**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)**
**Version 03 - in effect as of: 22 December 2006**

**CONTENTS**



**Annexes**

**Revision history of this document**

| Version Number | Date | Description and reason of revision |
|---|---|---|
| 01 | 21 January 2003 | Initial adoption |
| 02 | 8 July 2005 | • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.<br>• As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>. |
| 03 | 22 December 2006 | • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM. |

## SECTION A. General description of small-scale project activity

### A.1 Title of the small-scale project activity:

Title: UTE Barreiro S.A. Renewable Electricity Generation Project
Version: 02.2
Date: 06/11/2012

Historic:
Version 01: First version assessed.
Version 02: Revised after DOE assessment.
Version 02.1: Revised due to the methodology update.
Version 02.2: Revised due to a request for review.

### A.2. Description of the small-scale 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 100,267 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.

**Baseline**
Purchase of 350,400 MWh/year from CEMIG energy concessionaire.

**Project Scenario**
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, 100,267 MWh per year will be displaced from the grid, resulting in a yearly reduction of 48,565 tonnes of CO2 equivalent (tCO2e). Because the project will be credited for 21 years, a total of 2,105,607 MWh will be displaced, and a total of 1,019,881 tCO2e was estimated to be reduced during the whole 3 crediting periods. The project is helping Brazil fulfil its goals of promoting sustainable development. Specifically, the project:

- Benefits the local environment by reducing tar vapour emissions.
- Optimizes the use of natural resources.

- Diversifies the sources of electricity generation (a national target after 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:

| Name of Party involved (*) ((host) indicates a host Party) | Private and/or public entity(ies) project participants (*) (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Brazil | V&M do Brasil S.A. | No |
| *(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.* | | |

### A.4. Technical description of the small-scale project activity:

#### A.4.1. Location of the small-scale project activity:

##### A.4.1.1. Host 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

##### A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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

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:

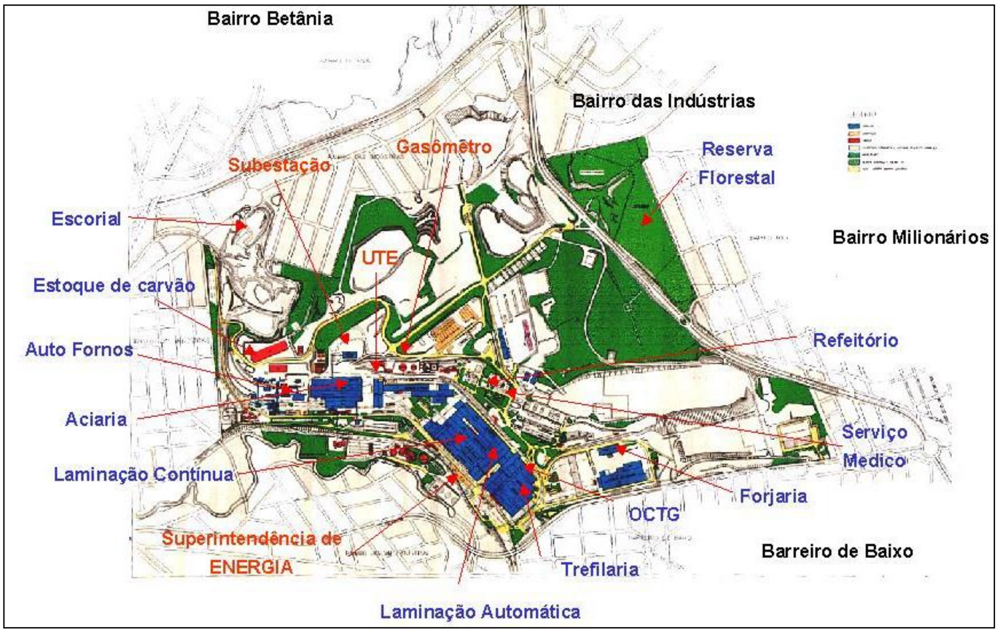



**Figure 2 - Location of the UTE Barreiro within the Integrated Steel Plant**

### A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Project category from Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)

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).

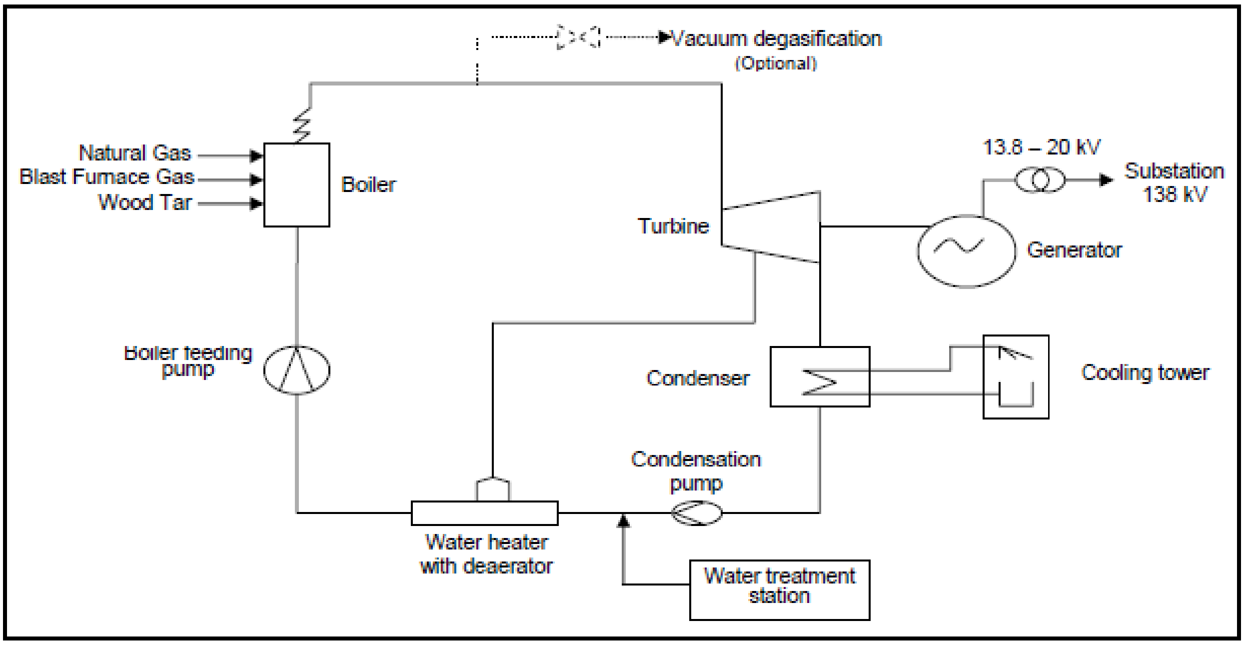



**Figure 3 - Simplified Scheme of generation process**
**(adapted from UTE Barreiro Environmental Plan - V&M do Brazil, 1999).**

