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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Gerdau Carbonisation Improvement Project.

A.2. Description of the project activity:

>>
The project consists of the introduction of a new technology to reduce the methane emissions associated with the production of charcoal for the steel factories of Gerdau, a large Brazilian steel producer. This technology consists of a methane incineration device (the 'burner') that will be linked to Gerdau's rectangular carbonisation kilns.

The baseline scenario is the free release of methane from Gerdau's carbonisation kilns. In the project scenario, it is estimated that the use of this new methane burning device will capture and destroy at least 85% of CH_4 emissions previously released to the atmosphere.

This project has the capacity to generate 1,787,948 tonnes of CO_{2e} emission reduction equivalents over a 7-year timeframe and 8,542,416 tCO2e over a 21-year timeframe, from methane emissions reduction due to the use of this new device.

A.3. Project participants:

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- **Gerdau S.A., Project Developer and owner of the carbon credits (www.gerdau.com.br)**. Gerdau Group is the largest producer of long steel in the Americas, with mills in Brazil, Argentina, Canada, the United States and Uruguay. Currently, Gerdau has an installed capacity of 14 million metric tons of steel per year. Gerdau has been part of Brazil's economic development for 101 years, growing out of the Pontas de Paris Nail Factory in Porto Alegre, state of Rio Grande do Sul. Today, the Gerdau Group has mills in 7 states in Brazil, including Minas Gerais where this project takes place.

- **EcoSecurities Ltd., Carbon Advisor and Annex 1 Sponsor (www.ecosecurities.com)**
  21 Beaumont Street, Oxford OX1 2NH, UK

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>
Brazil

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

>>
Minas Gerais state

A.4.1.3. City/Town/Community etc:

>>

Gerdau's rectangular carbonisation kilns are located in farms in the State of Minas Gerais:

- Três Marias (TMA);
- Olhos D'Água (OD);
- Rio Pardo de Minas (RPM);
- Sul de Minas (SMG), various locations.

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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The farms are located in the municipalities described above. Inside the farms, the new kilns with the methane destruction device will be installed in the same area where were the old kilns were installed.

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

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Category "10 - Fugitive emissions from fuels (solid, oil and gas)", from lst of sectoral scopes from UNFCCC (version 02/28.11.03).

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

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The new methane burning device used in the project was developed by Alexandre Pimenta, from Universidade Federal de Viçosa, Minas Gerais, Brasil. This methodology provides pollution control, reduction in greenhouse gas emissions and gas recovery in the carbonisation process. In this system, smoke from carbonisation gases is combusted in a methane burning device (a burner, know as "fornalha").

The burner is a refractory brick cell, with a burning mechanism with dimensions of 50 x 50 x 40 cm, made of 20mm steel bars (ASTM 1050). The burning mechanism is located inside a combustion chamber, whose interior is also made of refractory brick. For dealing with residues, there is an ash deposit slot below the burn cell and a ventilator for suction of carbonisation gases.

Each burner will be connected to 4 rectangular kilns in different stages of the carbonisation process. At any point in time, this new device will be extracting hot air from the kilns (using a 1,5 KW booster fan) that are in operation and pumping it into loaded kilns that are drying the wood before the carbonisation process.

There is a considerable reduction in the quantity of pollution and non-condensable gases [consisting mainly of CO (33%), CO_2 (57%), CH_4 (8%) and C_nH_m (2%)] after this additional process. Universidade Federal de Viçosa, the designer of these kilns, measured the efficiency of combustion of gases and found that nearly 100% of Hydrocarbons, including methane, are destroyed in the process (see Table 1). For conservativeness, however, it is assumed here that only 85% of all gases generated during the carbonisation process are captured and combusted in the burner.

This new technology also increases quality in the working environment, as the final products of the process will be CO_2 and H_2O, with nearly no release of pollutants.

Table 1: Results of using the burner to burn smoke from the carbonisation process (source: Pimenta, 2003).

Components	Before Burning	After Burning
Pollutants concentration (mg/Nm3)	50.000	2
Medium Temperature (^{0}C)	90	430
CO content (% gases)	3	--
CO_2 content (% gases)	5	6
O_2 content (% gases)	15	15
Total Hydrocarbons content (ppm)- including CH_4	12.000	20 - 30

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

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In the Gerdau project, the emissions reductions are a consequence of the improvement of the carbonisation process through the introduction of new methane burning devices attached to their rectangular charcoal kilns. Based on expected CERs revenues, Gerdau will invest in equipment required to capture the non-condensable gases from kilns and pump them into methane burning devices. This will prevent an estimated 85% of uncontrolled methane emissions which otherwise will be released to the atmosphere. The company will gradually increase the level of production using these improved kilns, starting with 72,000 tonnes of charcoal in 2005 and reaching 510,000 tonnes per year in 2012 (see Table 2).

Table 2: Chronogram for charcoal production using methane burning device.

Year		Charcoal production in new kilns (t)
1	2005	72,000
2	2006	108,000
3	2007	180,000
4	2008	300,000
5	2009	360,000
6	2010	390,000
7	2011	480,000
8	2012	510,000
9	2013	510,000
10	2014	510,000
11	2015	510,000
12	2016	510,000
13	2017	510,000
14	2018	510,000
15	2019	510,000
16	2020	510,000

17	2021	510,000
18	2022	510,000
19	2023	510,000
20	2024	510,000
21	2025	510,000

The method for estimating anthropogenic emissions by sources of greenhouse gases of the project activity was done by continuously measuring the level of charcoal produced (the 'proxy indicator') and using a carbon emission factor for this proxy indicator. By definition, the level of this proxy indicator is the same in the project and baseline scenarios. This proxy indicator will then be multiplied by the carbon emissions factor associated with it in the project and baseline scenarios.

