CLEAN DEVELOPMENT MECHANISM
PROJECT CONCEPT DOCUMENT (CDM-PDD)
Version 02 - effective: 1 July 2004)

CONTENTS

Annexes

SECTION A General description of project activity

A.1 Title of the project activity:

Electric Power Co-Generation by LDG Recovery – CST - Brasil
Document version 002
Document date: 11/17/2005

A.2. Description of the project activity

CST is an integrated steel industry based on coke, destined to the production of slabs (for foreign markets) and hot rolled coils (for both domestic and foreign markets). CST´s installed capacity is 5.0 Mt/year, being 3.0 Mt/year slabs and 2.0 Mt/year hot rolled coils. With this production, CST is the third biggest steelmaker in Brazil, with a 15% share of the production of the country.
CST´s process of steel production is based on mineral coal as energy source, and the most important processes are: the Coke Plant, the Sinter Plant, two Blast Furnaces, the Pig Iron Dessulfuring Plant, the Lime Plant, the Steel LD Converters, the Steel Refining, the Continuous Casting, and the Hot Strip Rolling Mill
CST has an environmental management system, having as one of its goals a continuous improvement to its environmental control systems. Another aspect, also emphasized in this system, is the search for excellence in energy efficiency, which has been being worked by using best operational efficiency and re-use of energy from gases generated in the production process. This has been made possible by the existence of a quite capable Energetic Model, supported by power co-generation units such as Thermoelectric Plants, Blast Furnace Top Turbine and Coke Dry Quenching.
The Clean Development Mechanism project as proposed is inserted in the search for excellence by the company relatively to energy efficiency, and consists of the implementation of a system to recover Steel Making Gas (LDG) for electric energy co-generation. The purpose of such initiative is to direct LDG to co-generation at the Thermoelectric Plants, made possible by the implementation of the 4th Thermoelectrical Plant.
The project consists of a system to recover the part of LDG rich in CO, to properly direct it towards Thermo-Electrical Plants and to use it for power co-generation. Most of the investment made will be applied on an adequate system for LDG cleaning, so as to condition the gas to the process requirements, adequate transportation, and electric power co-generation.
All CST´s strategical planning includes a corporate decision of establishing a balance between economic, social, and environmental dimensions upon conducting business, in due alignment with the principles of sustainable development. With this commitment, CST has elected eco-efficiency to be the reason and means to become a paradigm from an environmental point of view, while it is also committed with valuation of its employees, as well as with the development of the community, with policies and actions that reflect its vision of corporate social responsibility.
Thus, the present CDM project is aligned with these guidelines, and provides benefits, mainly in the areas of:

- Economy on the electric power consumption by co-generation, minimizing the impact on the public utilities;
- Reduction of GHG atmospheric emissions. By rationally using gas from production units to co-generate electric power, there will be a displacement of a share of electric energy produced by national power generation system, and an effective reduction of GHG emissions relative to the production of electric power that will be no longer imported from the network.

This CDM project involves an important step of coke based integrated steel industry at climatic changes level, and emphasizes its position as an environmentally responsible sector, considering the relevance of the issue.

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 participants (Yes/No)
Brazil	Provide project participant CST – Companhia Siderúrgica de Tubarão	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public t the stage of validation, a Party involved 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 project activity:

A.4.1 Location of the project activity:

A.4.1.1. Host Party (ies):

Brazil

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

Espírito Santo

A.4.1.3. City/Town/Community etc:

Serra

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

The project is located at CST which is strategically situated in Metropolitan Vitória Area in the State of Espírito Santo, in Brazilian Southeast. CST has a total area of 13.5 million m^2, 7 million of which occupied by the plant.
A well-outfitted highway and railroad network can be used by the plant, which is also linked to an excellent seaport system, one of the most efficient in the world, particularly the port of Praia Mole. Such an infrastructure favors the delivery of raw materials and other inputs, particularly iron ore and mineral coal, and facilitates the output of products, with an export terminal for steel products.

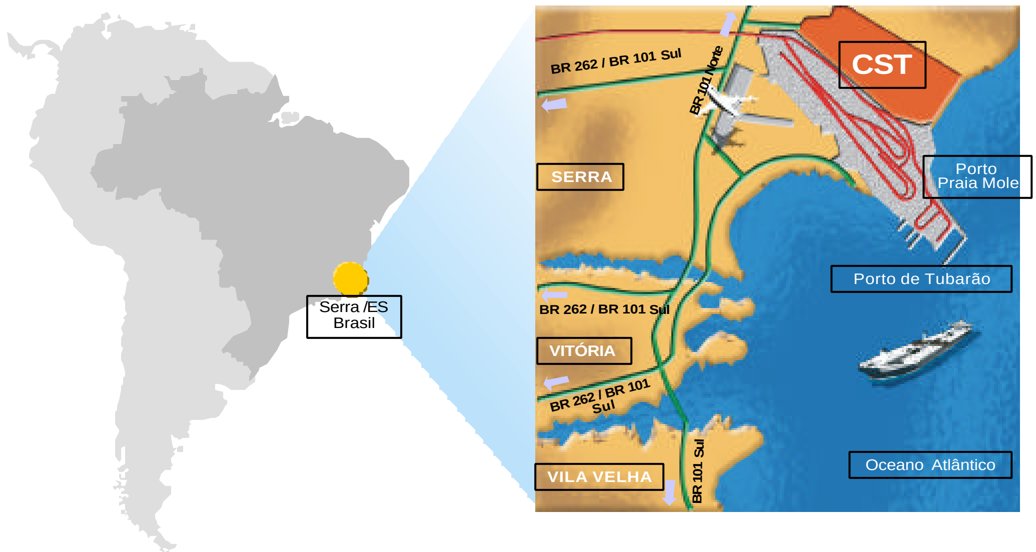


Figure 1: Location of CST

A.4.2 Category(ies) of project activity:

The activity of this project is to generate electric power by recovering and burning gas from industrial process.

