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:

Vale do Rosário Bagasse Cogeneration (VRBC).
Version 1 B
Date of the document: December 07th, 2005.

The only changes made to this version of the PDD compared to the PDD dated 08/01/2005 are related to the recalculation of the build margin emission factor with the plant efficiencies recommended by the CDM Executive Board at its 22nd meeting.

A.2. Description of the project activity:

This project activity consists of increasing efficiency in the bagasse (a renewable fuel source, residue from sugarcane processing) cogeneration facility at **Companhia Açucareira Vale do Rosário** (VR), a Brazilian sugar mill. With the implementation of this project, the mill has been able to sell electricity to the national grid, avoiding that fossil-fuelled thermal plants dispatch the same amount of energy to that grid. By that, the initiative avoids CO_2 emissions, also contributing to the regional and national sustainable development.

By investing to increase steam efficiency in the sugar and alcohol production and also increasing the efficiency in the steam production with more efficient boilers, VR generates surplus steam for using it exclusively on electricity production in its power-house, which also required buying turbo-generators.

The sponsors of the VRBC are concerned 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 VR project activity helps to enhance the consumption of renewable energy. Besides that, it is used to demonstrate the feasibility of electricity generation as a side-business source of revenue for the sugar industry. It is worthy to highlight that out of approximately 320 sugar mills in Brazil, the great majority produces energy for on-site use only, and not for grid supply, which is mainly due to the low-efficiency cogeneration equipment installed on those sugar mills.

Furthermore, the agribusiness based on sugarcane 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 creating jobs and achieving the sustainable development.

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

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

Contribution to sustainable development

Nowadays, VR is listed among the five major sugarcane enterprises in Southern Brazil. In the 2001/2002 harvesting season, it produced 4.1 million tons of sugarcane, 160.0 million liters of ethanol, and 290.5 thousand tons of sugar. In the 2002/2003 harvesting season, its production was 4.3 million tons of sugarcane, 140.9 million liters of ethanol, and 353.7 thousand tons of sugar.

In the continuous search for improvements in its productive performance, VR gives special attention to its human resources. To encourage its employees to be deeply engaged with the results of the company, VR has always developed human resources social services. The company believes that the employees' contribution to increase the quality of the products is heavily dependent on their quality of life. So, in order to assist them achieving a higher quality of life, the company offers a program called *Serviço Social* ("Social Service") to the employees and their relatives, assisting them with medical care, educational support, leisure activities and other services they may need.

The total amount of resources allocated to the *Serviço Social* program in the industrial area was around R$ 1.6 million[1] during 2002 harvest period only (April to December), enough to assist the 2,142 people listed in the program. Out of that number, 675 are directly employed by VR, with the remaining being the relatives and as such indirect beneficiaries of the program.[2]

The numbers increase if one considers also the agriculture operations, carried out by *Nova Aliança*, a company founded in 1978 to provide technical support to suppliers, and also to enlarge and ensure sugarcane supply to VR, adjusted to the increase of industrial capacity of the company. *Nova Aliança* employs 3,178 workers during the harvest period (April to December) and 2,778 workers during the inter-harvest months of the year. Moreover, the sugarcane suppliers employ about 1,958 people in the harvest season and 1,568 in the inter-harvest period.[3] All these workers are benefited by the *Serviço Social* program thus totalling 14,945 beneficiaries, including workers and relatives, for a total of R$ 1,6 million expended only in the harvest season of 2002.

VR is also the second largest sugar mill in terms of cogeneration of electricity and steam and undoubtedly is building up capacity of bagasse-based power production through the Brazilian sugar industry.

A.3. Project participants:

- **Companhia Açucareira Vale do Rosário** (VR), a Brazilian private company.

[1] Exchange rate in September 02, 2002 is R$/US$ 3.0286/1. Source: Brazilian Central Bank.

[2] Position in September 2002. The expenditures with the program not include the obligatory social duties, which amounted about R$ 2.1 millions in the harvest season of 2002. It is worth to note that this program has been implemented long before 2002.

[3] Data regarding 2002, updated until September.

- **Econergy Brasil Ltda**, a Brazilian private company which developed the baseline and monitoring methodology on the CDM.
- **Swedish Energy Agency**, the Government of Sweden, which purchase Certified Emission Reductions generated by the project as well as it assisted on the technical support on the CDM.

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.:

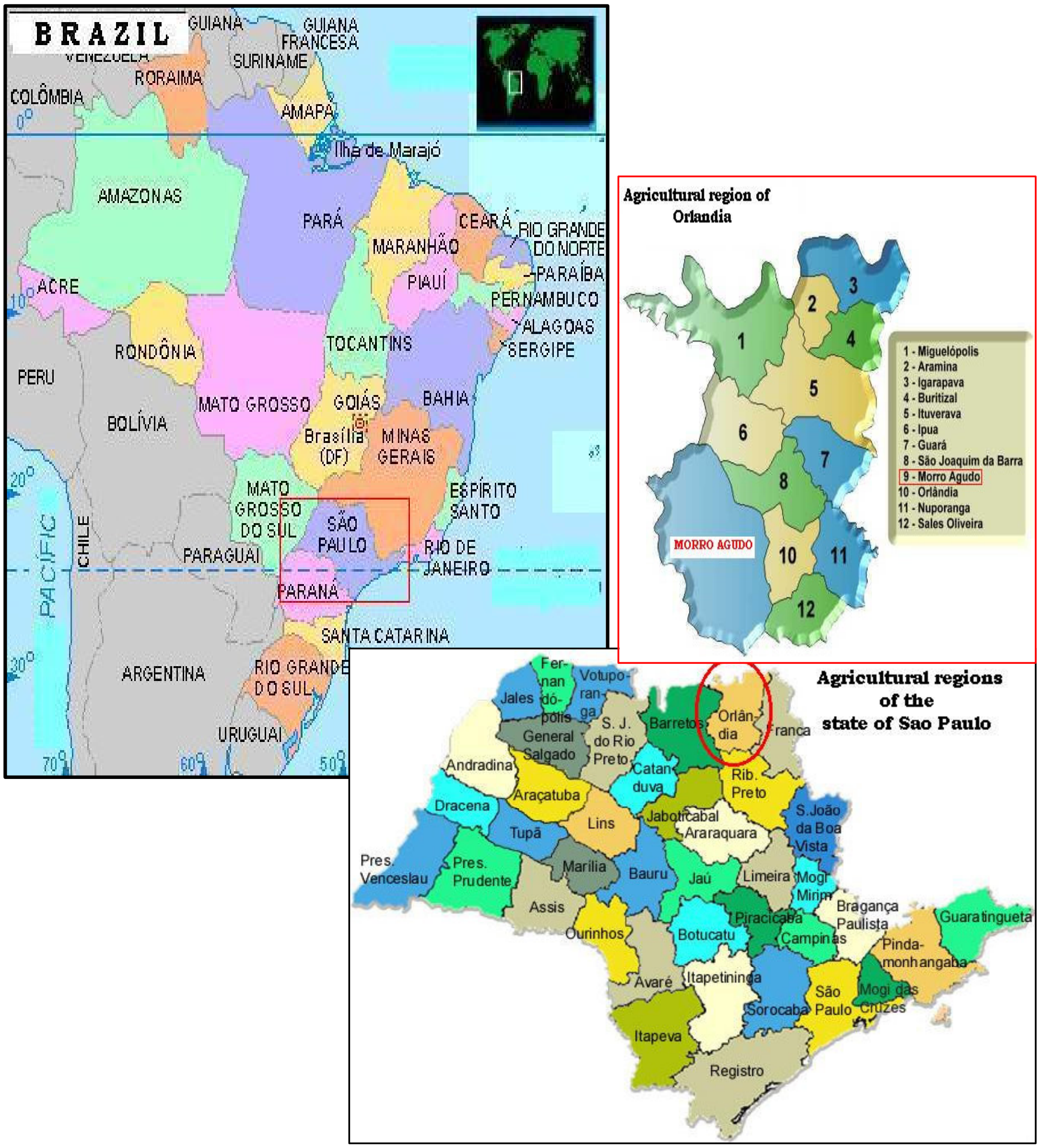
São Paulo

A.4.1.3. City/Town/Community etc:

Morro Agudo

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

Morro Agudo is located northeast in the State of São Paulo, about 340 kilometers (km) far from the state capital, São Paulo, in the agricultural region of Orlândia, as can be seen in Figure 1. The region holds an ample availability of manpower, and communication and transport infrastructures, and can be accessed through a direct highway from São Paulo, “Rodovia Anhangüera” (SP-330).



Source: Elaborated from Coordenadoria de Assistência Técnica Integral (CATI)[4].

Figure 1: Geographical position of the municipality of Morro Agudo

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:

[4] www.cati.sp.gov.br

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

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

Steam turbines are designed as either "backpressure" or "condensing" turbines. CHP applications typically employ backpressure turbines, wherein steam expands to a pressure that is still substantially above ambient pressure. It leaves the turbine still as a vapour and is sent to satisfy industrial heating needs, where it condenses back to water. It is then partially or fully returned to the boiler. Alternatively, if process steam demands can be met using only a portion of the available steam, a condensing-extraction steam turbine (CEST) might be used. This design includes the capability for some steam to be extracted at one or more points along the expansion path for meeting process needs (see Figure 2). Steam that is not extracted continues to expand to sub-atmospheric pressures, thereby increasing the amount of electricity generated per unit of steam compared to the backpressure turbine. The non-extracted steam is converted back to liquid water in a condenser that utilizes ambient air and/or a cold-water source as the coolant[5].

