CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Cargill Uberlândia Biomass Residues Fuel Switch Project
Version Number 3
06/02/07

A.2. Description of the project activity:

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The Cargill Uberlândia Biomass Residues Fuel Switch Project (hereafter, the "Project") developed by Cargill Agrícola S/A (hereafter referred to as the "Project Developer") is located in the state of Minas Gerais in Brazil (hereafter, the "Host Country"). The Project activity will reduce fuel oil combusted – consequently reducing CO_2 emissions – for steam generation at a Cargill production facility through the installation of a biomass residue-fueled boiler.

The biomass residue-fueled boiler, which has an installed capacity of 95 tons/hour of low pressure saturated steam at 12 bar, will replace three existing fossil fuel-fired boilers [1]. Cargill´s facility utilizes saturated steam to provide heat to its three production lines: soybean, corn and citric acid.

With the modification resulting from the implementation of the Project activity, Cargill's plant will be able to satisfy its demand for low pressure saturated steam through the combustion of renewable energy sources. These biomass residues – wood chips, branches and the tops of trees – are primarily a waste product of timber harvesting operations and activities associated with the forest industry. In the absence of the Project, Cargill's facility would continue to utilize steam generated by the three fossil fuel fired-boilers and a small, older biomass-residue fueled boiler[2]. Moreover, biomass residues from forest harvesting operations and activities at the local industries would be dumped or left to decay aerobically[3].

The Project will help the Host Country fulfill its goals of promoting sustainable development by providing several social, economic and environmental benefits.

Specifically, the Project activity:

- Increases employment opportunities locally by promoting the biomass residues market (for the transportation, loading, management of the residues).
- Reduces local air pollution from reduced combustion of fossil fuels.
- Contributes to income generation by increasing local sawmills' revenues through the purchase of biomass residues.

[1] The three fuel-fired boilers will be kept and used in cases of emergency.

[2] Installed in 1986

[3] Annex 5 is letters from biomass suppliers demonstrating that there will be an excess of residues without the Project activity

- Establishes a precedent for the industry by acting as a large scale clean technology project and encouraging the development of a modern, clean and more efficient steam generation system.
- Contributes to regional integration and cooperation with other sectors: i.e. promotes positive interaction between the agroindustry and forestry sectors.
- Guarantees the protection of 20% of natural forests on the land of the all the biomass suppliers involved[4].

A.3. Project participants:

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Project participants

Name of party involved (*) ((host) indicates a host party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Brazil	Cargill Agrícola S/A	No
Switzerland	Cargill International S.A.	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group plc.	No

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

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

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Brazil. (the "Host Country")

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

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Minas Gerais

A.4.1.3. City/Town/Community etc:

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Uberlândia

[4] See Annex 8: Cargill requires that all of the suppliers are in compliance with the 1965 Forest Code – Federal Law 4.771 -- that requires that 20% of any property area covered by forest is kept as forest

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

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880, Will Cargill Street, Uberlândia – Minas Gerais State, Brazil CEP 38402-350

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

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According to Annex A of the Kyoto Protocol, the Project activity fits in Sectoral Categories 01 (energy industries) and 04 (manufacturing industries).

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

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The Cargill plant in Uberlândia, includes three different production units: soybean, corn and citric acid. The processing of soybeans includes crushing, refining and packaging, resulting in soy oil, soy lecithin and soy meal. The corn is processed through a wet milling process and results in maize starches and sweeteners. Finally, the citric acid production line produces citric acid and sodium citrate through a sugar fermentation process. These three processes use steam generated from the plant's boilers for direct and indirect heating.

The technology to be employed by the Project activity is a biomass residue fueled Zanini 180 (SZ-180) boiler. The boiler burns only biomass residues[5]: wood chips and residues from the harvesting of trees– branches and the unusable top portion of the tree. These residues will be transported by trucks from suppliers in the area. The boiler will generate 95 tons/hour of low pressure saturated steam with 12 bar pressure at 83% efficiency.

The biomass-residue boiler will be installed in conjunction with complementary facilities and equipment such as a wood chip storage warehouse and a water demineralization system. Also, in order to protect against the risk of a shortage in the supply of biomass residues, the Project scenario includes a parallel activity of establishing a plantation on land that was previously used for grazing[6]. Asset exchange contracts will be established between Cargill and forestry product companies that state that the trees from the plantation will be exchanged for biomass residues – no profit will be earned from the trees by Cargill or from the biomass residues by the suppliers. These will prevent Cargill from having access to the lumber which therefore limits the usage of fuel from the plantation to biomass residues only. The plantation is necessary to insure that decreased availability from external suppliers will not result in a return to the former three fossil fuel boilers. The plantation is being established as a necessary component of the Project activity – an essential guaranteed future supply of residues.

	Project activity	**Baseline scenario, year n[7]**

[5] No fossil fuels will be used in the Zanini boiler

[6] The change in land use did not result in any pre-project activity emissions or displacement or pre project activities as the cattle that were formerly on the land are no longer being bred, due to an overall decline in the cattle market in the region.

[7] As the replacement of the biomass boiler will not generate emissions reductions, it will not be included in this table for simplicity's sake

Boiler type	Zanini 180	Z30, Z40, A55,
Fuel type	Biomass residues	Fuel oil
Amount of biomass used annually[8] **(t)**	82,870	0
Amount of fuel oil used annually (t)	0	44,688
Amount of steam generated (t)	564,451	651,884
Boiler lifetime (years)	50	30
Year installed at Cargill facility	2004	1992,1995,1995

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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The baseline is defined as the combustion of fuel oil by three boilers and of biomass residues by one boiler to produce steam for the Cargill facility production lines described above.

Greenhouse gas (GHG) emissions are reduced by the Project activity through the replacement of the use of fossil fuels (fuel oil) with the use of a renewable fuel (biomass residues). In the Project scenario, Cargill's new biomass-fired boiler replaces steam production from the three fossil fuel fired boilers, thus significantly reducing the use of fossil fuels. As the combustion of biomass residues is considered carbon neutral, the avoidance of the usage of fuel oil will consequently reduce CO_2.

Estimated emissions reductions from the Project

Years	Annual estimation of emission reductions in tonnes of CO_2e
2004	71,387
2005	122,379
2006	122,379
2007	122,379
2008	122,379
2009	122,379
2010	122,379
2011	122,379
2012	122,379
2013	122,379
2014	50,991
Total estimated reductions (tonnes of CO_2e)	1,223,790
Total number of crediting years	10 years

[8] Dry weight

Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	122,379

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline and monitoring methodology

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

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AM0036, version 01, 29 September 2006, "Fuel switch from fossil fuels to biomass residues in boilers for heat generation" is applied to the Project. The monitoring methodology associated with the approved methodology will be applied to the Project activity.

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

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The Project involves the installation of a new biomass residue-fueled boiler at a Cargill agroindustrial plant to produce steam, which will displace steam generated by fossil fueled boilers as in the baseline scenario. Thus, the Project activity is eligible under Scenario 2 of AM0036; replacement of existing boilers. The replacement of the three fuel oil boilers with the biomass residue fueled boiler will result in an increase in the use of biomass residues above historical levels. This would not be technically possible in the existing fossil fueled boilers without a retrofit or replacement of the boilers. The Project meets all the conditions listed in the applicability criteria of methodology AM0036. These include:

- The heat generated in the boiler(s) is not used for power generation.
    - The heat generated is used in the Cargill production process
- The increase of biomass residues beyond historical levels is technically not possible at the project site without significant capital investment in either the retrofit or replacements of existing boilers or the installation of new boilers;
    - Significant capital investment is needed to replace the fossil fuel based boilers in the Project activity and it is not possible to increase the capacity of the biomass residue-fueled boiler in the baseline scenario
- Existing biomass boilers at the project site have used only biomass *residues* (but no other type of biomass) for heat generation during the three years prior to the implementation of the project activity.
    - Only biomass residues – wood chips and branches – are combusted in the existing biomass residue-fueled boiler in the baseline scenario
- No biomass types other than biomass *residues*, as defined above, will be used in the boiler(s) during the crediting period (some fossil fuels may be co-fired);
    - Only biomass residues will be combusted in the boiler.
- The implementation of the project will not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;
    - There will be no increase in processing capacity

- The biomass residues used at the project site, site where the project activity is implemented, will not be stored for more than one year;
    - The biomass residues will be stored for approximately three months
- No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion.
    - No significant energy quantities are required to prepare the residues
- The biomass residues are transported to the project site by trucks.
    - Trucks will transport the residues
- As the project activity involves the replacement of existing boilers, all boilers existing at the project site prior to the implementation of the project activity are able to operate until the end of the crediting period without any retrofitting or replacement.
    - The lifetime of the three fuel oil boilers is 30 years from the beginning of operation (the boiler operation start dates are: 1992, 1995 and 1999)[9].

As the Project activity is in compliance with all of the above listed project criteria, AM0036 is applicable to the Project activity.

Furthermore, this methodology is applicable as the most plausible baseline scenarios are:

- For heat generation, H2 (continued operation of the existing boilers using the same fuel mix or less biomass residues as in the past);
- For the use of biomass residues, B1 (the biomass residues are dumped or left to decay under mainly aerobic conditions).

B.3. Description of the sources and gases included in the project boundary

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The Project boundary is as is specified in AM0036.

For the purpose of determining GHG emissions of the Project activity, the following emissions sources are included:

- CO_2 emissions from on-site electricity consumption that is attributable to the Project activity.
- CO_2 emissions from off-site transportation of biomass residues to the Project site.

For the purpose of determining the **baseline**, the following emission sources are included:

- CO_2 emissions from fossil fuels combusted in boilers.

The most likely baseline scenario for the use of the biomass residues is that the biomass residues would be dumped and left to decay aerobically (case B1), thus, CH_4 emissions from the treatment of biomass residues in the baseline and from combustion of biomass residues in the boilers will be included in the Project boundary.

The spatial extent of the Project boundary encompasses:

- The boiler(s) and related equipment at the Project site
- The vehicles used for transportation of biomass residues to the Project site.

[9] See Annex 6 for documentation

The boundary for leakage is 110 kilometers, the average distance that the biomass residues will be transported.

Gases and sources included in the Project boundary:

Source		Gas	Included	Justification/explanation
Baseline	Fossil fuel combustion in boilers for heat generation	CO_2	Yes	
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of the biomass residues	CO_2	No	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Yes	B1 is assumed as the baseline scenario
		N_2O	No	Excluded for simplification. This is conservative.
Project activity	On-site electricity consumption	CO_2	Yes	
		CH_4	No	Excluded for simplification. The emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. The emission source is assumed to be very small.
	Off-site transportation of biomass residues	CO_2	Yes	
		CH_4	No	Excluded for simplification. The emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. The emission source is assumed to be very small.
	Combustion of biomass residues for heat generation	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Yes	Decay of biomass residues is the baseline scenario
		N_2O	No	Excluded for simplification. The emission source is assumed to be very small.
	Biomass storage	CO_2	No	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small.
		N_2O	No	Excluded for simplification. The emission source is assumed to be very small.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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According to AM0036, the Project generates heat and its activities correspond to a fuel switch project type.

Prior to the Project activity, heat on the Project site was generated by three fuel oil boilers and one biomass residues boiler. According to AM0036, the most plausible baseline scenario will be determined only for the additional biomass residues used above historical levels.

Scenarios H2 – continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past – and B1 – biomass residues are dumped or left to decay under mainly aerobic conditions- are the baseline scenarios. This is further elaborated in section B.5. The formulae used to calculate and monitor emissions reductions are detailed in section B.6 and comply with the instructions of the chosen scenario.

Please refer to Annex 3 for the key information and data used to determine the baseline scenario.

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

According to AM0036, the following alternatives that are in compliance with the laws and regulatory requirements for energy generation in Minas Gerais and Brazil and have been considered for the heat and the biomass residues components of the Project activity.

The alternatives for heat generation:

- H1: The proposed project activity is not undertaken as a CDM project activity (heat generation with biomass residues).
- H2: Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past.
- H3: Continued operation of the existing boiler(s) using a different fuel (mix)
- H4: Improvement of the performance of the existing boiler(s)
- H5: Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past AND installation of (a) new boiler(s) that is/are fired with the same fuel type(s) and the same fuel mix (or a lower share of biomass) as the existing boiler(s)
- H6: Replacement of the existing boiler(s) with new boiler(s)

The alternatives for use of biomass residues

- B1: The biomass residues are dumped or left to decay under mainly aerobic conditions.
- B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters.
- B4: The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation)
- B5: The biomass residues are used as feedstock in a process (e.g. in the pulp and paper industry)
- B6: The biomass residues are used as fertilizer
- B7: The proposed project activity not undertaken as a CDM project activity (use of the biomass residues for heat generation)
- B8: Any other use of the biomass residues.

The uncontrolled burning of the biomass residues – B3 – has been excluded from further consideration in the barrier analysis as this alternative would not be in compliance with the applicable legal requirements.

Step 2. Barrier Analysis to eliminate alternatives to the project activity that face prohibitive barriers

The following barrier analysis, using guidance from the "Consolidated tool for demonstration of additionality (Version 2, 28 November 2005)", demonstrates that only alternatives H2 and B1 are not prevented by any barrier, and thus, those alternatives are the baseline scenario for heat generation and for the use of biomass residues respectively.

