CLEAN DEVELOPMENT MECHANISM

PROJECT DESIGN DOCUMENT (CDM-PDD)

UTE BARREIRO S.A.
RENEWABLE ELECTRICITY GENERATION PROJECT

Version 2.1

Prepared by
EcoSecurities Ltd

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Table of Contents

A. GENERAL DESCRIPTION OF PROJECT ACTIVITY

A.1 Title of the project activity:

UTE Barreiro S.A. Renewable Electricity Generation Project

A.2 Description of the project activity:

The project activity is a renewable energy project, which consists of the construction and operation of a 12.9 MW thermoelectric plant fired by blast furnace gas and wood tar to generate part of the electricity required by V&M Barreiro's Integrated Steel Plant (Usina Siderúrgica Integrada de Barreiro). Currently, V&M purchases approximately 350,400 MWh/year from the Companhia Energética de Minas Gerais (CEMIG); however, in the project scenario about 92,500 MWh/year will be supplied by the new renewable energy facility, thereby decreasing total demand from CEMIG to 258,000 MWh/year.

Use of both blast furnace gas and wood tar to generate electricity will not generate greenhouse gas (GHG) emissions. First, and in the absence of the project, the blast furnace gas, would have continued to be flared. Therefore it is assumed that there will be no additional GHG emissions associated with the use of this gas to generate electricity. Similarly, because the wood tar is a by-product of sustainable charcoal production, it can be considered a renewable source of energy with zero, or negligible, GHG emissions associated with its combustion. As a result, the project will be displacing electricity generation from a more fossil-intensive grid and reducing GHG emissions in the process.

Table 1 below summarises the baseline and project scenarios.

Table 1: Baseline and Project Scenarios for the Barreiro S.A. Renewable Fuel Generation Project.

Baseline scenario	Project interventions
?? Purchase of 350,400 MWh/year from CEMIG energy concessionaire	?? Generation of electricity on-site through the construction of a 12.9 MW generating station that will use blast furnace gas and wood tar as fuel

As a result of the project intervention, 92,500 MWh per year will be displaced from the grid, resulting in a yearly reduction of 63,634 tonnes of CO_2 equivalent (tCO_2e). Because the project will be credited for 21 years, a total of 1,942,500 MWh will be displaced, and a total of 1,312,106.2 tCO_2e will be reduced.

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

?? Benefits the local environment by reducing tar vapour emissions.

?? Optimises the use of natural resources.

?? Diversifies the sources of electricity generation (a national target after the 2001 Brazilian energy crises[1]).

?? Helps V&M do Brasil achieve its commitment to environmentally clean and environmentally friendly production.

?? Promotes Brazilian manufacturers producing equipment that can be used in renewable energy facilities (see below).

In addition, the project will generate approximately 16 jobs during operation and 100 jobs during construction.

A.3 Project participants:

✍ **V&M do Brazil S.A. as the carbon credit owner and energy supplier (www.vmtubes.com)**: the company was created in 1952 to produce seamless steel tubes. In 2000 Vallourec, a world leader in the production of seamless hot-rolled steel tubes of all kinds, gaining investments and competitiveness in the market, bought Mannesmann SA. Therefore, Vallourec & Mannesmann was founded in October 1997 by a joint venture between the French Vallourec Group (55 % of shares) and the German Mannesmannröhren-Werke (45% of shares) joining together all their productions units and marketing interests for seamless hot-rolled tubes.

V&M has agreed through a contract with CEMIG that V&M will be responsible for fuel supply, area concession and environmental instalation license obtainment. V&M will also be the owner of carbon credits.

- **EcoSecurities Ltd. Project CO_2 Advisor and Annex 1 Sponsor. (www.ecosecurities.com).**

[1] Brazilian Federal Government, MME (Ministério de Minas e Energia), 2003.

A.4 Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1 Host country Party(ies): Brazil

A.4.1.2 Region/State/Province etc.: State of Minas Gerais.

A.4.1.3 City/Town/Community etc: City of Belo Horizonte, Municipality of Belo Horizonte, community of Barreiro de Baixo.

A.4.1.4 Detail on physical location, including information allowing the unique identification of this project activity:

The thermoelectric plant will be located inside V&M Barreiro's Integrated Steel Plant. The Steel Plant is based in the community of Barreiro de Baixo, a heavily populated and industrialized area of Belo Horizonte, Capital of the State of Minas Gerais.

Figure 1: Barreiro's Integrated Steel Plant.

Within Barreiro's Integrated Steel Plant, the thermoelectric plant will be installed as indicated in figure 2:

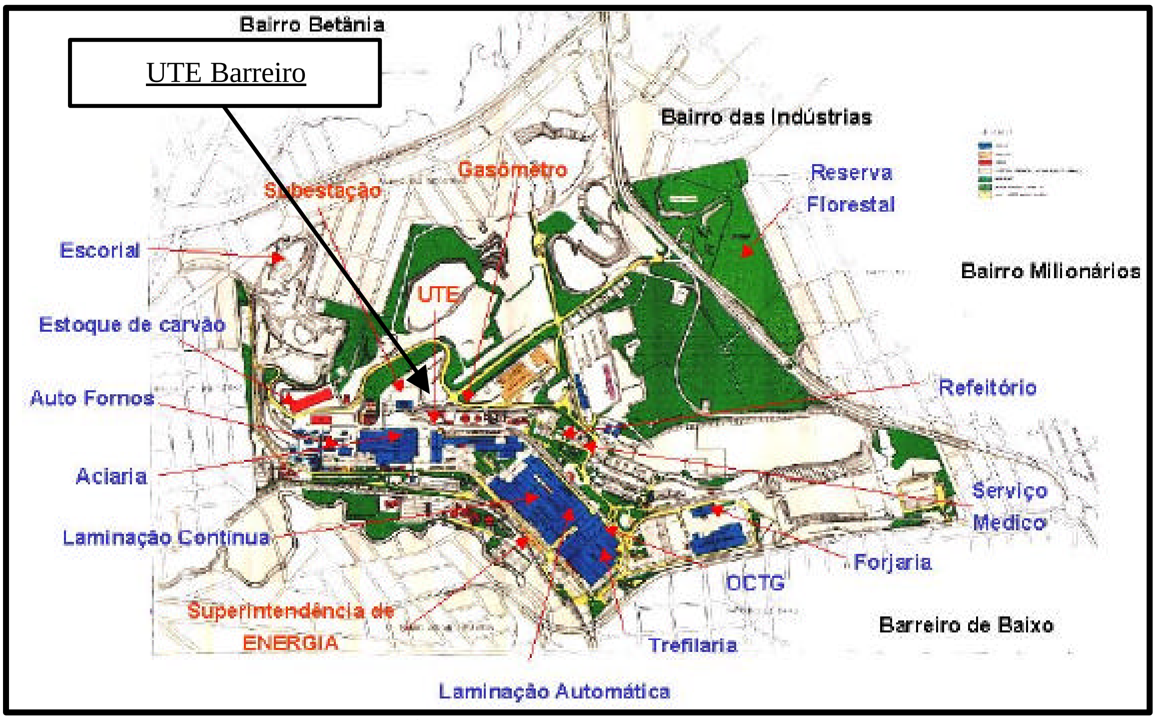

Figure 2: Location of the UTE Barreiro within the Integrated Steel Plant

A.4.2. Type and category (ies) and technology of project activity

According to the simplified modalities and procedures for small-scale CDM project activities, the UTE Barreiro Small Scale Renewable Energy Project falls under the Type/Category 1.D. (Renewable Energy Projects / Renewable electricity generation for a grid). The project will be generating electricity from renewable sources and displacing electricity generated by the grid.