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

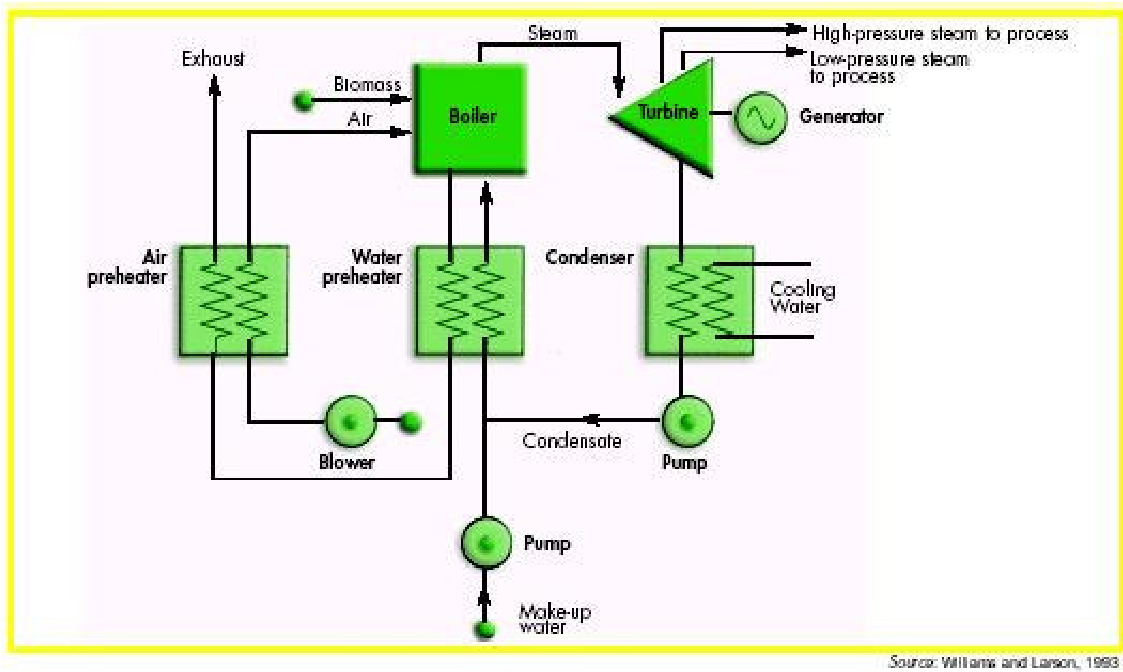


Figure 2: Schematic diagram of a biomass-fired steam-rankine cycle for cogeneration using a condensing-extraction steam turbine

Using steam-rankine cycle as the basic technology of its cogeneration system, for achieving an increasing amount of surplus electricity to be generated, VR began its efforts in two phases, which are:

The project phases are described as follows:

- **Phase 1 (1990-1994)**: involved installation of higher-efficiency steam turbines and a ten-year contract with then state-owned utility, *Companhia Paulista de Força e Luz* (CPFL), to sell 4 MW to the utility's grid.

- **Phase 2 (1995- 1997)**: involved acquisition of two new boilers and a 12 MW turbo-generator. Another ten-year contract with CPFL was signed then, in order to sell 15 MW of installed capacity to the utility's grid.

- **Phase 3 (2001)**: involves acquisition of a 15 MW turbo-generator and another stand-by one 4 MW turbo-generator in order to increase the surplus electricity available for sale to the grid by 15 MW;

- **Phase 4 (2003)**: as an expansion of the Phase 3 and operational in June 2003, it is based on increasing the pressure in the boiler, which increases the total surplus electric power generation capacity, allowing VR to sell an additional 35 MW energy to CPFL. This phase includes acquisition of one 65-bar boiler and two 25 MW turbo-generators, standing-by two 4 MW turbo-generators, and the enhancement of the energy hub from 138 kV to 42 MVA.

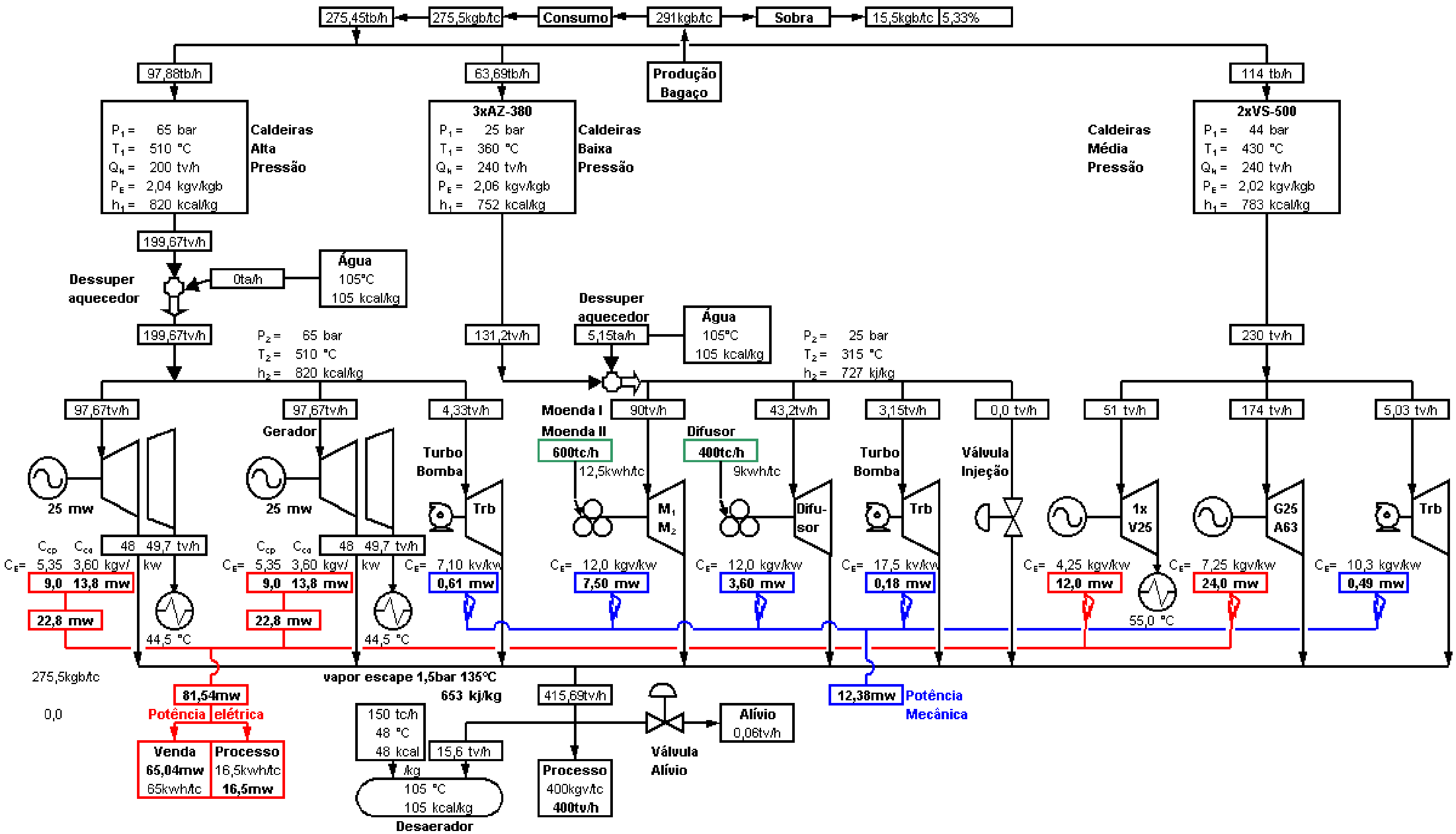
Below is a summary of the upgrades in the electricity generation capacity in the mill.

Component of the cogeneration system	Equipments		
	Before VRBC project activity implementation	VRBC project activity	
		Phase 3 (2001)	Phase 4 (2003)
	Total capacity = 36MW	Total capacity = 51MW	Total capacity = 101MW
OPERATION	6 turbo-generators: • 3 of 4MW; • 2 of 6MW • 1 of 12MW	6 turbo-generators: • 2 of 4MW • 2 of 6MW • 1 of 12MW • 1 of 15MW (condensing-type)	6 turbo-generators: • 2 of 6MW • 1 of 12MW • 1 of 15MW (condensing-type) • 2 of 25MW (condensing-type)
STAND BY	-	1 generator of 4MW	3 generators of 4MW

In spite of being unilaterally funded, technology transfer was applied in VRBC project activity, as the steam turbines are Swedish, manufactured by ABB. The boiler technology is domestic (Brazilian), as is much of the small equipment installed to work with the turbine. Further technical assistance has been incorporated into this CDM project by the Swedish Energy Agency.

It is worthy to note that the investments to increase efficiency in phases 3 and 4 are not intended to enhance the sugar production process. It is an entirely new project focused on better exploiting the biomass resource to increase renewable energy production through a closed cycle condensing type steam turbine.

The Energy Balance related to the cogeneration system after VRBC project activity implementation is indicated in Figure 3. The location of the additional equipments for generating the surplus electricity is indicated in Figure 4.



Note: Figures in red means retrofit or expansion.