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

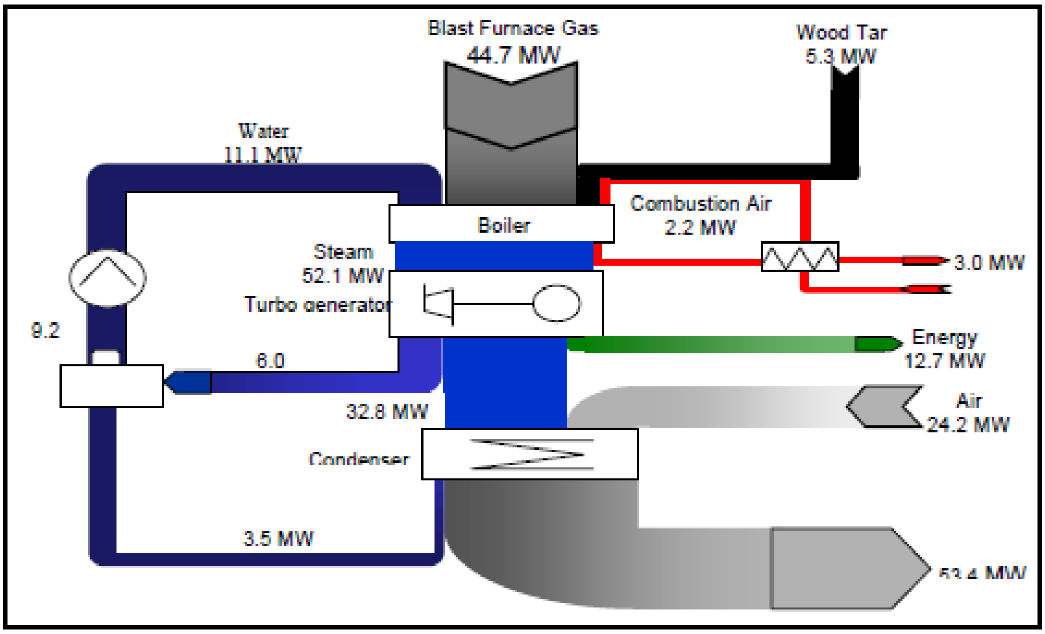



**Figure 4 - Energetic Balance Scheme**
**(adapted from UTE Barreiro Environmental Plan - V&M do Brazil, 1999).**

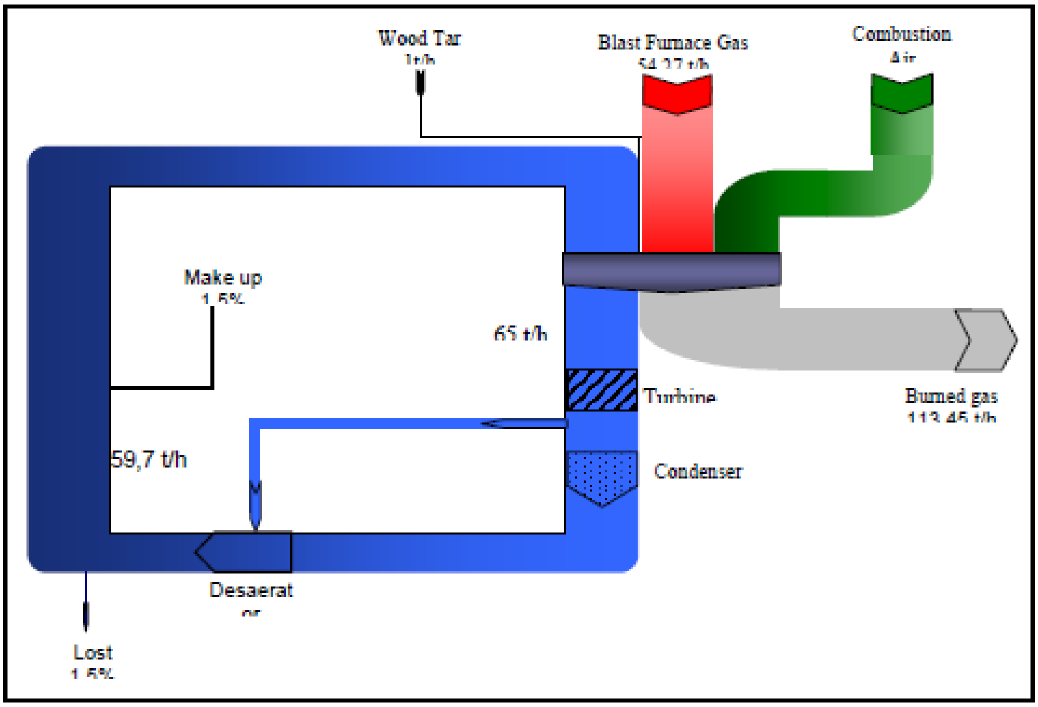



**Figure 5 - Mass Balance Scheme**
**(adapted from UTE Barreiro Environmental Plan - V&M do Brazil, 1999).**

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 through 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.

The Barreiro S.A. Renewable Fuel Generation Project will reduce GHG emissions by displacing fossil fuel-based electricity generation with GHG-neutral 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/m3) a supplemental energy supply will be required in addition to the 40,500 m3/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.

All the 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, the project results in direct reductions of GHG emissions.

The only greenhouse gas that will be considered in the project calculations is CO2. Methane (CH4) 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. N2O, HFCs, PFCs and SF6 are not aplicable to this project.

### A.4.3 Estimated amount of emission reductions over the chosen crediting period:

| Years | Estimation of annual emission reductions in tonnes of CO2 e |
|---|---|
| Since 01/01/2011 | 19,336 |
| 2012 | 19,336 |
| 2013 | 19,336 |
| 2014 | 19,336 |
| 2015 | 19,336 |
| 2016 | 19,336 |
| Until 31/12/2017 | 19,336 |
| **Total estimated reductions** (tonnes of $CO_2$e) | 135,352 |
| **Annual average of the estimated** | 19,336 |
| **Total number of crediting years reductions over the crediting period** | 7 years (renewable) |