In the case of the baseline scenario, the carbon emissions factor is 1.130 tCO2e emitted per tonne of charcoal produced using rectangular kilns without a methane burning device. This figure is derived from a review of carbonisation carbon emissions factors undertaken by the US EPA (1995). In the case of the project scenario, the manufacturer of the methane burning device already measured that almost 100% of the methane is destroyed in the process, but the project will use a conservative assumption that only 85% is destroyed.

In the absence of carbon finance, these improvements in Gerdau's carbonisation processes will not take place. This is because the only benefit from these improvements will come from the carbon credits obtained due to the reduction of methane emissions, and there is no legislation requiring methane capture and destruction.

This assumption is strongly reinforced by an analysis of the trends in the carbonisation sector in Brazil. Traditionally, charcoal kilns in Brazil generate a substantial amount of smoke in the carbonisation process, and all this smoke is released to the atmosphere. A survey of pig iron producers in the state, has shown that none currently recover or destroy methane emissions from their kilns. Gerdau itself currently uses approximately 480 kilns that generate methane emissions (Figures 1 and 2). While *Eucalyptus* plantation techniques have improved productivity dramatically over the past 20 years, the same cannot be said for charcoal technology (May and Chomitz, 2001). At least 90% of charcoal produced in Brazil over the late 1990´s was obtained from beehive type masonry kilns with low efficiency, also known as "rabo quente" (hot tail, very similar to Argentine half orange kilns) (Ferreira et al., 2000; Smith et al., 1999). There are no environmental standards for this segment of the industry and no specific legislation requiring improvements or emissions treatments.

Figure 1: Hot tail (known as 'Rabo Quente') and Rectangular kilns. Smoke from both types of carbonisation kilns is rich in methane and is currently released to the atmosphere.

Figure 2: Unloading charcoal from a rudimentary kiln in Salta, Argentina, similar to the Brazilian hot tail kilns. (Photo by M. Trossero, FAO)

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

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The estimation of CERs for the first crediting period and the total crediting period is as follows:

Crediting period	Emissions Baseline	Emissions Project	CERs
7yrs	2,135,700	320,355	1,787,948
21 yrs	10,203,900	1,530,585	8,542,416

A.4.5. Public funding of the project activity:

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Gerdau will not receive any public funding for the development of this project.

SECTION B. Application of a baseline methodology

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

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"GHG Destruction in Industrial Processes Baseline Methodology" (submitted for consideration by the CDM Methodologies Panel in parallel with this PDD)

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

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As there are no specific baseline methodology for this type of project already approved by the CDM Methodologies Panel, a new methodology was elaborated specifically for use in this type of activity.

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

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As stated in the baseline methodology chosen for this project, the determination of additionality is done using the CDM consolidated tool for demonstration of additionality, and the quantification of ERs derived for the project activity.

i) Determination of baseline scenario and project additionality

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

The following alternatives were identified for Gerdau:

Alternative 1: The project proponent could continue with the current business-as-usual practice of not collecting and destroying methane generated in the carbonisation process taking place in its rectangular kilns. In this case, all the methane produced would be released to the atmosphere.

Alternative 2: The project proponent would invest in a new technology to destroy the methane from carbonisation process.

In accordance with Gerdau's environmental, health and safety policy and strategy, all new carbonisation kilns to be constructed will be rectangular kilns (similar to Missouri kilns), as these permit the use of machinery for loading and unloading of kilns during charcoal production (as opposed to manual operation prevalent in more rudimentary kilns). The design of these rectangular kilns, however, do not require the use of methane burning devices, which will not be used in the absence of carbon finance.

Current Brazilian legislation does not require that carbonisation kilns to control or reduce GHG emissions. Furthermore, the implementation of environmental protection legislation in Brazil has a relatively long lead-time, and the Brazilian Federal government has no immediate plans to introduce legislation requiring the collection and destruction of GHGs from the carbonisation process. Moreover, historically in the Brazil there also tends to be a gulf between stated regulations and practice with regards to the implementation of environmental protection legislation.

Given the regulatory situation, Alternative 2 is not an economically attractive course of action for the project proponent. There are no expected benefits from this scenario, and it is therefore not considered a plausible baseline alternative. Alternative 2 is the proposed project activity and Alternative 1 the baseline.

Step 2: Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the methodology for determination of additionality, "if the CDM project activity generate no financial or economic benefits other than the CDM income, then the project should apply a simple cost analysis" (Option 1 of the consolidated methodology for additionality). This will be applied for this project.

Sub-step 2b: Application of simple cost analysis

The financial analysis of the introduction of this project is shown in the Table 3 below. As shown, the introduction of new methane burning devices in Gerdau's kilns will have a cost of US$ 3.8 million over the initial 7 years, or U$ 15.3 million over 21 years (see Table 3 below). At the same time, there are no sources of revenue expected from the project other than the sale of carbon credits.