Figure 3: Energy Balance Diagram for VRBC project activity

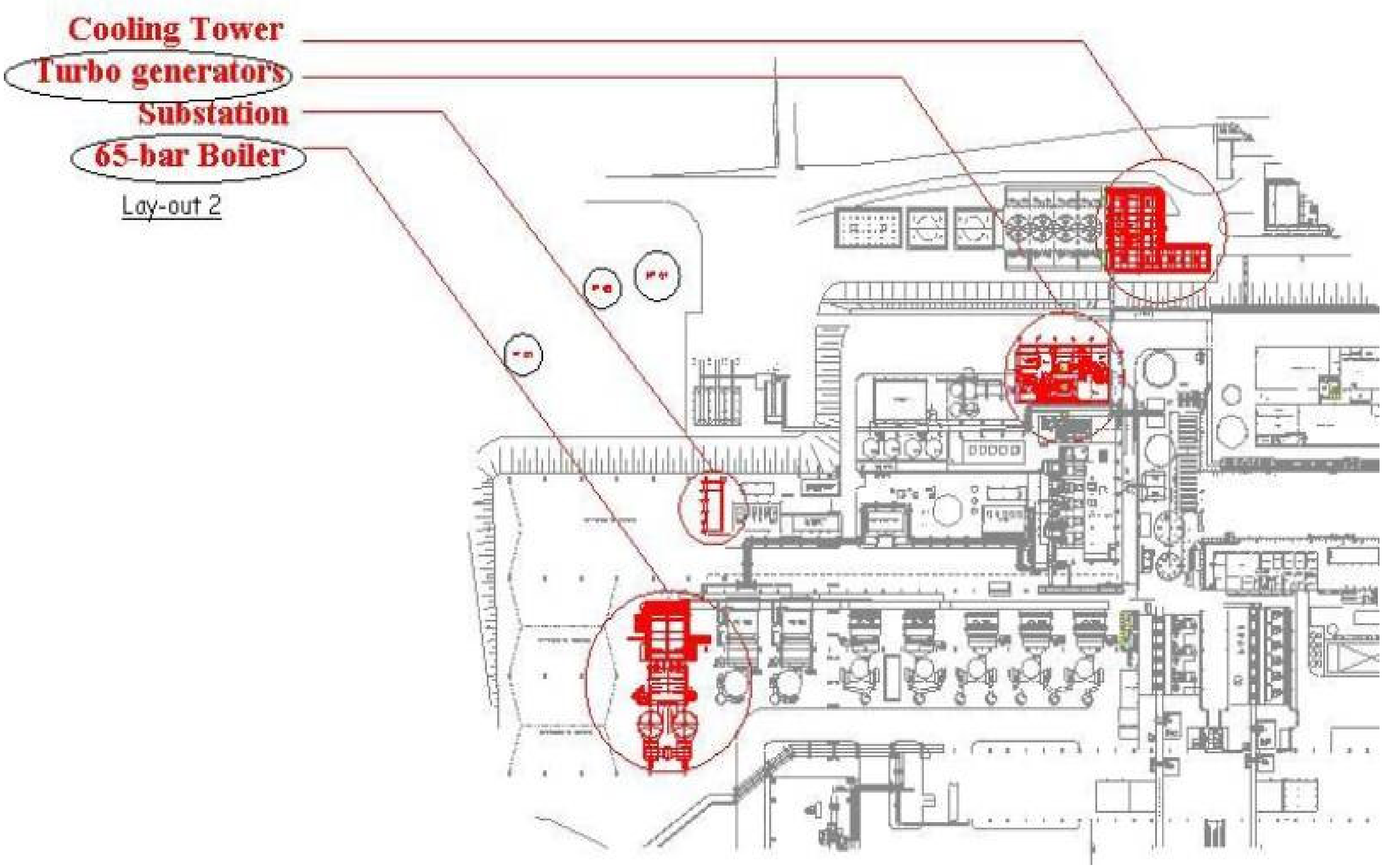


Figure 4: Location of installed equipments for VRBC project activity at VR site -Lay out

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 will not be able to produce the steam required by both the sugar production process and the power-generation turbo-generators. In order to avoid power-generation interruptions, the cogeneration expansion plan in VRBC includes investments in the sugar and ethanol production process in order to reduce the steam consumption in the sugar and ethanol production processes. This efficiency improvement is necessary in order to drive as much steam as possible to the cogeneration project. Consequently, the greater the quantity of electricity production that is sought, the higher the investment cost per MWh produced.

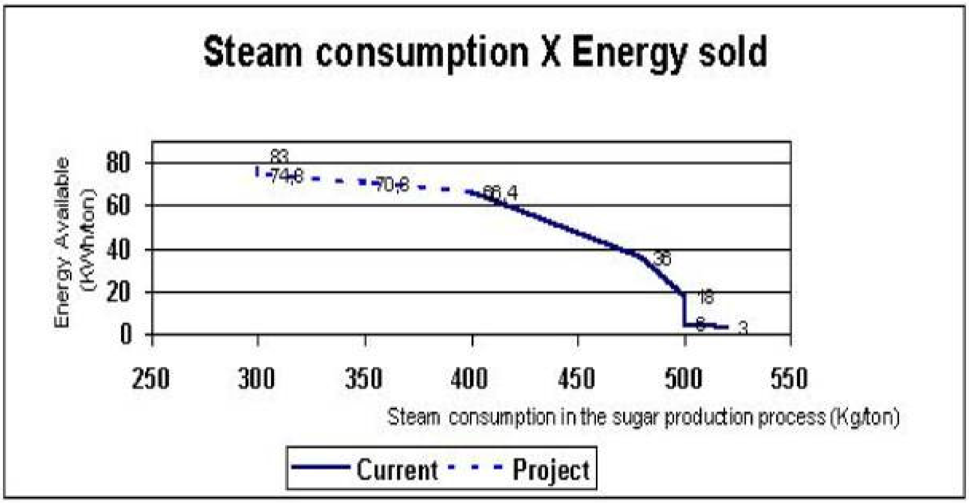


Figure 5. Steam Consumption vs. Energy Sold

The following chart shows the relationship between the steam consumption in the sugar and ethanol production process and energy available (kWh/ton of sugarcane) to supply the grid.

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

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

Bagasse is a fibrous biomass by-product from sugarcane processing, which accounts for about 25 percent on weight of fresh cane and approximately one third of the cane's energy content. In a typical Brazilian sugarcane mill, burning bagasse for generation of process heat and power production is a practice already established. It is estimated that around 700 MW of bagasse-based power capacity are currently installed in the state of São Paulo only[6]. The energy produced from these facilities is almost all consumed for their on purpose. Because of constraints that limited the access of independent power producers to the electric utilities market, there is no incentive for

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

sugarcane mills to operate in a more efficient way. Low-pressure boilers, very little concern with optimal use and control of steam, crushers mechanically activated by steam, energy intensive distillation methods, are a few examples of inefficient methods applied to the sugar industry as normal routine.[7]

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' need 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 energy and make the bagasse cogeneration electricity attractive for any potential purchasers.

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

This project activity is to reduce **176.937 tCO_2e** over the first crediting period.

[7] Nastari, 2000.

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
09/06/2001	13.272
2002	5.439
2003	22.034
2004	31.788
2005	31.775
2006	31.775
2007	31.775
08/08/2008	9.079
TOTAL ESTIMATED REDUCTIONS (TONNES OF CO_2E)	176.937
TOTAL NUMBER OF CREDITING YEARS	7
ANNUAL AVERAGE OVER THE CREDITING PERIOD OF ESTIMATED REDUCTIONS (TONNES OF CO_2E)	25.277

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline methodology

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

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

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

This methodology is applicable to VRBC because all the bagasse utilized by VR is produced internally as a by-product from sugarcane processing (alcohol and sugar production); the clean development mechanism encouraged the project owners to proceed with the project's final phases. The any change on bagasse production is strictly related to sugar and ethanol production, which might VR might wish to increase depending on their market condition, therefore the project activity itself has no effect on bagasse production. Finally, no bagasse will be stored for more than one year. Usually, a small amount of bagasse like 2% is stored at the Brazilian sugar mills during off-season (approximately 6 months) to serve as fuel at the beginning of the next season.

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

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

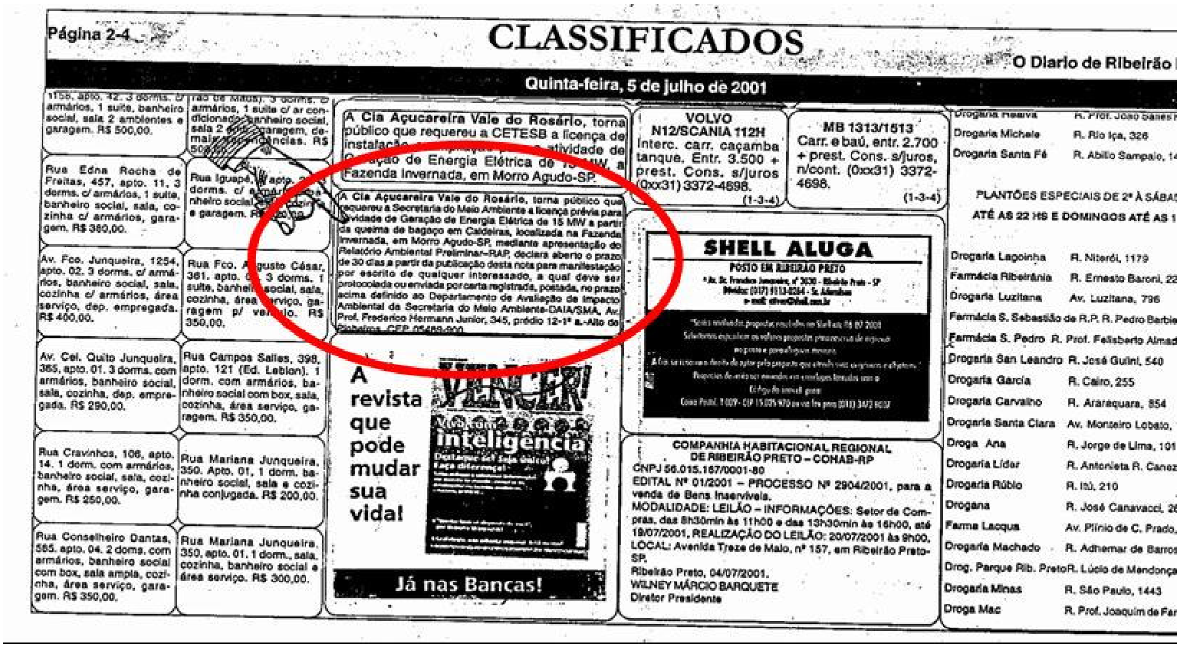
ID number	Data type	Value	Unit	Data Source
1. EG_y	Electricity supplied to the grid by the Project.	Obtained throughout project activity lifetime.	MWh	Project owner
2. EF_y	CO_2 emission factor of the Grid.	0,2677	tCO_2e/MWh	Calculated
3. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	0,4310	tCO_2e/MWh	This value was calculated using data information from ONS, the Brazilian electricity system manager.
4. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	0,1045	tCO_2e/MWh	This value was calculated using data information from ONS, the Brazilian electricity system manager.
10. λ_y	Fraction of time during which low-cost/ must-run sources are on the margin.	λ_{2002} = 0,5053 λ_{2003} = 0,5312 λ_{2004} = 0,5041	-	This value was calculated using data information from ONS, the Brazilian electricity system manager.