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

The aim of this project is to recover LDG, presently generated in the Steel Making Plant and burned there in flare, to be used for generating electric power at CST ThermoElectrical Plants, made possible by the implementation of the 4th Thermo Electrical Plant (CTE#4). This gas consists of CO, CO_2, N_2, and water vapor. The presence of high CO content makes recovery possible for electric power co-generation.
In the Figure 2 below, a typical variation of LDG constituents during generation can be verified, as well as the interval where recovery is possible.

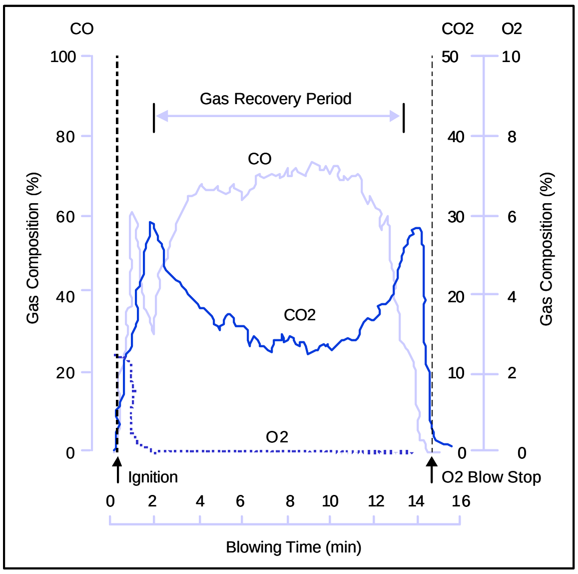


Figure 2 – Composition of LDG – reference for gas recovery

Recovered gas, properly free of dust, will be stored in a gasholder near CST´s utilities area, and will be used for burning at Thermo Electrical Plants. The system for cleaning gases will be optimized so as to ensure dust contents <50 mg/Nm^3

Power co-generation with LDG will be performed by burning it and obtaining electric power by means of existing generators (nominal outputs of 68 MW, 68 MW and 75 MW) and also of a new generator with nominal output of 75 MW, interconnected to CST in-house generation system, working in parallel with the utility company.

The LDG use for electric energy co-generation doesn't need the use of another auxiliary fuel, due to LDG own properties. As it was conceived, the project is designed to burn LDG on the power plants making possible to use at the same time also Blast Furnace gas and Coke Oven gas, generated at CST industrial process. This configuration is based exactly on the flexibility for electricity co-generation, due to maintenance shut down periods and others, making possible to increase the operational ratio of the power plant system.

In short, electric power co-generation from LDG recovery is to contribute to the following goals:

- To maintain Hot Strip Rolling Mill operational stability, allowing its normal operation.
- To improve existing CST in-house power generation system and to operate in parallel with the Utility Company, so as to contribute to reduce flicker effect as well as voltage oscillations on the network.
- To mitigate the impact of new loads to corporate power efficiency upon increasing production.
- To reduce the need to acquire electric power during normal operation, and particularly during maintenance of CTEs, as well as to make in-house generated power surplus available to the market.

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

In short, reduction of greenhouse gas emissions resulting from the project initiative will take place by implementing a system to recover Steel Making Plant gas (LDG) resulting from CST processes, converting its power potential into electrical power by corporate Thermo Electric plants, so as to avoid CST to acquire power from Brazilian Interconnected System, which shows an emission rate of 0.2783 tCO_2/MWh. This way each MWh produced by the activity of the project will avoid the emission of 278.3kg CO_2 to the atmosphere.

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

Year	Annual estimation of emission reductions in tonnes of CO_2eq
2004	21,379
2005	85,516
2006	91,090
2007	96,664
2008	96,664
2009	11,545
2010	11,545
2011	11,545
2012	11,545
2013	11,545
2014	8,659
Total estimated reductions (tonnes of CO_2eq)	457,696
Total number of crediting periods	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2eq.)	45,769

Conversion Rate: 0.2783tCO_2/MWh
Production of Electric Power from LDG started in September 2004

A.4.5 Public funding of the project activity:

There is no public funding involved with this project.

SECTION B Baseline methodology

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

"Consolidated baseline methodology for waste gas and/or heat for power generation"
Approved and consolidated methodology ACM0004.