Technical and investment barriers included in the analysis for heat generation include:

- Risk of shortage of biomass
- Risk of acquiring poor quality biomass
- Investment risk from the new boiler when the existing boilers work efficiently
- Increased difficulty of using biomass residues as opposed to fossil fuels.

Barriers included in the analysis of the biomass residues usage are:

- Investment necessary to create a landfill and transport the residues to the landfill
- Logistics necessary to organize the collection and transportation of the residues
- Risk of biomass shortage.

The alternatives for heat generation:

- H1: The proposed project activity is not undertaken as a CDM project activity (heat generation with biomass residues).
    - This is not plausible due to financial and logistical barriers as well as the risk of supply shortages and quality of biomass residues. See investment analysis in Step 3.
- **H2: Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past.**
    - **There are no barriers to this scenario. Fuel oil supply is reliable and the boilers work efficiently.**
- H3: Continued operation of the existing boiler(s) using a different fuel (mix).
    - Investment would be needed to adapt the boilers to a new fuel type as the fuel handling system of the fossil fuel boilers would need to be completely altered. This does not make financial sense as, in the baseline scenario, the fuel oil boilers work efficiently and fuel oil is readily available.
- H4: Improvement of the performance of the existing boiler(s)
    - This is possible but not plausible as the performance of the existing boilers is adequate, with 83-86% efficiency rate[10] so investment in an improvement does not make economic sense. Also, improving the performance would be technically difficult to achieve.
- H5: Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past AND installation of (a) new boiler(s) that is/are fired with the same fuel type(s) and the same fuel mix (or a lower share of biomass) as the existing boiler(s)

[10] Based on historical usage

- This is not plausible as an increase in capacity is not necessary. The installation of a new boiler is not economically feasible as there is no need for more steam.

- H6: Replacement of the existing boiler(s) with new boiler(s).
  - This is possible but not plausible as the existing boilers work sufficiently and efficiently, with 83%-86% efficiency rates, and will continue to do so for at least a further 22 years[11]-from the start of the Project activity. Additionally, fuel oil is readily available. For these reasons, replacement does not make economical sense.

The following tables summarize the barriers for the above alternatives:

Heat generation component

Barrier type		H1	H2	H3	H4	H5	H6
1.	Financial	Y	N	Y	Y	Y	Y
2.	Technical / Technological	Y	N	Y	Y	N	N

The alternatives for use of biomass residues

- **B1: The biomass residues are dumped or left to decay under mainly aerobic conditions.**
  - **This is the most possible and plausible scenario as with the implementation of the Project, Cargill purchases the majority of the biomass in the area[12], and therefore without the Project activity there would be few other large sources of demand for the residues, meaning they would predominantly be dumped or left to decay. There are no barriers preventing this scenario.**
- B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters.
  - This is not a plausible scenario as the wood chips are created where there is no existing landfill and it would be a major investment to build a landfill[13] and then transport the residues to the landfill.
- B4: The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation).
  - The predominant use of biomass residues (without the Cargill facility) would be leaving the biomass residues to decay aerobically as there would be an excess of residues without the Project activity[14]
- B5: The biomass residues are used as feedstock in a process (e.g. in the pulp and paper industry).
  - Plywood can be made from wood residues but this can be done only if bark is not present on the wood, presenting a technical barrier, as bark is part of the biomass residues. Also, there is little demand in the region for large amounts of plywood, making it economically not feasible.

[11] In accordance with the installation dates of the fossil fuel boilers

[12] See Annex 5 of letters from biomass residues suppliers (who supply 50% of the residues) stating that they would have an excess of biomass residues, without the existence of the Cargill Uberlandia Project.

[13] Ali, Mansoor; Cotton, Andrew; and Westlake, Ken. "Waste disposal in developing countries." June 2005.

[14] See Annex 5 for letters from biomass suppliers

- B6: The biomass residues are used as fertilizer.
  - This is not plausible as using wood residues as fertilizer causes a nitrogen deficiency in the soil, harming crops[15].
- B7: The proposed project activity not undertaken as a CDM project activity (use of the biomass residues for heat generation).
  - This is not plausible due to investment barriers – see investment analysis under Step 3 – and the technical barriers associated with the logistics of transporting and processing biomass residues.
- B8: Any other use of the biomass residues.
  - This is shown to be not plausible through the excess of biomass residues that are dumped or left to decay aerobically indicating that there is insufficient other uses of biomass residues in the region.

The following tables summarize the barriers for the above alternatives:

Use of biomass residues

Barrier type		B1	B2	B4	B5	B6	B7	B8
1.	Financial	N	Y	Y	Y	N	Y	N
2.	Technical / Technological	N	Y	N	Y	Y	Y	Y

A financial analysis is undertaken in section B.5, in order to demonstrate the economic lack of feasibility of the Project activity without carbon credits.

B.5. 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 (assessment and demonstration of additionality): >>

The Project activity will result in the reduction of greenhouse gas emissions that would not occur if the Project was not implemented. The numerous barriers and risks associated with the implementation of the proposed Project activity are identified below. Additionality is demonstrated using the "Consolidated tool for demonstration of additionality (Version 2, 28 November 2005)", according to AM0036. This tool for assessing additionality follows a step-based approach. Demonstration of the additionality of the Project activity is shown below.

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

Cargill Agricola S/A began analyzing its opportunity to install a biomass residues boiler as a CDM project in June 2003. One year- June 2004- after beginning to consider the CDM, the Project began operation[16]. A new methodology was submitted for the Project in August 2004. This methodology was

[15] According to the Colorado State University Cooperative Extensive- Agriculture, wood chips have a carbon-nitrogen ratio of 400:1 which, due to the low nitrogen content, would cause a nitrogen deficiency in plants. http://www.ext.colostate.edu/pubs/crops/00546.html

[16] See Annex 7

screened and registered as NM0065 by the Meth Panel in October 2004. This represents clear evidence that the Project is eligible for prompt start credits. The COP/MOP in Montreal extended the 31 December 2005 deadline for receiving prompt start credits until 31 March 2006 (see paragraph 4 of Further guidance relating to the CDM published on http://unfccc.int/meetings/cop_11/items/3394.php).

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

According to AM0036, the alternatives analyzed are in compliance with the laws and regulatory requirements for energy generation in Minas Gerais and Brazil and have been considered for the heat and the biomass residues components of the Project activity. Please refer to Section B.4.

According to the Tool for additionality, Project participants may select Step 2 or Step 3. In order to demonstrate additionality, Step 2 was chosen.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the "Tool for the demonstration and assessment of additionality (version 02)", three options can be applied to conduct the investment analysis. They are: the simple cost analysis (Option I), the investment comparison analysis (Option II) and the benchmark analysis (Option III).

Since this project will generate financial/economic benefits other than CDM-related income, through revenues from reduced fuel oil consumption, Option I (Simple Cost Analysis) is not applicable.

According to the Additionality Tool, if the alternatives to the CDM project activity do not include investments of comparable scale to the project, then Option III must be used.

Given that the project developer does not have alternative and comparable investment choices, the benchmark analysis (Option III) is more appropriate than investment comparison analysis (Option II) for assessing the financial attractiveness of the project activity.

Sub-step 2b: Option III - Apply benchmark analysis

The likelihood of the development of this project, as opposed to the continuation of the business as usual practice of fuel oil consumption (i.e. the baseline) will be determined by comparing the project Net Present Value (NPV) with and without carbon revenues. The analysis includes: the initial investment costs, operation and maintenance costs, savings due to the difference in fuel prices of the fuel oil in the baseline and biomass in the project scenario, and a market discount rate. This analysis includes the costs associated with the biomass residues fuelled boiler and the plantation that is necessary to ensure a continued supply of biomass residues for the Project activity.

Sub-step 2c: Calculation and comparison of financial indicators (only for options II and III)

The NPV of the Project activity is negative without the revenue for carbon credits, making the Project activity economically not feasible. However, with the inclusion of revenue from carbon credits, the NPV

of the Project activity is greatly increased, making the Project economically feasible and proving additionality.

The table below shows the financial analysis for the project activity. As shown, the project NPV is significantly negative (-126,324) in the absence of CDM revenues, making the project economically unattractive to the project developer.

Table – Summary of project financial analysis

	without carbon revenue
NPV	-126,324

Details for calculating the NPV are provided in table below in this section

In addition, there are a number of other issues that re-enforce the financial unattractiveness of the Project activity.

- Interest rates have been high in Brazil since the Real plan stabilized inflation in 1994[17]. As a consequence of the long period of inflation, the Brazilian currency experienced a strong devaluation, effectively precluding commercial banks from providing any long-term debt financing. The lack of a long-term debt market has had a severely negative direct impact on the financing of projects in Brazil especially renewable energy projects.
- In 2004, due to a weak Brazilian economy for an entire decade, the outlook for investments was one of caution. In 2004, the private sector was unsure about the economic situation and hesitant about infrastructure investments due to the uncertainty about potential changes in regulatory legislation as promoted by the current government[18].
- Since April 2002, the national goverment has implemented the Proinfa program (Programa de Incentivo às Fontes Alternativas de Energia Elétrica), which promotes the use of renewable energy in Brazil (http://www.eletrobras.gov.br/EM_Programas_Proinfa/default.asp.). However, although this program assists electricity generation or cogeneration initiatives, it does not include heat generation projects. There are no other state incentives or subsidies which favor the development of this type of project activity.

The above issues further demonstrate that the Project activity is not viable without carbon credits.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was undertaken using assumptions that are conservative from the point of view of analysing additionality, i.e. the 'best-case' conditions for the project NPV were assumed. It was supposed that the Project experienced a) investment cost savings of 10%; b) operating hours were increased by 10%; c) operating costs were decreased by 10%; and d) the net revenues were increased by 10%. The results are shown in the table below.

Table – Sensitivity analysis

[17] 16.25% in 2004, Banco Central do Brasil.

[18] PriceWaterhouseCoopers. "Highlights of Brazil: a wrap-up of 2004 and a forecast for 2005." 2004.

Scenario	% Change	NPV
Original	**n/a**	-126,324
Increase in Revenues	**10%**	2,338,534
Reduction in Investment Costs	**10%**	1,570,201
Reduction in Operational Costs	**10%**	920,977

Details for calculating the IRR are provided in Annex 3

The sensitivity analysis results in a positive NPV and a higher IRR under certain scenarios. However, given that parameters can change both in favour and against the project, it is unlikely that the project developer would base the decision to go ahead only on the optimistic scenarios identified in the sensitivity analysis (e.g. 10% rise in revenues). Such a decision would be unreasonable, especially given the risks of investment in Brazil as outlined in the three bullet points above. Furthermore, even if such higher rates of return were available from the project, these returns are still lower than rates of return available by investing in lower risk ventures such as investment funds in Brazil, where interest rates are much higher than in other countries: the opportunity cost of capital in Brazil is extremely high. The interest rates for bank loans at the time of project evaluation in 2004 were about 60%[19], a rate that indicates a cost of third party capital in the range of 40% if we discount the tax benefit In 2006 interest rates on bank loans are between 37 and 39%[20]. If the project were financed from internal capital (i.e. no loan repayments need to be made), we still have to consider the opportunity cost of capital for the company. Even investing in risk-free government bonds guarantees a return of between 18 and 20% (2004)[21]. Considering these economic circumstances we must conclude that a project with negative financial indicators in the base case and only marginally attractive numbers in the best case is not an attractive course of action. Given the high cost of third party financing and the attractive investment possibilities in the capital markets available to Brazilian entrepreneurs, investment in a fixed asset at these rates of return is not attractive. Even the high returns derived from the unrealistic scenarios generated by the sensitivity analysis (10% change in costs in favour of the project) are still similar or below the returns available from other sources today, and well below the rates at the time the decision was made in 2004. Consequently, the sensitivity analysis does not undermine the conclusion that the project is not an attractive investment, and therefore is financially additional.

Table B.5.3 –Economic parameters used in the project ($ represents US Dollars)

Name	Value	Source

[19] Source: http://www.bcb.gov.br/Pec/spread/port/economia_bancaria_e_credito.pdf

[20] In 2006 interest rates on bank loans are between 37 and 39%. Lower than at the time of decision making for the project but still below the rates of return experienced in the sensitivity analysis. Reference: Newspaper: Valor Econômico, 6th of February of 2007, Page C8

[21] Source: SELIC; Sistema Especial de Liquidação e Custodia, that is, Special System of Clearance and Custody, set by the Banco Central do Brasil - Central Bank of Brazil, http://www.bcb.gov.br/?SELICDIA

Cost of generating 1 tonne of steam using biomass	$6.7	Project developer
Cost of generating 1 tonne of steam using fuel oil	$13.9	Project developer
Total investment costs(US$)	$2,087,000	Project developer
Average annual operating costs of boiler and plantation (US$/year)	$2,794,917	Project developer
Income tax	30%	Brazilian Rate
Discount rate	16%	Banco Central do Brasil (Central Bank of Brazil) interest rate
Insurance	1%	Project developer
Steam production per year	564,451 tonnes/yr	Project developer

Step 3. Barrier analysis

Step 2 has been selected to prove additionality of the Project activity.