Sub-step 2d: Sensitivity analysis

The financial analysis for the project is shown in Table 3 below. As the project only involves a cost, and there is no revenue attached, no sensitivity analysis will change these results.

Step 4: Impact of CDM registration

The development of this project as a CDM project will enable the project company to sell emission reduction credits generating revenue for an activity that otherwise would not lead to revenue generation. At an assumed price of U$ 3.50 dollars per tonne of CO_2e (and a tax on carbon sales of 13.25%), it is expected that the project will generate US$ 4 million through the sale of carbon credits during the first 7 years, or US$ 24 million over 21 years The Net Present Value of the carbon project, discounted at 20% (the returns offered by a typical low-risk bank application in Brasil), is U$ 696,000, which compensates for the investment in the project (see Table 3).

Table 3: Financial analysis of the project.

		2,005	2,006	2,007	2,008	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016	2,017	2,018	2,019
Project costs																
Charcoal production (t)		72,000	108,000	180,000	300,000	360,000	390,000	480,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Carbonisation cycle (days)	10															
Cycles / kiln / year	30															
t of wood / cycle	10															
t of wood / cycle /year	300															
t charcoal / t wood	0.25															
Charcoal production (t) / kiln	75.0															
N° of carbonisation kilns in operation		960	1,440	2,400	4,000	4,800	5,200	6,400	6,800	6,800	6,800	6,800	6,800	6,800	6,800	6,800
N° of methane burners in operation	4	240	360	600	1,000	1,200	1,300	1,600	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
N° of new burners acquired every year		240	120	240	400	200	100	300	100	0	0	0	0	0	0	0
Price of methane burners (US$)	500															
Total Equipment Costs (US$)		**120,000**	**60,000**	**120,000**	**200,000**	**100,000**	**50,000**	**150,000**	**50,000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment O&M (%/year)	10.0%	12,000	18,000	30,000	50,000	60,000	65,000	80,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000
Booster fan electricity demand/consumption (MWh	1.5	2,592	3,888	6,480	10,800	12,960	14,040	17,280	18,360	18,360	18,360	18,360	18,360	18,360	18,360	18,360
Electricity costs (US$)	40.00	103,680	155,520	259,200	432,000	518,400	561,600	691,200	734,400	734,400	734,400	734,400	734,400	734,400	734,400	734,400
Total Project Costs (US$)		**235,680**	**233,520**	**409,200**	**682,000**	**678,400**	**676,600**	**921,200**	**869,400**	**819,400**	**819,400**	**819,400**	**819,400**	**819,400**	**819,400**	**819,400**
Revenues from Carbon Sales																
		68,112	102,168	170,281	283,801	340,561	368,942	454,082	482,462	482,462	482,462	482,462	482,462	482,462	482,462	482,462
Price of Carbon (US$/tCO2e)	3.50															
Gross Carbon Sales (US$)1		0	238,393	357,590	595,983	993,304	1,191,965	1,291,295	1,589,287	1,688,617	1,688,617	1,688,617	1,688,617	1,688,617	1,688,617	1,688,617
Taxes (US$)	13.25%		-31,587	-47,381	-78,968	-131,613	-157,935	-171,097	-210,580	-223,742	-223,742	-223,742	-223,742	-223,742	-223,742	-223,742
Net Carbon Sales (US$)		**0**	**206,806**	**310,209**	**517,015**	**861,691**	**1,034,030**	**1,120,199**	**1,378,706**	**1,464,875**	**1,464,875**	**1,464,875**	**1,464,875**	**1,464,875**	**1,464,875**	**1,464,875**
Project Cash Flow, with Carbon Sales		**-235,680**	**-26,714**	**-98,991**	**-164,985**	**183,291**	**357,430**	**198,999**	**509,306**	**645,475**	**645,475**	**645,475**	**645,475**	**645,475**	**645,475**	**645,475**
Net Present Value with carbon (US$)	**695,978**															
Project Cash Flow, without Carbon Sales		-235,680	-233,520	-409,200	-682,000	-678,400	-676,600	-921,200	-869,400	-819,400	-819,400	-819,400	-819,400	-819,400	-819,400	-819,400
Net Present Value without carbon (US$)	**-2,746,555**															

Notes:

1. Gross carbon sales are delayed for 1 year, as payments for credits only take place after validatin in conducted in the following year.
2. The discount rate used for the calculatin of Net Present Value is that of the Brazilian Government Bonds.