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

The project as introduced refers to the recovery of LDG, a steel making gas that presently is burned in the flare, to be burned in a thermo electrical plan, so as to generate electrical power. The justification for using the methodology ACM0004 is that it considers the project activity:

- *that displace electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels, electricity;*

- *where no fuel switch is done in the process where the waste heat or the waste gas is produced after the implementation of the project activity*

The project activity has within its scope the electric energy co-generation through LDG recovery and processing at the Thermo Electrical Plants, with is currently burnt in flare. With this electric power produced, CST will not demand the amount of energy from National Interconnected System, Subsystems South, Southeast-CenterWest (NIS – SSECW), and so reduce the electric energy production needs from national grid through Thermo Electrical Plants, consequently reducing the GHG emissions.
In CST project, no auxiliary fossil fuel will be burned to generate electric power, so the displacement of emission takes place just with the reduction of CO_2 emission in the national electric matrix. As it was conceived, the project is designed to burn LDG on the power plants making possible to use at the same time also Blast Furnace gas and Coke Oven gas, generated at CST industrial process. This configuration is based exactly on the flexibility for electricity co-generation, due to maintenance shut down periods and others, making possible to increase the operational ratio of the power plant system.
To calculate the National Interconnected System (NIS) emission rate, it is used the option 2 as proposed by ACM0004, "If the baseline scenery is importing electric power from National Interconnected System".

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

With implementation of the system to recover steel mill gas (LDG) power potential from gases resulting from CST processes will be converted into electric power by the Thermo Electrical Plants and therefore this power will not be acquired from Brazilian Electric Power Matrix any more, this way displacing resulting emission of Greenhouse Gases.
The implementation of the system to recover steel making gas (LDG) is an initiative on the power supply side, i.e., the future scenery is that should those initiatives not be implemented, the power to be generated would have to be acquired from the Brazilian Electric Power Matrix. Therefore, baseline emissions will be estimated from National Interconnected System, Subsystems South, Southeast-CenterWest (NIS-SSECW), combined with power generation potentials of the project as proposed.
The chosen methodology ACM0004 is applicable on projects where no fuel switch is done and the emissions will exist even after the implementation of the project activities. Through the recovery of the process waste gas there will be electric energy production, and the consequent displacing of an equivalent amount of GHG on the NIS – SSECW.
Once the GHG emissions reductions will occur on the NIS-SSECW it is necessary to estimate the correspondent emission factor (tonCO_2/MWh). Therefore, through the application of this factor at the amount of co-generated electric energy it will be possible to obtain the emissions reductions due to the project activities.

The SIN-SSECW emission factor estimation was done based on the National Operator System (NOS), which is fully approached on item B.5 of this PDD. The methodology used for the calculations is described on item E.5.

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

Reckoning benefits from reduction of the emission of greenhouse gases (GHG) will be made on MWh units of electric power generated by the project activity, multiplied by CO_2 emission factor by National Interconnected System (NIS) Subsystem South, Southeast,/Center-West(SSECW). In other words, each MWh produced by CST Thermo Electrical Plants by recovering LDG will reduce GHG emissions proportionally to SIN SSECO emission factor, as such electric power will reduce CST´s demand of power from Brazilian Electric System
The additionality of this project is to be demonstrated and assessed by the last version of **"Tool for the Demonstration and Assessment of Additionality"** created by CDM Executive Board and available on the UNFCCC website.
The project shows to be additional and compatible with rules and regulations it is subject to. The additionality of the project will be demonstrated below in the steps suggested by the tool as used.

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

In 2002 CST has worked, with the support of PricewaterhouseCoopers, on a study on the possibilities of inserting projects of Clean Development Mechanisms in its business. Several possibilities were considered, that can be found in the final report of this study.
Based on this first approach, some projects were given priority in the year of 2003, among them, the referenced project, consisting of electric power co-generation by recovering LDG, considering the rules as imposed by CDM. With the studies, CST has concluded that credits won from displaced GHG emissions in Brazilian Energy Matrix would contribute to the feasibility of the project within financial standards as considered by the corporation.
Therefore all project documentation was developed, as well as all approvals required from Designated Operational Entity (DOE), UNFCCC, and Designated National Authority (DNA). Due to the dimensions of the initiative, and its time schedule feasibility, other than its strategical relevance in the context of electric power self-sufficient supply for CST, operation start-up occurred in September 2004.

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

Sub-step 1ª. Definition of alternatives for the project activity

As previously mentioned, present scenario is LDG flare burning directly to the atmosphere after its generation at the steel making converters, since it is not used. Other potential scenario would be the usage of LDG as fuel for heating sources. This option was not considered since there was no effective demand for this usage, and the real demand was the electric energy amount to fulfill CST operational needs. According to the characteristics of the project there are therefore only 2 scenarios, as described below:

- The Baseline scenario, which is to maintain operation as it currently is by flare burning LDG and acquiring electric power as required from the national matrix.
- The Project scenario, i.e., to recover, to store and to use LDG for electric power generation at Thermo Electric Plants