For thermoelectric implementation, V&M do Brasil S.A. has implemented an "Environmental Control Plan"[2]. At the moment, any electricity lack may interrupt pig iron production and therefore the emergency bleeders would be opened, consequently releasing great amount of "black smoke" (blending of blast furnace gas with charcoal dust and ore residues). This will be avoided trough interlinking blast furnace blowers with thermoelectric generation.

According to the document above, and as it was mentioned in section A.2 above (Description of the project activity), the thermoelectric plant will operate a steam Rankine cycle with an installed capacity of 12.9 MW. The main equipment installed are: one multi-fuel boiler (blast furnace gas, wood tar) of 60 t/h of steam, at a pressure of 50 bar and 450°C, multiple stage steam condensation turbine, electric generator of 15.2 MVA at 13.8 kV, steam condenser, cooling tower, water treatment station and a substation and equipment to connect the plant to the grid (see figures 3,4 and 5 below).

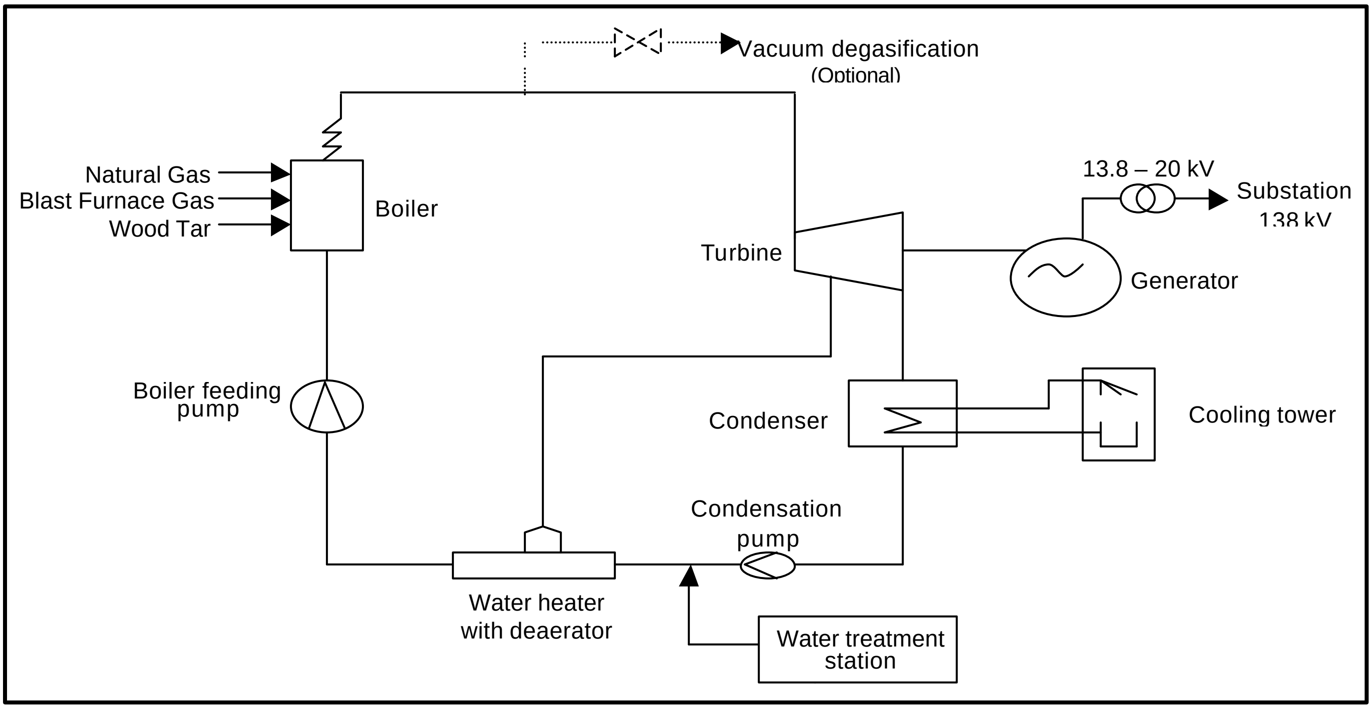

Figure 3: Simplified Scheme of generation process (adapted from UTE Barreiro Environmental Plan - V&M do Brazil, 1999).

[2] V&M do Brasil SA, 2001.

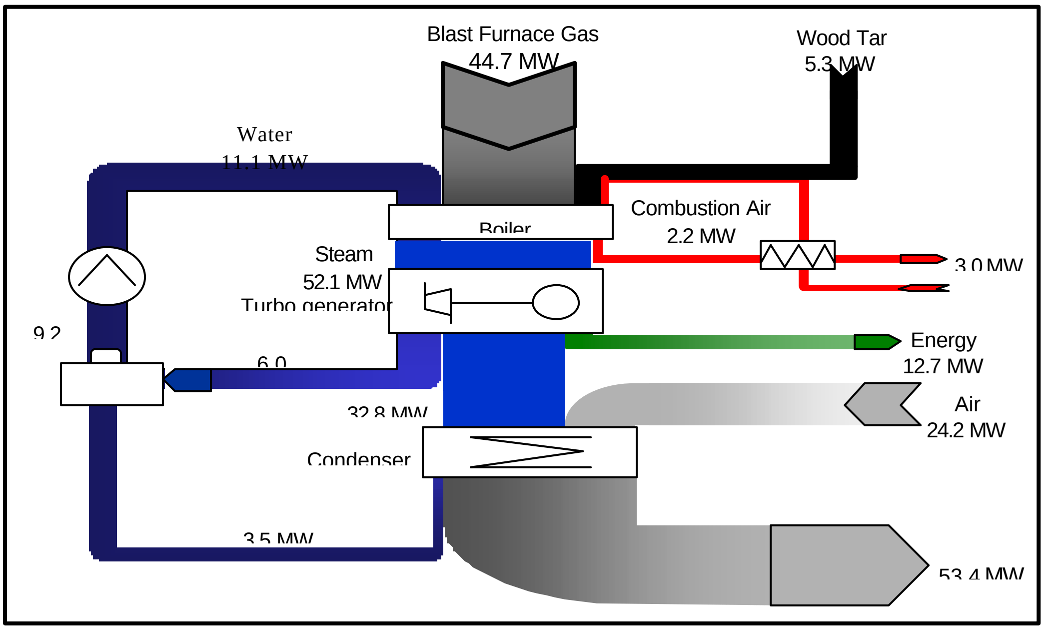

Figure 4: Mass Balance Scheme (adapted from UTE Barreiro Environmental Plan - V&M do Brazil, 1999).