		2,020	2,021	2,022	2,023	2,024	2,025	Totals
Project costs								
Charcoal production (t)		510,000	510,000	510,000	510,000	510,000	510,000	**9,030,000**
Carbonisation cycle (days)	10							
Cycles / kiln / year	30							
t of wood / cycle	10							
t of wood / cycle /year	300							
t charcoal / t wood	0.25							
Charcoal production (t) / kiln	75.0							
N° of carbonisation kilns in operation		6,800	6,800	6,800	6,800	6,800	6,800	
N° of methane burners in operation	4	1,700	1,700	1,700	1,700	1,700	1,700	30,100
N° of new burners acquired every year		0	0	0	0	0	0	1,700
Price of methane burners (US$)	500							
Total Equipment Costs (US$)		**0**	**0**	**0**	**0**	**0**	**0**	**850,000**
Equipment O&M (%/year)	10.0%	85,000	85,000	85,000	85,000	85,000	85,000	1,505,000
Booster fan electricity demand/consumption (MWh)	1.5	18,360	18,360	18,360	18,360	18,360	18,360	325,080
Electricity costs (US$)	40.00	734,400	734,400	734,400	734,400	734,400	734,400	13,003,200
Total Project Costs (US$)		**819,400**	**819,400**	**819,400**	**819,400**	**819,400**	**819,400**	**15,358,200**
Revenues from Carbon Sales								
		482,462	482,462	482,462	482,462	482,462	482,462	8,542,416
Price of Carbon (US$/tCO2e)	3.50							0
Gross Carbon Sales (US$)1		1,688,617	1,688,617	1,688,617	1,688,617	1,688,617	1,688,617	28,209,839
Taxes (US$)	13.25%	-223,742	-223,742	-223,742	-223,742	-223,742	-223,742	-3,737,804
Net Carbon Sales (US$)		**1,464,875**	**1,464,875**	**1,464,875**	**1,464,875**	**1,464,875**	**1,464,875**	**24,472,036**
Project Cash Flow, with Carbon Sales		**645,475**	**645,475**	**645,475**	**645,475**	**645,475**	**645,475**	**9,113,836**
Net Present Value with carbon (US$)	**695,978**							
Project Cash Flow, without Carbon Sales		-819,400	-819,400	-819,400	-819,400	-819,400	-819,400	**-15,358,200**
Net Present Value without carbon (US$)	**-2,746,555**							

Step 5: Common Practice Analysis

So far, there are no project already collecting and destroying GHGs from carbonisation processes in Brasil. A survey of pig iron producers in the state was conducted (see Table 4 below), based on the methodology proposed by the V&M do Brasil project (another steel producer in the region, whose survey methodology can be found in Annex 2 of their PDD, NM 0002), has shown that none currently recover or destroy methane emissions from their kilns. Only a few companies (e.g. Acesita, Plantar and V&M) are investigating the viability of using methane burning devices, but these are considering selling carbon credits to financially support these improvements.

To verify if the baseline continues to be accurate, a survey of 10 peer-competitor charcoal producers (the 'Control Group') will be conducted to determine how many of these companies carbonise methane emissions from their kilns in the absence of carbon finance incentives (a common practice analysis). An initial survey has already been conducted and has shown that none of these companies is currently recovering methane emissions from their kilns (see Table 4 below). These activities will be repeated every 7 years, to determine whether this baseline continues to be valid. Essentially, this survey will be repeated to ascertain whether the rest of the industry has already adopted methane recovery systems or not. A threshold of 50% was chosen to determine whether the baseline needs to be re-evaluated (i.e., if 50% or more of the control group has adopted a methane recovery design, the emission reductions from this activity will no longer be additional and the Project will not be able to claim them anymore).

Table 4: Kiln technology currently used by the 'Control Group', 10 companies with similar charcoal production characteristics to Gerdau, which will serve as the baseline group for the project.

Name of Company /owner	Type of charcoal kiln used	Production capacity (MDC/mo)	Comments
Calsete (Guilherme)	10% internal combustion, 40% JG, 50% conventional hot tail	34,000	Currently developing with the University of Viçosa a mobile kiln and installing chimneys in their traditional hot tail kilns.
Pitangui (Reginaldo)	Hot tail	30,000	Currently investing in a metal kiln design.
Metalsider (Célio Lessa)	80% hot tail, 20% JG.	10,000	Not interested in changing
Cossisa (João Júlio)	Brick kilns with rear chimneys, 3 m diameter, model JG.	12,000	Changed the design of all kilns to JG round kilns about 18 months ago, and are not considering any changes in the near future.
Sicafe (Galitinho)	100% hot tail	11,000	Subcontracts carbonisation, and it not interested in improving its kilns.
Siderpa (Robsney)	20% JG and 80% hot tail	19,000	Gradually changing the kiln designs to JG model.
Sama (Raimundo Figueiredo)	100% hot tail	10,000	Company too small to invest in technology improvements and follow market trends, but it is expected that sooner or later will move to JG design kilns.
AVG (Olegário Bernardes)	50% hot tail and 50% JG	22,000	Have the objective to move to a 100% JG in one or two years.
Valinhos (João Câncio)	100% hot tail	7,000	Working towards installing chimneys in their kilns.
Alterosa (André Parreira)	100% hot tail	18-20,000	Considering moving towards JG designs, within, likely, one year.

MDC (metros de carvão) = stacked meters of charcoal
JG = local brick beehive kiln design, with no methane capture devices.

ii) Calculation of emission reductions generated by the project

After the baseline scenario and additionality determination, it is then necessary to calculate the emissions associated with this the baseline and project scenarios. The calculation procedures are described in section E of this document.

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

>>

In the baseline there will be no methane capture and destruction.

In the project scenario, a methane burning device will be used, and emissions are expected to be less than 15% of the baseline emissions, given that the project will combust a minimum of 85% of the gases produced in the baseline scenario. See section E for more details on the ERs calculations.

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

>>

The project boundaries define the technical extent to which the effects of the project must be measured, monitored and verified. For the purposes of this analysis, the project's boundaries were assumed to be limited to the carbonisation plants. All sources of emissions and emission reductions associated with this project have been accounted for.