Should an option be made for burning LDG without recovering it for conversion into electric power, the scenario would be acquisition of electric power from NIS, and therefore increase the need of power generation in the system, resulting on an increase of generation based on NIS-SSECW thermal plants. This is supported by the aspects that follow:

i. Although the electric power supply matrix presently existing in Brazil is fully renewable, as it is mostly based on hydroelectric plants, there are signed that thermal plants´share is supposed to increase in the next years, so that the electric power supply system will make a more intensive use of fossil fuels. This increase is based on several facts:
   - The need to enlarge the generation and transmission system to meet the demand will determine a need of investments of about US$ 34 billion in the next 8 years (source: CCPE – Brazilian Committee for Electric Sector Expansion Planning), which corresponds to R$11 billion a year, just to provide the projected infrastructure capacity (this prediction was made officially by CCPE on 2002).
   - Rationed supply in 2001 involved political damage that no other administration would like to repeat in the next years, although the availability of resources for investments in electric power cannot be considered a priority, if compared with social agenda and other demands.
   - Short time expansion could be more easily done by inserting thermal natural gas plant in the system, also because:
     - ✓ Their construction takes less time.
     - ✓ They represent less environmental risk, in comparison with the most relevant part of non-explored Brazilian hydroelectric resources
     - ✓ Thermal plants involve a technology the investors of the new competitive power market are more familiarized with, due their previous experiences in their countries of origin.
     - ✓ Availability of gas from investments mostly made by Petrobras
     - ✓ Electric supply revitalization plan indicates the acquisition of thermal based emergency power to permit recovery of Brazilian water reservoirs with the years

ii. It is also important to emphasize information given by the Electric Power Crisis Management Chamber (CGE) in the document named: **“Programa Estratégico de Aumento da Oferta de Energia Elétrica”(Strategic Program to Increase Electric Power Supply)**, published in May 2002. This document includes a more detailed reference plan for the expansion program. Other than expanding generation, CGE has also been giving precedence and facilitating investments on power transmission and transformation, as per the table below:

Type of Initiative (Number of Units)	**Energy Supply Increasing (2001-2004)**				
	2001 (concluded)	**2002**	**2003**	**2004**	**Total**
Hydroelectric (24)	1.397	3.045	2.463	3.122	10.027
(*)Thermo Electric (40)	1.354	2.829	4.342	916	9.441
Emergency Thermo Electric (58)	-	2.153	-	-	2.153
Imports (5)	98	1.188	400	800	2.486
PCH (29)	66	170	145	-	381
Co-generation (17)	125	162	500	-	787
Wind Source (42)	2	261	394	393	1.050
Total (MW)	3.042	9.808	8.244	5.231	26.325
Transmission lines (26)-km	505	1.037	4.383	3.348	9.273
Substations (MVA)	-	3.347	4.450	1.050	8.847

(*) Considered a reduction of 30% due to non execution of the foreseen program.
Source: Programa Estratégico de Aumento da Oferta 2001 – 2004
(http://www.energiabrasil.gov.br/setframe.asp?Marcado=oferta&Pagina=oferta_resumo.asp)

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

The project complies with all existing laws and regulation in its area of interest and in the host country, Brazil.

Step 2 Investment Analysis

Sub-step 2a. Determination of the appropriate analysis method

Once the activity of the project generates larger income than carbon credits, option I of the additionality tool, of simple cost, cannot be used. Considering the kind of project and the standard method of analysis used by CST, the indicator to be used for financial analysis is Internal Return of Rate (IRR) Since there are not two investment options to compare, i.e., there is just one scenario considering the project and another maintaining the present situation, the option III, Benchmark Analysis, will be used.

Sub-step 2b. Option III Benchmark Analysis

In CST case, the benchmark used upon investment decisions is WACC (Weighted Average Capital Cost), historically used upon corporate investment analysis.

Sub-step 2c. Calculation and comparison of financial indicators

It will be considered the analysis of internal project return rate, the cash flow of which is:

Cash flow $= R_{ve} - (Inv + C_{op} + C_{man})$

R_{ve} income, power sale
Inv investment on the construction of the LDG recovery system (gasholders and pipeline) and of Thermal Electrical Plant #4
C_{op} total operating cost
C_{man} total maintenance cost