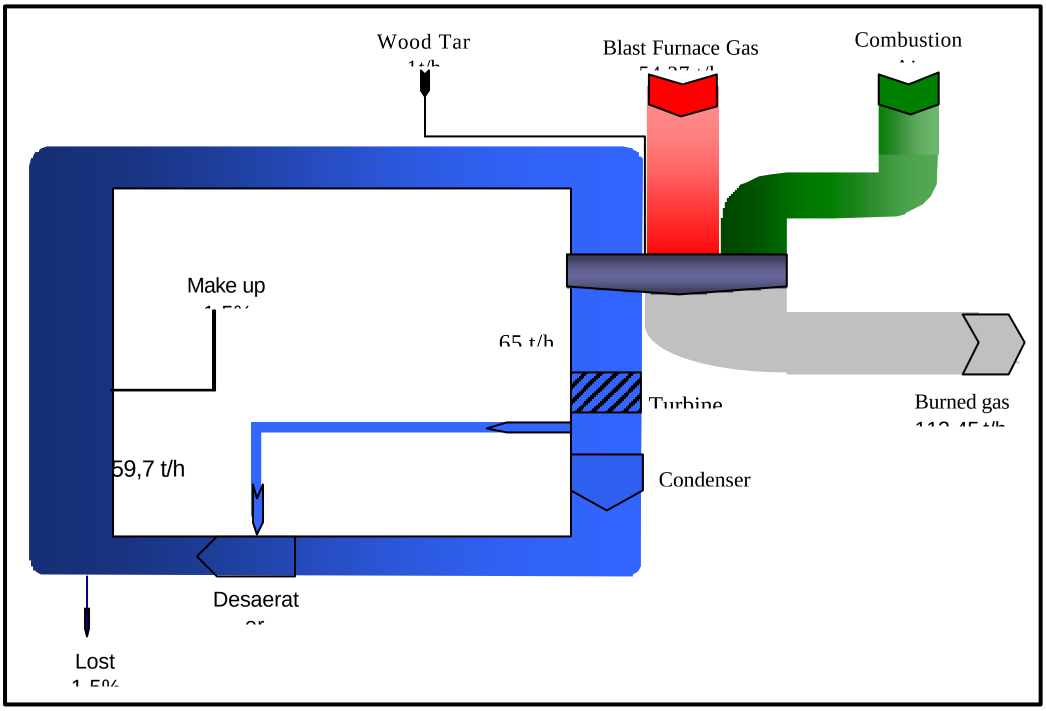

Figure 5: Energetic Balance Scheme (adapted from UTE Barreiro Environmental Plan - V&M do Brazil, 1999).

It is expected that the plant will not operate for 15 days per year due to maintenance operations. After the tenth functional year, the facility will stop operation for 45 days for turbine maintenance.

The technology and know-how being promoted by this project is environmentally safe and sound and will further promote such activities in the future. Indeed, this will be the first time that equipment of the sort provided for this project will be used to burn both blast furnace gas and wood tar to generate electricity.

Concerning the Barreiro thermoelectric supervision and control, *Toshiba do Brasil* has developed a "Control and Supervision System" (this plan is part of "Environmental Control Plan") to monitor the plant. According to this plan, there will be an operator team responsible for monitoring functions, working trough a computer system interlinked to thermoelectric plant. This will include carbon neutral fuels and water measurements, water treatment and demineralization, boiler safety and control, water cooling and circulation, generating unit control and auxiliary services (draining system, compressed air system, etc).

In addition, it is worth mentioning that the technology to be used is 100% Brazilian. *Equipálcool* will produce the boiler; *NG Turbinas* will produce the turbines and *Toshiba do Brazil* will produce the electric generator.

A.4.3. Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

The Barreiro S.A. Renewable Fuel Generation Project will reduce GHG emissions by displacing fossil fuel-based electricity generation with GHG-neutral biomass electricity generation. Specifically, the project will burn excess blast furnace gas and wood tar to generate electricity. Following are brief descriptions what occurs in the baseline and project activities with respect to both of these renewable fuel sources.

An important product of the iron making process, in addition to molten iron and slag, is a hot dirty gas known as blast furnace gas. The gas exits the top of the blast furnace and proceeds through gas cleaning equipment where particulate matter is removed from the gas and the gas is cooled. This gas has a considerable energy value so it is burned as a fuel in the "hot blast stoves" which are used to preheat the air entering the blast furnace to become "hot blast". Any of the gas not burned in the stoves is usually sent to the boiler house and is used to generate steam, which turns a turbo blower that generates the compressed air known as "cold blast" that comes to the stoves.

In this project, the remaining blast furnace gas, which is currently being flared, will be used as part of the fuel for electricity generation. Because the heating power of the blast furnace gas is relatively low (900 kcal/m^3) a supplemental energy supply will be required in addition to the 40,500 m^3/h of available blast furnace gas to produce electricity. This additional fuel supply will be obtained from wood tar.

Wood tar is collected during the carbonisation process where charcoal is produced from wood obtained through sustainably managed forestry activities. Recovery of chemicals from the vapours given off when hardwood is converted to charcoal was once a flourishing industry. However, as soon as petrochemicals appeared on the scene, wood as a source of methanol, acetic acid, speciality tars and preservatives became uneconomic. Although the outlook for recovery of by-product chemicals from wood distillation is not generally promising, there are possibilities of recovering tars and using the wood gas as a fuel to assist in making the carbonisation process more efficient. The economics, however, are marginal but, since recovery of by-products can reduce atmospheric pollution from wood carbonisation, the combined benefit may make it attractive.

Tar can be condensed as vapours from the kiln, where the wood is burnt, passing through an exhaust fan system. Heat is lost to the air through the metal wall of the flue and tar condenses on the inside surface. If no tar is needed the vapours go to the atmosphere and coalescence occurs across a vast region. The tar obtained has a heating value of approximately 4,600 kcal/kg and can be produced in quantities as great as 2 tonnes/hour with an average production of 500 kg/hour.

The two fuels used to generate electricity in the project scenario are thus carbon neutral, being produced by industrial processes using wood from renewable energy plantations. In turn, every MWh of electricity produced by UTE Barreiro will displace energy consumption from the local interconnected grid. Because the production of grid electricity is more carbon intensive than the electricity produced from this project, (calculations are shown in chapter E of this report), the project results in direct reductions of GHG emissions.

The only greenhouse gas that will be considered in the project calculations is CO_2. Methane (CH_4) emissions will not be modified by the project because (i) blast furnace gas - which contains approximately

2% methane - is combusted in both the baseline and project scenarios and (ii) there will be no change in the carbonisation process which produces wood tar. N_2O, HFCs, PFCs and SF_6 are not applicable to this project.