Emissions	Project Scenario	Baseline Scenario
Direct on-site	Conservatively, 85% of methane emissions from carbonisation kilns will be combusted through the use of a methane burning device	Uncontrolled release of 100% of methane emissions associated with carbonisation.
Direct off-site	-	-
Indirect on-site	Electricity needed for welding during installation of burners – excluded as this is expected to be negligible.	-
Indirect off-site	Electricity imported from grid for the booster operation needed for the new methane burning device. This is included and treated as leakage.	No electricity needed, as there will be no methane burning device.

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

>>

The baseline study was concluded in August 2004. The entity determining the baseline and participating in the project as the Carbon Advisor is EcoSecurities Ltd., UK. The individuals at EcoSecurities that prepared the baseline are Pablo Fernandez de Mello e Souza and Pedro Moura Costa. Both are listed in Annex 1 of this document.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

The project will start operating in January 2005.

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

>>

At least 21 years

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

C.2.1. Renewable crediting period

The project will choose a 21 year crediting period, renewed every 7 years.

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

>>

01/January /2005

C.2.1.2. Length of the first crediting period:

>>

7 (seven) years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Not Applicable

C.2.2.2. Length:

>>

Not applicable

SECTION D. Application of a monitoring methodology and plan

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

>>

"GHG Destruction in Industrial Processes Monitoring Methodology" (submitted for consideration by the CDM Methodologies Panel in parallel with this PDD)

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

>>

As there are no specific baseline methodology for this type of project already approved by the CDM Methodologies Panel, a new methodology was elaborated specifically for use in this type of activity. All the conditions to the application of this monitoring methodology are satisfied.

This monitoring methodology provides a road map to the necessary methodological, data collection and auditing needs and procedures for the project. To calculate emission reductions and support their verification, the project will require collection of the following data:

- Methane emissions per weight of charcoal produced (emission factor, taken from trusted sources)
- Percentage of gas combusted by new methane burning device (emissions factor, measurements done by equipment manufacturer)
- Amount of charcoal produced (measured continuously by the project developer)

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

D.2.1.1 Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	*Amount of charcoal produced (**QP_p**)*	*Gerdau data*	*Tonnes per year*	*M*	*Continuously*	*100%*	*Electronic and paper*	
2	Methane emissions per weight of charcoal produced (emission factor, ***EF_p***)	*USEPA, 1995.*	*CH4 tonnes per tonne of charcoal*	*C*	*At the beginning of each crediting period*	*Once*	*Electronic and paper*	This is an emissions factor taken from the literature and updated at the beginning of each new crediting period
3	Percentage of gas combusted in the new methane burning device (***% captured $_p$***)	*Equipment manufacturer*	*%*	*E*	*At the beginning of the project*	*Once*	*Electronic and paper*	This is an emissions factor based on measurements conducted by the equipment manufacturer

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

>>

$$E_p = (QP_p * EF_p) * (1- (\% destroyed_p)$$

Where:

E_p: Emissions in project scenario (tonnes CO_2e)

QP: Amount of produced CH4 in baseline (b) scenario (tonnes)

EF_p: Emissions Factor in project scenario (tonnes CO_2e/tonnes)

% Destroyed: It is the amount of GHG emissions that is actually captured and driven into the GHG destruction device used in the project (p)

For more details, see chapter E for more details.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c), estimated (e),**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
4	*Amount of charcoal produced(**QP_b**)*	*Gerdau data*	*Tonnes per year*	*M*	*Continuously*	*100%*	*Electronic and paper*	By definition, this is the same amount as in the project scenario
5	*Methane emissions per weight of charcoal produced (emission factor, **EF_b**)*	*USEPA, 1995.*	*CH4 tonnes per tonne of charcoal*	*C*	*At the beginning of each crediting period*	*Once*	*Electronic and paper*	This is an emissions factor taken from the literature and updated at the beginning of each new crediting period. Again, this is the same factor as used in the project scenario, as the amount of methane produced is the same in both scenarios
6	Percentage of methane combusted by methane burning devices (***% $destroyed_b$***)	*Equipment manufacturer*	%	*M*	-	-	-	There will not be a methane burning device in the baseline, so this factor is 0%.

7	*Discount rate*	*Gerdau data*	*%*	*M*	*At the beginning of each crediting period*	-	*Electronic and paper*	*Value used for baseline and additionality definition*

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

>>

$$E_b = QP_b * EF_b *(1-(\% \ Destroyed_b))$$

Where:

E_b: Emissions in the baseline scenario (tonnes CO_2e).

QP: Amount of charcoal produced in baseline (b) scenario (tonnes). By definition, this value is the same as in the project scenario.

EF_b: Emissions Factor on baseline scenario (tonnes CO_2e/tonnes of charcoal produced). This is the amount of methane produced in the carbonisation process, before it is destroyed by the new burners. This value is the same as in the project scenario. The emission factor for charcoal production in batch kilns is 0,054 t CH_4/t of charcoal, or 1,13 t of CO_2e/t of charcoal (US EPA 1995).

% $Destroyed_b$: There will not be the use of any methane burning device in the baseline scenario, so this figure is 0%.