As previously stated, the duration of the project is 10 years, but in the financial analysis a life time of 15 years was considered, and a perpetual flow was added in the 15th year.
R_{ve} is the income obtained by selling the power as generated by the project. The value as considered upon the analysis is power market value, meaning that the price of sale is considered to be the price at which CST would buy power in the market, since the income, for the project analysis in CST corresponds to the economy made by the company by not buying the power. The power sale value was considered to be the average rate as practiced in the demand contracts in the region S/SE/CW (South, Southeast, Center-West) at the time of project analysis, and determined upon an auction made in September/2002 at R$56.60 (weighted average of S and SE/CW prices) as well as the cost of using the network, of R$18,82. As the financial analysis was made in US dollars, the energy income was converted into that currency, considering an exchange rate of R$2.96/ US$ (PTAX average, May 2003). Therefore, calculations considered an income of US$ 25.48/MWh.
As the table indicates, LDG will be fully destined to electric power generation by 2008. Only in 2009 and after, a share of LDG will be destined to other uses in CST, to substitute the need of Natural Gas in other processes (calcinations and hot rolling strips) and will reduce generation of electric power. Therefore, the financial analysis of the project cannot consider a full investment in the Thermal Electrical Plant, as it would be a non-existing cost that would result a considerable reduction of IRR, favoring the project Therefore, for the financial analysis the investment in the Thermo Electrical Plant to be considered was the value as required to implement a power plant with generation capability of 16 MW, i.e., as if a plant was being implemented to operate with the projected amount of recovered LDG exclusively. This value is obtained from the average power to be generated using LDG along the project life time. According to the market parameters, and for calculation purposes, an investment in equipment and installation of about US$ 1.2 million/MW can be considered. Thus, from total investments for the 4th Thermo Electrical Plant, US$ 19.7 million refer to co-generation with LDG.
Such reasoning would not apply to the system of LDG recovery and transportation (gasholder and pipeline) as such unit would be entirely used, whichever the generated amount of power. This fact is reinforced by the assumption that LDG will be fully used for generating electric power between 2004 and 2008. Therefore this investment (gashouse and pipeline) is to be fully considered upon the financial analysis.
C_{op} and C_{man} represent operating and maintenance costs of both the gasholder and Thermo Electric Plant. For the gasholder, the annual maintenance cost corresponds to 1.5% of the value of the investment, and no operating cost is to be considered. For Thermo Electric Plant, operating and maintenance costs are estimated to be US$ 2/MWh.
Considering the data above, an IRR of 4.18% for the project was found, without the income of carbon credits, which indicates that the return is lower than the corporate WACC, so that is not attractive, from a financial point of view. Considering carbon credits, IRR amounts to 5.29%. As indicated above, CST has a serious commitment with the environmental issues, being considered by many as an example in the area of environmental management. This search for environmental excellence and energy self sufficiency were one of the reasons among others that rose interest in the corporation for this CDM project, eventhough the value found for the IRR. Besides that, questions like (i) to maintain Hot Strip Rolling Mill operational stability, (ii) to improve existing CST

in-house power generation system and (iii) to mitigate the impact of new loads to corporate power efficiency upon increasing production, also contributed to the decision for the project implementation.
The financial chart of this project is shown as follows:

Year	Investment	Gross Income	Maintenance Costs LDG	Oper/Maint Cost Power Plant	Free Cashflow
		US$/year	US$/year	US$/year	US$/year
2003	(34.790.000)	0	0	0	(34.790.000)
2004	(710.000)	1.957.382	244.500	153.641	849.241
2005	0	7.829.528	244.500	614.563	6.970.466
2006	0	8.339.841	244.500	654.619	7.440.722
2007	0	8.850.153	244.500	694.674	7.910.978
2008	0	8.850.153	244.500	694.674	7.910.978
2009	0	1.056.999	244.500	82.967	729.532
2010	0	1.056.999	244.500	82.967	729.532
2011	0	1.056.999	244.500	82.967	729.532
2012	0	1.056.999	244.500	82.967	729.532
2013	0	1.056.999	244.500	82.967	729.532
2014	0	1.056.999	244.500	82.967	729.532
2015	0	1.056.999	244.500	82.967	729.532
2016	0	1.056.999	244.500	82.967	729.532
2017	0	1.056.999	244.500	82.967	6.808.963

Sub-step 2d. Sensitivity Analysis

To complete financial analysis there is the last step, corresponding to sensitivity analysis of the project. As can be inferred from data as used for calculations, once the investment as made is given, parameters that can be changed are income and costs. Operating and maintenance costs are controlled and practically constant, due the characteristics of process operation, so that the most significant and decisive parameter for the results of the project comes to be the income. Thus, some scenarios of power prices will be studied. Since the financial analysis was made in US dollars and the price of power in Brazil is calculated considering the IGP-M inflation rate, exchange rate variation will also be considered. Thus, the sensitivity analysis will assess how the variation of either the electric power price or the dollar exchange rate can impact the project result.
For such purpose, the following scenarios were established for electric power:

- price 15% lower, resulting from a decrease in consumption, with an economy slow-down.
- price is maintained;
- price 30% higher, resulting from an increase in consumption, with the economy rising.

As for the US dollar, scenarios of high and low rates considered a 20% variation relative to the scenario of constant exchange rate.

Therefore the table below shows IRR to combine these scenarios.

	Dollar (R$/US$)		
Electric Power Price (R$/MWh)	**Low** (2,37)	**Constant** (2,96)	**High** (3,55)
Low (66.93)	6,74	1,37	-2,64

Constant (75,42)	9,90	4,18	1,18
High (92,40)	15,87	9,38	4,70

As indicated by the results of the sensitivity analysis, shown above, in most combinations of scenarios IRR continues to be lower than capital cost for the corporation, i.e, in exception of "high electric power price/ low exchange rate" scenario, all the others are less financially attractive. Then, can be concluded that even in a wide range of values to electricity price and exchange rate, the probability of the project continuing to be less attractive is considerably high, ratifying the calculation shown in item 2.c.

Step 3. Barrier Analysis

Since an option was made for investment analysis to establish the additionality, this step can be neglected.

