
66	S-SE-CO	H	S.Santiago	Jan-1980	1.420,0	1,00	0,0	0,0%	0,000
67	S-SE-CO	H	Itumbiara	Jan-1980	2.280,0	1,00	0,0	0,0%	0,000
68	S-SE-CO	O	Igarapé	Jan-1978	131,0	0,30	20,7	99,0%	0,902
69	S-SE-CO	H	Itauba	Jan-1978	512,4	1,00	0,0	0,0%	0,000
70	S-SE-CO	H	A. Vermelha (Jose E. Moraes)	Jan-1978	1.396,2	1,00	0,0	0,0%	0,000
71	S-SE-CO	H	S.Simão	Jan-1978	1.710,0	1,00	0,0	0,0%	0,000
72	S-SE-CO	H	Capivara	Jan-1977	640,0	1,00	0,0	0,0%	0,000
73	S-SE-CO	H	S.Osório	Jan-1975	1.078,0	1,00	0,0	0,0%	0,000
74	S-SE-CO	H	Marimbondo	Jan-1975	1.440,0	1,00	0,0	0,0%	0,000
75	S-SE-CO	H	Promissão	Jan-1975	264,0	1,00	0,0	0,0%	0,000
76	S-SE-CO	C	Pres. Medici	Jan-1974	446,0	0,26	26,0	98,0%	1,294
77	S-SE-CO	H	Volta Grande	Jan-1974	380,0	1,00	0,0	0,0%	0,000
78	S-SE-CO	H	Porto Colombia	Jun-1973	320,0	1,00	0,0	0,0%	0,000
79	S-SE-CO	H	Passo Fundo	Jan-1973	220,0	1,00	0,0	0,0%	0,000
80	S-SE-CO	H	Passo Real	Jan-1973	158,0	1,00	0,0	0,0%	0,000
81	S-SE-CO	H	Ilha Solteira	Jan-1973	3.444,0	1,00	0,0	0,0%	0,000
82	S-SE-CO	H	Mascarenhas	Jan-1973	131,0	1,00	0,0	0,0%	0,000
83	S-SE-CO	H	Gov. Parigot de Souza - GPS	Jan-1971	252,0	1,00	0,0	0,0%	0,000
84	S-SE-CO	H	Chavantes	Jan-1971	414,0	1,00	0,0	0,0%	0,000
85	S-SE-CO	H	Jaguara	Jan-1971	424,0	1,00	0,0	0,0%	0,000
86	S-SE-CO	H	Sá Carvalho	Apr-1970	78,0	1,00	0,0	0,0%	0,000
87	S-SE-CO	H	Estreito (Luiz Carlos Barreto)	Jan-1969	1.050,0	1,00	0,0	0,0%	0,000
88	S-SE-CO	H	Ibitinga	Jan-1969	131,5	1,00	0,0	0,0%	0,000
89	S-SE-CO	H	Jupiá	Jan-1969	1.551,2	1,00	0,0	0,0%	0,000
90	S-SE-CO	O	Alegrete	Jan-1968	66,0	0,26	20,7	99,0%	1,040
91	S-SE-CO	G	Campos (Roberto Silveira)	Jan-1968	30,0	0,24	15,3	99,5%	0,837
92	S-SE-CO	G	Santa Cruz (RJ)	Jan-1968	766,0	0,31	15,3	99,5%	0,648
93	S-SE-CO	H	Paraibuna	Jan-1968	85,0	1,00	0,0	0,0%	0,000
94	S-SE-CO	H	Limoeiro (Armando Salles de Olivie	Jan-1967	32,0	1,00	0,0	0,0%	0,000
95	S-SE-CO	H	Caconde	Jan-1966	80,4	1,00	0,0	0,0%	0,000
96	S-SE-CO	C	J.Lacerda C	Jan-1965	363,0	0,25	26,0	98,0%	1,345