D.2.3. Treatment of leakage in the monitoring plan

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

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
8	Electricity demand in project scenario (D_P)	Gerdau data	MWh / year	*M*	Continuously	*100%*	Electronic and paper	This is measured continuously and monitored by checking the electricity bills of Gerdau
9	Electricity demand in baseline scenario (D_b)	n.a.	MWh / year	*Na.*	Na.	*100%*	Electronic and paper	There is no need for electricity consumption in the baseline, so this parameter will not be measured
10	Emission factor of electricity used (EF)	*Ecosecurities (2004)*	CO_2e / MWh	*C*	At the beginning of each crediting period	*100%*	Electronic and paper	This EF was calculated as the combined margin for the South-Southeast electricity grid in Brasil, using combined margin approach described in the small scale methodology for projects type 1.D.

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

>>

$$L = (D_p - D_b) * EF$$

Where:

L: Leakage (tonnes CO_2 / year)

D_p: Electricity demand in project scenario (MWh / year). This will be monitored continuously.

D_b: Electricity demand in baseline scenario (MWh / year). There will not be any use of electricity in the baseline, This value is zero.

EF: Emissions Factor for electricity used in new methane burning devices (CO_2e/ MWh) - This is 0.6040 tCO2e/MWh, calculated using the CDM methodologies for small scale projects type 1.D, for the for South-Southeast electricity grid in Brasil.

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

>>

The emission reduction achieved by the project activity (ER) during a given year is the difference between the amount of GHG emitted in baseline scenario (E_b) and the amount of GHG emitted in the project scenario (E_p). After that, discount the leakage emission related to an increase of electricity demand to operate the boosters.

$$ER = E_b - E_p - L$$

Where:

ER: Emission Reduction (tonnes CO_2e)

E_b: Emissions in the baseline scenario (tonnes CO_2e)

E_p: Emissions in the project scenario (tonnes CO_2e)

L : Leakage (tonnes CO_2e)

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	Low	*Gerdau measures it with rigour, and already have quality control procedures for the collection and recording of this information. No special QA/QC procedure are planned.*
2	Medium	*This parameter is available from USEPA review study of charcoal emission factors. The carbon emission factor data was based on this study. For full reference, see Annex 2*
3	Low	*Gerdau will be the responsible for the implementation and operation of all equipment related to project scenario. This parameter estimation was based on a previous pilot project done during December 2003.*
4	Low	*Gerdau measures it with rigor, and already have quality control procedures for the collection and recording of this information. No special QA/QC procedure are planned.*
5	Medium	*This parameter is available from USEPA review study of charcoal emission factors. The carbon emission factor data was based on this study. For full reference, see Annex 2.*
6	Low	*There is no collection and destruction of methane in the baseline scenario*
7	Low	*This will be based on the published interest rates used for Brazilian government bonds*
8	Low	*This is from electricity bills sent to Gerdau. No special QA/QC procedure are planned, as there is no uncertainty attached to these data.*
9	Low	*There will not be the use of electricity in the baseline scenario.*
10	Medium	*No special procedure is planned to monitor this value, as it is based on numbers already validated in other PDDs in the same region. (Ecosecurities, 2004)*

In addition, a further quality control will be introduced to confirm that the common practices prevailing in the region are not those of the project activity. To verify if the baseline continues to be accurate, a survey of 10 peer-competitor charcoal producers (the 'Control Group') will be conducted to determine how many of these companies carbonise methane emissions from their kilns in the absence of carbon finance incentives (a common practice analysis). An initial survey has already been conducted and has shown that none of these companies is currently recovering methane emissions from their kilns (see Table 4 in section B.2 above). These activities will be repeated every 7 years, to determine whether this baseline continues to be valid. Essentially, this survey will be repeated to ascertain whether the rest of the industry has already adopted methane recovery systems or not. A threshold of 50% was chosen to determine whether the baseline needs to be re-evaluated (i.e., if 50% or more of the control group has adopted a methane recovery design, the emission reductions from this activity will no longer be additional and the Project will not be able to claim them anymore).

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

>>

The project will be managed as follows:

- Charcoal production and electricity data will be collected by the manager of each carbonisation centre of Gerdau. This will be sent to the Project Manager in Gerdau's headquarters.

- Gerdau's Project Manager will compile all the data provided by the regional managers in order to produce the monitoring reports.

- Monitoring reports will be sent to the validators that will conduct the annual certification audits.

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

>>

This methodology was concluded in August 2004. The entity determining the baseline and participating in the project as the Carbon Advisor is EcoSecurities Ltd., UK. The individuals at EcoSecurities that prepared the baseline are Pablo Fernandez de Mello e Souza and Pedro Moura Costa. Both are listed in Annex 1 of this document.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

The main source of greenhouse gas emissions in the project is methane released to the atmosphere from the carbonisation process. In the Gerdau project, the company will invest in the introduction of a new equipment to be connected to the carbonisation kilns that will combust methane, resulting in a reduction of GHG released to the atmosphere. The method for estimating anthropogenic GHG emissions by sources of the project activity is done by calculating the emissions associated with the methane emissions released in both the baseline scenario and the project scenario (see equation below).

$$ER = E_b - E_p - L$$

Where:

ER: Emission Reduction (tonnes CO_2e)

E_b: Emissions in the baseline scenario (tonnes CO_2e)

E_p: Emissions in the project scenario (tonnes CO_2e)

L : Leakage (tonnes CO_2e)

$$E_p = (QP_p * EF_p) * (1- (\% \text{ destroyed }_p))$$

Where:

E_p: Emissions in project scenario (tonnes CO_2e)

QP_p: Amount of charcoal produced in the project scenario (tonnes). The charcoal production is planned to grow from an initial level of 72,000 tonnes per year, in 2005, to 510,000 tonnes per year in 2012, as shown in Table 2 of this document (Section A.4.4.). This will be measured continuously.