### A.4.4. Public funding of the small-scale project activity:

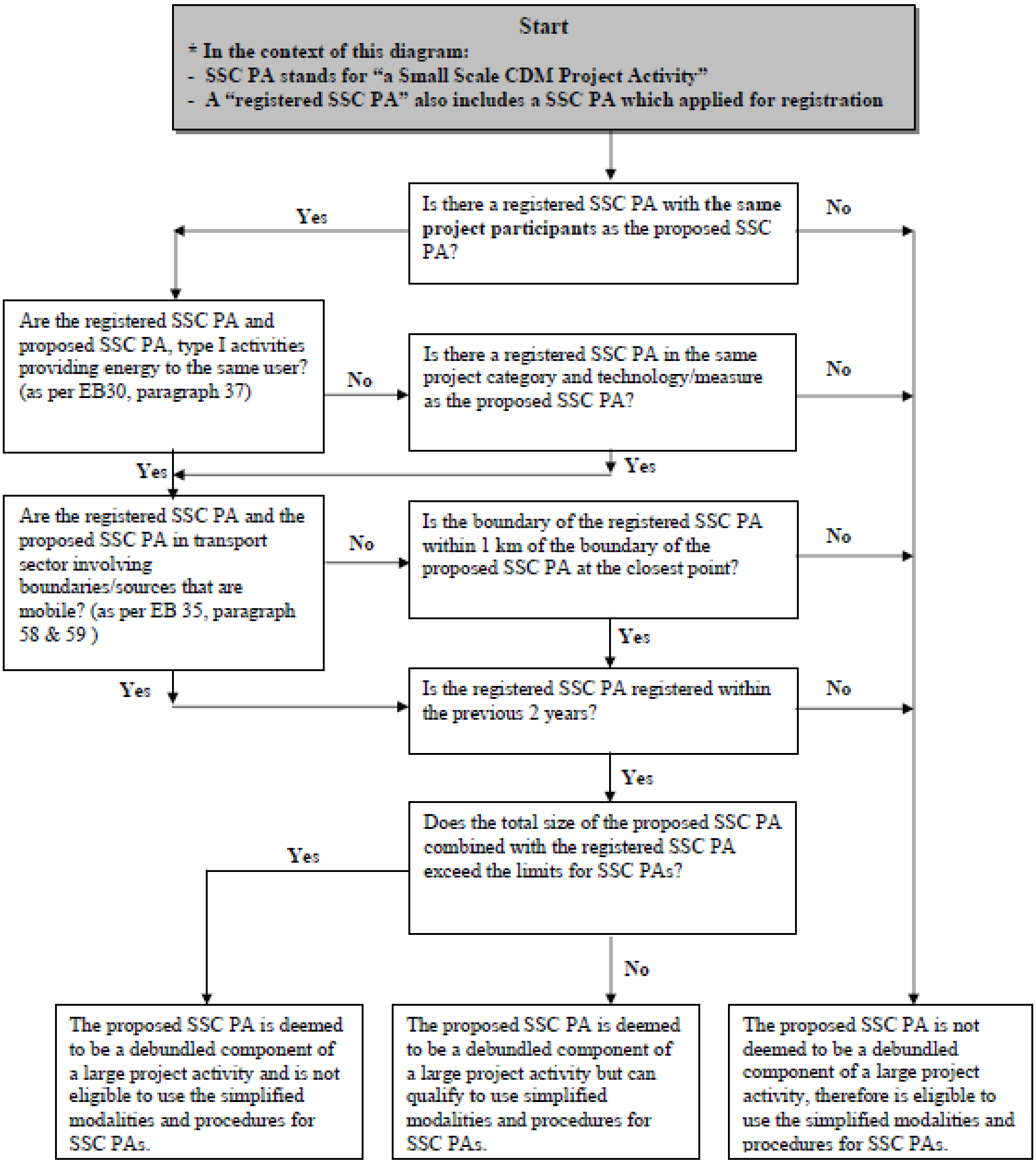
UTE Barreiro will not receive any public funding from Parties included in Annex I.

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

The occurrence of deblundling was evaluated applying the "***Guidelines on assessment of de-bundling for SSC project activities***", version 03, from the EB54 Annex 13, which states that a proposed small-scale project activity shall be deemed to be a de-bundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- By the same project participants;
- In the same project category and technology/measure; and

- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point.




Following the diagram above, the first condition to ensure the project activity is not deblunded states that: "*Is there a registered SSC PA with the same project participant as the proposed SSC PA?*", the answer for the question is **NO.**

Based on the answer, the PP concludes that: "*The project SSC PA is not a deemed to be a debundled component of a large project activity, therefore is eligible to use the simplified modalities and procedures for SSC PAs"*.

## SECTION B. Application of a baseline and monitoring methodology

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

The project activity applies the small scale methodology AMS.I-F "***Renewable electricity generation for captive use and mini-grid***", version 02, released in the EB61.

It is also applied the guidance on information on additionality (attachment A to appendix B) and general guidance on leakage in biomass project activities (attachment C to appendix B) and the methodological tools below:

- "***Tool to calculate the emission factor for an electricity system***", version 2.2.1, revised in the EB63 Annex 19; and

- "***Tool to calculate project or leakage $CO_2$ emissions from fossil fuel consumption***", version 02, revised in the EB41 Annex 11.

### B.2 Justification of the choice of the project category:

The project activity is in compliance with all the requirements of applicability of the methodology AMS.I.F version 02, presented below in italic, and following discussed by the PP:

**1.** *This comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e., in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:*

*(a) A national or a regional grid (grid hereafter);*

*(b) Fossil fuel fired captive power plant;*[3]

*(c) A carbon intensive mini-grid.*

✓ The project activity is displacing electricity from the grid, option (a) above, which was the scenario in absence of the project activity implementation.

**2.** *For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e., the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid.*

✓ The concept of mini-grid is not applicable to this project activity as the generation capacity of the power plant is 12.9MW.

[3] Where the users of the captive electricity are also connected to the grid in the project site.

3. *Illustration of respective situations under which each of the methodology (AMS-I.D, AMS-I.F and AMS-I.A[4]) applies is included in Table 2 of the methodology.*

✓ Project activity fits the project type 2 - Project displaces grid electricity consumption at the user end.

4. *Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:*
   - *The project activity is implemented in an existing reservoir with no change in the volume of reservoir;*
   - *The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;*
   - *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.*

✓ Not Applicable to biomass project activity.

5. *For biomass power plants, no other biomass types than renewable biomass[5] are to be used in the project plant.*

✓ Only renewable biomass from dedicated forest plantations are going to be used in the project activity.

6. *This methodology is applicable for project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition, (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).*

✓ The project activity is a Greenfield plant, so the option (a) is applicable.

7. *In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.*

✓ Not applicable, as the project activity is not a capacity addition.

8. *In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.*

[4] AMS-I.D "Grid connected renewable electricity generation", AMS-I.F "Renewable electricity generation for captive use and mini-grid" and AMS-I.A "Electricity generation by the user"
[5] Refer to Annex 18, EB 23, for the definition of renewable biomass.

✓ Not applicable, as the project activity is neither a retrofit nor replacement.

***9.*** *If the unit added has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel*[6]*, the capacity of the entire unit shall not exceed the limit of 15 MW.*

✓ The new co-fired unit has the generation capacity of 12.9 MW, not exceeding the specified limit.

***10.*** *Combined heat and power (co-generation) systems are not eligible under this category.*

✓ The project activity does not apply co-generation technology system, but only power generation.

***11.*** *If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions.*

✓ The electricity generated by the project activity is for captive use by the PP (V&M do Brasil S.A.), which have a contract with the supplier CEMIG to avoid double counting of emission redustions.

[6] A co-fired system uses both fossil and renewable fuels, for example the simultaneous combustion of both biomass residues and fossil fuels in a single boiler. Fossil fuel may be used during a period of time when the biomass is not available and due justification are provided.

**B.3. Description of the project boundary:**

The spatial extent of the project boundary includes the industrial facility consuming energy generated by the system. The boundary also extends to the project power plant and all power plants connected physically to the electricity system[7] that the CDM project power plant is connected to.

**B.4. Description of baseline and its development:**

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 100,267 MWh/year of electricity to V&M.

The proposed project activity falls under Type I.F 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 exactly 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 electricity for its own use.