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

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

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

(a) The starting date of this project activity occurred in year 2001, therefore commence after 2000, which can be confirmed at the CETESB (Companhia de Tecnologia e Saneamento Ambiental) from São Paulo State as VR required authorization (Anotação de Responsabilidade Técnica ART nº 1345122) to install the 15 MW capacity turbo-generator (phase 3) in 08 February 2001. Moreover, as part of the licensing process the project was open for stakeholder comments during 30 days, which is shown in request for comments published in the local newspaper amongst others, following.



Página 2-4

CLASSIFICADOS

O Diario de Ribeirão

Quinta-feira, 5 de julho de 2001

A Cia Açucareira Vale do Rosário, torna público que requereu a CETESB a licença de instalação ... atividade de Geração de Energia Elétrica de 15 MW, a Fazenda Invernada, em Morro Agudo-SP.

A Cia Açucareira Vale do Rosário, torna público que requereu a Secretaria do Meio Ambiente a licença prévia para atividade de Geração de Energia Elétrica de 15 MW a partir da queima de bagaço em Caldeiras, localizada na Fazenda Invernada, em Morro Agudo-SP, mediante apresentação do Relatório Ambiental Preliminar–RAP, declara aberto o prazo de 30 dias a partir da publicação desta nota para manifestação por escrito de qualquer interessado, a qual deve ser protocolada ou enviada por carta registrada, postada, no prazo acima definido ao Departamento de Avaliação de Impacto Ambiental da Secretaria do Meio Ambiente-DAIA/SMA, Av. Prof. Frederico Hermann Junior, 345, prédio 12-1º a.-Alto de Pinheiros, CEP 05489-900.

(b) Even though VR has been the leader in the development of cogeneration in the Brazilian sugar industry, going beyond previous cogeneration investments to achieve the more efficient biomass cogeneration production in this project requires a higher level of investment per capacity added to the system. Therefore, increasing cogeneration capacity is not the natural course of action for this company, whose core businesses are sugar and ethanol production. In order to mitigate the risk-perception so the corporate decision could be for investing even more in cogeneration, the CDM opportunity has been taken into account as a source of finance since 1999.

VR's CEO – Mr. Ricardo Brito – has been engaged with CDM possibilities since 1999, a semester before he attended a seminar at the São Paulo Business School (EAESP/FGV) as Moderator on the panel discussing projects elegibility, certification and generation of CERs (Qualificação de Projectos, Certificação e Geração de Créditos)[8], looking for a better understanding of the CDM procedures and the feasibility for using it as a source of funding to support the expansion of VR cogeneration. The other participants in the panel, as well as the EAESP/FGV might serve as alive evidence that the CDM has been considered in the project activity Moreover, VR is the case study of a Master Degree thesis in the Imperial College of Science, Technology and Medicine of the University of London, in the Center of Environmental Technology. The author of this thesis (DIC degree) is Mr. Joaquim Heck, current a VR's director, who wrote that thesis from September 1998 to September 1999, supervised by Dr. William Cavendish, in which he assessed the carbon emission reduction in this industry [9]. In addiction to all of the evendence mentioned in this paragraph, Mr. Marcelo Schunn Diniz Junqueira, the managing director of Econergy Brasil, which develops this Project Design Document, is also from the family of shareholders who controls VR and also wrote a thesis (MSc degree) from 1998 to 2002 in São Paulo Business School focusing on the case of VR CDM project as source of funding for expansion of its cogeneration project activity. This thesis was

[8] In this panel there were also Mrs. Sandra Brown, from Winrock International, Mr. Norm Anderson form BP Amoco, Mr. Peter Avram-Waganoff from IPRO Industrieprojekt GmbH, Mr. Manoel Regis Lima Verde Leal from Copersucar and Mr. Adwin Aalders from SGS.

[9] Heck, 1999.

supervised by Dr. Rubens Mazon[10]. Both studies were used to support Mr. Brito's clarification to VR's Board of Directors why CDM is an actual source of funding.

As investment capital within the company is limited, investing in expanding the cogeneration capacity at VR involves opportunity costs. The investment must be perceived by the company's Board to be more beneficial than other investments in the sugar and ethanol production processes at the mill. Mr. Brito persistently explored the CDM potential of the project with the intention to provide the company's Board with enough information to overcome the all other barriers described in this document.

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

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

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

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

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

3. Non applicable.

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

Step 3. Barrier analysis

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

1. According to COELHO (1999)[11], "large scale cogeneration program in sugar-alcohol sector has not yet occurred, due to several barriers, mainly economic, political and institutional", such as:

I. Technological Barriers

Technological barriers represent a very important issue for increasing bagasse cogeneration in Brazil, for despite of the fact that Rankine-cycle is a well known technology, the cogeneration units operate with low-efficiency and are not competitive comparing to other generation options. In this way there is a tricky issue about technology and economic value for such technology. Although this technology is well developed, the economic value for its application is not for projects on the scale similar to the sugar mills in Brazil. COELHO (1999) justifies that by highlighting that the unitary

[10] Junqueira, 2002.
[11] Coelho, S. T. ''Mecanismos para Implementação da Cogeração de Eletrecidade a partir de biomass. Um Modelo para os Estado de São Paulo". Programa Interunidades de pós-graduação em Energia. São Paulo, Agosto de 1999.

costs ($/installed MW) are significantly influenced by scale-effect. As the bagasse cogeneration unit should have a small scale due to the high cost for transportation of the fuel (bagasse), investments are high. Therefore, as a lower cost of capital is wanted, the result is a simplified installation and lower efficiency.

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

Moreover, SWISHER (1997)[12] considers difficult to convince the local distributor that the energy to be acquired, generally generated during the harvest season, is sufficiently reliable to be accounted in the distributor's planning.

II. Institutional and Political Barriers

From the electric sector point of view, according COELHO (1999), acquiring electricity other than hydroelectric would not be a priority, arguing that for the electricity is generated only during the harvest season, no firm energy could be offered. However, the biggest advantage of the bagasse based electricity is that it is produced during the period where hydroelectric plants face difficulties due to the low level of rains. As a result, COELHO (1999) suggests that there is a significant prejudice and conservativeness of the distributors when deciding whether to purchase or not bagasse based energy.

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

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

Other barriers have more to do with the lack of adequate commercial contractual agreements from the energy buyers (i.e. bankable long-term contracts and payment guarantee mechanisms for non-creditworthy local public-sector and private customers) and that influences directly making more difficult to obtain a long-term financing from a bank and/or development bank. Some other financing barriers occur simply due to prohibitively high transaction costs, which include the bureaucracy to secure the environmental license.
Since 1997, according to SWISHER (1997), the announcement of a Cogeneration Decree has been awaited, and that was supposed to have this positive influence on corporate decision-making with respect to biomass project implementation. The original Cogeneration Decree proposal, which was never approved, called for mandatory purchase by the regional utilities - "*concessionárias*" - from

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[12] 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. Prepared for Global Environment Facility (GEF) Secretariat,Washington DC, 1997.

cogenerating and self-generating facilities[13]. Instead of renewable energy, the government expansion plan for electric energy, approved in August is based on fossil fuel – Natural Gas. This expansion plan called Thermoelectricity Priority Plan (PPT) became a reality right before the energy crisis. The Thermoelectricity Priority Plan beneficiaries, which were mainly natural gas thermal plants, through the Ministry of Mines and Energy (MME) Decree 3,371 from December 2000, counted on guaranteed, long term and attractive price conditions on Natural Gas supply and Energy sales, together with financing from the national development bank BNDES. And though the PPT plan is not likely to be fully implemented, the public-sector policies for renewable energy are not considered reliable enough by the executives of the private sector to support cogeneration expansion in the sugar mills. This assumption is clearly shown in the following list of rules and/or regulations to the energy sector that have been set 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;
- **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;
- **December 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.

[13] Presidential Decree on the co-generation of electric energy, draft of 5 August 1997.

- **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.

For this CDM project analysis purposes, by the time the project started there were no institutional incentive like PROINFA to be considered. Therefore, the company's decision on signing a long-term PPA with the local distributor undoubtedly represented a significant risk that the mill was willing to risk.

Although PROINFA entered into force in the year 2004, it does not affect the current PPAs, because PROINFA is planned to buy energy from project that will generated electricity by January 2006 only. Therefore, the project activity does not have its operating phases eligible for the PROINFA.

III. Economic and Investment Barriers

"There are several reasons for the Brazilian utilities' reluctance to offer higher prices for co-generated power. One important reason stems from their assumption that their costs are geographically uniform – i.e., that there is essentially a single value for their avoided cost in the industrial sector. If this cost value does not indicate that sufficient savings are available from buying co-generated power, and then there is little economic motivation, under either a public monopoly or a privatized competitive structure, for a utility to pay enough for co-generation to satisfy potential investors' financial criteria" [14] as stated by SWISHER (1997). In fact, the economic cost is the reason that Brazilian utilities do not buy cogeneration electricity energy, at least, while the energy sector regulation does not guarantee them the right to pass such cost through the end user tariff. The cost of cogeneration electricity ranges from US$ 35 to US$ 105 per MWh, according to the Expansion Plan 2001-2010 from Brazil Government, which is described as higher than the marginal cost for electricity expansion in the system – US$ 33/MWh[15].

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

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

IV. Cultural Barrier

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

[15] "Como se pode observar, os custos unitários da fontes alternativas de energia ainda são altos comparados ao custo marginal de expansão do sistema, hoje calculado em US$33/MWh". IN: Brazil, Ministry of Mines and Energy, 2001, pg. 80.

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

There are also questions regarding the managerial capacity of the companies that comprise the Brazilian sugarcane industry. In many cases, they have demonstrated the will to undertake investments in new technologies, but without sufficient financial and entrepreneurial capacity to complete such projects, according to WALTER (1994)[16].

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

Step 4. Common practice analysis.

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

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

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

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

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

Step 5. Impact of CDM registration

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[16] Walter, A.C.S. Viabilidade e Perspectivas da Co-geração e Geração Termelétrica no Setor Sucro-alcooleiro. (Tese de Doutorado). UNICAMP, Campinas, 1994.

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

Moreover, the CDM project registration must influence other similar projects to move toward the use of CER sales as economic benefits, therefore there would also be a benefit by having all of those followers working strictly on the sustainable environmental management, as this is requested by any project intending to registry.