Step 4. Common practice analysis

The limit of the project is the Brazilian territory, and therefore the analysis will be focused on the issue of common practice of Brazilian steel making plants with LD steel mills, and therefore LDG generation. According to data from Brazilian Steel Industry Institute (IBS) there are 09 steel making plants in Brazil meeting the requirements of this category, but only 3 of them (Açominas, CSN, and Usiminas) recover LDG for using in process (see table below). Only two of them, Açominas and CSN use such gas to generate electric power. CST would therefore be the 3rd to use co-generation through LDG, which characterizes as a non-usual practice in the sector. Among the main factors that drives the decision for using LDG as electric energy co-generation purposes, it can be highlighted, besides the regional characteristics of each site, the technical difficulties associated with the mismatch on LDG generation and also the particularities for the energy policies of each company.

Company Site	Number of LD Converters	LDG Recovery	LDG for Electric Energy Co-Generation
Acesita	02	No	No
Belgo Mineira (João Monlevade)	02	No	No
CSN	03	**Yes**	**Yes**
COSIPA	03	No	No
CST (*)	02	**Yes**	**Yes**
Gerdau Açominas	02	**Yes**	**Yes**
Gerdau (Barão de Cocais)	01	No	No
USIMINAS	03	**Yes**	No
V&M do Brasil	01	No	No

Source: Brazilian Iron and Steel Institute (situation in 2004)
(*) Considering the current project implemented

Step 5. Impact of registering the project with CDM

The benefit of registering the project with CDM will potentiate CST´s sustainable development actions, particularly in the issues relative to social projects coordinated by the corporation. With a philosophy of partnership and cooperation, CST has been attempting to continuously reinforce its relations with the society and the most varied segments of the communities in the region of influence of its plant, including, of course, its own employees. Committed to an active contribution to a better social inclusion, CST is focused on transforming the society by joining projects to change social reality. In this context, its action has been concentrated in projects involved with improving the quality of education, both formal education and professional training.

With this commitment, CST develops, according to its corporate plan, a series of actions, both internal and external, conducted by policies that are continuously improved according to a sustainability approach that is present in the whole strategic planning. This way the Company ensures its perenity, growing the recognition and confidence of a society that receives increasing benefits from the wealth generated by its business activities.

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

It would be reasonable to consider the boundaries of the State of Espírito Santo as the physical limits of the project, since all power generated by CST is consumed by CST itself or made available, at least theoretically, to the State.

However, as the most part of Brazil counts with an integrated and centralized power dispatch system, one could not ensure that power to be made available by CST would be consumed within the State of Espírito Santo.

Based on that assumption, and for the purposes of the present study, the limits of the project are assumed to be the National Interconnected System of Region South, Southeast/Center-West, and therefore all emission sources and emission reductions associated with initiatives as mentioned within the referenced regions are to be considered.

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

The baseline for calculating the emission rate for NIS-SSECW was developed according to the parameters of ACM0004, option 2 – Baseline scenario, being power imported from NIS, where the emission factor is calculated in accordance with ACM0002 parameters.

Brazilian electric power system has been historically divided into two sub-systems: North-Northeast (N-NE) and South-Southeast-Center-West (S-SE-CW) This is mostly due to the historical evolution of the physical system, that has naturally been developed next to large consumption centers in the country.

The natural evolution of both systems increasingly demonstrates that an integration is to come about. In 1998, the Brazilian Government announced the first part of an interconnection line between N-NE and S-SE-CW. With investments of about US$ 700 million, the main purpose of the connection, at least in the Government's point of view, was to help to solve electric power problems existing in the country. S-SE-CW region could supply to N-NE in case of need, and conversely.

In spite of the established connection, technical documents still consider the Brazilian system as having two subsystems (Bosi , 2000)

"…where the Brazilian Electric Power System is divided into three separate sub-systems"

(i) The Interconnected System South/Southeast/Center-West

(ii) The Interconnected System North/Northeast, and

(iii) The Insulated System (corresponding to 300 locations electrically insulated from interconnected systems)"

Bosi (2000) also provides strong arguments favoring the so-called multi-project Baselines:

"For large countries, with different boundary circumstances and different power systems based in different regions, baselines of multi-projects in the electric sector may require to be disaggregated below the country level for a believable representation of *what could have happened otherwise*".