The calculations of the baseline emissions are conducted according to methodology AMS.I.F version 01. This methodology was selected because the Interconnected National System (SIN) 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 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 used are from ONS- Operador Nacional do Sistema.

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:**

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:

[7] Refer to the latest approved version of the "Tool to calculate the emission factor for an electricity system" for definition of an electricity system.

**Scenario 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.

**Scenario 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.

**Scenario 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:

**B.1. 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, orglobal standard, and generally, if there are technological risks associated with the particular projectoutcome being evaluated.

**B.2. 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 economicconditions in the country.

**B.3. 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.

| **Scenarios and Barriers** | **B.1** | **B.2** | **B.3** |
|---|---|---|---|
| 1 - Current Scenario | No | No | No |
| 2 - Fossil fuel source to generate electricity | No | Yes | No |
| 3 - Renewable fuel source to generate electricity | Yes | Yes | No |

**Overcome of the additionality analysis:** As the Scenario 3 is the only scenario presented which faces more barriers, as presented above, the implementation of the project activity as the Scenario 3 is additional.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

The calculation of the emission reductions claimed by the Project participant is based on the methodology AMS.I.F version 01, as presented below:

**BASELINE EMISSIONS**

The baseline emissions are the product of electrical energy displaced with electricity produced by the renewable generating unit multiplied by an emission factor.

$$BEy = EG_{BL,\,y} * EF_{CO2} \qquad \textbf{(1)}$$

Where:

$BE_y$ = Baseline Emissions in year $y$ (tCO2);

$EG_{BL,\,y}$ = Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year $y$ (MWh);

$EF_{CO2,\,GRID}$ = Emission Factor in year y (tCO2e/MWh).

The Emission Factor can be calculated in a transparent and conservative manner following the methodology option (a):
A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the most recent version of the 'Tool to calculate the Emission Factor for an electricity system', version 02.2.1.

***Calculation of the $EF_{CO2,\,GRID}$***

With the objective of stimulating the contribution, in terms of reduction of $CO_2$ emissions, of CDM projects that generate energy to the grid, the Ministry of Science and Technology – MCT calculates the combined margin $CO_2$ emission factor for grid-connected power generation in year y using the latest version of the "Tool to calculate the emission factor for an electricity system", as ACM0002 methodology requires. Briefly, the emission factor of the grid for CDM is a combination of emission factor of operating margin, which reflects the intensity of $CO_2$ emissions from energy dispatched at the margin, with the emission factor of the margin of construction, which reflects the intensity of $CO_2$ emissions of the last plants built. It is a widely used algorithm to quantify the contribution of a future power plant that will

generate electric power to the grid in terms of reducing $CO_2$ emissions comparing to a baseline scenario. This factor serves to quantify the issue that is being displaced at the margin. Its usefulness is associated with CDM projects, and applies only for estimating the certified emission reductions (RCEs - Reduções Certificadas de Emissões) for CDM projects. All the documentation of the calculation method used by MCT as well as the values for the published Emission Factors can be found at MCT webpage.

According to the "Tool to calculate the emission factor for an electricity system", v.2.2.1, the project participants shall apply the following six steps:

STEP 1. Identify the relevant electric power system.

STEP 2. Select an operating margin (OM) method.

STEP 3. Calculate the operating margin emission factor according to the selected method.

STEP 4. Identify the cohort of power units to be included in the build margin (BM).

STEP 5. Calculate the build margin emission factor.

STEP 6. Calculate the combined margin (CM) emissions factor.

***Step 1: Identify the relevant electric power system***

The Ministry of Science and Technology - MCT adopts, for CDM project activity, a Single Electrical System for any project activity of CDM connected to the National Interconnected System and which applies the tool to calculate the emission factor for an electrical system.

***Step 2: Select an operating margin (OM) method.***

The Step 2 regards the OM calculation method. The 4 choices available for this factor are:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

Any of the four methods can be used, however, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydropower production.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following quality of data:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of CDM-PDD to DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or

- Ex post option: The year in which the project activity displaces grid electric power, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the

emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same quality of data (y, y-1 or y-2) should be used throughout all crediting periods.

For the dispatch data analysis OM, use the year in which the project activity displaces grid electric power and update the emission factor annually during the monitoring. The quality of data chosen should be documented in the CDM-PDD and not be changed during the crediting periods.

Power plants registered as CDM project activities should be included in the sample group that is used to calculate the operating margin if the criteria for including the power source in the sample group apply.

OM calculation method chosen is (c) Dispatch data analysis OM, due to the fact that this is the recommended method by MCT. Moreover, MCT, along with ONS (Electric System National Operator), calculates and publishes the hourly emissions. The Dispatch data analysis does not permit to fix the Emission Factor for OM ex-ante, therefore continuous monitoring will be required to know the value of this parameter. Due to this factor, STEP 3 will not be required to be done by project participants and MCT ex-post value will be used.

***Step 3: Calculate the operating margin emission factor according to the selected method.***

It was chosen the method (c) Dispatch data analysis OM, which is determined based on the power units that are actually dispatched at the margin during each hour h where the project is displacing electric power. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

The emission factor is calculated as follows:

$$EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where:

$EF_{grid,OM-DD,y}$ = dispatch data analysis operating margin CO emission factor in year y;

$EG_{PJ,h}$ = electric power displaced by project activity in hour h of year y (MWh);

$EF_{EL,DD,h}$ = $CO_2$ emission factor for power units in the top of the dispatch order in hour h in year y ($tCO_2$/MWh);

$EG_{PJ,y}$ = total electric power displaced by project activity in year y (MWh);

$h$ = hours in year y in which the project activity is displacing grid electric power;
$y$ = year in which the project activity is displacing grid electric power.

If hourly fuel consumption data is available, then the hourly emissions factor is determined as:

$$EF_{EL,DD,h} = \frac{\sum_{i,n} FC_{i,n,h} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{n} EG_{n,h}}$$

Where:

$EF_{EL,DD,h}$ = $CO_2$ emission factor for power units in the top of the dispatch order in hour h in year y (t $CO_2$/MWh);

$FC_{i,n,h}$ = amount of fossil fuel type i consumed by power unit n in hour h (mass or volume unit);

$NCV_{i,y}$ = net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit);

$EF_{CO2,i,y}$ = $CO_2$ emission factor of fossil fuel type i in year y ($tCO_2$/GJ);

$EG_{n,h}$ = electric power generated and delivered to the grid by power unit n in hour h (MWh);

$n$ = power units in the top of the dispatch (as defined below);

$i$ = fossil fuel types combusted in power unit n in year y;

$h$ = hours in year y in which the project activity is displacing grid electric power;

$y$ = year in which the project activity is displacing grid electric power.

Otherwise, the hourly emissions factor is calculated based on the energy efficiency of the power unit and the fuel type used, as follow:

$$EF_{EL,DD,h} = \frac{\sum_{n} EG_{n,h} \cdot EF_{EL,n,y}}{\sum_{n} EG_{n,h}}$$

Where:

$EF_{EL,DD,h}$ = $CO_2$ emission factor for power units in the top of the dispatch order in hour h in year y (t $CO_2$/MWh);

$EG_{n,h}$ = net quantity of electricity generated and delivered to the grid by power unit n in hour h (MWh);

$EF_{EL,n,y}$ = $CO_2$ emission factor of power unit n in year y ($tCO_2$/MWh);

$h$ = hours in year y in which the project activity is displacing grid electric power;

$y$ = year in which the project activity is displacing grid electric power.