A.4.4. Public funding of the project activity:

UTE Barreiro will not receive any public funding from Parties included in Annex I.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

The sponsoring company, V&M, is developing two other CDM projects: V&M do Brasil Fuel Switch Project, submitted with a new methodology to the Executive Board as NM 0002 on 10th May of 2003 and the V&M do Brasil Forestry Project, which has not yet been presented. However, these other projects are significantly different and could not be considered as part of the same project as the one being considered here. The V&M do Brasil Fuel Switch Project, for example, is a large-scale project and addresses the use of fuels in the coking process, not the generation of electricity from renewable sources. The V&M do Brasil Forestry Project is a land use, land use change and forestry sector project. Both of these other projects are proceeding separately and are not technically or procedurally related to the UTE Barreiro project. As indicated in paragraph 2 of Appendix C of the simplified modalities and procedures for small-scale CDM project activities, neither of the other projects being developed by V&M are in the same project category and technology/measure, indicating that this project is indeed separate from the others. Table 2 below presents key information about all three projects regarding the fact that the project activity being analyzed here does not represent a debundling of a bigger project.

Table 2: Debundling Occurrence Analysis

Item \ Project	UTE Barreiro	V&M do Brasil Fuel Switch Project	V&M do Brasil Forestry Project	Occurrence of Debundling
Project Participants	V&M do Brazil S.A. and CEMIG	V&M do Brazil S.A.	V&M do Brazil S.A.	No
Project category	Renewable electricity generation for a grid	Fuel switching - coal to charcoal - and Kiln conversion resulting in avoided methane emissions	Land Use Change	No

Register	To be registered soon	To be registered soon	To be registered soon	Possible
Boundary	Same	Same	Different	Yes
Result (the project will be a debundling of a larger project if the four item above occurs):				**No**

B. BASELINE METHODOLOGY

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

The baseline category of the project activity was specified according to the list of the small-scale CDM project activity categories contained in Appendix B of the simplified modalities and procedures for small-scale CDM project activities. The UTE Barreiro Small-Scale Renewable Energy Project falls under the Type/Category I.D. (Renewable Energy Projects / Renewable electricity generation for a grid) of those guidelines.

B.2. Project category applicable to the project activity:

In the baseline scenario, V&M purchases approximately 350,400 MWh/year, which is needed for its operations, from CEMIG, the relevant electricity utility. In the project scenario, a new 12.9 MW thermoelectric plant fired by blast furnace and wood tar will be supplying about 92,500 MWh/year of electricity to V&M, thereby decreasing total demand from CEMIG to 258,000 MWh/year.

The proposed project activity falls under Type I.D of the simplified modalities and procedures for small scale projects because the installed capacity of the plant will be under 15 MW and will be displacing fossil-fuel based electricity generation from the grid with GHG-neutral biomass electricity generation. Indeed the project is not selling electricity for the grid, however in cases where the project company would have purchased electricity from the grid, but instead is using its own electricity , the project company is acting in exaclty the same manner that any other electricity buyer in the market. For example , in the case of Barreiro, if they would sell electricity generation for the grid and would buy it back, it would have the same effect of simply generating eletricity for its own use.

Since all the steel production from Barreiro Plant is based on the use of charcoal obtained from their own renewable eucalyptus plantations, the blast furnace gas by-product of the steel production can be considered as a renewable source of energy. In order to consider the blast furnace gas and wood tar a renewable energy one has to be sure of the origin of the wood and of the renewable practices used for its production. In this case all the wood is supplied from tree plantations managed by V&M Florestal, a subsidiary of V&M do Brasil S.A., whose main objective is to supply all the charcoal needed by the V&M do Brasil steel production. The company is certified by the Forest Stewardship Council (FSC) which provides a credible guarantee that the final product comes from a well-managed forest.

The calculations of the baseline emissions are conducted according to option (a) of paragraph 29 of Appendix B of the small-scale modalities and procedures. This option is selected because the system from which electricity is being displaced consists both of existing generating plants (reflected by the operating margin) and future plants (reflected by the build margin); the recent capacity additions to the system are calculated by taking the most recent 20% plants built. The average of these factors best reflects the impacts of the project on the GHG emissions in the system. Therefore, and as indicated in the guidelines, calculating the emission reductions in the baseline scenario in this way leads to a conservative and transparent result. The data and assumptions used to apply the methodology are from a study published by IEA (Bosi et al.,2002).

B.3. Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity (*i.e., explanation of how and why this project is additional and therefore not identical with the baseline scenario*):

The UTE Barreiro project will result in GHG emission reductions due to the fact that the project scenario is not the same as the baseline scenario. To determine the baseline scenario two analyses were conducted. First, a list of possible scenarios was developed. Second, each of those scenarios was evaluated according to the most important barriers facing such outcomes. The result is a matrix that summarises the analysis, providing an indication of the barriers faced by each scenario; the most plausible scenario will be the one with fewest barriers.

As indicated above, three different scenarios were considered:

1) The continuation of actual activities – This scenario represents the continuation of current practice, which is the purchase of electricity from the grid to maintain V&M Barreiro's Integrated Steel Plant production rate.

2) The construction of a fossil fuel generation plant – This scenario is based on the construction of a new fossil fuel generating plant of 12.9 MW to reduce purchases and therefore dependence on the grid.

3) The construction of a renewable generation plant - This scenario is based on the construction of a new renewable fuel generating plant of 12.9 MW, to reduce purchases and therefore dependence on the grid.

The barriers were as follows:

?? Technical/technological – This barrier evaluates whether the technology is currently available, if there are indigenous skills to operate it, if the application of the technology is a regional, national, or global standard, and generally, if there are technological risks associated with the particular project outcome being evaluated.

?? Financial/economical – This barrier evaluates the viability, attractiveness and financial and economic risks associated with each scenario, considering the overall economics of the project and/or economic conditions in the country.

?? Prevailing business practice – This barrier evaluates whether the proposed activity represents prevailing business practice in the industry. In other words, this barrier assesses whether, in the absence of regulations, it is a standard practice in the industry, if there is experience to apply the technology, and if there tends to be high-level management priority for such activities.

With respect to the **technical / technological barrier**, this element poses difficulties only for Scenario 3, construction of a renewable energy plant. Specifically:

?? In the case of Scenario 1 (Continuation), there are no technical/technological issues as this simply represents a continuation of current practices and does not involve any new technology or innovation. Indeed, in this scenario there are no technical/technological implications as the scenario calls for continued purchases of electricity from the grid.

?? In the case of constructing a fossil fuel generation plant, there are no significant technical/technological barriers. All the technologies involved in this scenario are available in the market, and have been used effectively around Brazil. As a result, this technology option faces few barriers to implementation.

?? In the case of Scenario 3, constructing a renewable energy generation plant, there are important technical/technological barriers, and these stem from the fact that the plant will use here to fore waste products. Specifically, this plant would represent the first application in which wood tar will be used to generate electricity. As indicated above, wood tar is a by-product of the carbonisation process in which charcoal is produced from wood, and currently this waste stream is not used productively. In addition, thermoeletric generation using blast furnace gas from charcoal-based pig iron systems is perceived as an unusual technology and there are few examples of this application on a commercial scale. Thus, important technical/technological barriers exist with respect to constructing a renewable energy plant that relies on wood tar and blast furnace gas.

With respect to **financial / economical** barriers, only the construction of on-site power plants faces this obstacle. Specifically:

?? The continuation of current practices does not pose any financial/economical barriers as the structure and practices necessary are already installed, requiring no further financing. Moreover, the company has always purchased electricity from the grid, and has been able to maintain high profits and increases in production.