Finally, it is necessary to consider that although both systems are connected today, the electric power flow between them is limited by the capacity of transmission lines. Thus, only a part of the electric power generated in each of the systems can be transmitted. It is to expect that such part can change its direction and magnitude (until the limit of transmission lines) depending on hydrological patterns, climate, and other non-controllable factors. However it is not to expect that it represents a significant amount of the power demand of each sub-system. It should also be considered that the SE-NE interconnection was completed in 2004 only.
Presently Brazilian electric power system has nearly 91.3 GW of installed capacity, from a total of 1,420 generating companies. From these, nearly 70% are hydroelectric plants, 10% natural gas fueled thermo electrical plants, 5.3% diesel and fossil fuel thermoelectric plants, 3.1% plants fueled by biomass (sugarcane bagasse, rice bran, wood, etc…), 2% nuclear plants, 1.4% mineral coal plants, and yet 8.1 GW of installed capacity from neighboring countries (Argentina, Uruguay, Venezuela, and Paraguay) that can transmit power to the Brazilian network. (http:// www.aneel.gov.br/ aplicacoes /capacidadebrasil/ OperacaoCapacidadeBrasil.asp).
This extra capacity is really mostly ensured by 6.3 GW of the Paraguayan part of Binacional Itaipu, a hydroelectric plant jointly operated by Brazil and Paraguay, that delivers practically all generated power to the Brazilian network.
Approved methodologies AM0015 (Bagasse-based cogeneration connected to an electricity grid) and ACM0002 (Consolidated baseline methodology for grid-connected electricity generation from renewable sources) require the submittal of a project to consider "all generation sources serving the system". Therefore, upon using one of these methodologies, the submittal of a project in Brazil is supposed to search for and to research all power plants delivering to the Brazilian system.
Actually, there are no public information on power generation sources available in Brazil. The national dispatch center, ONS (*Operador Nacional do Sistema)*, claims that dispatch information is strategical for the agents of the electrical sector, and therefore should not be made available. On the other hand ANEEL, Brazilian Electric Power Agency, provides information in the installed capacity and other legal aspects of the electric sector, but no information on dispatch can be obtained with them.
Considering these aspects, the submittal of projects has been looking for a possible solution to calculate emission factor in Brazil in a more accurate way. Since real information on dispatch is essential, ONS was contracted to explain to participants the grade of detailed information that could be made available. After months of negotiations, daily informations on dispatchs of plants were made available, relative to the years of 2002, 2003, and 2004.
Project bidders, after analyzing the feasibility of applying such information, concluded that it was the most important one to determine the emission factor for the Brazilian network. According to ANEEL, ONS actually centralizes and dispatches plants amounting to a total 75,547 MW installed capacity on 31/12/2004, of the whole 98,848.5 MW installed in Brazil in the same period of time (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), including the capacity of neighboring countries available to export to Brazil and emergency plants, to be dispatched only during periods of low availability in the network. Thus, the emission factor is calculated considering 76.4% of Brazilian installed capacity, which is a good figure, considering all difficulties involved with obtaining dispatch information in Brazil. Also, the remaining 23.6% correspond to plants, the dispatches of which are not coordinated by ONS, since they either operates based on power acquisition agreements not under the control of the dispatch authority, or located

in non-interconnected systems, to which ONS has no access. Therefore this percent figure will not be affected by CDM projects, and there is no reason to consider it in the calculations to determine the emission factor.
On the other hand, other project bidders have also attempted to insert information of plants not centrally dispatched by ONS, to meet the requirements of the methodology. This has been done by considering information supplied by International Energy Agency (IEA), that was used in the study "Road-Testing Baselines for Greenhouse Gas Mitigation Projects in the Electric Power Sector". Actually, the use of such information associated with ONS´s real dispatch information was eventually refused by project bidders, since data as generated were based on assumptions, and ONS´s daily dispatch information was based on real situations. Anyway, the analysis of both databases permitted project bidders to have an idea of how the emission rate could be, should all plants and dispatch information as used be accurate. The table below shows the margin as constructed in both cases.

IEA / ONS Constructed margin (tCO_2 / MWh)	ONS Constructed margin (tCO_2 / MWh)
0,205	0,1256

Considering all rational explanation, project developers have decided to consider ONS information only, so as to determine the emission factor the most conservative way as possible.
Efficiency data on fossil fuel plants were taken from IEA document. This was made after considering that there was no more detailed information on efficiency, from public, renowned, and reliable sources.
From the reference as mentioned, the efficiency of conversion (%) of fossil fuels to thermo electrical plants fed with fossil fuel was calculated based on the installed capacity of each plant and on the power effectively produced. For most thermo electrical plants under construction, a constant value of 30% was used to estimate its fossil fuel conversion efficiency.
This value was based on data as available in the literature and on observation of real conditions of this kind of plants operating in Brazil. It was assumed that the only 02 natural gas-combined cycle plants (amounting to 648 MW) have higher efficiency rate, i.e. 45%.
Also, only data relative to plants under construction in 2002 (starting operation in 2003) were estimated. All other efficiencies were calculated. As far as it is know, there has been no upgrade of the older thermo electrical plants as analyzed in the period (2002 to 2004). Therefore project participants have concluded that the best option available was to use such numbers, although they are not well consolidated.
Consolidated data on hour dispatch coming from ONS were used to determine the *lambda* factor for each of the years having available data. Total generation of low cost plants with mandatory dispatch is determined by total generation less generation of thermo electrical plants fed with fossil fuel, being such data determined upon daily dispatch data provided by ONS.
All this information was directed to the current CDM project validators and thoroughly discussed with them, with the purpose to clarify every item and every possible doubt.
A summary of analyses follows. At first, a table with the 122 plants dispatched by ONS is shown. Then it comes a table with summarized conclusions of the analysis, with the calculation of the emission factor as presented. Finally, the curve of load duration for S-SE-CW system is presented.