Step 4. Common Practice Analysis

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

Common practice of industries of the industrial sector in the region is the baseline scenario: to use fuel oil and other fossil fuels as the main fuel source[22]. Due to financial and technical barriers associated with the use of a biomass residue boiler, use of fossil fuel boilers is the most attractive scenario in the region.

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

The Minas Gerais region is chosen as the region for comparison due to the large size of Brazil and the many differences, climatically, economically and politically between the different regions of the country. In the Minas Gerais region[23], heat generation from biomass residues is not common practice, especially at the scale of the Project activity. According to Agencia Nacional de Energia Elétrica (ANEEL) there is no combustion of biomass electricity generation (generally considered to be more attractive than heat generation from biomass) in the Uberlandia area. However, one other biomass residues boiler similar to the size of the Project activity exists at the Satipel facility. It was installed in 1998 and makes use of existing plantations owned by Satipel. That is at the time of boiler installation, the Satipel facility already had harvestable forests available. In fact, 85% of the boiler's biomass residues supply comes from these plantations, hence, the risks and costs associated with the installation of a new biomass residue fueled boiler and the establishment of a residue supply chain did not apply to this activity.

Step 5. Impact of CDM registration

[22] Campbell, Frank (GEF). "Brazil trees hold secret to 'clean' fuel?." http://www.brasilemb.org/environment/environ_brasil_fuel.shtml. 2005

[23] Due to the large size of Brazil and significant differences between regions, only the local region of Minas Gerais is included.

The CDM revenue expected for the Project has been one of the key issues that encouraged the Project developer to undertake the proposed Project activity. The impact of approval and registration of the Project as a CDM activity will bring sustainable development benefits to the Project developer, the local forest industry and the Host Country[24].

For the Project developer, the CDM component represents an extra source of income that will significantly enhance cash flow. The revenue from CDM will change the Net Present Value of the Project activity from a negative to a positive value, making the Project Activity economically feasible.

Carbon Credits Impacts	
	$
NPV without Carbon Credits	-126,324
NPV considering Carbon Credits	**2,717,245**

With the addition of CDM revenues, the Negative NPV is significantly improved. Although with carbon revenues, the NPV, under current carbon prices, remains negative, CDM participation brings numerous other attendant benefits, including reduced currency risks due to the fact that CDM revenue is gained in US$, enhanced international participation in the project, international publicity of the project and recognition of its environmental benefits, and the added prestige associated with a pioneering CDM project activity. The use of the CDM will allow the Project developer to overcome the investment barrier previously demonstrated.

B.6 Emission reductions

B.6.1. Explanation of methodological choices:

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Baseline emissions:

$$BE_y = BE_{HG,y} + BE_{BF,y}$$

(Equation 1)

Where:

BE_y = Baseline emissions during the year *y* (tCO_2e/yr)

$BE_{HG,y}$ = Baseline emissions from fossil fuel combustion for heat generation in the boiler(s) (tCO_2/yr)

$BE_{BF,y}$ = Baseline emissions due to uncontrolled burning or decay of the biomass residues (tCO_2e/yr)

a) Baseline emissions from fossil fuel combustion in boilers for heat generation ($BE_{HG,y}$)

$$BE_{HG,y} = (HG_{PJ,biomass,y} * EF_{FF,CO2,y}) / n_{boiler,FF}$$

(Equation 2)

[24] Refer to Section A.2.

Where:
$BE_{HG,y}$ = Baseline emissions from fossil fuel combustion for heat generation in the boiler(s) (tCO_{2e}/yr)
$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of the project activity during the year *y* (GJ/yr)
$EF_{FF,CO2,y}$ = CO_2 emission factor of the fossil fuel type displaced by biomass residues (tCO_{2e}/GJ)
$\eta_{boiler,FF}$ = Average net efficiency of heat generation in the boiler(s) when fired with fossil fuels

For the purpose of determining $EF_{FF,CO2,y}$, as a conservative approach, the least carbon intensive fuel type (i.e. the fuel type with the lowest CO_2 emission factor per GJ) will be used among the fossil types used in boilers at the Project site during the most recent three years prior to the implementation of the Project activity and the fossil fuel types used in boilers at the Project site during the year y.

Case B: Use of some biomass residues for heat generation in the absence of the project activity
Case B was selected because prior to the Project activity, a biomass-residue boiler was in use at the Project site.

To be conservative, the minimum value of the two equations presented in AM0036 was used. This was the value from equation 3, seen below.

$$HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y} - HG_{PJ,total,y} * MAX\left\{\begin{matrix}(HG_{biomass,historic,n} / HG_{total,historic,n});\\ (HG_{biomass,historic,n-1} / HG_{total,historic,n-1}); (HG_{biomass,historic,n-2} / HG_{total,historic,n-2})\end{matrix}\right\}$$

(Equation 3)

Where:
$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$ = Total heat generated from firing biomass residues in all boilers at the project site during the year *y* (GJ/yr)
$HG_{PJ,total,y}$ = Total heat generated in boilers at the project site, using both biomass residues and fossil fuels, during the year *y* (GJ/yr)
$HG_{biomass,historic,n}$ = Historical annual heat generation from using biomass residues in boilers at the project site during the year *n* (GJ/yr)
$HG_{total,historic,n}$ = Historical annual total heat generation, from using biomass residues and fossil fuels, in boilers at the project site during the year *n* (GJ/yr)
n = Year prior to the implementation of the project activity

b) Baseline emissions due to decay of the biomass residues

CH_4 emissions due to the decay of biomass residues were chosen to be included in the Project boundary. Only one type of biomass residue *k* – wood residues – has been used, so equation 4 was selected.

$$BF_{PJ,k,y} = BF_{k,y} * (HG_{PJ,biomass,y} / HG)_{PJ,biomass,total,y}$$

(Equation 4)

Where:
$BF_{PJ,k,y}$ = Quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter)
$BF_{k,y}$ = Quantity of biomass residue type *k* fired in all boiler(s) at the project site during the year *y* (tons of dry matter)
$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$ = Total heat generated from firing biomass residues in all boilers at the project site during the year *y* (GJ/yr)

Aerobic decay of the biomass residues (case B1)
Following AM0036, if case B1 is selected, baseline emissions are calculated as follows:

$$BE_{BF,y} = GWP_{CH4} * \sum_{k} BF_{PJ,k,y} * NCV_{k} * EF_{burning,CH4,k,y}$$

(Equation 5)

Where:
$BE_{BF,y}$ = Baseline emissions due to uncontrolled burning or decay of the biomass residues (tCO_2e/yr)
GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
$BF_{PJ,k,y}$ = Quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter)
NCV_k = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter)
$EF_{burning,CH4,k,y}$ = CH_4 emission factor for uncontrolled burning of the biomass residue type *k* during the year *y* (tCH_4/GJ).

The default CH_4 emission factor of 0.0027 tCH_4/t biomass is used with a conservativeness factor of 0.73, as the estimated uncertainty range is greater than 100%. This results in and emission factor of 0.001971 tCH_4/t biomass[25].

Project emissions:

$$PE_{y} = PE_{CO2,FF,y} + PE_{CO2,EC,y} + PE_{CO2,TR,y} + GWP_{CH4} * PE_{CH4,BF,y}$$

(Equation 6)

Where:

PE_y:	Project emissions during the year *y* (tCO_2e/yr)
$PE_{CO2,FF,y}$:	CO2 emissions from on-site fossil fuel combustion attributable to the project activity (tCO_2e/yr)
$PE_{CO2,EC,y}$:	CO_2 emissions from off-site transportation of biomass residues to the project site (tCO_2e/yr)

,

[25] 2006 IPCC Guidelines

$PE_{CO2,TR,y}$ CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2e/yr) ,

$PE_{CH4,BF,y}$: Methane emissions from the combustion of biomass residues in the boiler(s) (tCH_4/yr)
GWP_{CH4}: Global Warming Potential for methane valid for the relevant commitment period (tCO_2e/tCH_4)

a) CO_2 emissions from on-site fossil fuel consumption ($PE_{CO2,FF,y}$)

Not applicable

b) CO_2 emissions from on-site electricity consumption ($PE_{CO2,EC,y}$)

$$PE_{CO2,EF,y} = EC_{PJ,y} * EF_{grid,y}$$

(Equation 7)

Where:
$PE_{CO2,EC,y}$ = CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr)
$EC_{PJ,y}$ = On-site electricity consumption attributable to the project activity during the year *y* (MWh)
$EF_{grid,y}$ = CO_2 emission factor for electricity used from the grid (tCO_2/MWh).

ACM0002 version 6, 19 May 2006[26] was used to calculate the grid emission factor of the Brazilian South-Southeast-Midwest grid.

- Calculate the Operating Margin (OM)

Simple Adjusted OM. This emission factor ($EF_{OM,simple\ adjusted,y}$) is a variation on the previous method, where the power sources (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (*j*):

$$EF_{OM,simple\bar{a}djusted,y} = (1-\lambda_y).\frac{\sum_{i,j} F_{i,j,y} COEF_{i,j}}{\sum_{j} GEB_{j,y}} + \frac{\sum_{i,k} F_{i,k,y} COEF_{i,k}}{\sum_{k} GENk_{k,y}}$$

(Equation 8)

where $F_{i,k,y}$, $COEF_{i,k}$ and GEN_k are analogous to the variables described for the simple OM method above for plants *k*; the years(s) *y* can reflect either of the two vintages noted for simple OM above, and

λ_y = number of hours per year for which low-cost/must run sources are on margin/ 8760 hours per year

(Equation 9)

where lambda (λ_y) should be calculated as follows:

Step i) Plot a Load Duration Curve. Collect chronological load data (typically in MW) for each hour of

[26] Approved by DNV in 2006 as the acceptable Brazil South-Southeast-Midwest grid emission factor.

a year, and sort load data from highest to lowest MW level. Plot MW against 8760 hours in the year, in descending order.

Step ii) Organize Data by Generating Sources. Collect data for, and calculate total annual generation (in MWh) from low-cost/must-run resources (i.e. $\Sigma_k GEN_{k,y}$).

Step iii) Fill Load Duration Curve. Plot a horizontal line across load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from lowcost/must-run resources (i.e. $\Sigma_k GEN_{k,y}$).

Step iv) Determine the "Number of hours per year for which low-cost/must-run sources are on the margin". First, locate the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low cost/must-run sources do not appear on the margin and λ_y is equal to zero. Lambda (λ_y) is the calculated number of hours divided by 8760.

- Calculate the build margin emission factor ($EF_{BM,y}$) as the generation weighted average emission factor (tCO_{2e}/MWh) of a sample of power plants *m*, as follows:

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

(Equation 10)

Where:
-$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method (ACM0002, v06) for plants *m*, based on the most recent information available on plants already built.

Option 1 was selected: The Build Margin emission factor $EF_{BM,y}$ *ex-ante* is based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.[7]

- Calculate the baseline emission factor EF_y, as the weighted average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$):

$$EF_y = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y}$$

(Equation 11)

Where:

-The weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and
-$EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

c) CO_2 emissions from transportation of biomass residues to the project site ($PE_{CO2,y,TR,}$)

Option 1 was selected:

$$PE_{CO2,TR,y} = (\sum_{k} BF_{PJ,k,y} / TL_y) * AVD_y * EF_{km,CO2,y}$$

(Equation 12)

Where:
$PE_{CO2,TR,y}$ = CO_2 emissions from off-site transportation of biomass residues to the project site (tCO_2/yr)
AVD_y = Average round trip distance (from and to) between the biomass fuel supply sites and the site of the project plant during the year *y* (km)
$EF_{km,CO2,y}$ Average CO_2 emission factor for the trucks measured during the year y (tCO_2/km)
$BF_{PJ,k,y}$ = Quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter or liter)[4]
TL_y = Average truck load of the trucks used (tons)

Diesel fueled trucks will be used.

d) CH_4 emissions from combustion of biomass residues in the boilers ($PE_{CH4,BF,y}$)

Project participants decided to include CH_4 emissions from combustion of biomass residues in the boilers in the Project boundary**:**

$$PE_{CH4,BF,y} = EF_{CH4,BF} * \sum_{k} BF_{PJ,k,y} * NCV_k$$

(Equation 13)

Where:
$PE_{CH4,BF,y}$ = CH_4 emissions from combustion of biomass residues in the boiler(s) (tCH_4/yr)
$EF_{CH4,BF}$ = CH_4 emission factor for the combustion of the biomass residues in the boilers (tCH_4/GJ)
$BF_{PJ,k,y}$ = Quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* (tons of dry matter)
NCV_k = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter)

A conservativeness factor of 1.37[27] was assumed. Thus a CH_4 emission factor of 41.1kg/TJ should be used.

Leakage emissions:

There will be no leakage emissions. Approach L_3 was chosen to demonstrate that there is an excess of biomass residues in the region. This excess is demonstrated through letters[28] from biomass residue suppliers in the region; these letters demonstrate that without the Project activity, the suppliers would have an excess of residues.