The CO2 emission factor of power unit n should be determined as per the guidance for the simple OM.

To determine the set of power units *n* that are in the top of the dispatch, obtain from a national dispatch centre:

- The dispatch grid system in operation for each power unit of the system, including imported electric power units; and
- The total amount of power (MWh) that is dispatched throughout the power units in the system during each hour *h* that project activity is displacing electric power.

At each hour *h*, arrange each power generating unit by using the merit order. The group of power units *n* in the dispatch margin includes the units in the top x% of the total electric power dispatched in hour *h*, where x% is equal to the greater of either:

(a) 10%; or

(b) The quantity of electric power displaced by project activity during hour *h* divided by the total electric power in the grid during that hour *h*.

The MCT adopts the option (a) above.

***Step 4: Identify the cohort of power units to be included in the build margin (BM).***

The sample group of power generating units m used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electrical system that comprises 20% of system generation (in MWh) and that has been built most recently.

Project participants should use the set of power generating units that comprises the larger annual generation.

As a general guidance, a power unit is considered to have been built at the date when it started to supply electric power to the grid.

Power plants registered as CDM project activities should be **e**xcluded from sample group m.

However, if the group of power generating units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power generating unit(s) that is(are) built more than 10 years ago, then:

(i) exclude power generating unit(s) that is (are) built more than 10 years ago from the group; and

(ii) include grid-connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electrical system.

If, after the exclusion of power generating units built more than 10 years ago and inclusion of registered CDM project activities, the sample group of power units m does not meet either condition (a) or (b) above, the sample group m shall also include power units built more than 10 years ago, starting with the ones built most recently, until either condition (a) or (b) above is met. If there are no power units registered as CDM project activities in the relevant electric power system, and if after the exclusion of power units built more than 10 years ago the sample group of power units m does not meet either condition (a) or (b) above, power units built more than 10 years ago shall be included in the sample group m, starting with the ones built most recently, until either condition (a) or (b) above is met.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

In terms of quality of data, project participants can choose between one of the following two options:

Option 1: for the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: for the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

In this project activity, Option 2 was taken based on the published information by MCT.

***Step 5: Calculate the build margin emission factor.***

The build margin emission factor is the generation-weighted average emission factor ($tCO_2$/MWh) of all power generating units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = build margin $CO_2$ emission factor in year y (t $CO_2$/MWh);

$EG_{m,y}$ = quantity of electric power generated and delivered to the grid by power generating unit m in year y (MWh);

$EF_{EL,m,y}$ = CO2 emission factor of power generating unit m in year y (t CO2/MWh);

$m$ = power units included in the build margin;

$y$ = most recent historical year for which the power generation data is available.

$CO_2$ emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in step 3 (a) for simple OM method, using for y the most recent historical year for which power generation data is available, and using for m the power generating units included in the build margin.

***Step 6: Calculate the combined margin emission factor.***

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM}$$

Where:

$EF_{grid,OM-DD,y}$ = $CO_2$ emission factor determined by the dispatch analysis data of the operating margin in year y (t $CO_2$/MWh);

$EF_{grid,BM,y}$ = build margin $CO_2$ emission factor in year y (t $CO_2$/MWh);

$w_{OM}$ = weighting of operation margin emission factor (%);

$w_{BM}$ = weighting of build margin emission factor (%).

The following default values should be used for $w_{OM}$ and $w_{BM}$:

- Wind and solar power generation project activities: $w_{OM}$ = 0.75 and $w_{BM}$ = 0.25 (due to their intermittent and non-dispatching nature) for the first crediting period and for subsequent crediting periods.

- All other projects: $w_{OM}$ = 0.5 and $w_{BM}$ = 0.5 for the first crediting period, and $w_{OM}$ = 0.25 and $w_{BM}$ = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology referring to this tool.

Alternative weights can be proposed, since $w_{OM}$ + $w_{BM}$ = 1 be submitted for the Executive Board consideration, taking into account the guidelines described below. The values for $w_{OM}$ + $w_{BM}$ applied by project participants should be fixed for a crediting period and may be revised at the renewal of the crediting period.

For this second crediting period of the project activity, it will be applied: $w_{OM}$ = 0.25 and $w_{BM}$ = 0.75.

**PROJECT EMISSIONS**

The emissions from the project activity are due to the use of fossil fuel to stabilize the net calorific value of the components used in the boiler to generate electricity (process *j*), such as natural gas and coke, following the "***Tool to calculate project or leakage $CO_2$ emissions from fossil fuel consumption***", version 02:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y} \qquad \textbf{(2)}$$

Where:

$PE_{FC,j,y}$ = $CO_2$ emissions from fóssil fuel combustion in the process *j* in the year *y* ($tCO_2$/year);

$FC_i$ = Quantity of fossil fuel type *i* consumed in year y ($Nm^3$ or tonne/year);

$COEF_{i,y}$ = $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit);

i = The fuel types combusted in process *j* during the year *y*

As stated by the tool applied: *the $CO_2$ emission coefficient $COEF_{i,y}$ can be calculated using one of the two Options presented, depending on the availability of data on the fossil fuel type i.*

The option B was chosen to be applied due to its better applicability in the PP's monitoring system, as it is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \qquad (3)$$

Where:

$COEF_{i,y}$ = $CO_2$ emission coefficient of fuel type *I* in year *y* ($tCO_2$/mass or volume unit);
$NCV_i$ = Net Calorific Value of fossil fuel type *i* ($MJ/Nm^3$ or tonne);
$EF_i$ = $CO_2$ Emission Factor of fossil fuel type *i* ($tCO_2$/MJ).

**LEAKAGE**

As the equipment to generate electricity was not transferred from another activity, there is no necessity of leakage to be considered in the project activity, as stated in the paragraph 19 of the methodology applied (AMS.I.F version 01). **LEy = 0 $tCO_2$e/year**

**EMISSION REDUCTIONS**

The emission reductions are calculated as follows:

**ERy = BEy - PEy - LEy**

Where:

ERy = Emission Reductions in the year *y* ($tCO_2$e/year);
BEy = Baseline Emissions in the year *y* ($tCO_2$e/year);
PEy = Project Emissions in the year *y* ($tCO_2$e/year);
LEy = Leakage Emissions in the year *y* ($tCO_2$e/year) = 0 (Zero).