EF_p: Emissions Factor in project scenario (tonnes CO_2e/tonnes of charcoal). The emission factor for charcoal production in batch kilns is 0.054 t CH_4/t of charcoal, or 1.13 t of CO_2e/t of charcoal (US EPA 1995).

% Destroyed$_p$: Amount of GHG combusted by the new methane burning device used in the project scenario (%). Universidade Federal de Viçosa, the designer of these kilns, measured the efficiency of combustion of gases and found that nearly 100% of Hydrocarbons, including methane, are destroyed in the process (see Table 1 in Section A.4.3.). For conservativeness, however, it is assumed here that only 85% of all gases generated during the carbonisation process are combusted in the burner.

Project emissions are estimated as 320,355 tonnes of CO_{2e} over a 7-year timeframe and 1,530,585 tCO2e over a 21-year timeframe.

E.2. Estimated leakage:

>>

The leakage source of a carbonisation improvement is the electricity required to pump methane from the kilns to the burners. Each booster used to pump gas consumes 10.8 MWh per year. The electricity will come from the Brazilian South-Southeast grid. The emissions factor for the electricity from the grid is 0.6040 tCO2e/MWh, calculated using the combined margin approach described in methodologies for small scale projects type 1.D.

$$\textbf{Leakage} = (D_p - D_b) * EF$$

Where:

D_p: total amount of electricity used from grid in the project scenario (MWh). This will be measured continuously, but is expected to grow from 1,728 to 12,240 MWh/year during the course of the project.

D_b: total amount of electricity used from grid in the baseline scenario (MWh). There will not be the use of electricity in the baseline scenario.

EF: Emissions Factor for electricity used in new methane burning devices (CO_2e/ MWh) - This is 0.6040 tCO2e/MWh, calculated using the CDM methodologies for small scale projects type 1.D, for the for South-Southeast electricity grid in Brasil.

The total leakage over 21 years is estimated to be 216,720 tCO2e. The yearly figures are shown in Section E.6.

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

>>

The sum of E.1 and E.2, is 1,661,484 tCO2e over 21 years. The yearly figures are shown in section E.6.

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

>>

The formula used for baseline estimations is:

$$E_b = QP_b * EF_b * (1-(\% \text{ Destroyed}_b)$$

Where:

E_b: Emissions in the baseline scenario (tonnes CO_2e)

QP_b: Amount of charcoal produced in the baseline scenario (tonnes). This is, by definition, the same as in the project scenario. The charcoal production is planned to grow from an initial level of 72,000 tonnes per year, in 2005, to 510 000 tonnes per year in 2012. This will be measured continuously.

EF_b: Emissions Factor in baseline scenario (tonnes CO_2e/tonnes of charcoal). This is the amount of methane produced in the carbonisation process, before the new burners destroy it. This value is the same as in the project scenario. The emission factor for charcoal production in batch kilns is 0.054 t CH_4/t of charcoal, or 1.13 t of CO_2e/t of charcoal (US EPA 1995).

***% Destroyed$_b$*:** There will not be the use of any methane-burning device in the baseline scenario, so this figure is 0%.

Baseline emissions are estimated as 2,135,700 tonnes of CO_{2e} over a 7-year timeframe and 10,203,900 tCO2e over a 21-year timeframe. The yearly figures are shown in Section E.6.]

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

>>

This project has the capacity to generate 1,787,948 tonnes of CO_{2e} emission reduction equivalents over a 7-year timeframe and 8,542,416 tCO2e over a 21-year timeframe, from methane emissions reduction due to the use of this new device. The yearly figures are shown in Section E.6.

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

		2,005	2,006	2,007	2,008	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016
Baseline emissions		$E_b = QP_b * EF_b * (1-(\% \text{ Destroyed}_b))$											
Quantity of charcoal produced (QP_b, t)		72,000	108,000	180,000	300,000	360,000	390,000	480,000	510,000	510,000	510,000	510,000	510,000
Charcoal Carbon Emission Factor (EFb, tCO_2e/t charcoal)	1.130												
% destroyed	0%												
Baseline Emissions (E_b, tCO_2e)		**81,360**	**122,040**	**203,400**	**339,000**	**406,800**	**440,700**	**542,400**	**576,300**	**576,300**	**576,300**	**576,300**	**576,300**
Project emissions		$E_p = QP_p * EF_p * (1-(\% \text{ Destroyed}_p))$											
Quantity of charcoal produced (QP_p, t)		72,000	108,000	180,000	300,000	360,000	390,000	480,000	510,000	510,000	510,000	510,000	510,000
Charcoal Carbon Emission Factor (EF_p, tCO_2e/t charcoal)	1.130												
% destroyed, project	85%												
Project Emissions (E_p, tCO_2e)		**12,204**	**18,306**	**30,510**	**50,850**	**61,020**	**66,105**	**81,360**	**86,445**	**86,445**	**86,445**	**86,445**	**86,445**
Leakage		$L = (D_p - D_b) * EF$											
N° of methane burners in operation		240	360	600	1,000	1,200	1,300	1,600	1,700	1,700	1,700	1,700	1,700
Number of hours operation per year	7200	10,800											
Booster electricity demand/consumption in project (D_p, MWh)	1.5	1,728	2,592	4,320	7,200	8,640	9,360	11,520	12,240	12,240	12,240	12,240	12,240
Booster electricity demand/consumption in baseline (D_b, MWh)	0.0	0	0	0	0	0	0	0	0	0	0	0	0
EF (combined margin for Brasil, tCO_2/MWh)	0.6040												
Leakage (L, tCO_2e)		**1,044**	**1,566**	**2,609**	**4,349**	**5,219**	**5,653**	**6,958**	**7,393**	**7,393**	**7,393**	**7,393**	**7,393**
Emission Reductions (ER, tCO_2e)		**68,112**	**102,168**	**170,281**	**283,801**	**340,561**	**368,942**	**454,082**	**482,462**	**482,462**	**482,462**	**482,462**	**482,462**