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 likely to attract new players and new technology (there are companies currently developing new type of boilers – extra-efficient – and the purchase of such equipment is to be fostered due to CER sales revenue) and reducing the investor's risk.

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

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

Baseline energy grid: for VRBC, the South-Southeast and Midwest subsystem of the Brazilian grid is considered as a boundary, since it is the system to which Vale do Rosário is connected and therefore receives all the bagasse-based produced electricity.

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

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

1. Date of completing the final draft of this baseline section

   01/08/2005.

2. Name of person/entity determining the baseline

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

09/06/2001

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

25y-0m.[17]

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:

09/06/2001

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

NA

C.2.2.2. Length:

NA

SECTION D. Application of a monitoring methodology and plan

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

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

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

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

The methodology considers monitoring emissions reductions generated from cogeneration projects with sugarcane bagasse. The energy produced by the project could be electricity exported to a grid-connected system and/or energy used to substitute fossil fuel off-grid connected. And that is exactly the case with VRBC: the project exploits a by-product from the sugarcane milling process (bagasse) to produce and commercialize renewable electricity connected to a regional Brazilian grid. The methodology is therefore fully applicable to VRBC, and justification for choosing it

The applicability of the methodology is described in the paragraph B1.1 of this document.

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

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

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

ID number *(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

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

NA

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

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

1. EG_y	Electricity supplied to the grid by the Project.	Readings of the energy metering connected to the grid and Receipt of Sales.	MWh	*M*	Monthly	*100 %*	Electronic and paper	Double check by receipt of sales. Will be archived according to internal procedures, until 2 years after the end of the crediting period.
2. EF_y	CO_2 emission factor of the Grid.	Calculated	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
3. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	Factor calculated from ONS, the Brazilian electricity system manager.	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
4. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	Factor calculated from ONS, the Brazilian electricity system manager.	tCO_2e/MWh	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.
10. λ_y	Fraction of time during which low-cost/ must-run sources are on the margin.	Factor calculated from ONS, the Brazilian electricity system manager.	index	*C*	At the validation and yearly after registration	*0%*	Electronic and paper	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

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

$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}}$ (tCO_2e/GWh) $EF_{BM} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_m GEN_{m,y}}$ (tCO_2e/GWh) $EF_{electricity} = \frac{EF_{OM} + EF_{BM}}{2}$ (tCO_2e/GWh) $BE_{electricity,y} = EF_{electricity} . EG_y$	$F_{i,j(or\ m),y}$ 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 EG_y Is the net quantity of electricity generated in the bagasse-based cogeneration plant due to the project activity during the year y in MWh, and $EF_{electricity,y}$ Is the CO_2 baseline emission factor for the electricity.

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

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

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

Not applicable

D.2.3. Treatment of leakage in the monitoring plan

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

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

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

Not applicable

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

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

PE_y=0 **L_y=0** **$BE_{electricity,y} = EF_{electricity} \cdot EG_y$**	the year y in tons of CO_2 $BE_{thermal,y}$: Are the baseline emissions due to displacement of thermal energy during the year y in tons of CO_2 PE_y: Are the project emissions during the year y in tons of CO_2. L_y: Are the leakage emissions during the year y in tons of CO_2.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	*Low*	These data will be directly used for calculation of emission reductions. Sales record and other records are used to ensure the consistency.
2	*Low*	Data does not need to be monitored
3	*Low*	Data does not need to be monitored
4	*Low*	Data does not need to be monitored
10	*Low*	Data does not need to be monitored

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

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

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

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

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

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

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

Thus, $\mathbf{PE_y = 0}$

E.2. Estimated leakage:

The surplus bagasse that used to be sold to three industrial consumers (Carol, Brejeiro, and Cargill) before the implementation of the project activity is now being consumed internally, at the cogeneration system. And two of the three former consumers, Brejeiro and Carol, are currently purchasing biomass from another supplier (see negative declarations of substituting bagasse for fossil fuel, in "Other Annexes" section of this PDD). And the third consumer, Cargill, had been advised by governmental agencies to switch its steam boiler from oil to biomass as a measure to diminish emission of particles long before VRBC project was implemented. Thus, VRBC project activity does not adversely incur in leakage, and thus the parameter L_y (leakage) is null

Thus, $\mathbf{L_y = 0}$

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

$\mathbf{L_y + PE_y = 0}$

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

The baseline methodology considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario. In Brazil, there are two main grids, South-Southeast-Midwest and North-Northeast, therefore the 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:

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

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

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

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

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

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

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

$$EF_{OM,simple\_adjusted,2004} = (1-\lambda_{2004}) \frac{\sum_{i,j} F_{i,j,2004}.COEF_{i,j}}{\sum_{j} GEN_{j,2004}} \therefore EF_{OM,simple\_adjusted,2004} = 0{,}4327 \ tCO_2/MWh$$

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

$$EF_{OM,simple\_adjusted\ 2002\_2004} = 0{,}4310 \ tCO_2/MWh$$

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:

$$EF_{BM,2004} = 0{,}1045 \ tCO_2/MWh$$

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:

$$EF_{electricity,2002-2004} = 0{,}5 * 0{,}4310 + 0{,}5 * 0{,}1045 = 0{,}2677 \ tCO_2/MWh$$

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.

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

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

$BE_{electricity,y}$ = 0,2677 tCO_2/MWh . EG_y (in tCO_2e)

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

The emissions reduction of this project activity is

ER = $BE_{electricity,y}$ – (L_y + PE_y) = 0,2677 tCO_2/MWh . EG_y – 0 → **ER = 0,2677 tCO_2/MWh . EG_y**

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

	BASE			Phase 3**		Phase 4***					
=====================>Year	1998	1999	2000	09 June 2001	2002*	2003	2004	2005	2006	2007	08 June 2008 (****)
Total Installed Capacity (MW)	36	36	36	51	51	101	101	101	101	101	101
Energy sold to the grid (MWh)	75.264	89.241	79.403	130.880	101.620	163.610	200.046	200.000	200.000	200.000	57.143
Average "Old" Energy sold to the grid (MWh)		81.303		81.303	81.303	81.303	81.303	81.303	81.303	81.303	23.229
The most likely energy available to supply the grid applying for CERs. Real data for 2001,2002, 2003 and 2004; following the reviewed PPA in following years (MWh)				49.577	20.317	82.307	118.743	118.697	118.697	118.697	33.913
Baseline emission factor (tCO_2/MWh)				0,268	0,268	0,268	0,268	0,268	0,268	0,268	0,268
Total expected GHG emission reductions (tCO_2e/yr)				**13.272**	**5.439**	**22.034**	**31.788**	**31.775**	**31.775**	**31.775**	**9.079**

NOTE: (*) The poor results of electricity generated in 2002 were due to mainly the energy crisis in Brazil in the previous years, causing also a revision on the PPA between the sugar mill and the utility; (**) Data for the period until 2002 are based on real performance, considering energy sold to the CPFL and to the spot market; (***) Data for 2005 and beyond are based on estimated performance and the reviewed PPA: (****) Considering 2 months of the 7-month harvest season.

SECTION F. Environmental impacts

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

The possible environmental impacts of VRBC project activity are to reviewed by the State Secretary of Environment (SMA - *Secretaria de Estado do Meio Ambiente*) through a report called "Preliminary Environmental Report" (RAP - *Relatório Ambiental Preliminar*) prepared by the company and sent to SMA. VR filed the document on July 2nd, 2001 but, with the objective of improving that report, SMA requested a new RAP, which was prepared and delivered to the agency. After analyzing the new report, SMA authorized the state environmental agency (Companhia de Tecnologia e Saneamento Ambiental – CETESB) to issue VR a Previous Environmental License, which was the license 00498, Process SMA Nº 13.632/01, dated May 03, 2002. The RAP was then analyzed by CETESB, as it happens with all projects under licensing in São Paulo state. CETESB approved it, and issued the Installation License. In this license, CETESB makes 3 technical demands for issuing the Working License for VRBC:

(i) Sewage produced within the mill must be treated separately from other industrial effluents, according to norms NBR 7229/93 and NBR 13969/97, from ABNT, the Brazilian Association for Technical Standards;

(ii) Gaseous effluents from the boilers must be released to the atmosphere through chimneys and the colorimetric density of the smog must comply with article 31 of Law's 997/76.

(iii) Liquid effluents from the industry can be used in sugarcane irrigation, if it operates following to the soil characteristics, thereby, avoiding any risks of pollution to the natural environment.

All requests made by CETESB were fulfilled, and so the company obtained a Partial Working License for the bagasse cogeneration project activity. In fact, VR requested the license for the whole project facility. However, at the moment VR started operating the new 15 MW turbo-generator, the other phase of this project were still being installed, therefore VR requested a working license for the former one only. CETESB issued a preliminary working license for the mill to fully operate its cogeneration unit until June 2004, when the agency will check the boilers' monitoring procedures for lately issuing the definitive working license. Due to the overload work on CETESB the agency was not possible to check the boiler until the present time.

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 secretary of environment and CETESB already analyzed the most relevant impacts from the project activity through the RAP, and issuance of the definite working license is conditioned to the compliance with the technical demands for the installation of the project. As already said, the demands have been fully complied with, and CETESB will check, the measures taken by VR, in order to be able to issue the definite working license for VRBC.

SECTION G. Stakeholders' comments

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

In order to ensure transparency in its operational activities and, at same time, to comply with the Brazilian environmental laws[18], the local stakeholders were invited to comment on the project activity in both phases of the project, Phase 3 and Phase 4.

Regarding Phase 3, calls for stakeholders' comments for 30 days thereafter were published on July 5th and 6th of 2001 in the state-owned official newspaper (called *Diário Oficial*) and two local newspapers, "*O Diário de Ribeirão Preto*" and "*A Tribuna de Morro Agudo*", being the former a daily newspaper with regional coverage.

The same procedure was adopted for the Phase 4, announcing the application for of the Previous Environmental License to CETESB and calling for stakeholders' comments through newspapers announcements in the state-owned official newspaper (*Diário Oficial*) and a local newspaper (*A Tribuna de Morro Agudo*),.