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

| **Data / Parameter:** | $EF_{CO2, BM}$ |
|---|---|
| Data unit: | $tCO_2$e/MWh |
| Description: | Building Margim Emission Factor in year y |
| Source of data used: | Official data from the Brazilian Ministry of Science and Technology (MCT) |
| Value applied: | 0.1404 |
| Justification of the choice of data or description of measurement methods and procedures actually | Parameter determined ex-ante in the registered PDD, base-year 2010, as established by “Tool to calculate the emission factor for an electricity system” |

| | |
|---|---|
| applied : | |
| Any comment: | Applied in the equation (3) |

| **Data / Parameter:** | Moisture content of the Blast Furnace Gas (wet basis) |
|---|---|
| Data unit: | % |
| Description: | - |
| Source of data used: | Project participant measurements |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The biomass BFG is a dry biomass, therefore without moisture content. |
| Any comment: | Not applied in any equation. |

### B.6.3 Ex-ante calculation of emission reductions:

**Baseline Emissions**

$BEy = EG_{BL, y} \times EF_{CO2}$

$BEy = 100,267 \times 0.2250 =$ **22,556 $tCO_2$**

**Project Emissions**

$PE_{FC, j, y} = \sum FC_i \times COEF_i)$

$PE_{FC, j, y} = \sum FC_i \times (NCV_i * EF_i)$

$PE_{FC, j, y} = 1,522,124 \times 0.000003771 \times 56.1 =$ **3,220 $tCO_2$**

**Leakage = 0**

**Emission Reductions**

ERy = BEy - PEy - Ley

**ERy = 22,556 - 3,220 - 0 = 19,336 $tCO_2$**

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

| Years | Baseline Emissions (tCO2e/year) | Project Emissions (tCO2e/year) | Leakage (tCO2e/year) | Emission Reductions (tCO2e/year) |
|---|---|---|---|---|
| 01/01/2011 | 22,556 | 3,220 | 0 | 19,336 |
| 2012 | 22,556 | 3,220 | 0 | 19,336 |
| 2013 | 22,556 | 3,220 | 0 | 19,336 |
| 2014 | 22,556 | 3,220 | 0 | 19,336 |
| 2015 | 22,556 | 3,220 | 0 | 19,336 |
| 2016 | 22,556 | 3,220 | 0 | 19,336 |
| 31/12/2017 | 22,556 | 3,220 | 0 | 19,336 |
| **Total** | **157,892** | **22,540** | **0** | **135,352** |
| **Crediting Period** | **7 years (renewable)** | | | |

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

### B.7.1 Data and parameters monitored:

| **Data / Parameter:** | $EG_{BL,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y*. |
| Source of data to be used: | Project participant measurement. |
| Value of data | 100,267 |
| Description of measurement methods and procedures to be applied: | The measurements will be undertaken using main and backup energy meters. The data is monitored continuously and collected manually by the O&M Supervisor team, and then aggregated/recorded daily and monthly.<br><br><u>Monitoring Equipment Information</u><br>Type (Number): Energy Meters (8950 and 9176)<br>Accuracy: Class 0.3<br>Resolution: -<br>Calibration Frequency: 2 years |
| QA/QC procedures to be applied: | The energy meters will be calibrated following the internal procedure PT-LCMIII 01.01 and the Module 12 of ANEEL (Energy National Agency).<br>It will be cross-checked with the purchase invoices from the PP. |
| Any comment: | Applied in the equation (1) |

| **Data / Parameter:** | $FC_{NG,y}$ |
|---|---|
| Data unit: | $Nm^3$/year |
| Description: | Quantity of natural gas consumed in year y |
| Source of data to be used: | Project participants measurements |

| | |
|---|---|
| Value of data | 1,522,124 |
| Description of measurement methods and procedures to be applied: | The parameter will be measured continuously using a flowmeter, and then aggregated/recorded daily and monthly.<br><br>*Ex-ante data: Historical data 2010*<br><br>Monitoring Equipment Information<br>Type (Number): Flow Meters (9621)<br>Accuracy: ± 2%<br>Resolution: 0.1 $Nm^3/h$<br>Calibration Frequency: 1 year |
| QA/QC procedures to be applied: | The measurement equipment will be regularly calibrated following internal standards to ensure accuracy and reliability in the measurements.<br>It will be cross checked with purchase invoices from the gas supplier. |
| Any comment: | Applied in the equation (2) |

| | |
|---|---|
| **Data / Parameter:** | $FC_{BFG,y}$ |
| Data unit: | $Nm^3$/year |
| Description: | Quantity of blast furnace gas (biomass) consumed in year y |
| Source of data to be used: | Project participant measurements |
| Value of data | 254,445,108 |
| Description of measurement methods and procedures to be applied: | The parameter will be measured continuously using a flowmeter, and then aggregated/recorded daily and monthly.<br><br>*Ex-ante data: Historical data 2010*<br><br>Monitoring Equipment Information<br>Type (Number): Flow Meter (9620)<br>Accuracy: ± 2%<br>Resolution: 0.1 $Nm^3/h$<br>Calibration Frequency: 2 years |
| QA/QC procedures to be applied: | The measurement equipment will be regularly calibrated following internal standards to ensure accuracy and reliability in the measurements.<br>The quantity of blast furnace gas consumed will be cross-checked with its net calorific value to ensure the measurement consistency with the balance energy annual data on energy generation, fossil fuels and biomass used. |
| Any comment: | N/A |

| | |
|---|---|
| **Data / Parameter:** | $FC_{TAR,y}$ |
| Data unit: | tonnes/year |
| Description: | Quantity of wood tar consumed in year y |
| Source of data to be used: | Project participant measurements |
| Value of data | 78.07 |
| Description of measurement methods and procedures to be | The parameter will be measured continuously using a flowmeter, and then aggregated/recorded daily and monthly. *Ex-ante data: Historical data 2010.*<br>Monitoring Equipment Information |

| | |
|---|---|
| applied: | Type (Number): Mass Flow Meter (8850)<br>Accuracy: ± 0.42 %<br>Resolution: - Kg/h<br>Calibration Frequency: 1 year |
| QA/QC procedures to be applied: | The measurement equipment will be regularly calibrated following internal standards to ensure accuracy and reliability in the measurements.<br>The quantity of wood tar will be cross-checked to ensure the measurement consistency with annual data on energy generation, fossil fuels and biomass used. |
| Any comment: | N/A |

| **Data / Parameter:** | Moisture content of the Wood Tar (wet basis) |
|---|---|
| Data unit: | % |
| Description: | - |
| Source of data to be used: | *Ex-ante data*: Scientific publication on energetic analysis of the carbonization process of dedicated plantation wood (Silva R.F. 2009 – page 125). |
| Value of data | 10 |
| Description of measurement methods and procedures to be applied: | The wood tar used in the project activity is a by-product from the carbonization process of the production of charcoal.<br><br>*Ex-post data:* The moisture content of the wood tar will be analyzed in external laboratories whenever used in the project activity, as its use for electricity generation does not often occur due to its small availability. |
| QA/QC procedures to be applied: | N/A |
| Any comment: | Not applied in any equation. |

| **Data / Parameter:** | $NCV_{NG}$ |
|---|---|
| Data unit: | $TJ/Nm^3$ |
| Description: | Net Calorific Value of the natural gas |
| Source of data to be used: | Supplier's data |
| Value of data | 0.00003771 * |
| Description of measurement methods and procedures to be applied: | Data provided monthly by the Natural Gas Supplyer (GASMIG).<br>** Ex-ante value: Historical data 2010.* |
| QA/QC procedures to be applied: | N/A |
| Any comment: | Applied in the equation (3) |