>>

	2,017	2,018	2,019	2,020	2,021	2,022	2,023	2,024	2,025	Total
Baseline emissions										
Quantity of charcoal produced (QP_b, t)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	**9,030,000**
Charcoal Carbon Emission Factor (EFb, tCO_2e/t charcoal)										0
% destroyed										
Baseline Emissions (E_b, tCO_2e)	**576,300**	**576,300**	**576,300**	**576,300**	**576,300**	**576,300**	**576,300**	**576,300**	**576,300**	**10,203,900**
Project emissions										
Quantity of charcoal produced (QP_p, t)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	**9,030,000**
Charcoal Carbon Emission Factor (EF_p, tCO_2e/t charcoal)										
% destroyed, project										
Project Emissions (E_p, tCO_2e)	**86,445**	**86,445**	**86,445**	**86,445**	**86,445**	**86,445**	**86,445**	**86,445**	**86,445**	**1,530,585**
Leakage										
N° of methane burners in operation	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	
Number of hours operation per year										
Booster electricity demand/consumption in project (D_p, MWh)	12,240	12,240	12,240	12,240	12,240	12,240	12,240	12,240	12,240	**216,720**
Booster electricity demand/consumption in baseline (D_b, MWh)	0	0	0	0	0	0	0	0	0	**0**
EF (combined margin for Brasil, tCO2/MWh)										
Leakage (L, tCO_2e)	**7,393**	**7,393**	**7,393**	**7,393**	**7,393**	**7,393**	**7,393**	**7,393**	**7,393**	**130,899**
Emission Reductions (ER, tCO_2e)	**482,462**	**482,462**	**482,462**	**482,462**	**482,462**	**482,462**	**482,462**	**482,462**	**482,462**	**8,542,416**

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

LIST OF REFERENCES

Brazilian Ministry of Mines and Energy (MME), 2003. Brazilian Energy Balance. Rio de Janeiro, Brasil.168p.

Ecosecurities, 2004. CDM-PDD UTE Barreiro Renewable Electricity Generation Project.

Ferreira, Omar C. and Eidelman, Frida, 2000. Emission of greenhouse effect gases in vegetal coal production. *Economy and Energy* 20.

May, P. and Chomitz, K., 2001. The charcoal-based iron industry in Minas Gerais, Brazil, and the global environment. World Bank Development Research Department, August 2001.

Pimenta, A. S. 2003. Eliminação do Impacto Ambiental da Carbonização com a Queima da Fumaça em Fornalha tipo Celular. Viçosa, Minas Gerais.

Smith, R.K., Pennise, D.M., Kummongkol, P., Chaiwong, V., Ritgeen, K., Zhang, J., Panyathanaya, W., Ramussen, R.A., Khalil, M.A.K., 1999. Charcoal-Making Kilns in Thailand, US EPA study EPA-600/R-99-109, Washington DC

USEPA, 1995. Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources. U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

Annex 3

BASELINE INFORMATION

Basic Data	
Cycle (days)	10
Cycles / kiln / year	30
t of Wood/Cycle (Gerdau)	10
t of wood/ cycle /year	300
t Charcoal / t wood	0,25
Charcoal production (t) / kiln/ year	75

Carbon Credits Results (21 Years)	
CERs (tCO2e)	8.542.416
Gross Sales (US$)	28.209.839
Taxes (US$)	-3.737.804
Total Net Sales (US$)	24.472.036

Project Data	
Furnaces / Kilns (Gerdau)	4
Equipment O&M (%/Year)	10,0%
Price of Furnace & Booster	500
Booster rate (KW)	1,5
Electricity cost (US$/ MWh)	40
Carbon Credits Data	
Charcoal Emission Factor	1,130
Proportion of methane destroyed (%)	85%
Global Warming Potential methane	21
Price of Carbon (US$/tCO$_2$e)	3,50
Taxes	13,25%
Leakage (tCO$_2$/MWh)	0,6040
Discount rate (%)	20%

Project Results (21 Years)	
N° of Kilns	6.800
N° of Furnaces	1.700
Furnaces acquisition (US$)	0
Equipment O&M (US$)	1.505.000
Booster electricity consumption (MWh)	325.080
Electricity costs (US$)	13.003.200
Total Project Costs (US$)	14.508.200
Project Cash Flow, with Carbon Sales (US$)	9.113.836
Net Present Value (US$)	695.978
Project Cash Flow, without Carbon Sales (US$)	-15.358.200
Net Present Value(US$)	-2.746.555

Annex 4

MONITORING PLAN
Please refer to Part D of this PDD