Emission reductions:

$$ER_y = BE_y - PE_y - LE_y$$

[27] 2006 IPCC Guidelines

[28] Refer to Annex 5

(Equation 14)

Where:

ER_y:	Emissions reductions of the Project activity during the year *y* (tCO_2/yr)
BE_y:	Baseline emissions during the year y (tCO_2/yr)
PE_y:	Project emissions during the year y (tCO_2/yr)
LE_y:	Leakage emissions during the year y (tCO_2/yr)

Total emission reductions are calculated *ex ante,* using an estimated value for efficiency of equipment. The accurate emissions reduction calculation will be based on measured data during the Project activity.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$\eta_{boiler,FF}$
Data unit:	
Description:	Average net efficiency of heat generation in the boiler(s) when fired with fossil fuels
Source of data used:	Historical data
Value applied:	86%
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Boiler efficiency ranged from 83%-86%. 86% was used in order to be conservative

Data / Parameter:	**$HG_{biomass,historic,n}$ / $HG_{biomass,historic,n-1}$ / $HG_{biomass,historic,n-2}$**
Data unit:	GJ
Description:	Historical annual heat generation from firing biomass residues in boilers at the Project site during the year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to the implementation of the Project activity.
Source of data used:	Onsite measurements
Value applied:	657,486 ; 671,513 ; 680,211
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods and procedures as according to AM0036

Any comment:	

Data / Parameter:	**$BF_{k,n}$ / $BF_{k,n-1}$ / $BF_{k,n-2}$**
Data unit:	Tonnes of biomass residues per year
Description:	Quantity of biomass residue type *k* fired in all boiler(s) at the project site during the historical year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to implementation of the Project activity
Source of data used:	On-site measurements
Value applied:	35,305;41,297;43,886
Justification of the choice of data or description of measurement methods and procedures actually applied :	Weight was used. The value will be cross-checked with the quantity of heat generated and any fuel purchase receipts.
Any comment:	

Data / Parameter:	**$FC_{i,n}$ / $FC_{i,n-1}$ / $FC_{i,n-2}$**
Data unit:	Tonnes of fuel oil per year
Description:	Quantity of fossil fuel type *i* fired in all boiler(s) at the Project site during the historical year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to implementation of the Project activity
Source of data used:	On-site measurements
Value applied:	44,688; 41,341; 34,639
Justification of the choice of data or description of measurement methods and procedures actually applied :	Weight is used. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts.
Any comment:	

Data / Parameter:	**$EF_{CO2,FF,I}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor for fuel oil
Source of data used:	2006 IPCC.
Value applied:	0.0774
Justification of the choice of data or description of measurement methods and procedures actually applied :	2006 IPCC Guidelines default value was used because accurate and reliable local or national data is not available. This number is considered conservative.

Any comment:	

Data / Parameter:	
Data unit:	MWh
Description:	Highest historical electricity generation at the Project site during the most recent three years prior to the implementation of the Project activity
Source of data used:	On-site measurements
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	No electricity is generated on site.

B.6.3 Ex-ante calculation of emission reductions:

>>

Baseline emissions:

$$BE_y = BE_{HG,y} + BE_{BF,y}$$

(As according to equation 1)

Baseline emissions	125,084	t CO2/yr

c) Baseline emissions from fossil fuel combustion in boilers for heat generation ($BE_{HG,y}$)

$$BE_{HG,y} = (HG_{PJ,biomass,y} * EF_{FF,CO2,y}) / n_{boiler,FF}$$

(As according to equation 2)

Case B: Use of some biomass residues for heat generation in the absence of the project activity
Case B was selected because prior to the Project activity, a biomass-residue boiler was in use at the Project site.

$$HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y} - HG_{PJ,total,y}^{*}$$

$$MAX\left\{\begin{matrix}(HG_{biomass,historic,n} / HG_{total,historic,n});\\ (HG_{biomass,historic,n-1} / HG_{total,historic,n-1}); (HG_{biomass,historic,n-2} / HG_{total,historic,n-2})\end{matrix}\right\}$$

(As according to equation 3)

Baseline emissions from fossil fuel combustion for heat generation in the boilers	121,447	t CO2/yr

d) Baseline emissions due to decay of the biomass residues

CH_4 emissions due to the decay of biomass residues were chosen to be included in the Project boundary.

Aerobic decay of the biomass residues (case B1)
Following AM0036, if case B1 is selected, baseline emissions are calculated assuming that the biomass residues would be burned in an uncontrolled manner:

$$BE_{BF,y} = GWP_{CH4} * \sum_{k} BF_{PJ,k,y} * NCV_{k} * EF_{burning,CH4,k,y}$$

(As according to equation 5)

The default CH_4 emission factor of 0.0027 tCH_4/t biomass is used with a conservativeness factor of 0.73. This results in an emission factor of 0.001971 tCH_4/t biomass[29].

Baseline emissions due to uncontrolled burning or decay of the biomass residues	3,637	t CO2/yr

Project emissions:

$$PE_{y} = PE_{CO2,FF,y} + PE_{CO2,EC,y} + PE_{CO2,TR,y} + GWP_{CH4} * PE_{CH4,BF,y}$$

(As according to equation 6)

Project emissions	2,705	t CO2/yr

e) CO_2 emissions from on-site fossil fuel combustion ($PE_{CO2,FF,y}$)

CO2 emissions from on-site fossil fuel combustion	-	t CO2/yr

f) CO_2 emissions from on-site electricity consumption

$$PE_{CO2,EF,y} = EC_{PJ,y} * EF_{grid,y}$$

(As according to equation 7)

[29] 2006 IPCC Guidelines

CO2 emissions from on-site electricity consumption	1,347	t CO2/yr

g) CO_2 emissions from transportation of biomass residues to the project site ($PE_{TR,CO2,y}$)

Option 1 was selected:

$$PE_{CO2,TR,y} = (\sum_k BF_{PJ,k,y} / TL_y) * AVD_y * EF_{km,CO2,y}$$

(Equation 12)

CO2 emissions from off-site transportation of biomass residues	496	t CO2/yr

h) CH_4 emissions from combustion of biomass residues in the boilers ($PE_{CH4,BF,y}$)

Project participants decided to include CH_4 emissions from combustion of biomass residues in the boilers in the Project boundary**:**

$$PE_{CH4,BF,y} = EF_{CH4,BF} * \sum_k BF_{PJ,k,y} * NCV_k$$

(Equation 13)

A conservativeness factor of 1.37[30] was assumed.

CH4 emissions from combustion of biomass residues in the boiler	861	t CO2/yr

Leakage emissions:

There will be no leakage emissions. Approach L_3 was chosen to demonstrate that there is an excess of biomass residues in the region[31]. This excess is demonstrated through letters from biomass residue suppliers in the region stating that if the Project did not exist, they would have an excess of residues. The boundary will encompass 110 kilometers as the majority of the biomass comes from 110 km away.

Emission reductions:

$$ER_y = BE_y - PE_y - LE_y$$

(Equation 14)

[30] 2006 IPCC Guidelines

[31] See Annex 5

Emissions reductions	**122,379**	**t CO2/yr**

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Year	Estimation of project activity emissions reductions (tonnes of CO_2 e)	Estimation of baseline emissions reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2004	1,578	72,965	0	71,387
2005	2,705	125,084	0	122,379
2006	2,705	125,084	0	122,379
2007	2,705	125,084	0	122,379
2008	2,705	125,084	0	122,379
2009	2,705	125,084	0	122,379
2010	2,705	125,084	0	122,379
2011	2,705	125,084	0	122,379
2012	2,705	125,084	0	122,379
2013	2,705	125,084	0	122,379
2014	1,127	52,118	0	50,991
Total (tonnes of CO_2e)	27,050	1,250,840	0	1,223,790

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1. Data and parameters monitored:

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Data / Parameter:	**$EF_{FF,CO2,y}$**
Data unit:	tCO_2e/GJ
Description:	CO_2 emission factor of the fossil fuel type displaced by biomass residues for the year *y*
Source of data to be used:	2006 IPCC Guidelines defaults
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0774
Description of measurement methods and procedures to be	The appropriateness of this number will be reviewed annually.

applied:	
QA/QC procedures to be applied:	This number was checked with national default data and is similar to the IPCC default.
Any comment:	Only fuel oil is used at the Project site so the NCV of fuel oil is selected.

Data / Parameter:	$HG_{PJ,total,y}$
Data unit:	GJ/yr
Description:	Total heat generated in all boilers at the Project site, firing both biomass residues and fossil fuels, during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2,081,594
Description of measurement methods and procedures to be applied:	Measurement methods and procedures as according to AM0036
QA/QC procedures to be applied:	The consistency of the metered net heat generation will be cross-checked with the quantity of biomass and fossil fuel fired.
Any comment:	

Data / Parameter:	$BF_{k,y}$
Data unit:	t/yr
Description:	Quantity of biomass residue type *k* fired in all boiler(s) at the Project site during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	116,278
Description of measurement methods and procedures to be applied:	The quantity shall be crosschecked with the quantity of heat generated and any fuel purchase receipts (if available) and then weight will be deducted to account for moisture.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	

Data / Parameter:	**Moisture content of the biomass residues**

Data unit:	% Water content
Description:	Moisture content of each biomass residue type *k*
Source of data to be used:	On-site measurements
Measurement procedures (if any):	
Monitoring frequency	Daily testing of biomass residues, mean values calculated at least annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**$FC_{i,y}$**
Data unit:	t/yr
Description:	Quantity of fossil fuel type *i* fired in all boiler(s) at the Project site during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	14,446
Description of measurement methods and procedures to be applied:	Monitored continuously, aggregated at least annually.
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	Fossil fuel boilers will only be started for routine maintenance and in case of emergency.

Data / Parameter:	**$EC_{PJ,y}$**
Data unit:	MWh
Description:	On-site electricity consumption attributable to the Project activity during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	5,160 MWh/yr
Description of measurement	Electricity meters will be used to monitor continuously and aggregate data at least annually. The quantity shall be cross-checked with electricity purchase

methods and procedures to be applied:	receipts.
QA/QC procedures to be applied:	Cross-check measurement results with invoices for purchased electricity if available.
Any comment:	

Data / Parameter:	**$EF_{grid,y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for electricity used from the grid
Source of data to be used:	ACM0002 version 06, 19 May 2006
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.2611
Description of measurement methods and procedures to be applied:	Calculated once at the start of the Project activity, in accordance with ACM0002 Version 6..
QA/QC procedures to be applied:	Please refer to ACM0002, version 06, 19 May 2006
Any comment:	

Data / Parameter:	**TL_y**
Data unit:	Tons
Description:	Average truck load of the trucks used
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	30
Description of measurement methods and procedures to be applied:	Determined by averaging the weights of each truck carrying biomass to the Project plant. Weight is recorded at a weight bridge. Data will be aggregated annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**AVD_y**
Data unit:	Km

Description:	Average return trip distance (from and to) between the biomass fuel supply sites and the site of the Project plant during the year *y*
Source of data to be used:	Records by Project participants on the origin of the biomass
Value of data applied for the purpose of calculating expected emission reductions in section B.5	220
Description of measurement methods and procedures to be applied:	This is monitored regularly.
QA/QC procedures to be applied:	Consistency of distance records will be checked by provided comparing recorded distances with other information from other sources (e.g. maps).
Any comment:	

Data / Parameter:	**NCV_i**
Data unit:	GJ/t
Description:	Net calorific value of fuel oil
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	40.40
Description of measurement methods and procedures to be applied:	2006 IPCC default values were used.
QA/QC procedures to be applied:	IPCC default values will be reviewed annually.
Any comment:	

Data / Parameter:	**NCV_k**
Data unit:	GJ/t
Description:	Net calorific value of wood biomass residue *k*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in	11.357

section B.5	
Description of measurement methods and procedures to be applied:	Calculation of the NCV will be made based on the moisture content of the biomass residues. The residues will be sent to a reputable lab at least bi-annually for confirmation of the NCV .
QA/QC procedures to be applied:	Consistency of the measurements will be checked by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	

Data / Parameter:	**$EF_{km,CO2,y}$**
Data unit:	tCO_2/km
Description:	Average CO_2 emission factor per km for the trucks during the year *y*
Source of data to be used:	1996 IPCC Guidelines default (not available in 2006 Guidelines)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.000770 tCO_2/km
Description of measurement methods and procedures to be applied:	Default value was used i.e. the estimated emission factor for European diesel heavy-duty vehicles
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**$EF_{CH4,BF}$**
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for the combustion of the biomass residues in the boilers
Source of data to be used:	Default values as provided in AM0036
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.000041
Description of measurement methods and procedures to be	

applied:	
QA/QC procedures to be applied:	
Any comment:	A conservative factor of 1.37 has been applied

Data / Parameter:	$EF_{burning,CH4,k,y}$
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for uncontrolled burning of the biomass residue type *k* during the year *y*
Source of data to be used:	2006 IPCC Guidelines default
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.000322
Description of measurement methods and procedures to be applied:	Default values should be reviewed annually.
QA/QC procedures to be applied:	
Any comment:	A conservative factor of 0.73 is applied

Data / Parameter:	
Data unit:	
Description:	Availability of a surplus of biomass residue type *k* (which can not be sold or utilized) at the ultimate supplier to the Project and a representative sample of other suppliers in the defined geographical region.
Source of data to be used:	Letters from suppliers
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Monitored annually
QA/QC procedures to be applied:	
Any comment:	See Annex 5, the sample of suppliers represents 50% of all residues purchased

B.7.2 Description of the monitoring plan:

>>

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the Cargill Uberlândia Biomass Residues Fuel Switch Project.