| **Data / Parameter:** | $NCV_{BFG}$ |
|---|---|
| Data unit: | $kcal/Nm^3$ |
| Description: | Net Calorific Value of the blast furnace gas (BFG) |
| Source of data to be used: | Project participant measurements |
| Value of data | 905 |
| Description of | The parameter measurements will be made quarterly in laboratories using a |

| | |
|---|---|
| measurement methods and procedures to be applied: | calorimeter. At least three samples per measurement will be taken and the average value of 2011 will be used for the whole of the crediting period.<br><br>*Ex-ante value: Historical data 2010.*<br><br>Monitoring Equipment Information<br>Type (Number): Calorimeter (7805)<br>Range: 0 to 1600 kcal / $Nm^3$<br>Accuracy: ± 2 %<br>Resolution: 1 kcal / $Nm^3$<br>Calibration Frequency: 6 months |
| QA/QC procedures to be applied: | The NCV value will be checked by comparing the measurement results with relevant data sources and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conduct. |
| Any comment: | Not applied in the calculations. |

| **Data / Parameter:** | $NCV_{WOOD\ TAR}$ |
|---|---|
| Data unit: | kJ/kg |
| Description: | Net Calorific Value of the wood tar |
| Source of data to be used: | Scientific publication on energetic analysis of the carbonization process of dedicated plantation wood (Silva R.F. 2009 – page 125). |
| Value of data | 22,393 |
| Description of measurement methods and procedures to be applied: | The wood tar used in the project activity is a by-product from the carbonization process of the production of charcoal.<br>The net calorific value of wood tar has to be analyzed in external laboratories, as its use for electricity generation is a new application of this by-product. |
| QA/QC procedures to be applied: | The NCV value will be checked by comparing the measurement results with relevant data sources and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conduct. |
| Any comment: | Not applied in the calculations. |

| **Data / Parameter:** | $EF_{NG}$ |
|---|---|
| Data unit: | $tCO_2/TJ$ |
| Description: | $CO_2$ Emission Factor of the natural gas |
| Source of data to be used: | 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Energy – Table 2.2. |
| Value of data | 56.1 |
| Description of measurement methods and procedures to be applied: | The data will be updated based on the latest data published by the IPCC.<br>It was applied the Default Emission Factor Value for ERs' estimation. |
| QA/QC procedures to be applied: | N/A |
| Any comment: | Applied in the equation (3) |

| **Data / Parameter:** | $EF_{CO2,\ OM}$ |
|---|---|

| | |
|---|---|
| Data unit: | $tCO_2e/MWh$ |
| Description: | Operation Margim Emission Factor in year y |
| Source of data to be used: | Official data from the Brazilian Ministry of Science and Technology (MCT) |
| Value of data | 0.4787 |
| Description of measurement methods and procedures to be applied: | Official data published annually by the MCT<br><br>*Ex-ante data: Base year 2010* |
| QA/QC procedures to be applied: | N/A |
| Any comment: | Applied for the calculation of $EF_{CO2, GRID}$ |

| **Data / Parameter:** | $EF_{CO2, GRID}$ |
|---|---|
| Data unit: | $tCO_2e/MWh$ |
| Description: | National Grid Emission Factor in year y |
| Source of data to be used: | Official data from the Brazilian Ministry of Science and Technology (MCT) |
| Value of data | 0.2250 |
| Description of measurement methods and procedures to be applied: | Calculated based on the equation presented in the section B.6.1 above:<br><br>$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM}$<br>Where:<br>$W_{OM} = 0.25$ and $w_{BM} = 0.75$ |
| QA/QC procedures to be applied: | N/A |
| Any comment: | Applied in the equation (1) |

### B.7.2 Description of the monitoring plan:

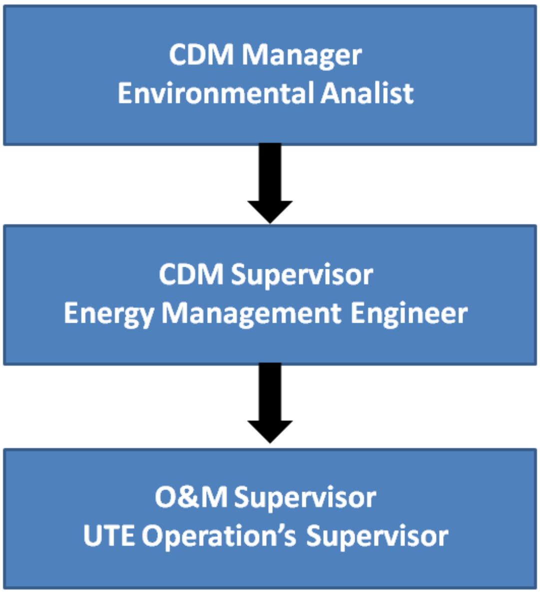
The objective of the monitoring plan is to insure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period. The project owner will be responsible for the implementation of the monitoring plan.

**1. Monitoring Purpose**

The main monitoring data are the net electricity generated by the project activity ($EG_Y$); the emission factor of the grid ($EF_{GRID, CM, Y}$) thorough its components of calculation ($EF_{BM}$ and $EF_{OM}$); the net calorific value ($NCV_{NG}$), the emission factor ($EF_{NG}$) and the quantity of natural gas ($FC_{NG}$) consumed in the project activity; the quantity of wood tar ($FC_{TAR, Y}$) and blast-furnace gas ($FC_{BFG, Y}$) consumed in the project activity.

**2. Monitoring Organization**

The functional diagram of responsibilities, including the personnel positions, follows the V&MB internal procedure PT-Gestão Energia-02 (or other procedure which revises and/or replaces it futurely), and is presented below:




Clear roles/responsibilities are detailed below:

- **Operation's Mill Technician / O&M Supervisor:**
  - Daily collects and registers the monitored data;
  - Monthly sends a Workbook Spreadsheet with all monitored data to the CDM Supervisor;
  - To ensure that calibration of the metering instruments is carried out periodically in accordance with technical regulations;
  - To be audited by the DOE.

- **Energy Management Engineer / CDM Supervisor:**
  - Responsible for collecting at a monthly basis all the monitored data from the O&M Manager and recording them in a specific folder (\\srvoffice\pm\2- Credito de carbono) with all the information regarding the monitoring plan;
  - To analyze the accuracy of monitored data and send them to the CDM Manager;
  - To support the O&M Manager in the auditing to verify the accuracy of the credits.

- **Environmental Analist / CDM Manager:**
  - To calculate the annual emission reductions on the basis of net electricity generated, as per meter reading, and the grid emission factor, as per official data published by the Brazilian DNA;
  - To prepare a monitoring report, which will include among others a summary of daily and/or monthly operations and equipments' calibration;
  - To analyze the consistency of the credits generated by the project activity
  - To contract the DOE for validation and verification services;

- To support the UTE division in the auditing to verify the accuracy of the credits;
- To execute the CERs' commercialization.