Also, as a requirement of the Brazilian Interministerial Commission on Global Climate Change, the Brazilian DNA, VR invited several organizations and institutions to comment the CDM project being developed. Letters[19] were sent to the following recipients:

- Fórum Brasileiro de ONG's e Movimentos Sociais para o Meio Ambiente / *Brazilian NGO Forum*
- CETESB / *Environmental Sanitation Tecnology Company*
- Coordenadoria de Viação, Transporte e Meio Ambiente de Morro Agudo / *Transport and Environmental Coordination of Morro Agudo*
- Rotary Club de Orlândia / *Rotary Club of Orlândia*
- Promotoria de Justiça de Morro Agudo / *Attorning of Morro Agudo*
- Prefeitura Municipal de Morro Agudo / *Municipal Administration of Morro Agudo*
- Câmara Municial de Morro Agudo / *Municipal Legislation Chamber of Morro Agudo*

G.2. Summary of the comments received:

VR did not receive any comments on the project.

[18] According to resolution CONAMA 001/86 and Resolution SMA 42/94. The first covering national and the further, state environmental regulation.

[19] The copy of these invitations, as well as the answers, are available in hold of Project participants.

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

Since no comments were received, VR proceeded with the project as initially planned.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Usina Vale do Rosário
Street/P.O.Box:	
Building:	Fazenda Invernada
City:	Morro Agudo
State/Region:	SP
Postfix/ZIP:	Zona rural
Country:	Brazil
Telephone:	+55 (16) 3820-2000
FAX:	+55 (16) 3820-2001
E-Mail:	vr.diretoria@valedorosario.com.br
URL:	http://www.valedorosario.com.br
Represented by:	
Title:	Managing Director/CEO
Salutation:	Mr.
Last Name:	Brito
Middle Name:	-
First Name:	Ricardo
Department:	Directory
Mobile:	-
Direct FAX:	Same above
Direct tel:	Same above
Personal E-Mail:	vr.diretoria@valedorosario.com.br

Organization:	Econergy Brasil Ltda
Street/P.O.Box:	
Building:	Rua Pará, 76 CJ 41
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	01243-020
Country:	Brazil
Telephone:	+55 (16) 3219 0068
FAX:	+55 (16) 3219 0693
E-Mail:	junqueira@econergy.com.br
URL:	www.econergy.com.br
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Junqueira
Middle Name:	Schunn Diniz-
First Name:	Marcelo
Department:	
Mobile:	+55 (11) 8263 3017
Direct FAX:	Same above
Direct tel:	Same above

Personal E-Mail:	The same as above

Organization:	Swedish Energy Agency
Street/P.O.Box:	P.O. Box 310
Building:	
City:	Eskilstuna
State/Region:	
Postfix/ZIP:	SE 631 04
Country:	Sweden
Telephone:	+46 16 544 20 00
FAX:	+46 16 544 20 99
E-Mail:	stem@stem.se
URL:	
Represented by:	
Title:	Head Climate Change Division
Salutation:	Mr.
Last Name:	Boström
Middle Name:	-
First Name:	Bengt
Department:	The System Analysis Department
Mobile:	+46-706 48 85 79
Direct FAX:	+46 16 544 20 99
Direct tel:	+46 16 544 20 81
Personal E-Mail:	bengt.bostrom@stem.se

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no Annex I public funding involved in VRBC project activity. The investments made in order to implementing the project activity were financed by a local bank as an intermediary of the Brazilian National Development Bank (BNDES - *Banco Nacional de Desenvolvimento Econômico e Social*).

BNDES is the chief federal agency for long-term funding which aims to promote the Brazilian development. Its main sources of funding are three: (i) return from past operations; (ii) funds raised in capital markets (Brazilian and international) and from multilateral financial organizations; and (iii) funds from the Worker's Assistance Fund (FAT), which is a stable source of resources provided for in the Brazilian Constitution. The FAT fund is made up of resources originating from private company revenues, income from state-controlled companies, the federal government, the states, the Federal District (Brasilia), municipalities, and payrolls of non-profit organizations. With this fund resource structure, the Bank does not have to depend on budgeted funds from the Treasury, nor any kind of foreign official development assistance.[20]

BNDES offers a comprehensive line of financial products and services to provide the best possible cost and conditions for long-term funding requirements. In the case of VRBC project activity, it was used a credit line called FINAME, directed to finance acquisition of new machinery and equipment manufactured in the domestic market.

Annex 3

BASELINE INFORMATION

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

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

Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000)[21]:

"… 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

[20] For more details on BNDES, the Brazilian National Development Bank, see its web site available at <http://www.bndes.gov.br/english >.

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

(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

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

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

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

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

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

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

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was contacted, in order to let participants know until which degree of detail information could be provided. After several months of talks, plants' daily dispatch information was made available for years 2002, 2003 and 2004.

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75.547 MW of installed capacity by 31/12/2004, out of the total 98.848,5 MW installed in Brazil by the same date (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Such capacity in fact is constituted by plants with 30 MW installed capacity or above, connected to the system through 138 kV 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 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	0,1045

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

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

From the mentioned reference:

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

Therefore only data for plants under construction in 2002 (with operation start in 2002, 2003 and 2004) was estimated. All others efficiencies were calculated. To the best of our knowledge there was no retrofit/modernization of the older fossil-fuelled power plants in the analyzed period (2002 to 2004). For that reason project participants find the application of such numbers to be not only reasonable but the best available option.

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

On the following pages, a summary of the analysis is provided. First, the table with the 130 plants dispatched by the ONS are provided. Then, a table with the summarized conclusions of the analysis, with the emission factor calculation displayed. Finally, the load duration curves for the S-SE-MW system are presented.