The Monitoring Plan for this Project has been developed to ensure that from the start, the Project is well organised in terms of the collection and archiving of complete and reliable data.

All data will be archived electronically, and backed up regularly. Moreover, data will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this Project activity (whichever occurs later).

The operating and maintenance personnel will be skilled technicians, with extensive experience in equipment operation, maintenance and calibration, and emergency procedures. EcoSecurities' will also provide guidance on CDM monitoring requirements and data recording and reporting. Please refer to Annex 4 for more information regarding responsibilities at the site. Overall responsibility for the monitoring and maintenance of all required tasks and their adequate management lies with the Operational Manager at Cargill Agrícola S/A.

Detailed procedures for data collection, calibration of monitoring equipment, maintenance of monitoring equipment and installations, and for record handling will be established. All staff involved in the CDM Project will receive appropriate training.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

The baseline study and the monitoring methodology were concluded on 12/12/2006. The entity determining the baseline study and the monitoring methodology and participating in the Project as the Carbon Advisor is EcoSecurities Group plc listed in Annex 1 of this document.

Detailed baseline and monitoring information is contained in Annexes 3 and 4.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

01/06/04

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

>>

50 years[32]

[32] See Annex 6

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:

>>
Not applicable

C.2.1.2. Length of the first crediting period:

>>
Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/06/04

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

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

>>
Complying with the environmental legislation, in 2003, the Project Developers received approval for a Report of Evaluation and Environmental Performance (RADA) which is required by the State Foundation of Environment of Minas Gerais State (FEAM).

The Project has no negative environmental impacts. Instead, it has only positive impacts such as the utilization of clean, renewable energy and the prevention of uncontrollable burning of biomass.

D.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:

>>
There are no significant negative impacts from the Project activity. Instead, the Project results in positive environmental benefits such as:

- Usage of waste residues;
- Decrease in uncontrollable burnings;
- Decrease in air pollution from fossil fuel burning;
- Decrease in greenhouse gas emissions from burning of fossil fuels and decay of biomass residues.

SECTION E. Stakeholders' comments

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

>>

According to the Resolution #1 dated 2 December 2003, from the Brazilian Inter-Ministerial Commission of Climate Change (CIMGC), decreed on 7 July 1999[33], any CDM projects must send a letter with description of the Project and an invitation for comments to local stakeholders. On 13 December 2006[34], letters with receipts of confirmation were sent to local stakeholders including:

- Municipal Secretariat for the environment;
- FEAM – Minas Gerais State Environment Agency,
- Municipal Chamber,
- Uberlândia City hall,
- Fórum Brasileiro de Organizações Não Governamentais e Movimentos sociais para o Meio Ambiente e Desenvolvimento (GT Comércio e Meio Ambiente) – National NGOs Fórum & Local Social Association,
- Neighbourhood public association.

E.2. Summary of the comments received:

>>

During the stakeholder consultation, one comment was received. It was received from The Association of the Custodio Pereira Neighborhood and discussed the positive benefits from the Project activity such as avoiding accumulation of biomass residues, generating revenue for business owners and contributing to a better future.

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

As only a positive comment about the Project was received, no action was necessary.

[33] Source: http://www.mct.gov.br/clima/comunic/pdf/Resolução01p.pdf

[34] The original stakeholder consultation was completed 17 March 2004. A new consultation was completed to account for the change in methodology

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable

Annex 3

BASELINE INFORMATION

Variable	Value	Unit	Data Source
Incremental steam generation from the Project activity	1,349,988	GJ/yr	Calculated
Steam generation from existing biomass-residue in year y	583,308	GJ/yr	Calculated
Steam generation from fuel oil boiler in year y	51,395	GJ/yr	Calculated
Biomass residues used from Project activity	82,870	Tonnes/yr	Estimation based on information from the Project developer
Biomass residues used in existing boiler in year y	33,408	Tonnes/yr	Estimation based on information from the Project developer
Biomass residues used in existing boiler in year n	35,305	Tonnes/yr	Project developer
Fuel oil consumed in year n	44,688	Tonnes/yr	Project developer
Fuel oil NCV	40.40	GJ/t fuel	2006 IPCC guidelines
Biomass NCV	11.36	GJ/t biomass	Project developer
CH_4 emissions factor for combustion of biomass in boilers	0.000041	tCH_4/GJ	2006 IPCC guidelines
CH_4 emission factor for uncontrolled burning of biomass	0.000322	tCH_4/GJ	2006 IPCC guidelines
Estimated emission factors for heavy duty diesel vehicles	0.001011	$t\ CO_2e/km$	Revised 1996 IPCC Guidelines
Total dry biomass residues consumption	116,278	Tonnes /year	Calculated
Fuel oil consumption	14,446	Tonnes /year	Project Developer
Biomass average return trip distance	220	Km	Project Developer
Average truck load	30	Tonne	Project Developer
Methane Global Warming Potential	21		Revised 1996 IPCC Guidelines

Financial analysis

INPUTS

Enter basic parameters below, and enter annual CER flows in 'CER flow' tab

PROJECT DATA	
Methodology (Small/Large scale)	Large
Total Crediting period (years)	10
Date project starts operating (year)	2004

10
21

Small
Large

Fuel costs	
US$/t of Steam (biomass)	6.7
US$/t of Steam (Fuel Oil)	13.9
Cost per t of biomass	24.2
Amount of biomass used	71,443.0
Amount of steam generated from biomass	256,494.0
Cost per t of fuel oil	202.7
Amount of fuel oil used	44,688.0
Amount of steam generated from fuel oil	651,884.0

FINANCIAL PARAMETERS	
Income Taxes	30%
Discount rate	16%
Depreciation	0%
Price of carbon (US$/tCO2)	10.00
Validation and registration costs ($)	30,000
Verification costs ($)	5,000

COSTS AND EQUIPMENT (US$)	
(if known, override it, otherwise use generic defaults below)	
Pre-operational Costs	0
Investment costs (boilers & equipment)	2,087,000
Investment costs (plantation)	0
Total Investment (US$)	2,087,000
Operating Costs (boilers & equipment) (US$/year)	1,309,337
Operating costs (plantation) (US$/year)	0.00
Other costs	0.00
Contingencies	10%
Insurance	1%
Steam Production (t/yr)	564,451

Plantation operational costs

Total	R$	US$
2004/05	904,338.03	361,735
2005/06	7,227,655.69	2,891,062
2006/07	7,676,629.26	3,070,652
2007/08	2,715,570.91	1,086,228
2008/09	3,471,349.07	1,388,540
2009/10	3,770,065.15	1,508,026
2010/11	4,089,468.36	1,635,787
2011/12	4,229,866.26	1,691,947
2012/13	2,629,885.09	1,051,954
2013/14	424,670.19	169,868

Total operating costs

Total	US$
2004/05	1,671,072
2005/06	4,200,399
2006/07	4,379,989
2007/08	2,395,565
2008/09	2,697,877
2009/10	2,817,363
2010/11	2,945,124
2011/12	3,001,284
2012/13	2,361,291
2013/14	1,479,205
Average	2,794,917

	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Financial Analysis:**												
2													
3	**CASH FLOW WITHOUT CDM**		*0*	1	*2*	3	4	5	6	7	8	9	10
4			***2004***	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
5	Projected Emission Reductions (tCO_2)		*71,387*	*122,379*	*122,379*	*122,379*	*122,379*	*122,379*	*122,379*	*122,379*	*117,983*	*117,983*	*50,991*
6													
7	**REVENUE**												
8	Steam Production t		*0*	*564,451*	*564,451*	*564,451*	*564,451*	*564,451*	*564,451*	*564,451*	*564,451*	*564,451*	*564,451*
9	Cost fuel oil: $/t steam		*$0.0*	*$13.9*	*$13.9*	*$13.9*	*$13.9*	*$13.9*	*$13.9*	*$13.9*	*$13.9*	*$13.9*	*$13.9*
10	Cost chips: $/t steam		*$0.0*	*$6.7*	*$6.7*	*$6.7*	*$6.7*	*$6.7*	*$6.7*	*$6.7*	*$6.7*	*$6.7*	*$6.7*
11	**Net Revenue from fuel savings (US$)**		***$0***	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**
12													
13	**COSTS & INVESTMENT**												
14	**a) Investment**												
15	Pre-operational Costs (US$)	0	*$0*										
16	Investment (boilers & equipment) (US$)		*$2,087,000*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
17	Investment (plantation) (US$)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
18	**TOTAL INVESTMENT (US$)**		***$2,087,000***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
19													
20	**b) Operational costs**												
21													
22	Boilers & Equipment		*$0*	$1,309,337	$1,309,337	$1,309,337	$1,309,337	$1,309,337	$1,309,337	$1,309,337	$1,309,337	$1,309,337	$1,309,337
23	Plantation costs		$361,735	$2,891,062	$3,070,652	$1,086,228	$1,388,540	$1,508,026	$1,635,787	$1,691,947	$1,051,954	$169,868	$361,735
24	Total Operating Costs		*$361,735*	*$4,200,399*	*$4,379,989*	*$2,395,565*	*$2,697,877*	*$2,817,363*	*$2,945,124*	*$3,001,284*	*$2,361,291*	*$1,479,205*	*$1,671,072*
25	Other costs	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
26	Insurance (US$)	1.0%	*$0*	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870
27	Contingencies	10%	*$208,700*	*$208,700*	*$208,700*	*$208,700*	*$208,700*	*$208,700*	*$208,700*	*$208,700*	*$208,700*	*$208,700*	*$208,700*
28	**Total Costs (US$)**		***$2,657,435***	***$4,429,969***	***$4,609,559***	***$2,625,135***	***$2,927,447***	***$3,046,933***	***$3,174,694***	***$3,230,854***	***$2,590,861***	***$1,708,775***	***$1,900,642***
29													
30	**CASH FLOW without CDM**												
31	Depreciation	0.00%	*0*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
32	Gross profit before tax		*(570,435)*	-$395,312	-$574,902	$1,409,522	$1,107,210	$987,724	$859,963	$803,804	$1,443,796	$2,325,882	$2,134,015
33	Cummulative (for carryforward tax)		*(570,435)*	-$965,747	-$1,540,649	-$131,127	$976,083	$1,963,807	$2,823,770	$3,627,573	$5,071,369	$7,397,251	$9,531,266
34	**Income Tax**	30%	*$0*	$0	$0	$0	$0	$332,163	$296,317	$257,989	$241,141	$433,139	$697,765
36													
37	**Cashflow without CDM**		***-$2,657,435***	**-$395,312**	**-$574,902**	**$1,409,522**	**$1,107,210**	**$655,561**	**$563,645**	**$545,815**	**$1,202,655**	**$1,892,743**	**$1,436,250**
38	Cummulative (for carryforward tax)		*-$2,657,435*	-$3,052,747	-$3,627,649	-$2,218,127	-$1,110,917	-$455,356	$108,289	$654,104	$1,856,759	$3,749,502	$5,185,752
39													
40		**21 years**	**10 years**										
41													
42	Net Present Value (US$)	(126,324)	(126,324)										

Sensitivity Analysis

	B	C	D	E	F	G	H	I	J	K	L	M	N
4	**PROJECT CASH FLOW**		**0**	1	2	3	4	5	6	7	8	9	10
5	**REVENUE**		***2004***	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
6	Projected emission reductions (tCO_2)		0	71,387	122,379	122,379	122,379	122,379	122,379	122,379	122,379	117,983	117,983
8	**REVENUE**												
9	**I) Heat generation**												
10	**Net revenue (US$)**		**$0**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**
11	*10% increase in revenues*		*$0*	*$4,438,123*	*$4,438,123*	*$4,438,123*	*$4,438,123*	*$4,438,123*	*$4,438,123*	*$4,438,123*	*$4,438,123*	*$4,438,123*	*$4,438,123*
13	**COSTS & INVESTMENT**												
14	**a) Investment**												
15	Pre-operational Costs	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
16	Investment	0	$2,087,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**SubTotal : Total investment**		**$2,087,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
18	*10% reduction in total investment costs*		$1,878,300	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
19	*Depreciation*		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
21	**b) Operational costs**												
22	**SubTotal : Total O&M**		**$0**	**$4,200,399**	**$4,379,989**	**$2,395,565**	**$2,697,877**	**$2,817,363**	**$2,945,124**	**$3,001,284**	**$2,361,291**	**$1,479,205**	**$1,671,072**
23	**10% reduction in O&M costs**		**$0**	**$3,780,359**	**$3,941,990**	**$2,156,009**	**$2,428,089**	**$2,535,627**	**$2,650,612**	**$2,701,155**	**$2,125,162**	**$1,331,285**	**$1,503,965**
24	**TOTAL CASHFLOW OUT (U$)**		**$2,295,700**	**$4,009,929**	**$4,171,560**	**$2,385,579**	**$2,657,659**	**$2,765,197**	**$2,880,182**	**$2,930,725**	**$2,354,732**	**$1,560,855**	**$1,733,535**