?? Building an on-site fossil fuel generation plant would pose financial/economical barriers due to the fact that the current Brazilian economic situation inhibits investments with long-term returns. For example, the current high interest rates constrain the acquisition of external loans, thus reducing investment capacity.

?? The construction of a renewable fuel generation plant faces the same financial/economic barriers as the construction of the fossil fuel generating facility. In addition, however, it is commonly understood that renewable energy systems face specific financial/economic barriers due to the fact that technical/technological innovations carry with them further risk premiums in terms of financing. It is worth noting that there are no direct subsidies or promotional support for the implementation of independent renewable energy plants. Although PROINFA promotes renewables (e.g., biomass, wind, and small hydro units), it works by providing guaranteed prices that are higher than the market price for electricity for the next 20 years. However, this scenario does not intend to sell energy to the grid and thus does not fit into PROINFA's scope.

With respect to the barrier related to the **prevailing business practice**, presents no barrier for scenarios at all. Specifically:

?? Continuing purchases of electricity from the grid (Scenario 1) presents no particular obstacles. This practice has been used effectively in the past with good results, and the continued operation of existing facilities and actual practices presents no real barriers.

?? Building an on-site fossil fuel generation plant faces no barrier also, as CEMIG would be the operator of thermoelectric and V&M would not have to make significant changes and adaptations in production process or employees activities.

?? The construction of a renewable fuel generation plant faces no barrier at all, as V&M will be the purchaser of electricity generated by CEMIG. As mentioned before, CEMIG will be the operator of new thermoelectric plant and therefore V&M will not present any significant changes and adaptations in their production process and employees activities.

Table 3 below summarises the results of the analysis regarding the barriers faced by each of the plausible scenarios. As the table indicates, Scenario 1 faces no barriers, whereas Scenario 2 faces one important barrier – the financial/economic barrier. Importantly, Scenario 3 faces all of the barriers discussed above.

Table 3: Summary of Barriers Analysis.

Barrier Evaluated		1	2	3
		The continuation of current activities	The construction of a fossil fuel generation plant	The construction of a renewable fuel generation plant
1.	Technical / Technological	No	No	Yes
2.	Financial / Economical	No	Yes	Yes
3.	Prevailing Business Practice	No	No	No
Summary		3 No; 0 Yes	2 No; 1 Yes	1 No; 2 Yes

To conclude, the barrier analysis above has clearly shown that the most plausible scenario is the continuation of current practices (continuation of purchases of electricity from the grid). Alternatives such as the construction of new on-site generating facilities are not the most plausible scenarios, particularly in the case of a renewable energy facility relying on wood tar and blast furnace gas. Therefore, the project scenario is not the same as the baseline scenario and each of these is defined as follows:

?? The **baseline scenario** is represented by the continued purchasing of electricity from the grid to maintain steel production. In this baseline scenario, V&M purchases approximately 350,400 MWh/year from CEMIG for its Barreiro Integrated Steel Plant.

?? The **project scenario** is represented by the construction of an on-site renewable fuel thermoelectric plant with installed capacity of 12.9 MW, and a net generation capacity of 11.5 MW. In this project scenario, the new renewable energy facility will generate approximately 90,700 MWh per year and 1,904,363 MWh over 21 years, and displace more carbon-intensive energy from the grid.

B.4. Description of the project boundary for the project activity:

For the purpose of this analysis, and according to paragraph 26 of the simplified modalities and procedures for small-scale projects (Appendix B), the project activity boundary encompasses the physical, geographical site of the renewable generation source, which in this case is the V&M Barreiro plant, where the UTE Barreiro is located, in the municipality of Belo Horizonte, Minas Gerais state.

The boundary for the baseline, however, is defined as the grid level and for the project this only relates to the interconnected grid from which the plant currently draws its electricity. The project boundary for the baseline will include all the direct emissions related to the electricity produced by the power plants that will be displaced by this project.

Conforming to the guidelines and rules for the small-scale project activities, the emissions related to production, transport and distribution of the fuel used in the power plants in the baseline are not included in the project boundary, as these do not occur at the physical and geographical site of the project. For the same reason the emissions related to the transport and distribution of electricity are also excluded from the project boundary.

B.5. Details of baseline and its development:

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

The baseline to be used in calculating the emission reductions from this project is that outlined in option (a) of paragraph 29 of Appendix B (simplified modalities and procedures for small-scale CDM project activities).

B.5.2 Date of completing the final draft of this baseline section:

09/06/2004

B.5.3 Name of person/entity determining the baseline:

The entity determining the baseline and participating in the project as the CO_2 Advisor is EcoSecurities Ltd. The individuals at EcoSecurities that prepared the baseline are Pablo Fernandez de Mello e Souza and Flávia Resende.

C. DURATION OF THE PROJECT ACTIVITY AND CREDITING PERIOD

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/12/2003

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

30 (thirty) years

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

C.2.1. Renewable crediting period (at most seven 7 years per period)

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

01/01/2004

C.2.1.2. Length of the first crediting period:

7y-0m

D. MONITORING METHODOLOGY AND PLAN

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

According to the simplified modalities and procedures for small-scale CDM project activities, the UTE Barreiro Small Scale Renewable Energy Project falls under the Type/Category 1.D. (Renewable Energy Projects / Renewable electricity generation for a grid); the project will be generating electricity from renewable sources and displacing electricity generated by the grid. Consequently, the monitoring methodology to be used is the one outlined in paragraph 31 of the document mentioned above. Specifically, the monitoring "shall consist of metering the electricity generated by the renewable technology. In the case of co-fired plants, the amount of biomass input and its energy content shall be monitored."

It is worth noting that there may be some instances in which the renewable fuels (i.e., wood tar and blast furnace gas) will not be in sufficient supply to generate the requisite electricity. In these cases, natural gas may be burned. However, the consumption of natural gas will be monitored, in case of ocasional use of this fuel. This will be done by the amount of gas consumed multiplied by natural gas conversion factors specified in table below, in order to estimate the emissions.

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

Since the Appendix B of the simplified modalities and procedures gives only an indication of the items to monitor and not a "methodology choice", this Monitoring Methodology and Plan will follow the provisions stated at the Draft simplified modalities and procedures for small-scale CDM project activities available at the:
http://cdm.unfccc.int/pac/howto/SmallScalePA/index.html dated 19 Apr 04; site time: 15:10.
In order to ensure that the monitoring effort collects the relevant measurements, and that the verification effort is consistent with the project activity design and definition of the baseline case, the Monitoring & Verification (M&V) Plan specifies the indicators that will be measured and verified.

D.3. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

Table 4: Data to be collected in order to monitor emissions from the project activity, and how this data will be archived.