ONS Dispatched Plants

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fossil fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
1	S-SE-CO	H	Jauru	Sep-2003	121.5	1	0.0	0.0%	0.000
2	S-SE-CO	H	Gauporé	Sep-2003	120.0	1	0.0	0.0%	0.000
3	S-SE-CO	G	Três Lagoas	Aug-2003	306.0	0.3	15.3	99.5%	0.670
4	S-SE-CO	H	Funil (MG)	Jan-2003	180.0	1	0.0	0.0%	0.000
5	S-SE-CO	H	Itiquira I	Sep-2002	156.1	1	0.0	0.0%	0.000
6	S-SE-CO	G	Araucária	Sep-2002	484.5	0.3	15.3	99.5%	0.670
7	S-SE-CO	G	Canoas	Sep-2002	160.6	0.3	15.3	99.5%	0.670
8	S-SE-CO	H	Piraju	Sep-2002	81.0	1	0.0	0.0%	0.000
9	S-SE-CO	G	Nova Piratininga	Jun-2002	384.9	0.3	15.3	99.5%	0.670
10	S-SE-CO	O	PCT CGTEE	Jun-2002	5.0	0.3	20.7	99.0%	0.902
11	S-SE-CO	H	Rosal	Jun-2002	55.0	1	0.0	0.0%	0.000
12	S-SE-CO	G	Ibirité	May-2002	226.0	0.3	15.3	99.5%	0.670
13	S-SE-CO	H	Cana Brava	May-2002	465.9	1	0.0	0.0%	0.000
14	S-SE-CO	H	Sta. Clara	Jan-2002	60.0	1	0.0	0.0%	0.000
15	S-SE-CO	H	Machadinho	Jan-2002	1,140.0	1	0.0	0.0%	0.000
16	S-SE-CO	G	Juiz de Fora	Nov-2001	87.0	0.28	15.3	99.5%	0.718
17	S-SE-CO	G	Macaé Merchant	Nov-2001	922.6	0.24	15.3	99.5%	0.837
18	S-SE-CO	H	Lajeado (ANEEL res. 402/2001)	Nov-2001	902.5	1	0.0	0.0%	0.000
19	S-SE-CO	G	Eletrobolt	Oct-2001	379.0	0.24	15.3	99.5%	0.837
20	S-SE-CO	H	Porto Estrela	Sep-2001	112.0	1	0.0	0.0%	0.000
21	S-SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	529.2	0.3	15.3	99.5%	0.670
22	S-SE-CO	G	W. Arjona	Jan-2001	194.0	0.25	15.3	99.5%	0.804
23	S-SE-CO	G	Uruguaiana	Jan-2000	639.9	0.45	15.3	99.5%	0.447
24	S-SE-CO	H	S. Caxias	Jan-1999	1,240.0	1	0.0	0.0%	0.000
25	S-SE-CO	H	Canoas I	Jan-1999	82.5	1	0.0	0.0%	0.000
26	S-SE-CO	H	Canoas II	Jan-1999	72.0	1	0.0	0.0%	0.000
27	S-SE-CO	H	Igarapava	Jan-1999	210.0	1	0.0	0.0%	0.000
28	S-SE-CO	H	Porto Primavera	Jan-1999	1,540.0	1	0.0	0.0%	0.000
29	S-SE-CO	D	Cuiaba (Mario Covas)	Oct-1998	529.2	0.27	20.2	99.0%	0.978
30	S-SE-CO	H	Sobragi	Sep-1998	60.0	1	0.0	0.0%	0.000
31	S-SE-CO	H	PCH EMAE	Jan-1998	26.0	1	0.0	0.0%	0.000
32	S-SE-CO	H	PCH CEEE	Jan-1998	25.0	1	0.0	0.0%	0.000
33	S-SE-CO	H	PCH ENERSUL	Jan-1998	43.0	1	0.0	0.0%	0.000
34	S-SE-CO	H	PCH CEB	Jan-1998	15.0	1	0.0	0.0%	0.000
35	S-SE-CO	H	PCH ESCELSA	Jan-1998	62.0	1	0.0	0.0%	0.000
36	S-SE-CO	H	PCH CELESC	Jan-1998	50.0	1	0.0	0.0%	0.000
37	S-SE-CO	H	PCH CEMAT	Jan-1998	145.0	1	0.0	0.0%	0.000
38	S-SE-CO	H	PCH CELG	Jan-1998	15.0	1	0.0	0.0%	0.000
39	S-SE-CO	H	PCH CERJ	Jan-1998	59.0	1	0.0	0.0%	0.000
40	S-SE-CO	H	PCH COPEL	Jan-1998	70.0	1	0.0	0.0%	0.000
41	S-SE-CO	H	PCH CEMIG	Jan-1998	84.0	1	0.0	0.0%	0.000
42	S-SE-CO	H	PCH CPFL	Jan-1998	55.0	1	0.0	0.0%	0.000
43	S-SE-CO	H	S. Mesa	Jan-1998	1,275.0	1	0.0	0.0%	0.000
44	S-SE-CO	H	PCH EPAULO	Jan-1998	26.0	1	0.0	0.0%	0.000
45	S-SE-CO	H	Guilmam Amorim	Jan-1997	140.0	1	0.0	0.0%	0.000
46	S-SE-CO	H	Corumbá	Jan-1997	375.0	1	0.0	0.0%	0.000
47	S-SE-CO	H	Miranda	Jan-1997	408.0	1	0.0	0.0%	0.000
48	S-SE-CO	H	Noav Ponte	Jan-1994	510.0	1	0.0	0.0%	0.000
49	S-SE-CO	H	Segredo (Gov. Ney Braga)	Jan-1992	1,260.0	1	0.0	0.0%	0.000
50	S-SE-CO	H	Taquaruçu	Jan-1989	554.0	1	0.0	0.0%	0.000
51	S-SE-CO	H	Manso	Jan-1988	210.0	1	0.0	0.0%	0.000
52	S-SE-CO	H	D. Francisca	Jan-1987	125.0	1	0.0	0.0%	0.000
53	S-SE-CO	H	Itá	Jan-1987	1,450.0	1	0.0	0.0%	0.000
54	S-SE-CO	H	Rosana	Jan-1987	369.2	1	0.0	0.0%	0.000
55	S-SE-CO	N	Angra	Jan-1985	1,874.0	1	0.0	0.0%	0.000
56	S-SE-CO	H	T. Irmãos	Jan-1985	807.5	1	0.0	0.0%	0.000
57	S-SE-CO	H	Itaipu 60 Hz	Jan-1983	6,300.0	1	0.0	0.0%	0.000
58	S-SE-CO	H	Itaipu 50 Hz	Jan-1983	5,375.0	1	0.0	0.0%	0.000
59	S-SE-CO	H	Emborcação	Jan-1982	1,192.0	1	0.0	0.0%	0.000
60	S-SE-CO	H	Nova Avanhandava	Jan-1982	347.4	1	0.0	0.0%	0.000
61	S-SE-CO	H	Gov. Bento Munhoz - GBM	Jan-1980	1,676.0	1	0.0	0.0%	0.000
62	S-SE-CO	H	S.Santiago	Jan-1980	1,420.0	1	0.0	0.0%	0.000
63	S-SE-CO	H	Itumbiara	Jan-1980	2,280.0	1	0.0	0.0%	0.000
64	S-SE-CO	O	Igarapé	Jan-1978	131.0	0.3	20.7	99.0%	0.902
65	S-SE-CO	H	Itauba	Jan-1978	512.4	1	0.0	0.0%	0.000
66	S-SE-CO	H	A. Vermelha (Jose E. Moraes)	Jan-1978	1,396.2	1	0.0	0.0%	0.000
67	S-SE-CO	H	S.Simão	Jan-1978	1,710.0	1	0.0	0.0%	0.000
68	S-SE-CO	H	Capivara	Jan-1977	640.0	1	0.0	0.0%	0.000
69	S-SE-CO	H	S.Osório	Jan-1975	1,078.0	1	0.0	0.0%	0.000
70	S-SE-CO	H	Marimbondo	Jan-1975	1,440.0	1	0.0	0.0%	0.000
71	S-SE-CO	H	Promissão	Jan-1975	264.0	1	0.0	0.0%	0.000
72	S-SE-CO	C	Pres. Medici	Jan-1974	446.0	0.26	26.0	98.0%	1.294
73	S-SE-CO	H	Volta Grande	Jan-1974	380.0	1	0.0	0.0%	0.000
74	S-SE-CO	H	Porto Colombia	Jun-1973	320.0	1	0.0	0.0%	0.000
75	S-SE-CO	H	Passo Fundo	Jan-1973	220.0	1	0.0	0.0%	0.000
76	S-SE-CO	H	Passo Real	Jan-1973	158.0	1	0.0	0.0%	0.000
77	S-SE-CO	H	Ilha Solteira	Jan-1973	3,444.0	1	0.0	0.0%	0.000
78	S-SE-CO	H	Mascarenhas	Jan-1973	131.0	1	0.0	0.0%	0.000
79	S-SE-CO	H	Gov. Parigot de Souza - GPS	Jan-1971	252.0	1	0.0	0.0%	0.000
80	S-SE-CO	H	Chavantes	Jan-1971	414.0	1	0.0	0.0%	0.000
81	S-SE-CO	H	Jaguara	Jan-1971	424.0	1	0.0	0.0%	0.000
82	S-SE-CO	H	Sá Carvalho	Apr-1970	78.0	1	0.0	0.0%	0.000
83	S-SE-CO	H	Estreito (Luiz Carlos Barreto)	Jan-1969	1,050.0	1	0.0	0.0%	0.000
84	S-SE-CO	H	Ibitinga	Jan-1969	131.5	1	0.0	0.0%	0.000
85	S-SE-CO	H	Jupiá	Jan-1969	1,551.2	1	0.0	0.0%	0.000
86	S-SE-CO	O	Alegrete	Jan-1968	66.0	0.26	20.7	99.0%	1.040
87	S-SE-CO	G	Campos (Roberto Silveira)	Jan-1968	30.0	0.24	15.3	99.5%	0.837
88	S-SE-CO	G	Santa Cruz (RJ)	Jan-1968	766.0	0.31	15.3	99.5%	0.648
89	S-SE-CO	H	Paraibuna	Jan-1968	85.0	1	0.0	0.0%	0.000
90	S-SE-CO	H	Limoeiro (Armando Salles de Oliviera)	Jan-1967	32.0	1	0.0	0.0%	0.000
91	S-SE-CO	H	Caconde	Jan-1966	80.4	1	0.0	0.0%	0.000
92	S-SE-CO	C	J.Lacerda C	Jan-1965	363.0	0.25	26.0	98.0%	1.345
93	S-SE-CO	C	J.Lacerda B	Jan-1965	262.0	0.21	26.0	98.0%	1.602
94	S-SE-CO	C	J.Lacerda A	Jan-1965	232.0	0.18	26.0	98.0%	1.869
95	S-SE-CO	H	Bariri (Alvaro de Souza Lima)	Jan-1965	143.1	1	0.0	0.0%	0.000
96	S-SE-CO	H	Funil (RJ)	Jan-1965	216.0	1	0.0	0.0%	0.000
97	S-SE-CO	C	Figueira	Jan-1963	20.0	0.3	26.0	98.0%	1.121
98	S-SE-CO	H	Furnas	Jan-1963	1,216.0	1	0.0	0.0%	0.000
99	S-SE-CO	H	Barra Bonita	Jan-1963	140.8	1	0.0	0.0%	0.000
100	S-SE-CO	C	Charqueadas	Jan-1962	72.0	0.23	26.0	98.0%	1.462
101	S-SE-CO	H	Jurumirim (Armando A. Laydner)	Jan-1962	97.7	1	0.0	0.0%	0.000
102	S-SE-CO	H	Jacui	Jan-1962	180.0	1	0.0	0.0%	0.000
103	S-SE-CO	H	Pereira Passos	Jan-1962	99.1	1	0.0	0.0%	0.000
104	S-SE-CO	H	Tres Marias	Jan-1962	396.0	1	0.0	0.0%	0.000
105	S-SE-CO	H	Euclides da Cunha	Jan-1960	108.8	1	0.0	0.0%	0.000
106	S-SE-CO	H	Camargos	Jan-1960	46.0	1	0.0	0.0%	0.000
107	S-SE-CO	H	Santa Branca	Jan-1960	56.1	1	0.0	0.0%	0.000
108	S-SE-CO	H	Cachoeira Dourada	Jan-1959	658.0	1	0.0	0.0%	0.000
109	S-SE-CO	H	Salto Grande (Lucas N. Garcez)	Jan-1958	70.0	1	0.0	0.0%	0.000
110	S-SE-CO	H	Salto Grande (MG)	Jan-1956	102.0	1	0.0	0.0%	0.000
111	S-SE-CO	H	Mascarenhas de Moraes (Peixoto)	Jan-1956	478.0	1	0.0	0.0%	0.000
112	S-SE-CO	H	Itutinga	Jan-1955	52.0	1	0.0	0.0%	0.000
113	S-SE-CO	C	S. Jerônimo	Jan-1954	20.0	0.26	26.0	98.0%	1.294
114	S-SE-CO	O	Carioba	Jan-1954	36.2	0.3	20.7	99.0%	0.902
115	S-SE-CO	O	Piratininga	Jan-1954	472.0	0.3	20.7	99.0%	0.902
116	S-SE-CO	H	Canastra	Jan-1953	42.5	1	0.0	0.0%	0.000
117	S-SE-CO	H	Nilo Peçanha	Jan-1953	378.4	1	0.0	0.0%	0.000
118	S-SE-CO	H	Fontes Nova	Jan-1940	130.3	1	0.0	0.0%	0.000
119	S-SE-CO	H	Henry Borden Sub.	Jan-1926	420.0	1	0.0	0.0%	0.000
120	S-SE-CO	H	Henry Borden Ext.	Jan-1926	469.0	1	0.0	0.0%	0.000
121	S-SE-CO	H	I. Pombos	Jan-1924	189.7	1	0.0	0.0%	0.000
122	S-SE-CO	H	Jaguari	Jan-1917	11.8	1	0.0	0.0%	0.000
				Total (MW) =	**64,478.6**				

* 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).