Cash flow considering 10% increase in revenues (10% rise in tariff or 10% rise in operating hours)

	B	C	D	E	F	G	H	I	J	K	L	M	N
28	**CASH FLOW WITHOUT CERs**												
29	Depreciation	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
30	Gross profit before tax		-$208,700	$428,193	$266,563	$2,052,544	$1,780,464	$1,672,926	$1,557,941	$1,507,398	$2,083,391	$2,877,268	$2,704,588
31	Cummulative (for carryforward tax)		-$208,700	$219,493	$486,056	$2,538,600	$4,319,064	$5,991,990	$7,549,931	$9,057,328	$11,140,719	$14,017,987	$16,722,575
32	**Tax**	30%	$0	$0	$128,458	$79,969	$615,763	$534,139	$501,878	$467,382	$452,219	$625,017	$863,180
33	Net profit		-$208,700	$299,735	$186,594	$1,436,781	$1,246,325	$1,171,048	$1,090,559	$1,055,178	$1,458,374	$2,014,088	$1,893,211
34	**Without-carbon cashflow**		**-$2,295,700**	**$428,193**	**$138,105**	**$1,972,575**	**$1,164,701**	**$1,138,787**	**$1,056,063**	**$1,040,015**	**$1,631,172**	**$2,252,251**	**$1,841,407**
35	Cummulative		-$2,295,700	-$1,867,507	-$1,729,402	$243,173	$1,407,874	$2,546,661	$3,602,724	$4,642,739	$6,273,911	$8,526,162	$10,367,569

		For 21 years	For 10 years
38		**without CDM**	**without CDM**
39	Net Present Value ($)	2,338,534	2,338,534
40	IRR	37.23%	37.23%
41	Discount rate	16%	16%

Cash flow considering 10% decrease in capital costs

	B	C	D	E	F	G	H	I	J	K	L	M	N
46	**CASH FLOW WITHOUT CERs**												
47	Depreciation	0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
48	Gross profit before tax		-$779,135	-$395,312	-$574,902	$1,409,522	$1,107,210	$987,724	$859,963	$803,804	$1,443,796	$2,325,882	$2,134,015
49	Cummulative (for carryforward tax)		-$779,135	-$1,174,447	-$1,749,349	-$339,827	$767,383	$1,755,107	$2,615,070	$3,418,873	$4,862,669	$7,188,551	$9,322,566
50	**Tax**	30%	$0	$0	$0	$0	$0	$332,163	$296,317	$257,989	$241,141	$433,139	$697,765
51	Net profit		-$779,135	-$395,312	-$574,902	$1,409,522	$775,047	$691,407	$601,974	$562,662	$1,010,657	$1,628,117	$1,493,810
52	**Without-carbon cashflow**		**-$2,295,700**	**$24,728**	**-$136,903**	**$1,649,078**	**$1,376,998**	**$937,297**	**$858,158**	**$845,943**	**$1,438,784**	**$2,040,664**	**$1,603,357**
53	Cummulative		-$2,295,700	-$2,270,972	-$2,407,875	-$758,797	$618,201	$1,555,498	$2,413,656	$3,259,599	$4,698,383	$6,739,047	$8,342,404

		For 21 years	For 10 years
56		**without CDM**	**without CDM**
57	Net Present Value ($)	1,570,201	1,570,201
58	IRR	29.18%	29.18%
59	Discount rate	16%	16%

Cash flow considering 10% reduction in operational costs

	B	C	D	E	F	G	H	I	J	K	L	M	N
63	**CASH FLOW WITHOUT CERs**												
64	10% reduction in opeartional costs US$/MWh		$325,562	$3,780,359	$3,941,990	$2,156,009	$2,428,089	$2,535,627	$2,650,612	$2,701,155	$2,125,162	$1,331,285	$1,503,965
65	Total O&M		$325,562	$3,780,359	$3,941,990	$2,156,009	$2,428,089	$2,535,627	$2,650,612	$2,701,155	$2,125,162	$1,331,285	$1,503,965
66	Total cashflow out		$2,621,262	$4,009,929	$4,171,560	$2,385,579	$2,657,659	$2,765,197	$2,880,182	$2,930,725	$2,354,732	$1,560,855	$1,733,535
67	Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
68	Gross Profit before Tax		-$534,262	$24,728	-$136,903	$1,649,078	$1,376,998	$1,269,460	$1,154,475	$1,103,932	$1,679,925	$2,473,802	$2,301,122
69	Cumulative (for carryforward tax)		-$534,262	-$509,534	-$646,437	$1,002,641	$2,379,639	$3,649,100	$4,803,575	$5,907,507	$7,587,432	$10,061,234	$12,362,356
70	Tax	30%	$0	$0	$0	$0	$494,723	$413,099	$380,838	$346,343	$331,180	$503,978	$742,141
71	Net profit		-$534,262	$24,728	-$136,903	$1,649,078	$882,275	$856,361	$773,637	$757,589	$1,348,746	$1,969,825	$1,558,981
72	**Without Carbon Cashflow**		-$2,621,262	$24,728	-$136,903	$1,649,078	$882,275	$856,361	$773,637	$757,589	$1,348,746	$1,969,825	$1,558,981

		For 21 years	For 10 years
75		Without CDM	Without CDM
76	NPV	807,647	920,977
77	IRR	23%	23%
78	Discount Rate	16%	16%

	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Financial analysis:**												
2													
3													
4	**CASHFLOW WITH CDM**		***0***	1	2	3	4	5	6	7	8	9	10
5			***2004***	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
6	Projected emission reductions (tCO_2)		*0*	*71,387*	*122,379*	*122,379*	*122,379*	*122,379*	*122,379*	*122,379*	*122,379*	*117,983*	*117,983*
7													
8	**REVENUE**												
9	**Net revenue from fuel oil savings (US$)**		***$0***	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**	**$4,034,657**
11	**II) Carbon Sales**												
12	Price of Carbon (US$ / tCO_2e)	10.00											
13	**Carbon Revenue (US$)**		***$0***	**$0**	**$713,870**	**$1,223,790**	**$1,223,790**	**$1,223,790**	**$1,223,790**	**$1,223,790**	**$1,223,790**	**$1,223,790**	**$1,179,830**
14													
15	**TOTAL REVENUE (US$)**		***$0***	**$4,034,657**	**$4,748,527**	**$5,258,447**	**$5,258,447**	**$5,258,447**	**$5,258,447**	**$5,258,447**	**$5,258,447**	**$5,258,447**	**$5,214,487**
16													
17	**COSTS & INVESTMENT**												
18	**a) Investment**												
19	Pre-operational Costs (US$)	0	$0										
20	Investment (US$)	2,087,000	$2,087,000										
21	**TOTAL INVESTMENT (US$)**		**$2,087,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
22													
23	**b) Operational costs**												
24	Boilers & Equipment		$0	$1,282,084	$1,282,084	$1,282,084	$1,282,084	$1,282,084	$1,282,084	$1,282,084	$1,282,084	$1,282,084	$1,282,084
25	Plantation costs		$0	$361,735	$2,891,062	$3,070,652	$1,086,228	$1,388,540	$1,508,026	$1,635,787	$1,691,947	$1,051,954	$169,868
26	Total operational costs		$361,735	$4,200,399	$4,379,989	$2,395,565	$2,697,877	$2,817,363	$2,945,124	$3,001,284	$2,361,291	$1,479,205	$1,671,072
27	Other costs	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28	Carbon Offset Monitoring and verification	30,000	$0	$0	$30,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
29	Insurance (US$)	1%	$0	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870	$20,870
30	Contingencies	10%	$208,700	$208,700	$208,700	$208,700	$208,700	$208,700	$208,700	$208,700	$208,700	$208,700	$208,700
31	**TOTAL COSTS (US$)**		**$2,657,435**	**$4,429,969**	**$4,639,559**	**$2,635,135**	**$2,937,447**	**$3,056,933**	**$3,184,694**	**$3,240,854**	**$2,600,861**	**$1,718,775**	**$1,910,642**
32													
33	**CASH FLOW with CDM**												
34	Depreciation	0%	*0*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
35	Gross profit before tax		-$570,435	-$395,312	$108,968	$2,623,312	$2,321,000	$2,201,514	$2,073,753	$2,017,594	$2,657,586	$3,539,672	$3,303,845
36	Cummulative (for carryforward tax)		-$570,435	-$965,747	-$856,779	$1,766,533	$4,087,533	$6,289,047	$8,362,800	$10,380,393	$13,037,979	$16,577,651	$19,881,496
37	**Income Tax**	30%	*0*	$0	$0	$0	$786,994	$696,300	$660,454	$622,126	$605,278	$797,276	$1,061,902
38	Net Profit		-$570,435	-$395,312	$108,968	$1,836,318	$1,624,700	$1,541,060	$1,451,627	$1,412,315	$1,860,310	$2,477,770	$2,312,691
39	**Cashflow with CDM**		**-$2,657,435**	**(395,312)**	**108,968**	**2,623,312**	**1,534,007**	**1,505,214**	**1,413,298**	**1,395,468**	**2,052,308**	**2,742,396**	**2,241,943**
40	Cummulative (for carryforward tax)		-$2,657,435	-$3,052,747	-$2,943,779	-$320,467	$1,213,539	$2,718,753	$4,132,052	$5,527,520	$7,579,827	$10,322,224	$12,564,167
41													
42		**21 years**	**10 years**										
43		**with CDM**	**with CDM**										
44	Net Present Value (US$)	2,717,245	2,717,245										

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid[35]

Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [MWh]	Imports [MWh]
2003	0.9823	288,933,290	274,670,644	459,586
2004	0.9163	302,906,198	284,748,295	1,468,275
2005	0.8086	314,533,592	296,690,687	3,535,252
	Total (2003-2005) =	**906,373,081**	**856,109,626**	**5,463,113**

$EF_{OM,\ simple\text{-}adjusted}$ [tCO2/MWh]	$EF_{BM,2005}$	Lambda	
0.4349	0.0872	λ_{2003}	
Alternative weights	**Default weights**	0.5312	
	w_{OM} = 0.75	w_{OM} = 0.5	λ_{2004}
	w_{BM} = 0.25	w_{BM} = 0.5	0.5055
Alternative EF_y **[tCO2/MWh]**	**Default EF_y [tCO2/MWh]**	λ_{2005}	
0.3480	**0.2611**	0.5130	

[35] All grid data is according to Operador Nacional do Sistema Elétrico, Centro Nacional de Operação do Sistema, Acompanhamento Diário da Operação do SIN (daily reports from Jan. 1, 2003 to Dec. 31, 2005).