ID n°	Data type	Data variable	Data unit	Measured (m), calculated (c) indicated (I)or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
D.3.1	Energy	Net electricity produced by UTE Barreiro S.A. plant	MWh/ month	M	Monthly	100%	Electronic and paper	During the whole crediting period + 2 years	
D.3.2	Fuel	Amount of Natural gas used	m^3	M	Monthly	100%	Electronic and paper		Two- party verification
D.3.3		Amount of Blast furnace gas used	m^3						-
D.3.4		Amount of Wood tar used	tonne						-
D.3.5		Origin of Charcoal used in blast furnaces	N/A	I					-
D.3.6		Origin of Wood tar	N/A						-
D.3.7	Conversion factors	MWh to TJ conversion factor	TJ / MWh	C	Once	100%	Electronic and paper	Bibliographic reference	-
D.3.8		Natural gas Emission Factor	tC / TJ					Bibliographic reference	
D.3.9		Carbon to Natural gas conversion factor	tCH_4 / tC					Bibliographic reference	
D.3.10		Natural gas to CO_2 conversion factor	tCO_2 / tCH_4					Bibliographic reference	
D.3.11		Carbon content of natural gas per unit of energy	tCO_2 / GJ					During the whole crediting period + 2 years	
D.3.12		Carbon content of renewable fuel per unit of energy	tCO_2 / GJ					Bibliographic reference	
D.3.13		Natural gas oxidation factor	%	M	Annually	100%	Electronic and paper	Bibliographic reference	
D.3.14		Carbon intensity rate of operational, construction and combined margins	tCO_2 / MWh	C	Once per period	100%	Electronic and paper	Bibliographic reference	

CEMIG, as the Project Operator will be responsible for data collection above while V&M will be responsible for data check and correction.

This monitoring plan contains simplified monitoring requirements to reduce monitoring costs as permitted by small -scale project procedures. Once implemented, the relevant data report will be submitted to a designated operational entity contracted to verify the emission reductions achieved during the crediting period. Any revisions requiring improved accuracy and/or completeness of information will be justified and will be submitted to a designated operational entity for validation. The plan is designed to collect and archive all data needed to:

a) Estimate or measure anthropogenic emissions by sources of greenhouse gases occurring within the project boundary during the crediting period as specified in appendix B for the Type/Category 1.D.;

b) Determine the baseline of anthropogenic emissions by sources of greenhouse gases occurring within the project boundary during the crediting period, as specified in appendix B for the Type/Category 1.D.;

c) Calculate the reductions of anthropogenic emissions by sources by the proposed small-scale CDM project activity, and for leakage effects, in accordance with provisions of appendix B for the Type/Category 1.D.

The plan does not include monitoring of any variable regarding leakage since no leakage is expected. Nevertheless, in the case of evidence of any leakage, this plan will be revised in order to include a suitable variable.

D.4. Name of person/entity determining the monitoring methodology:

The entity determining the monitoring plan and participating in the project as the CO_2 Advisor is EcoSecurities Ltd. The individuals at EcoSecurities that prepared the baseline are Pablo Fernandez de Mello e Souza and Flávia Resende.

E. CALCULATION OF GHG EMISSIONS REDUCTIONS BY SOURCES

E.1. Formulae used:

The formula used to measure the emissions reductions is:

$$ER_{net} = (E_b * G_b) - (E_p * G_p) - (E_t * C_t) - L$$

Where:

ER_{net} : Emission reduction

E_b: Energy *required* from grid in *baseline* activity case

G_b: Carbon intensity of energy from grid in *baseline* case

E_p: Energy *required* from grid in *project* activity case

G_p: Carbon intensity of energy from grid in *project* activity case

E_t: Energy *produced* in *project* activity case

C_t: Carbon intensity of energy in *project* activity case

L: Carbon emission of leakage

Once the baseline case has been defined, accounting for the GHG reductions for the renewable fuel based electricity energy project activity is relatively simple. Net emission reductions (ERnet) are calculated by the amount of energy displaced from the grid, discounting any emissions related to the operation of the thermoelectric plant or any leakage.

The formula used to estimate the baseline emissions is:

$$Emissions_b = E_b * C_b$$

Where:

$Emissions_b$: Baseline emissions

E_b: Energy required from grid in *baseline* activity case

C_b: Carbon intensity of energy from grid

For estimating the baseline carbon intensity, the project developer decided to use the combined margin carbon intensity for sub-national Brazilian grid. The data and assumptions used to apply the methodology are from a study published by IEA (Bosi et al.,2002).

The anthropogenic emissions by sources of GHGs of the project activity ($Emissions_p$) were estimated by multiplying the energy produced in the project case and the carbon intensity of energy in project case, as follow:

$$Emissions_p = (E_g * C_g) + (E_p * C_p)$$

Where:

$Emissions_p$: GHGs Emissions from anthropogenic sources

E_g: Energy required from *grid* during project activity (MWh)

C_g: Carbon intensity of the *grid* energy (tCO_2 / MWh)

E_p: *Project* Energy production (MWh)

C_p: Carbon intensity of the *project* energy produced (tCO_2 / MWh)

The amount of energy displaced from the grid is calculated as the difference between the energy required in the baseline activity case minus the energy required in the project case, considering that this difference was caused by the additional energy consumed by the project activity (the energy required to maintain the generation plant).

The energy required from grid in the project scenario was estimated by the following formula:

$$E_p = (E_b + E_w) – (E_t - E_n)$$

E_p: Energy required from grid in project activity case

E_b: Energy required from grid in baseline activity case

E_w: Energy required to maintain the generation plant

E_t: Total Energy produced in project activity case

E_n: Total energy produced in project activity case by burning natural gas

The energy required to maintain the thermoelectric (E_w) was estimated to be 1.45 MW. Thus, if the new renewable plant operates 93% of the time, which corresponds to 339 days/year, it would generate 11,797.2 MWh/year.

The carbon emission intensity of the project activity is calculated following the formula in section E.1.2.1, considering the occasional utilisation of natural gas as fuel for thermoelectric activity.

As explained before, one can assume the project activity carbon intensity is function of the amount of natural gas used, and no emissions leakage was identified, so "L" is equal to zero.

The thermoelectric plant has an installed capacity of 12.9 MW, and the system will produce the maximum capacity, of which 1.45 is to maintain itself, and the surplus of 11.45 MW can be used in the steel production processes. The plant would generate enough electricity to displace 1,904,719.3 MWh from CEMIG, during 21 years.

E.1.1 Selected formulae as provided in appendix B

The baseline emissions were calculated using the procedure described in option (a) of paragraph 29 (a) of Appendix B of the simplified modalities and procedures for a small-scale CDM project activity:

"29. For all other systems, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh) calculated in a transparent and conservative manner as:

(a) The average of the "approximate operating margin" and the "build margin", where:

(i) The "approximate operating margin" is the weighted average emissions (in kg CO2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

(ii) The "build margin" is the weighted average emissions (in kg CO_2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of the most recent 20% of existing plants or the 5 most recent plants".

UTE Barreiro is connected to the South-Southeast grid, and as suggested by the methodology, calculations of baseline emissions are based on a combined margin approach for the entire 21-year project period. Such a methodology reflects a project's typical effect on GHG emissions of (i) the operation of current or future power plants (referred to as the operating margin) and (ii) what and/or when new facilities will be built (referred to as the build margin). Thus, the combined approach uses a weighted average of the Operating Margin and the Build Margin.

E.1.2 Description of formulae when not provided in appendix B

E.1.2.1 Describe the formulae used to estimate anthopogenic emissions by sources of GHGs due to the project activity within the project boundary

The carbon intensity of the energy supplied (C_p) by the project activity depends on the fuel used, which is essentially renewable fuel, and occasionally natural gas. The renewable fuel generation technologies, by definition, emit very little or no direct GHG emissions, since it comes from sustainable forestry grown. So, the C_p value is assumed to be a function of the amount of natural gas used to produce energy.