In order to ensure accuracy of the monitored data, the team involved in the monitoring of the project activity received training on monitoring methodologies, monitoring procedures and requirements, and archiving of data. Other trainings are expected to take place throughout the second crediting period.

**3. Monitoring Equipment and Data Management**

The equipments used to control the UTE Barreiro are:

- Electric energy meter equipments (Main / Mestre and Backup / Escravo);
- Flowmeters to measure Wood tar, Natural gas and Blast-furnace gas.

Data will be archived at the end of each month using electronic spreadsheets. The electronic files will be stored on the V&M system/server and, in addition, a hard copy printout will be and archived by the CDM Supervisor. At the end of each crediting year, a monitoring report will be compiled detailing the metering results and evidences.

In order to facilitate the auditor's reference, monitoring results will be indexed. All paper-based information will be stored by the project owner. All data records will be kept for a period of 2 years following the end of the crediting period.

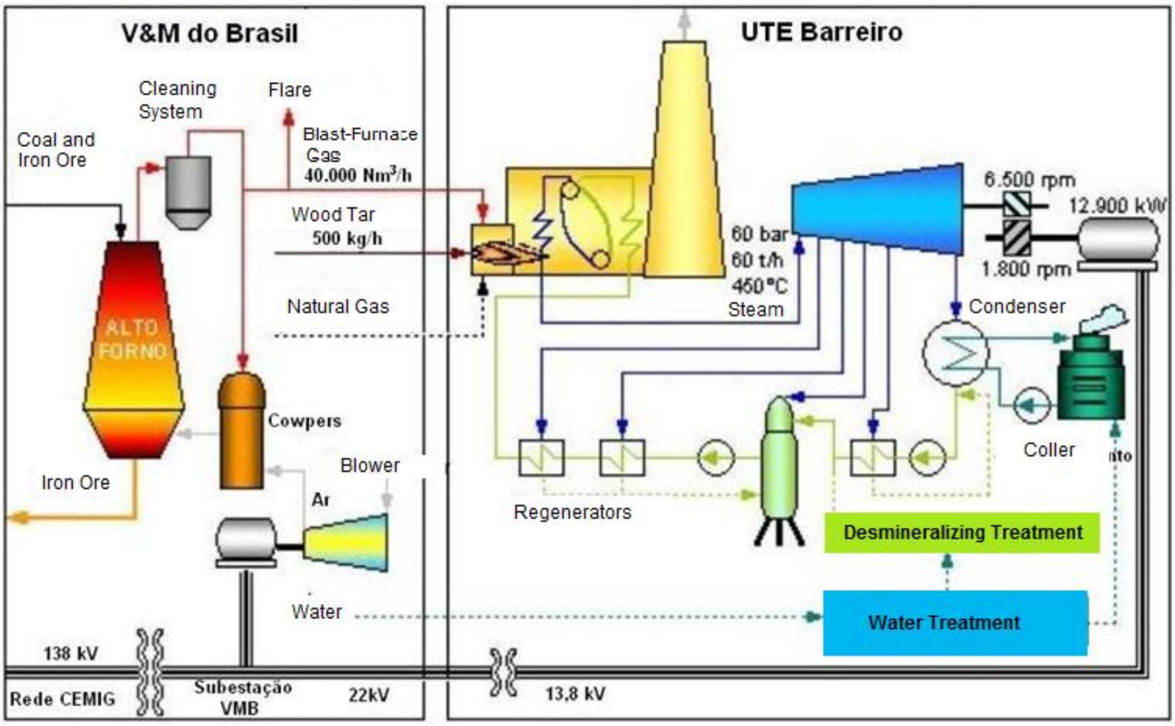



**Figure 6 – Flowdiagram of UTE Barreiro**

**4. Calibration**

The calibration process occurs in two different stages: (i) the equipments are previously calibrated in accordance with internal procedures in which all the manufacturer; (ii) after it, when the plant is being tested, the measurement devices are once again calibrated on site. The calibration reports will archived together with the monitored data.

All the meters installed were tested and calibrated in accordance with internal procedures in which all the manufacturer's recommendations were fulfilled. Moreover if any errors are detected in the measuring device, it will be immediately replaced by backup meters that were previously calibrated. The damaged measuring device will be repaired, recalibrate and will return to the monitoring system.

**5. Emergency Service Plan**

The UTE Barreiro has an Emergency Action Plan (Plano de Ação de Emergência) that has all emergency procedures related to the operation of the project activity. The goal of the Plan is to define the actions and orientations to be followed by the sectors involved when any emergency situation or sinister happen, aiming to control the situation and minimizing the consequences. This procedure is the PE-UTBA-002, or any other which revises or replaces it futurely.

To ensure the data security in case of accidents, backup data is permanently kept in the O&M Supervisor Department and in the CEMIG system/server. The CDM Supervisor also archives all monitored data related to the project activity in the V&M system/server and in paper for at least 2 years after the end of the crediting period.

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

The baseline and monitoring methodology application was complete on 29/09/2011 by:

**<u>Carbon Advisor</u>**

Mr. Leandro Salvático - lsalvatico@waycarbon.com

**KEYASSOCIADOS / WAYCARBON CONSULTORIA E TREINAMENTO S.A.**
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**<u>Project Owner</u>**

Mr. Alexandre Mello - alexandre.mello@vmtubes.com.br

Mr. Felipe Fleury - felipe.fleury@vmtubes.com.br

**VALLOUREC & MANNESMANN TUBES**
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## 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 starting date of the project activity is 01/12/2003.

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

Following the Option (c) Use Default Values of the "*Tool to determine the remaining lifetime of equipment*", version 01, the expected lifetime of the main equipments is 25 (twenty five) years and it has been operating normally since its implementation.

The expected remaining lifetime of the project activity is 18 (eighteen) years counting from the starting date of the second crediting period.

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

#### C.2.1. Renewable crediting period

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

The first crediting period started on 01/01/2004.

The second crediting period started on 01/01/2011.

##### C.2.1.2. Length of the first crediting period:

The length of the crediting period is 7 years – 0 months (renewable).

#### C.2.2. Fixed crediting period:

##### C.2.2.1. Starting date:

N/A

##### C.2.2.2. Length:

N/A

## SECTION D. Environmental impacts

### D.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.

The Operational License nº 336/09 SUPRAM was presented to DOE to ensure compliance of the project activity with the state and federal legislation.

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

No significant impacts were caused by the project activity, as detailed in the EIA/RIMA.

## SECTION E. Stakeholders' comments

### E.1. Brief description 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 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. Letters were dispatched by fax or email to the institutions mentioned above.

### E.2. Summary of the comments received:

No comments were received during the validation process.

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

Not Applicable as no comments were received in the local stakeholder consultation.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
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| URL: | www.vmtubes.com.br |
| Represented by: | Mr. Alexandre Mello |
| Title: | Sustainability Assistent |
| Salutation: | Mr. |
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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

## BASELINE INFORMATION

All information regarding Baseline is in the section B.1 to B.6 above.

## Annex 4

### MONITORING INFORMATION

The monitoring information is in the section B.7 above.

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