97	S-SE-CO	C	J.Lacerda B	Jan-1965	262,0	0,21	26,0	98,0%	1,602
98	S-SE-CO	C	J.Lacerda A	Jan-1965	232,0	0,18	26,0	98,0%	1,869
99	S-SE-CO	H	Bariri (Alvaro de Souza Lima)	Jan-1965	143,1	1,00	0,0	0,0%	0,000
100	S-SE-CO	H	Funil (RJ)	Jan-1965	216,0	1,00	0,0	0,0%	0,000
101	S-SE-CO	C	Figueira	Jan-1963	20,0	0,30	26,0	98,0%	1,121
102	S-SE-CO	H	Furnas	Jan-1963	1.216,0	1,00	0,0	0,0%	0,000
103	S-SE-CO	H	Barra Bonita	Jan-1963	140,8	1,00	0,0	0,0%	0,000
104	S-SE-CO	C	Charqueadas	Jan-1962	72,0	0,23	26,0	98,0%	1,462
105	S-SE-CO	H	Jurumirim (Armando A. Laydner)	Jan-1962	97,7	1,00	0,0	0,0%	0,000
106	S-SE-CO	H	Jacui	Jan-1962	180,0	1,00	0,0	0,0%	0,000
107	S-SE-CO	H	Pereira Passos	Jan-1962	99,1	1,00	0,0	0,0%	0,000
108	S-SE-CO	H	Tres Marias	Jan-1962	396,0	1,00	0,0	0,0%	0,000
109	S-SE-CO	H	Euclides da Cunha	Jan-1960	108,8	1,00	0,0	0,0%	0,000
110	S-SE-CO	H	Camargos	Jan-1960	46,0	1,00	0,0	0,0%	0,000
111	S-SE-CO	H	Santa Branca	Jan-1960	56,1	1,00	0,0	0,0%	0,000
112	S-SE-CO	H	Cachoeira Dourada	Jan-1959	658,0	1,00	0,0	0,0%	0,000
113	S-SE-CO	H	Salto Grande (Lucas N. Garcez)	Jan-1958	70,0	1,00	0,0	0,0%	0,000
114	S-SE-CO	H	Salto Grande (MG)	Jan-1956	102,0	1,00	0,0	0,0%	0,000
115	S-SE-CO	H	Mascarenhas de Moraes (Peixoto)	Jan-1956	478,0	1,00	0,0	0,0%	0,000
116	S-SE-CO	H	Itutinga	Jan-1955	52,0	1,00	0,0	0,0%	0,000
117	S-SE-CO	C	S. Jerônimo	Jan-1954	20,0	0,26	26,0	98,0%	1,294
118	S-SE-CO	O	Carioba	Jan-1954	36,2	0,30	20,7	99,0%	0,902
119	S-SE-CO	O	Piratininga	Jan-1954	472,0	0,30	20,7	99,0%	0,902
120	S-SE-CO	H	Canastra	Jan-1953	42,5	1,00	0,0	0,0%	0,000
121	S-SE-CO	H	Nilo Peçanha	Jan-1953	378,4	1,00	0,0	0,0%	0,000
122	S-SE-CO	H	Fontes Nova	Jan-1940	130,3	1,00	0,0	0,0%	0,000
123	S-SE-CO	H	Henry Borden Sub.	Jan-1926	420,0	1,00	0,0	0,0%	0,000
124	S-SE-CO	H	Henry Borden Ext.	Jan-1926	469,0	1,00	0,0	0,0%	0,000
125	S-SE-CO	H	I. Pombos	Jan-1924	189,7	1,00	0,0	0,0%	0,000
126	S-SE-CO	H	Jaguari	Jan-1917	11,8	1,00	0,0	0,0%	0,000
				Total (MW) =	**66.007,1**				