The carbon emission intensity of the project activity is calculated following the formula below:

$$C_p = ((A_b * C_b) + (A_w * C_w) + (A_n * C_n)) / E_p$$

Where:

C_p: Carbon intensity of the *project* energy produced (t CO_2/MWh)

A_b: Amount of *blast furnace gas* used in the period (tonnes of fuel)

C_b: CO_2 intensity of *blast furnace gas* combustion (t CO_2 / t fuel)

A_w: Amount of *wood tar* used in the period (tonnes of fuel)

C_w: CO_2 intensity of *wood tar* combustion (t CO_2 / t fuel)

A_n: Amount of *natural gas* used in the period (tonnes of fuel)

C_n: CO_2 intensity of *natural gas* combustion (t CO_2 / t fuel)

E_p: Project Energy production (MWh)

E.1.2.2 Describe the formulae used to estimate leakage due to project activity, wheere required, for the applicable project category in appendix B of the simplified modalities and procedures for small scale CDM project activities

As explained before, one can assume the project activity carbon intensity is function of the amount of natural gas used, and no emissions leakage was identified, so "L" is equal to zero.

E.1.2.3 Describe the formulae used to estimate leakage due to project activity, wheere required, for the applicable project category in appendix B of the simplified modalities and procedures for small scale CDM project activities

See section E.1 above.

E.1.2.4 Describe the formulae used to estimate leakage due to project activity, wheere required, for the applicable project category in appendix B of the simplified modalities and procedures for small scale CDM project activities

See section E.1 above.

E.2 Table providing values obtained when applying formulae above:

Table 7: Values for CER´s calculations for period I (From 2003 to 2009).

		Formula	unit	Period I 2003	2004	2005	2006	2007	2008	2009
Data from South-Southeastern electricity grid										
A1.	Operating margin (OM)		tCO2/MWh	0,957	0,957	0,957	0,957	0,957	0,957	0,957
A2.	Building margin (BM)		tCO2/MWh	0,421	0,421	0,421	0,421	0,421	0,421	0,421
A3.	Combined margin (CM)	=(A1+A2)/2	tCO2/MWh	0,689	0,689	0,689	0,689	0,689	0,689	0,689
Data from UTE Barreiro project										
B.	days of operation per year**		days/year	226,0	339,5	339,5	339,5	339,5	339,5	339,5
C.	hours of operation per year***	=B * 24	hours/year	5.423,8	8.146,8	8.146,8	8.146,8	8.146,8	8.146,8	8.146,8
D.	Installed capacity**		MW	12,9	12,9	12,9	12,9	12,9	12,9	12,9
E.	Expected maximum energy production**		MW	12,9	12,9	12,9	12,9	12,9	12,9	12,9
F.	Expected Efficiency		%	25,1	25,1	25,1	25,1	25,1	25,1	25,1
G.	Assured net Power		MW	11,446	11,430	11,414	11,398	11,382	11,366	11,350
H.	Total energy produced by Plant ***	=(E * C)	MWh/year	69.966,5	105.093,7	105.093,7	105.093,7	105.093,7	105.093,7	105.093,7
I.	Projected % of energy supplied by Natural Gas**		%	5,0	5,0	5,0	5,0	5,0	5,0	5,0
J.	Natural Gas Oxidation Fraction		%	99,5	99,5	99,5	99,5	99,5	99,5	99,5
K.	Expected Natural Gas use at project activity	=(H / F) * I * M * N * O	t CH4/year	1.023,6	1.537,5	1.537,5	1.537,5	1.537,5	1.537,5	1.537,5
L.	Project activity emissions	=K * P	tCO2/year	2.814,8	4.206,9	4.206,9	4.206,9	4.206,9	4.206,9	4.206,9
Conversion Factors										
M.	MWh to TJ conversion factor		TJ/MWh	0,0036	0,0036	0,0036	0,0036	0,0036	0,0036	0,0036
N.	Natural Gas Emission Factor		tC/TJ	15,3	15,3	15,3	15,3	15,3	15,3	15,3
O.	Carbon to Natural Gas conversion factor		tCH4/tC	1,33	1,33	1,33	1,33	1,33	1,33	1,33
P.	Natural Gas to CO2 conversion factor		tCO2/tCH4	2,75	2,75	2,75	2,75	2,75	2,75	2,75
Baseline Data										
Q.	Total energy demand **		MWh/year	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0
R.	Amount of energy imported from grid **		MWh/year	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0
Project Data										
S.	Total energy demand **	=Q + (E - G)*24*365	MWh/year	363.137,04	363.137,04	363.137,04	363.137,04	363.137,04	363.137,04	363.137,04
T.	Amount of energy imported from grid **	=S - (Q - R) - H	MWh/year	293.170,54	258.043,32	258.043,32	258.043,32	258.043,32	258.043,32	258.043,32
U.	Net amount of energy produced by project ***	= G * C	MWh/year	62.080,36	93.117,92	92.987,58	92.857,23	92.726,88	92.596,53	92.466,18
V.	Energy displaced from grid ***	=R - T (max = U)	tCO2/year	57.229,46	92.356,68	92.356,68	92.356,68	92.356,68	92.356,68	92.356,68
Total Emission										
W.	energy displaced from the grid ***	=(R - T) * n° of years	tCO2/period				**611.369,5**			
X.	Total expected GHG enission reduction ***	= V * (A3)	tCO2e/year	39.431,1	63.633,8	63.633,8	63.633,8	63.633,8	63.633,8	63.633,8
Y.	Total expected GHG enission reduction ***	= W * (A3)	tCO2e/period				**421.233,6**			
Z.	Cumulative expected GHG enission reduction ***		tCO2e	39.431,1	103.064,9	166.698,6	230.332,4	293.966,1	357.599,9	421.233,6

Sources:

** Data V&M team

*** Estimated data.

Table 8: Values for CER´s calculations for period II (From 2010 to 2016).