Summary table

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	

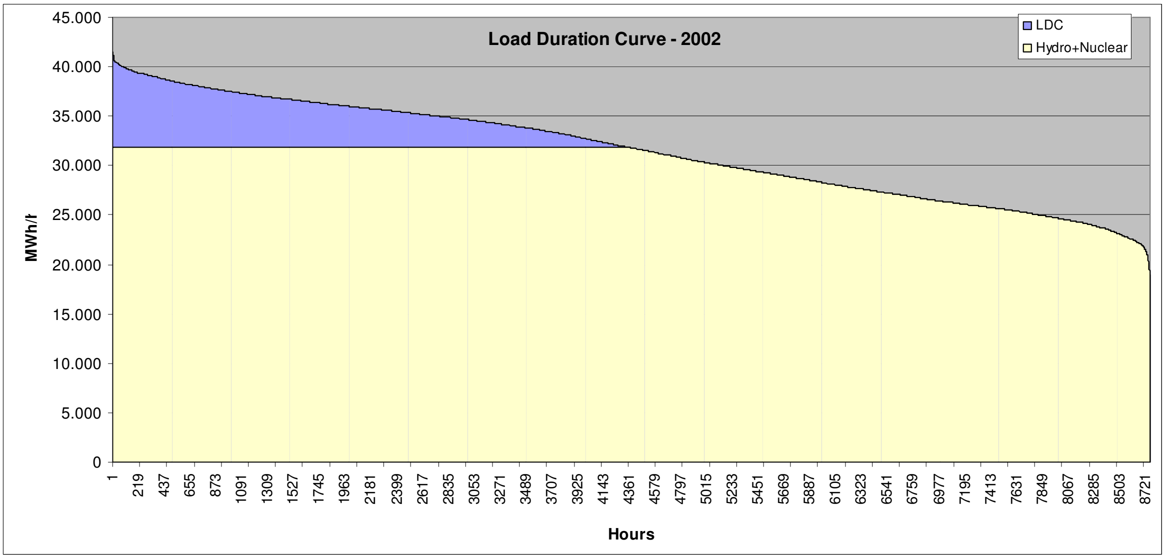

Figure 6. Load duration curve for the S-SE-MW system, 2001

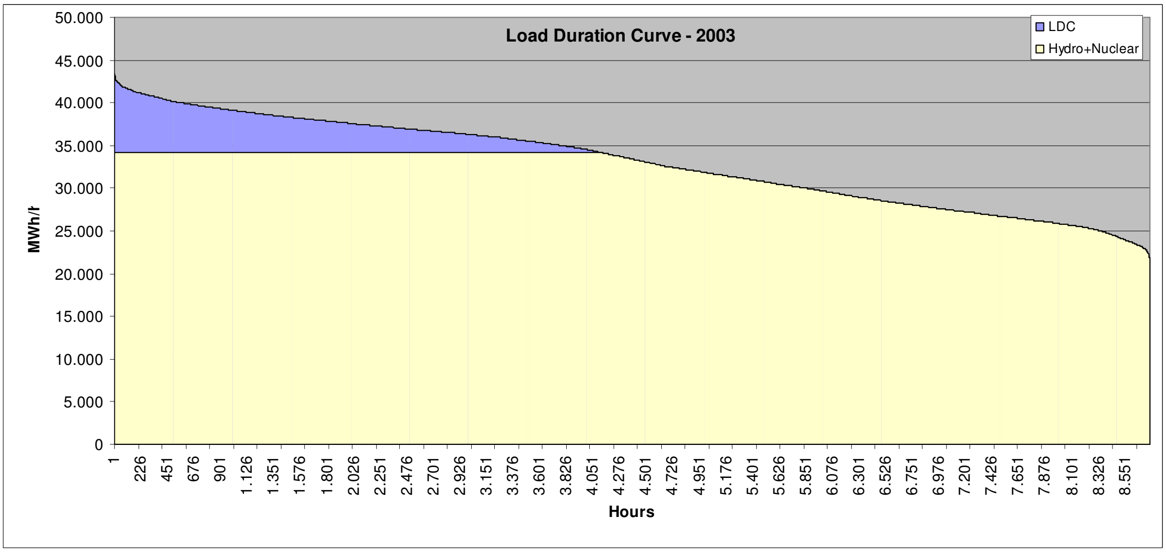

Figure 7. Load duration curve for the S-SE-MW system, 2002

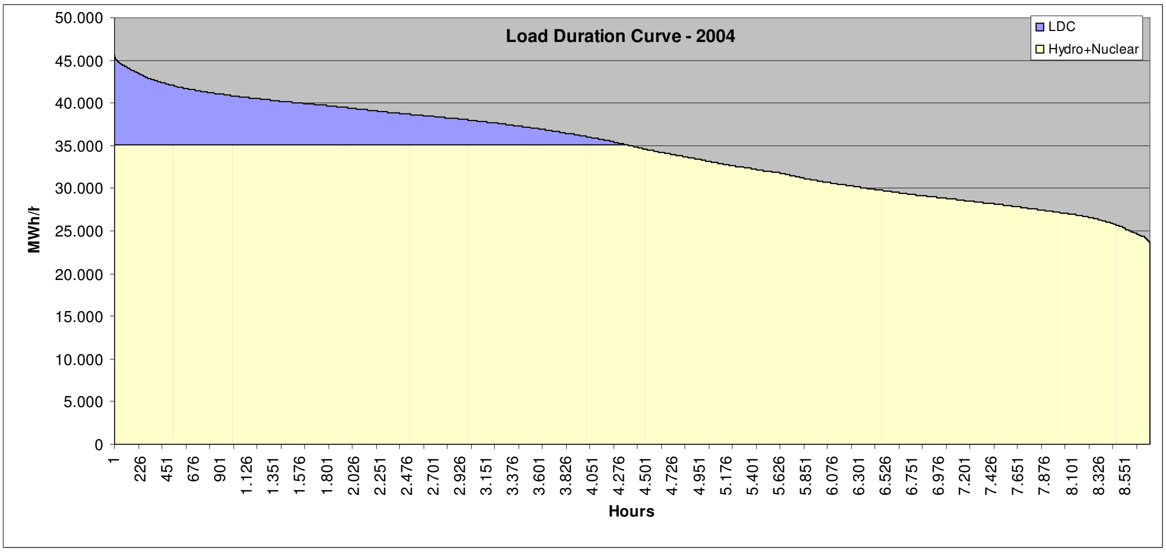

Figure 8. Load duration curve for the S-SE-MW system, 2003

Annex 4

MONITORING PLAN

According to the section D of this document, the main variable to be monitored in this project activity is the quantity of energy exported to the grid, from year 2001 up to the end of the last crediting period. Since no leakage nor any off-grid emissions change were identified in this project activity, there will be no need to monitor the variables for these cases. The monitoring will occur as follows:

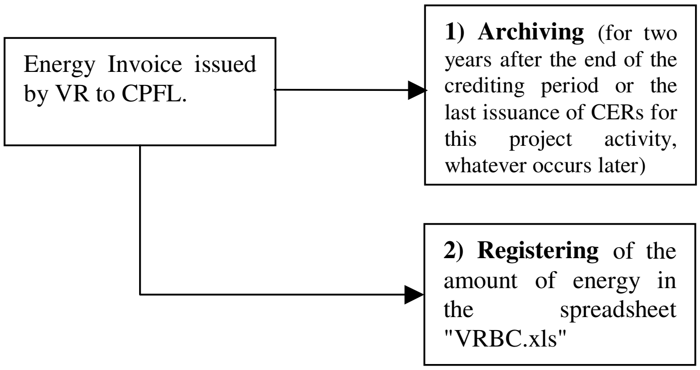

Figure 9. Monitoring procedures for VRBC

The quantity of energy exported to the grid will be monitored through the energy invoice emitted by VR to the energy distributor, CPFL. 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 "VRBC.xls", which shall be the instrument for the further Verification.

Apart of that, following recommendations of the Executive Board on the use of ex-ante and ex-post approaches in order to determine emission reductions, the project participants will update the baseline emission factor on an yearly basis after the project is registered. This means collecting and archiving data on the Brazilian electricity system every year.

Such data in Brazil, as already explained, is provided by the electricity system manager, ONS. This entity has been contacted several times in order to provide the information that allowed calculation of the emission factor for years 2001-2003. The same procedure will be carried out for the coming years, when the project is registered.

The basic information provided by the manager is the daily dispatch data of each plant connected to the grid. This information will be updated in the spreadsheet ONS Emission Factors SSECO.xls, which is of knowledge of the validators. Such database will be forwarded to the verifier.

OTHER ANNEXES

CAROL

Cooperativa dos Agricultores da Região de Orlândia

Rua 06 Nº 1676 - Tel.: (016) 3820 1000 Fax: (016) 3820 1143
ORLÂNDIA SP CEP: 14620-000
Internet: www.carol.com.br E-mail: carol@carol.com.br

Á

Quem

Possa

Interessar

A CAROL - Cooperativa dos Agricultores da Região de Orlândia, declara, que embora, na safra de 2001, não tenha adquirido, da Cia Açucareira Vale do Rosário a matéria -prima Bagaço de Cana para fomento de suas caldeiras, não houve a necessidade de uso de óleo combustível, uma vez que seu funcionamento se deu por meio de queima de lenha e bagaço de cana adquirido de outros fornecedores.

Por ser expressão da verdade, firmamos a presente declaração.

Orlândia(SP), 2[illegible] de novembro de 2001.

Humberto Fernando Dal Pino
Superintendente

Figure 10: Negative declaration of use of fossil fuel of former VR bagasse customer (Carol)

BREJEIRO

À

QUEM

POSSA

INTERESSAR

A Brejeiro, Produtos Alimentícios Orlândia S A Comércio e Indústria, declara, que embora, na safra de 2001, não tenha adquirido, da Cia Açucareira Vale do Rosário a matéria-prima Bagaço de Cana como combustível de suas caldeiras, não houve necessidade de uso de óleo combustível, uma vez que seu funcionamento se deu por meio de queima de cavaco de madeira e bagaço de cana adquirido de outros fornecedores.

Por ser expressão da verdade, firmamos a presente declaração.

Orlândia (SP), 30 de Novembro de 2001

PRODUTOS ALIMENTÍCIOS ORLÂNDIA S/A COM. E IND.
DIRETOR

Produtos Alimentícios Orlândia SA Comércio e Indústria
Avenida do Café, Nº 129 - Centro - Orlândia - SP - Cx. Postal 11 - CEP 14620-000 Telex 16659
Fone/Pabx: (16) 3820-5000 - Fax (16) 3820-5005 / 3820-500

Figure 11: Negative declaration of use of fossil fuel of former VR bagasse customer (Brejeiro)