* Subsystem: S - south, SE-CO - Southeast-Midwest

** 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 GHG mitigation projects in the electric power sector.* OECD/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).

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid

Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [GWh]	Imports [MWh]
2002	0,8504	275.402.896	258.720	1.607.395
2003	0,9378	288.493.929	274.649	459.586
2004	0,8726	297.879.874	284.748	1.468.275
	Total (2001-2003) =	861.776.699	818.118	3.535.256
	$EF_{OM, simple-adjusted}$ [tCO2/MWh]	$EF_{BM,2004}$	Lambda	
	0,4310	0,1045	λ_{2002}	
	Alternative weights	Default weights	0,5053	
	w_{OM} = 0,75	w_{OM} = 0,5	λ_{2003}	
	w_{BM} = 0,25	w_{BM} = 0,5	0,5312	
	EF_{CM} [tCO2/MWh]	Default EF_{OM} [tCO2/MWh]	λ_{2004}	
	0,3494	0,2677	0,5041	

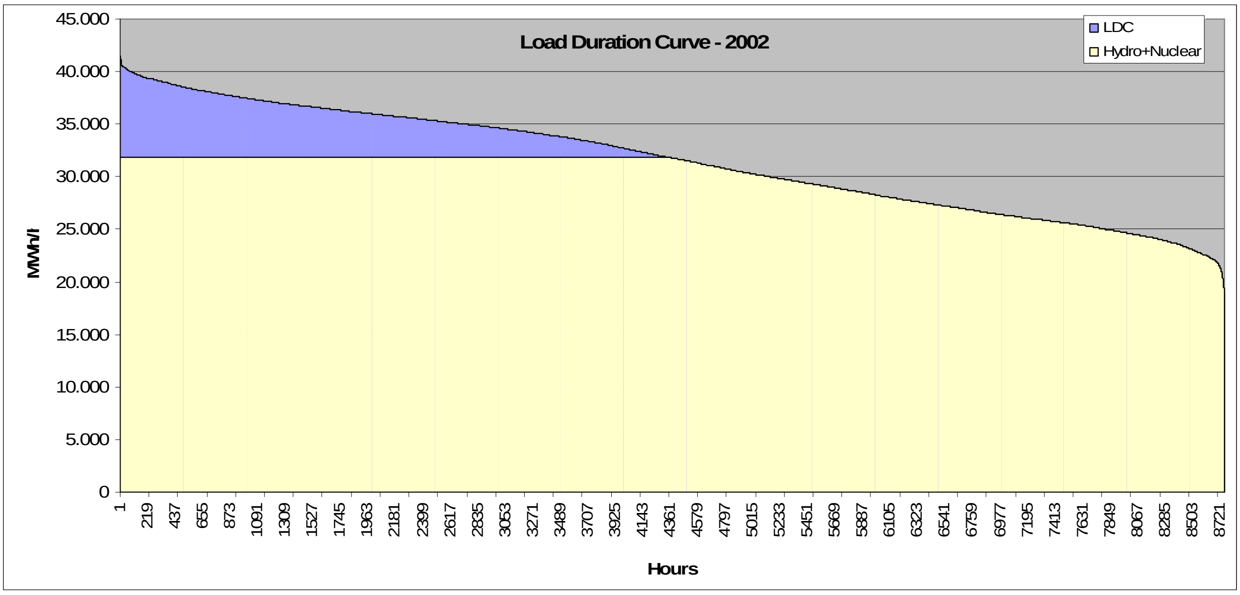

Figure 5. Load duration curve for the S-SE-CO sub system, 2002

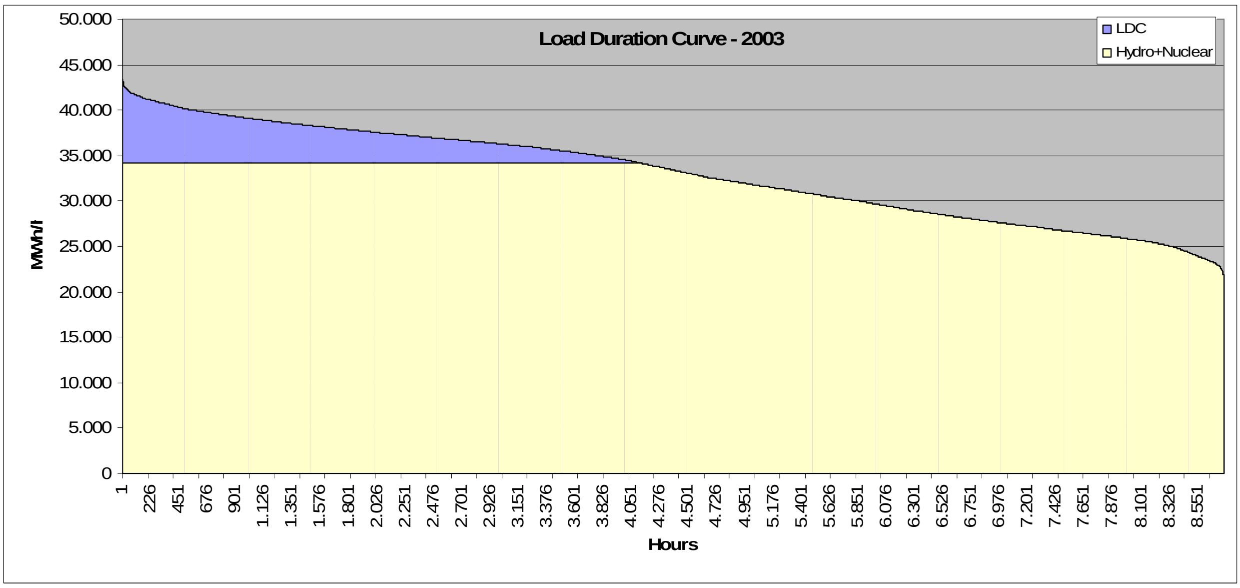

Figure 6. Load duration curve for the S-SE-CO sub system, 2003