			Period II			
2010	2011	2012	2013	2014	2015	2016
0,957	0,957	0,957	0,957	0,957	0,957	0,957
0,421	0,421	0,421	0,421	0,421	0,421	0,421
0,689	0,689	0,689	0,689	0,689	0,689	0,689
339,5	339,5	294,5	339,5	339,5	339,5	339,5
8.146,8	8.146,8	8.146,8	8.146,8	8.146,8	8.146,8	8.146,8
12,9	12,9	12,9	12,9	12,9	12,9	12,9
12,9	12,9	12,9	12,9	12,9	12,9	12,9
25,1	25,1	25,1	25,1	25,1	25,1	25,1
11,334	11,318	11,302	11,446	11,430	11,414	11,398
105.093,7	105.093,7	105.093,7	105.093,7	105.093,7	105.093,7	105.093,7
5,0	5,0	5,0	5,0	5,0	5,0	5,0
99,5	99,5	99,5	99,5	99,5	99,5	99,5
1.537,5	1.537,5	1.537,5	1.537,5	1.537,5	1.537,5	1.537,5
4.206,9	4.206,9	4.206,9	4.206,9	4.206,9	4.206,9	4.206,9
0,0036	0,0036	0,0036	0,0036	0,0036	0,0036	0,0036
15,3	15,3	15,3	15,3	15,3	15,3	15,3
1,33	1,33	1,33	1,33	1,33	1,33	1,33
2,75	2,75	2,75	2,75	2,75	2,75	2,75
350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0
350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0
363.137,04	363.137,04	363.137,04	363.137,04	363.137,04	363.137,04	363.137,04
258.043,32	258.043,32	258.043,32	258.043,32	258.043,32	258.043,32	258.043,32
92.335,83	92.205,48	92.075,13	93.248,27	93.117,92	92.987,58	92.857,23
92.356,68	92.356,68	92.356,68	92.356,68	92.356,68	92.356,68	92.356,68
			646.496,8			
63.633,8	63.633,8	63.633,8	63.633,8	63.633,8	63.633,8	63.633,8
			445.436,3			
484.867,4	548.501,1	612.134,9	675.768,6	739.402,4	803.036,1	866.669,9

Table 9: Values for CER´s calculations for period III (From 2017 to 2023).

Period III						
2017	2018	2019	2020	2021	2022	2023
0,957	0,957	0,957	0,957	0,957	0,957	0,957
0,421	0,421	0,421	0,421	0,421	0,421	0,421
0,689	0,689	0,689	0,689	0,689	0,689	0,689
339,5	339,5	339,5	339,5	339,5	339,5	339,5
8.146,8	8.146,8	8.146,8	8.146,8	8.146,8	8.146,8	8.146,8
12,9	12,9	12,9	12,9	12,9	12,9	12,9
12,9	12,9	12,9	12,9	12,9	12,9	12,9
25,1	25,1	25,1	25,1	25,1	25,1	25,1
11,382	11,366	11,350	11,334	11,318	11,302	11,286
105.093,7	105.093,7	105.093,7	105.093,7	105.093,7	105.093,7	105.093,7
5,0	5,0	5,0	5,0	5,0	5,0	5,0
99,5	99,5	99,5	99,5	99,5	99,5	99,5
1.537,5	1.537,5	1.537,5	1.537,5	1.537,5	1.537,5	1.537,5
4.206,9	4.206,9	4.206,9	4.206,9	4.206,9	4.206,9	4.206,9
0,0036	0,0036	0,0036	0,0036	0,0036	0,0036	0,0036
15,3	15,3	15,3	15,3	15,3	15,3	15,3
1,33	1,33	1,33	1,33	1,33	1,33	1,33
2,75	2,75	2,75	2,75	2,75	2,75	2,75
350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0
350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0	350.400,0
363.137,04	363.137,04	363.137,04	363.137,04	363.137,04	363.137,04	363.137,04
258.043,32	258.043,32	258.043,32	258.043,32	258.043,32	258.043,32	258.043,32
92.726,88	92.596,53	92.466,18	92.335,83	92.205,48	92.075,13	91.944,78
92.356,68	92.356,68	92.356,68	92.356,68	92.356,68	92.356,68	92.356,68
			646.496,8			
63.633,8	63.633,8	63.633,8	63.633,8	63.633,8	63.633,8	63.633,8
			445.436,3			
930.303,6	993.937,4	1.057.571,1	1.121.204,9	1.184.838,6	1.248.472,4	1.312.106,2

F. ENVIRONMENTAL IMPACTS

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

As part of the process of constructing the UTE Barreiro a series of legal steps must be taken to have the required licenses to operate. Among them, at the beginning of project, an EIA-RIMA (Environmental Impact Assessment-Environmental Impact Report) was prepared. This document gives detailed information about the project to authorities, as well as a report to lay people.

Following the EIA-RIMA, the following steps in the process have to do with obtaining the building and operation licenses. Both of these have been obtained, concluding that UTE Barreiro is according with all legal requirements.

The EIA-RIMA indicated there are no significant environmental impacts in the region due to the installation of the UTE Barreiro project. However, considering that the UTE Barreiro project is to be installed near a residential district, the air pollution and the noise were identified as the most important points to be addressed.

Considering air pollution, there is no significant additional pollution, since the main fuel to be used is already burned at the site and the additional wood tar to be used is limited and represents only a small fraction of total amount of fuel.The wood tar will be burned with excess of O_2, to guarantee the total combustion and thus minimizing the formation of smut. Moreover, as a condition to the project activity, a filter and a full time analyser of CO_2, O_2 and C_nH_n will be installed in the chimney to monitor the combustion performance and guarantee the total combustion of all fuels used in the plant.

About the noise, the area near the UTE Barreiro installation is Dom Bosco district, and the nearest residence is at a distance of about 250 m, 20 m lower than the plant, and there is a two-floor building between the plant and the community. To mitigate the noise from the plant, the turbines will be installed inside a building, with a wall about 20 cm wide, and the ventilator will be pointed to opposite side of community. Finally, a dense layer of trees has been planted between the residence district and the UTE Barreiro project to further reduce the noise emanating from the plant.

The residues from the boiler generated by day-to-day waste of the operators and water waste are very small if compared with the total production of the plant. All the structures, treatment stations, filter, etc are already constructed to address the needs of the entire facility (i.e., the V&M Integrated Steel Plant), and it can easily absorb the UTE Barreiro waste and residues production.

The impacts on the fauna and flora are minute, since the new plant will be installed in an old building inside the V&M Integrated Steel Plant. The impact on the water bodies are also very small, as the waste water from the increase in 10 operators will be directed to the wastewater treatment system (PROSAM), avoiding any dumping inside the Arrudas stream. The tanks of wood tar are stocked inside a sealed basin, avoiding ground and ground water contamination.

G. STAKEHOLDERS COMMENTS

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

According with the Resolution n.1 from December 2nd, 2003, the Inter-ministerial Commission of Climate Change, decreed on July, 7th, 1999[3], that any CDM project must send a letter with a description of the project and an invitation for comments by local stakeholders. In this case, the local stakeholders are represented by:

?? City Hall;

?? Environment Agencies form the State and Local Authority;

?? Brazilian Forum of NGOs;

?? District Attorney (known in Portuguese as Ministério Público, i.e. the permanent institution essential for legal functions responsible for defend the legal order, democracy and social/individual interests); and

?? Local communities associations.

Local stakeholders were invited to raise their concerns and provide comments on the project activity for 30 days after they received the letter of invitation. EcoSecurities Brasil Ltda. and V&M were prepared to answer any doubts about the project during this period. Letters were dispatched by fax or email to the institutions mentioned above.

This chapter will be fulfilled with comments from interested parties, according the instructions in resolution n°1, article 3°-II, from Designated Operational Entity (National Authority), the Comissão Interministerial de Mudança Global do Clima (CIMGC).

G.2. Summary of the comments received:

To date, no comments have been received.

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

Any comments that are received will be presented in this section and subsequently addressed (should the need arise).

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

ANNEX 1: CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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ANNEX 2: INFORMATION REGARDING PUBLIC FUNDING

No public funding from Parties included in the Annex I is involved in the project.

ANNEX 3: REFERENCES

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