	2003	
	Generation (MWh)	Fuel Consumption (TJ)
JAURU	78,921	0
GUAPORÉ	86,201	0
TRÊS LAGOAS	233,793	2,806
FUNIL (MG)	370,111	0
ITIQUIRA I	408,728	0
ARAUCÁRIA	22	0
CANOAS	182,256	2,187
PIRAJU	417,894	0
N. PIRATININGA	47,847	574
PCT CGTEE	0	0
ROSAL	316,262	0
IBIRITÉ	530,761	6,369
CANA BRAVA	2,200,434	0
STA CLARA	169,471	0
MACHADINHO	3,436,304	0
JUIZ DE FORA	6,845	75
Macaé Merchant	2,389,507	35,843
LAJEADO (ANEEL res. 402/2001)	4,457,790	0
ELETROBOLT	242,364	3,635
D. FRANCISCA	895,131	0
Porto Estrela	410,136	0
Cuiaba (Mario Covas)	2,228,109	26,737
W.ARJONA	549,729	7,916
URUGUAIANA	1,751,486	24,251
S.CAXIAS	5,556,125	0
CANOAS I	594,298	0
CANOAS II	507,843	0
IGARAPAVA	1,140,260	0
P.PRIMAVERA	9,059,670	0
Cuiaba (Mario Covas)	0	0
SOBRAGI	341,073	0
PCH EMAE	103,188	0
PCH CEEE	240,724	0
PCH ENERSUL	119,405	0
PCH CEB	76,857	0
PCH ESCELSA	260,910	0
PCH CELESC	442,080	0
PCH CEMAT	966,348	0
PCH CELG	80,666	0
PCH CERJ	256,284	0
PCH COPEL	421,439	0
PCH CEMIG	564,461	0
PCH CPFL	328,332	0
S. MESA	4,490,258	0
PCH EPAULO	0	0
Guilmam Amorim	511,414	0
CORUMBA	1,604,930	0
MIRANDA	1,778,457	0
NOVA PONTE	2,208,901	0
SEGREDO (Gov. Ney Braga)	5,253,636	0
TAQUARUÇU	2,251,810	0
MANSO	841,600	0
ITÁ	5,222,265	0
ROSANA	2,029,045	0
ANGRA	13,355,432	0
T.IRMÃOS	2,493,761	0
ITAIPU 60 Hz	46,309,279	0
ITAIPU 50 Hz	36,692,448	0
EMBORCAÇÃO	3,928,062	0
Nova Avanhandava	1,377,657	0
Gov. Bento Munhoz - GBM	4,178,204	0
S.SANTIAGO	6,124,508	0
ITUMBIARA	7,342,183	0
IGARAPÉ	33,791	406
ITAUBA	1,895,033	0
A. Vermelha (Jose E. Moraes)	7,280,135	0
S.SIMÃO	10,850,060	0
CAPIVARA	3,527,028	0
S.OSÓRIO	4,305,490	0
MARIMBONDO	6,614,912	0
PROMISSÃO	998,520	0
Pres. Medici	1,306,186	18,086
Volta Grande	1,892,826	0
Porto Colombia	1,849,042	0
Passo Fundo	1,176,518	0
PASSO REAL	771,223	0
Ilha Solteira	16,060,345	0
MASCARENHAS	777,134	0
Gov. Parigot de Souza - GPS	1,001,495	0
CHAVANTES	2,026,711	0
JAGUARA	2,649,364	0
SA CARVALHO	302,343	0
Estreito (Luiz Carlos Barreto)	3,084,388	0
IBITINGA	600,891	0
JUPIA	8,944,402	0
ALEGRETE	0	0
CAMPOS (Roberto Silveira)	0	0
Santa Cruz (RJ)	540,073	6,272
PARAIBUNA	265,808	0
LIMOEIRO (Armando Salles de Oliviera)	128,521	0
CACONDE	340,046	0
J.LACERDA C	1,985,975	28,598
J.LACERDA B	1,126,809	19,317
J.LACERDA A	583,250	11,665
BARIRI (Alvaro de Souza Lima)	541,316	0
FUNIL (RJ)	619,432	0
FIGUEIRA	54,554	655
FURNAS	4,499,554	0
Barra Bonita	477,594	0
CHARQUEADAS	136,595	2,138
Jurumirim (Armando A. Laydner)	439,132	0
JACUI	1,419,402	0
Pereira Passos	326,708	0
Tres Marias	1,818,886	0
Euclides da Cunha	419,565	0
CAMARGOS	157,100	0
Santa Branca	134,029	0
Cachoeira Dourada	2,959,147	0
Salto Grande (Lucas N. Garcez)	427,192	0
Salto Grande (MG)	513,869	0
Mascarenhas de Moraes (Peixoto)	2,207,257	0
ITUTINGA	210,152	0
S. JERÔNIMO	43,993	609
CARIOBA	0	0
PIRATININGA	289,700	3,725
CANASTRA	237,695	0
Nilo PEÇANHA	2,386,456	0
FONTES NOVA	719,497	0
H.BORDEN Sub.	63,638	0
H.BORDEN Ext	448,281	0
I. POMBOS	680,168	0

	2004	
	Generation (MWh)	Fuel Consumption (TJ)
TermoRio	120,326	1,444
Candonga	129,327	0
Queimado	360,952	0
Norte Fluminense	1,507,181	18,086
JAURU	487,636	0
GUAPORÉ	335,127	0
TRÊS LAGOAS	1,419,067	17,029
FUNIL (MG)	667,597	0
ITIQUIRA I	856,539	0
ARAUCÁRIA	22	0
CANOAS	527,587	6,331
PIRAJU	466,775	0
N. PIRATININGA	13,820	166
PCT CGTEE	0	0
ROSAL	384,555	0
IBIRITÉ	1,245,228	14,943
CANA BRAVA	2,214,839	0
STA CLARA	345,880	0
MACHADINHO	4,337,016	0
JUIZ DE FORA	66,002	849
Macaé Merchant	740,098	11,101
LAJEADO (ANEEL res. 402/2001)	4,331,991	0
ELETROBOLT	1,324,501	19,868
D. FRANCISCA	683,674	0
Porto Estrela	554,865	0
Cuiaba (Mario Covas)	1,659,230	19,911
W.ARJONA	538,087	7,748
URUGUAIANA	2,270,176	31,433
S.CAXIAS	6,015,459	0
CANOAS I	578,928	0
CANOAS II	486,299	0
IGARAPAVA	1,090,945	0
P.PRIMAVERA	9,472,700	0
SOBRAGI	395,652	0
PCH EMAE	137,132	0
PCH CEEE	215,617	0
PCH ENERSUL	174,892	0
PCH CEB	109,606	0
PCH ESCELSA	353,471	0
PCH CELESC	468,240	0
PCH CEMAT	1,353,714	0
PCH CELG	73,309	0
PCH CERJ	297,264	0
PCH COPEL	707,277	0
PCH CEMIG	672,546	0
PCH CPFL	458,822	0
S. MESA	4,397,135	0
Guilmam Amorim	661,366	0
CORUMBA	2,163,267	0
MIRANDA	1,069,831	0
NOVA PONTE	1,302,593	0
SEGREDO (Gov. Ney Braga)	5,897,593	0
TAQUARUÇU	2,022,042	0
MANSO	732,036	0
ITÁ	6,054,272	0
ROSANA	1,864,543	0
ANGRA	11,581,987	0
T.IRMÃOS	2,058,733	0
ITAIPU 60 Hz	46,853,256	0
ITAIPU 50 Hz	36,935,778	0
EMBORCAÇÃO	4,312,481	0
Nova Avanhandava	1,406,957	0
Gov. Bento Munhoz - GBM	5,352,443	0
S.SANTIAGO	6,886,744	0
ITUMBIARA	7,854,963	0
IGARAPÉ	19,989	240
ITAUBA	1,233,332	0
A. Vermelha (Jose E. Moraes)	6,520,363	0
S.SIMÃO	12,205,751	0
CAPIVARA	3,302,087	0
S.OSÓRIO	484,648	0
MARIMBONDO	6,349,261	0
PROMISSÃO	1,048,625	0
Pres. Medici	1,492,153	20,661
Volta Grande	1,793,617	0
Porto Colombia	1,715,325	0
Passo Fundo	705,586	0
PASSO REAL	549,702	0
Ilha Solteira	15,868,207	0
MASCARENHAS	786,812	0
Gov. Parigot de Souza - GPS	1,204,667	0
CHAVANTES	1,935,377	0
JAGUARA	2,606,033	0
SA CARVALHO	464,819	0
Estreito (Luiz Carlos Barreto)	2,940,054	0
IBITINGA	712,124	0
JUPIA	8,790,288	0
ALEGRETE	0	0
CAMPOS (Roberto Silveira)	0	0
Santa Cruz (RJ)	199,124	2,312
PARAIBUNA	199,289	0
LIMOEIRO (Armando Salles de Oliviera)	165,483	0
CACONDE	260,607	0
J.LACERDA C	2,330,323	33,557
J.LACERDA B	1,304,788	22,368
J.LACERDA A	873,490	17,470
BARIRI (Alvaro de Souza Lima)	630,646	0
FUNIL (RJ)	685,740	0
FIGUEIRA	73,448	881
FURNAS	4,288,104	0
Barra Bonita	567,300	0
CHARQUEADAS	239,467	3,748
Jurumirim (Armando A. Laydner)	445,781	0
JACUI	1,178,249	0
Pereira Passos	384,896	0
Tres Marias	1,892,922	0
Euclides da Cunha	561,413	0
CAMARGOS	188,520	0
Santa Branca	99,619	0
Cachoeira Dourada	3,315,489	0
Salto Grande, SP (Lucas N. Garcez)	484,648	0
Salto Grande (MG)	579,590	0
Mascarenhas de Moraes (Peixoto)	2,337,376	0
ITUTINGA	239,530	0
S. JERÔNIMO	30,845	427
CARIOBA	0	0
PIRATININGA	162,952	2,095
CANASTRA	148,084	0
Nilo PEÇANHA	2,689,893	0
FONTES NOVA	803,368	0
H.BORDEN Sub.	5,393	0

	2005	
	Generation (MWh)	Fuel Consumption (TJ)
Quebra Queixo	16,197	0
Quirinhos	25,167	0
Barra Grande	248,690	0
Mimoso	48,329	0
Ponte de Pedra	439,462	0
Almoreis	122,877	0
Santa Clara PR	321,818	0
Monte Claro	243,331	0
Termorio	1,150,380	8,283
PCH CESP	0	0
Candonga	566,936	0
Queimado	588,657	0
Norte Fluminense	3,635,646	26,177
JAURU	514,779	0
GUAPORÉ	389,619	0
TRÊS LAGOAS	690,051	7,763
FUNIL (MG)	800,466	0
ITIQUIRA I	1,104,190	0
ARAUCÁRIA	0	0
CANOAS	927,537	10,436
PIRAJU	446,366	0
N. PIRATININGA	231,010	2,599
PCT CGTEE	0	0
ROSAL	421,891	0
IBIRITÉ	490,201	5,515
CANA BRAVA	2,316,663	0
STA CLARA MG	332,249	0
MACHADINHO	4,480,027	0
JUIZ DE FORA	232,477	2,615
Macaé Merchant	119,568	1,345
LAJEADO (ANEEL res	4,539,333	0
ELETROBOLT	190,904	2,148
D. FRANCISCA	761,279	0
Porto Estrela	593,357	0
Cuiaba (Mario Covas)	1,229,232	13,829
W.ARJONA	728,836	8,199
URUGUAIANA	1,733,424	12,481
S.CAXIAS	5,920,260	0
CANOAS I	555,667	0
CANOAS II	441,828	0
IGARAPAVA	1,297,196	0
P.PRIMAVERA	9,686,480	0
SOBRAGI	385,988	0
PCH EMAE	149,526	0
PCH CEEE	173,917	0
PCH ENERSUL	162,165	0
PCH CEB	114,097	0
PCH ESCELSA	500,563	0
PCH CELESC	481,799	0
PCH CEMAT	1,515,897	0
PCH CELG	72,592	0
PCH CERJ	311,762	0
PCH COPEL	578,787	0
PCH CEMIG	619,029	0
PCH CPFL	461,440	0
S. MESA	4,731,322	0
PCH EPAULO	0	0
Guilmam Amorim	632,333	0
CORUMBÁ	1,923,111	0
MIRANDA	1,480,071	0
NOVA PONTE	2,015,019	0
SEGREDO (Gov. Ney B	5,587,794	0
TAQUARUÇU	2,032,597	0
MANSO	616,312	0
ITÁ	5,940,371	0
ROSANA	1,880,873	0
ANGRA	9,864,879	0
T.IRMÃOS	2,030,080	0
ITAIPU 60 Hz	43,263,219	0
ITAIPU 50 Hz	38,437,460	0
EMBORCAÇÃO	5,428,696	0
Nova Avanhandava	1,424,680	0
Gov. Bento Munhoz - G	5,264,925	0
S.SANTIAGO	6,337,245	0
ITUMBIARA	8,810,284	0
IGARAPÉ	13,604	148
ITAUBA	1,725,629	0
A. Vermelha (Jose E. M	7,426,577	0
S.SIMÃO	11,878,356	0
CAPIVARA	3,445,003	0
S.OSÓRIO	4,404,318	0
MARIMBONDO	6,694,731	0
PROMISSÃO	1,022,782	0
Pres. Medici	1,699,573	18,541
Volta Grande	2,181,749	0
Porto Colombia	1,955,931	0
Passo Fundo	994,464	0
PASSO REAL	671,226	0
Ilha Solteira	16,814,479	0
MASCARENHAS	795,700	0
Gov. Parigot de Souza -	1,240,817	0
CHAVANTES	1,786,328	0
JAGUARA	2,694,795	0
SA CARVALHO	478,444	0
Estreito (Luiz Carl	4,208,999	0
IBITINGA	698,094	0
JUPIA	9,114,514	0
ALEGRETE	0	0
CAMPOS (Roberto Silv	0	0
Santa Cruz (RJ)	176,628	1,987
PARAIBUNA	272,422	0
LIMOEIRO (Armando S	157,213	0
CACONDE	400,542	0
J.LACERDA C	2,012,313	21,953
J.LACERDA B	1,188,746	12,968
J.LACERDA A	877,032	9,568
BARIRI (Alvaro de Souz	603,788	0
FUNIL (RJ)	857,914	0
FIGUEIRA	81,238	886
FURNAS	5,687,817	0
Barra Bonita	547,013	0
CHARQUEADAS	213,418	2,328
Jurumirim (Armando A.	454,698	0
JACUI	1,174,695	0
Pereira Passos	397,305	0
Tres Marias	2,543,413	0
Euclides da Cunha	534,411	0
CAMARGOS	200,117	0
Santa Branca	148,713	0
Cachoeira Dourada	3,604,388	0
Salto Grande (Lucas N.	486,456	0

Annex 4

MONITORING INFORMATION

Operational procedures and responsibilities for monitoring and quality assurance of emissions from Project activity (E=responsible for executing, R=responsible for overseen and assuring quality, I=to be informed)

Task	Cargill Agrícola S/A		Equipment Supplier	EcoSecurities
	Lead Engineer	Site Engineer		
Collect data	R	E	N/A	N/A
Enter data into spreadsheet	R	E	N/A	N/A
Make monthly and annual reports	R	E	N/A	I
Achieve data & reports	R	E	N/A	I
Calibration / Maintenance, rectify faults	I	R	E	I

Annex 5[36]
LETTERS FROM BIOMASS RESIDUES SUPPLIERS

Agrotec – Empreendimentos Agropecuários Ltda.