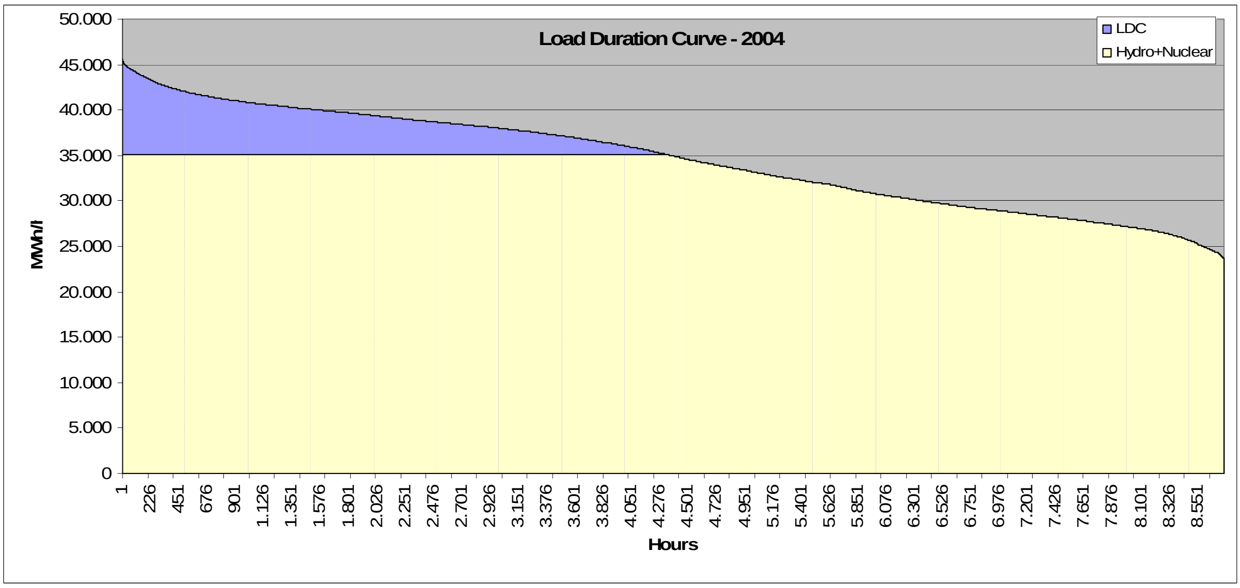

Figure 7. Load duration curve for the S-SE-CO sub system, 2004

Água Bonita Bagasse Cogeneration Project (ABBCP)

Electricity Produced / Emission Reduction	Before Phase 1			Crediting period							
Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total CERs
Electricity Produced (MWh)	3.276	4.680	5.616	78.029	89.318	89.318	89.318	89.318	89.318	89.318	
Sugar-cane crushed (t)	279.805	396.355	467.863	847.000	1.058.750	1.058.750	1.058.750	1.058.750	1.058.750	1.058.750	
Efficiency of Electricity Production ($Mwh_{el}/TJ_{bagaço}$)		4,94		46,06	35,15	35,15	35,15	35,15	35,15	35,15	
$EG_{projeto\ plant}$ (MWh)				78.029	89.318	89.318	89.318	89.318	89.318	89.318	
EG (MWh)				69.655	76.758	76.758	76.758	76.758	76.758	76.758	
Emission Factor (CO_2e/MWh_{el})	0,2677	0,2677	0,2677	0,2677	0,2677	0,2677	0,2677	0,2677	0,2677	0,2677	
Total CO_2 emissions reductions, tCO2e/year	**0**	**0**	**0**	**18.647**	**20.548**	**20.548**	**20.548**	**20.548**	**20.548**	**20.548**	**141.935**

Data available from 2003 to 2005. Data from 2006 on are estimated

Figure 8. ABBCP Emission Reduction Estimative

Annex 4

MONITORING PLAN

According to the section D of this document, the variables that will be monitored in this project activity are the quantity of energy produced by the project plant and the amount of sugar-cane crushed, from year 2006 up to the end of the last crediting period. Since no leakage nor any off-grid emissions change were identified in this project activity, there will be no need to monitor the variables for these cases. The monitoring will occur as follows:

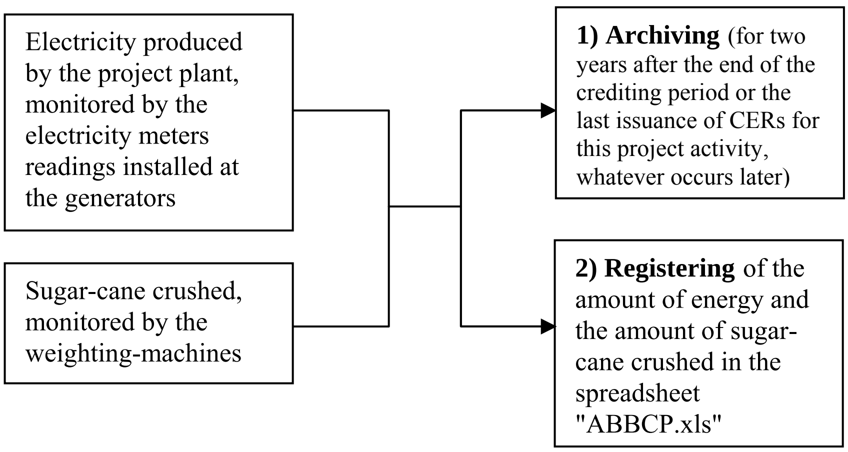

Figure 9. Monitoring procedures for Água Bonita

The quantity of energy produced by the project plant will be monitored through the energy meters installed at the generators and the amount of sugar-cane crushed will be monitored by measures at the weighting-machines. 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 "ABBCP.xls", which shall be the instrument for the further Verification.