STATEMENT

AGROTEC EMPREENDIMENTOS AGROPECUÁRIOS LTDA., registered in the National Register of Legal Entities (CNPJ) with nº 25.447.657/0001-22, hereby states that **Cargill Agrícola S/A** purchases approximately 2,500 (two thousand five hundred) tons per month of chips (pine shavings from planted forest) residue of the industrial process in our sawmill, which corresponds to approximately 35% of our availability.

For several years, in the absence of Cargill, there would be no demand for these biomass residues and they would not be used.

This being true, we sign this statement.

Catalão (GO), January 18, 2007

(SIGNATURE)

AGROTEC EMPREENDIMENTOS AGROPECUÁRIOS LTDA.

José Dionísio Pertile

Av Presidente Medici, 155 – Setor Santa Cruz – CEP 75706-420 – Catalão/GO – Fone (64) 3441-8700 E-mail: vgrande@terra.com.br

[36] Included in the PDD are translations of letters. Actual letters in Portuguese are available.

MADEIREIRA PESSONHA

CGC: 71.250.229/0001-22 Insc. Estadual: 498.131.456-0053
Rodovia MG 462, Km 62 – Zona Rural Perdizes – MG CEP 38.170.000
Fone: (0XX34) 3663-2100 Fax: (0XX34)3663-2101
E – mail: madeireirapessonha@netperdizes.com.br

Dear Sirs,

I, **ANDERSON GONÇALVES RAMOS,** in the name of **MADEIREIRA PESSONHA LTDA.,** hereby certify that **CARGILL AGRÍCOLA S.A.** purchases approximately 3,000.00 tons of forest residue per month, which corresponds to approximately 80% of the total availability of the forest residue of **MADEIREIRA PESSONHA LTDA.**

Since 2004, in the absence of Cargill, there would be no demand for these biomass residues, which could not be sold and would not be used.

Yours truly,

(SIGNATURE)

_____
Anderson Gonçalves Ramos
Administrative Manager

(STAMP)

71.250.229/0001-22
MADEIREIRA PESSONHA LTDA.
Rodovia MG 462 – KM 62
Zona Rural – CEP 38170-000
Perdizes –Minas Gerais

MADESTRELA
AGROFLORESTAL LTDA

Dear Sirs,

I, **ADEMIR JOSÉ OLIVEIRA,** in the name of **MADESTRELA AGROFLORESTAL LTDA.,** hereby certify that **CARGILL AGRÍCOLA S.A.** purchases approximately 1,500.00 tons of forest residue per month, which corresponds to approximately 80% of the total availability of the forest residue of **MADESTRELA AGROFLORESTAL LTDA.**

Since 2005, in the absence of Cargill, there would be no demand for these biomass residues, which could not be sold and would not be used.

Yours truly,

(SIGNATURE)

_____

Ademir José Oliveira
Managing Partner

(STAMP)

06.286.138/0001-85
MADESTRELA
AGROFLORESTAL LTDA
Rod. BR 223 (access – Estrela do Sul)
Km 01 -640
Estrela do Sul-MG
CEP

Dear Sirs,

I, **DANNY FAUST CRUZ,** Commercial Director of **SERCAL – COMERCIAL EXPORTADORA LTDA.,** hereby certify that **CARGILL AGRÍCOLA S.A.** purchases approximately 850 tons of pine shavings per month, which corresponds to approximately 65% of the total availability of the pine shavings of our company.

This new activity of our company creates about 50 direct jobs and we count on the consumption of Cargill Agrícola in order to continue production during the whole year.

We do not have other consumers for large volumes in the area, which, in the absence of Cargill, would make the shavings activity non-feasible, not only for our company but for many others here.

Since 2005, in the absence of Cargill, there would be no demand for these biomass residues, which could not be sold and would not be used.

Yours truly,

(SIGNATURE)

_____

Danny Faust Cruz
Commercial Director

STATEMENT:

In the middle of the year of 2000, Gabriel Cabral de Faria Neto and Jarbas de Sousa Júnior founded a company in the sector of BIOMASS processing, REFLORESCE ARTEFATOS E COMERCIO DE MADEIRAS LTDA.

Upon making a research of the raw material supplier, we verified that SATIPEL, the owner of a forest of pine trees (pinus), with a planted area of around 50,000 ha, was the largest supplier of wood in the area.

Upon a visit to purchase the material, we noticed an enormous quantity of forest residues, composed of branches, stumps without specification of size and diameter, material not being used originated from forest harvesting.

Upon talking to the forestry engineer, we verified that this material had no destination and was becoming a problem to Satipel, as it made re-planting not feasible and at that time the only option for cleaning was to burn the material. In this situation, REFLORESCE proposed the development of equipment to process on site the material that until then had been discarded, as a test. Once the results were satisfactory, parameters were established and an agreement was made to exploit the niche of raw material. This work created a great offer of the final product (shavings) and, as it was a new product on the market until then unknown, we were afraid of having problems with the sale of the production. It was then that we visited CARGILL AGRÍCOLA S/A, who was already using disintegrated wood of its own production in its boilers, and showed them our product, which was qualified as good and our entire production of this new category of biomass was contracted.

Thus we conclude that CARGILL AGRÍCOLA S/A was the great forerunner in this new industrial and commercial activity, contributing to the appearance of other companies in this sector and creating hundreds of new jobs. REFLORESCE LTDA., contracted by CARGILL AGRÍCOLA S/A, has supplied since 2001 approximately 1000 tons of shavings per month, which corresponds to 100% of our production.

This having been said, we remain at your disposal for any further information that may be required.

(SIGNATURES)

REFLORESCE ARTEFATOS E COMERCIO DE MADEIRAS LTDA.
Rua Padre Eustáquio, 28 Centro Romaria/ MG
CEP: 38 520-000 Fone/Fax: (34) 3848-1421
E-mail: refloresce@netvip.com.br

Annex 6
PROOF OF BOILER LIFETIMES

FROM: PROTERMO **PHONE Nº 011 51843470** **Jan. 18, 2007 01:19PM P2**

Information on boilers

São Paulo, January 18, 2007

Cargill Agrícola S/A
Rua Will Cargill, 880
Uberlândia – MG
38402-350

Attn.: Eng. Waldemir Guimarães Nogueria – Utilities
Re;: Boilers
Subj.: Information

Dear Sirs,

The basic difference between the operation of boilers with fuel oil or biomass is that in the first case there is the presence of sulphur in the fuel.

According to the quality of the fuel oil, the operational parameters and the project of the boiler, the useful life of a unit operated with fuel oil may be much shorter than the other operated with biomass, due to the appearance of sulphuric acid in the combustion gases, mainly affecting air savers and pre-heaters.

Due to this fact, the average useful life expectation of an oil boiler is approximately 30 years, while the one of a biomass boiler is approximately 50 years.

Yours truly,

(SIGNATURE)
Eng. Álvaro Chemmer

Annex 7
PROOF OF STEP 0

São Paulo, April 26, 2004

To: Cargill Agrícola S/A

C/of: Ana Maria Silva

Please find enclosed a CD containing the Project Design Document – PDD referring to the Cargill project for the installation of a new boiler using biomass, in Portuguese and in English, together with their corresponding attachments.

Yours truly,

(SIGNATURE)

_____

Rodrigo Gonçalves Pires
Energy & Environment

Annex 8
PROOF OF SUPPLIER COMPLIANCE WITH 1965 FOREST CODE

FEDERATIVE REPUBLIC OF BRAZIL
State of Minas Gerais

(OFFICIAL SEAL)

Real Estate Registry of Prata
Bel. Patricia Pelissari Rizzo
Official
Lúcia Pelissari Rizzo
Sub-official

I HEREBY CERTIFY that upon reviewing, according to request of the interested party, the Books of this Service, I verified in the Real Estate Registry that on **pages 114, of book 2-K, it was registered with nº R.I-2074, on 12/15/81**, the purchase of property in the name of **JOSÉ AUGUSTO FRANCO VILELA** (Individual Tax Payer ID nº 490.067.546-68 and ID nº M-2.605.232/SSP/MG) from Alcides Augusto Vilela and his wife Eleida Franco Vilela, bearers of the same Individual Tax Payer ID nº 079.549.166-72, in the amount of Cr$58,000,000.00, in accordance with deed of public record dated 10/14/81, recorded in notes at the 2nd. local Notary, in book 078, pages 185/187; by force of matriculation nº 2,074, of book 2-K, pages 114 (partial); property with the following characteristics: **THE NAKED REAL ESTATE** of rural property, located in this municipality and district, at the **FAZENDA SALTO E PONTE**, in a place called **"COCAL E RIO DAS PEDRAS",** composed partly of land, cultivated and fields, **with a total area of 1,446,85.72 hectares, being 363,00.00 ha cultivated and 1,083,85.72 ha fields,** with buildings consisting of house, stable, barn and other existing buildings, bordering on different sides with Valéria Franco Vilela, José Augusto Franco Vilela, Paulo Vilela, Antônio Nunes Rezende, Túlio Vilela Rezende, Márcio Rezende Junqueira, Sinibaldo Alves Junqueira, again with Márcio Rezende Junqueira**,** Paulo Vilela, then with Geraldo Nunes, Neirton Alves da Silva, and again with Valéria Franco Vilela, or the successors of the above. Conditions: **The grantors only sold their property on the above mentioned real estate, reserving for themselves the LIFETIME USUFRUCT on it, which will be fully received by the surviving donor so that the property will only be consolidated in the name of the grantee after the death of both grantors, as indicated in the deed.** Other conditions: the ones of the deed. Fees and taxes paid, as indicated in deed.

I FURTHER CERTIFY THAT, as can be seen in annotation nº **AV.28-2074,** dated 11.21.2005, by means of Liability Agreement of Annotation and Preservation of Forest Reservation dated 11.10.2005, an original copy of this document remains filed in this Registry, in the appropriate file nº 09, pages 026, together with the corresponding map, the proprietor (José Augusto Franco Vilela) of the real estate registered with nº R.1-2074 above, has stipulated, in accordance with existing legislation, that the area of 289.37 ha (two hundred and eighty nine hectares and thirty seven ares), not less than 20% of the entire property, within the limits indicated

(STAMP OF REGISTRY

in the agreement and on the map, will be recorded as of limited use, and no type of exploitation may be carried out on it, except if authorized by I.E.F.

I further certify that, as can be seen in registry **R-42-2074,** dated 01.09.2007, by means of the Agreement of Participation in the Program of Forestry Development, in order to comply with the Integrated Forestry Plan dated December 11, 2006, executed by the proprietor **JOSÉ AUGUSTO FRANCO VILELA,** Brazilian, married, bearer of ID nº M-2.605.232/SSP/MG and of Individual Tax Payer ID nº 490.067.546-68, with home address in Uberlândia-MG, at Rua XV de Novembro, nº 365, Tabajara and **CARGILL AGRICOLA S.A.,** a private legal entity, with headquarters at Av. Morumbi, 8.234, Brooklin – São Paulo – SP, enrolled in the National Register of Legal Entities with nº 60.498.706/0001-57, with branch office in Uberlândia/MG, located at Rua Will Cargill, 880, Distrito Industrial, enrolled in the National Register of Legal Entities with nº 60.498.706/0134-88 and State Enrollment nº 702.024.703.0776, a partnership was established between CARGILL and the PROPRIETOR to enable the planting and maintenance of reforestation on the property described in the agreement, in accordance with the terms and conditions established therein. **AREA OF PLANTING OF FOREST: the proprietor shall make available in the year of 2006/2007 an area of 335.09 ha (three hundred and thirty five hectares and nine ares) at the property called FAZENDA SALTO E PONTE, located in this Municipality of Prata-MG, registered with nº R-1-2074,** which is identified in the attached sketch, for the planting of EUCALIPTUS FOREST, and CARGILL shall have the guarantee of 75% (seventy five percent) of the total volume obtained with this Reforesting Project, and the remaining 25% shall belong to the proprietor. TERM: 12 (twelve) years, from date of execution of agreement. **As stipulated in clause 12.4 of the agreement, in case the property is sold, the new proprietor shall respect the covenant in this document.** Other clauses and conditions: those of the agreement, which has also been registered with nº R-2971, in Book 3 – Auxiliary Register, and one of its original copies is filed in the appropriate file in this Registry, and is an integral part of this registration.

****

NOTHING FURTHER.
Prata – MG, January 9, 2007.

In witness of the truth.

(SIGNATURE)

(CERTIFICATION STAMP)

Patricia Pelissari Rizzo
Official

(REGISTRY STAMP)

Annex 9
REFERENCES

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Agencia Nacional de Energia Elétrica (ANEEL). Electricity producers combusting biomass residues. www.aneel.gov.br. 2006.

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Resolution #1 dated on December 2nd, 2003, from the Brazilian Inter-Ministerial Commission of Climate Change (Comissão Interministerial de Mudança Global do Clima -CIMGC), decreed on July 7th, 1999.