Plants dispatched by ONS

Subsystem*	Fuel	Plant	Operation start-up (2, 4, 5)	Installed capacity (MW) (1)	Conversion efficiency (%) of fossil fuel (2)	Carbon Emission Rate (tC/TJ) (3)	Carbon Oxidation Fraction (3)	Emission (tCO_2/MWh)
S-SE-CO	H	Jauru	Set-2003	121,5	1	0.0	0.0%	0.000
S-SE-CO	H	Guaporé	Set-2003	120.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Três LAugas	Aug-2003	306	0.3	15.3	99.5%	0.670
S-SE-CO	H	Funil (MG)	Jan-2003	180.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itiquira I	Set-2002	156.1	1	0.0	0.0%	0.000
S-SE-CO	G.	Araucária	Set-2002	484.5	0.3	15.3	99.5%	0.670
S-SE-CO	G.	Canoas	Set-2002	160.6	0.3	15.3	99.5%	0.670
S-SE-CO	H	Piraju	Set-2002	81.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Nova Piratininga	Jun-2002	384.9	0.3	15.3	99.5%	0.670
S-SE-CO	O	PCT CGTEE	Jun-2002	5.0	0.3	20.7	99.0%	0.902
S-SE-CO	H	Rosal	Jun-2002	55.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Ibirité	Mai-2002	226.0	0.3	15.3	99.5%	0.670
S-SE-CO	H	Cana Brava	Mai-2002	465.9	1	0.0	0.0%	0.000
S-SE-CO	H	Sta. Clara	Jan-2002	60.0	1	0.0	0.0%	0.000
S-SE-CO	H	Machadinho	Jan-2002	1,140.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Juiz de Fora	Nov-2001	87.0	0.28	15.3	99.5%	0.718
S-SE-CO	G.	Macaé Merchant	Nov-2001	922.6	0.24	15.3	99.5%	0.837
S-SE-CO	H	Lajeado (ANEEL res.402/2001	Nov-2001	902.5	1	0.0	0.0%	0.000
S-SE-CO	G.	Eletrobolt	Oct-2001	379.0	0.24	15.3	99.5%	0.837
S-SE-CO	H	Porto Estrela	Sep-2001	112.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Cuiaba (Mario Covas)	Aug-2001	529.2	0.3	15.3	99.5%	0.670
S-SE-CO	G.	W.Arjona	Jan-2001	194.0	0.25	15.3	99.5%	0.804
S-SE-CO	G.	Uruguaiana	Jan-2000	639.9	0.45	15.3	99.5%	0.447
S-SE-CO	H	S. Caxias	Jan-1999	1,240.0	1	0.0	0.0%	0.000
S-SE-CO	H	Canoas I	Jan-1999	82.5	1	0.0	0.0%	0.000
S-SE-CO	H	Canoas II	Jan-1999	72.0	1	0.0	0.0%	0.000
S-SE-CO	H	Igarapava	Jan-1999	210.0	1	0.0	0.0%	0.000
S-SE-CO	H	Porto Primavera	Jan-1999	1,540.0	1	0.0	0.0%	0.000
S-SE-CO	D.	Cuiaba (Mario Covas)	Jan-1998	529.2	0.27	20.2	99.0%	0.978
S-SE-CO	H	Sobragi	Set-1998	60.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH EMAE	Jan-1998	26.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEEE	Jan-1998	25.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH ENERSUL	Jan-1998	43.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEB	Jan-1998	15.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH ESCELSA	Jan-1998	62.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CELESC	Jan-1998	50.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEMAT	Jan-1998	145.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CELG	Jan-1998	15.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CERJ	Jan-1998	59.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH COPEL	Jan-1998	70.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEMIG	Jan-1998	84.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CPFL	Jan-1998	55.0	1	0.0	0.0%	0.000
S-SE-CO	H	S.Mesa	Jan-1998	1,275.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH EPAULO	Jan-1998	26.0	1	0.0	0.0%	0.000
S-SE-CO	H	Guilmam Amorim	Jan-1997	140.0	1	0.0	0.0%	0.000
S-SE-CO	H	Corumbá	Jan-1997	375.0	1	0.0	0.0%	0.000
S-SE-CO	H	Miranda	Jan-1997	408.0	1	0.0	0.0%	0.000
S-SE-CO	H	Nova Ponte	Jan-1994	510.0	1	0.0	0.0%	0.000
S-SE-CO	H	Segredo(Gov.Ney	Jan-1992	1,260.0	1	0.0	0.0%	0.000

		Braga)						
S-SE-CO	H	Taquaruçu	Jan-1989	554.0	1	0.0	0.0%	0.000
S-SE-CO	H	Manso	Jan-1988	210.0	1	0.0	0.0%	0.000
S-SE-CO	H	D. Francisca	Jan-1987	125.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itá	Jan-1987	1,450.0	1	0.0	0.0%	0.000
S-SE-CO	H	Rosana	Jan-1987	369.2	1	0.0	0.0%	0.000
S-SE-CO	N	Angra	Jan-1985	1,874.0	1	0.0	0.0%	0.000
S-SE-CO	H	T. irmãos	Jan-1985	807.5	1	0.0	0.0%	0.000
S-SE-CO	H	Itaipú 60 Hz	Jan-1983	6,300.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itaipú 50 Hz	Jan-1983	5,375.0	1	0.0	0.0%	0.000
S-SE-CO	H	Emborcação	Jan-1982	1,192.0	1	0.0	0.0%	0.000
S-SE-CO	H	Nova Avanhandava	Jan-1982	347.4	1	0.0	0.0%	0.000
S-SE-CO	H	Gov.Bento Munhoz - GBM	Jan-1980	1,676.0	1	0.0	0.0%	0.000
S-SE-CO	H	S.SantiAug	Jan-1980	1,420.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itumbiara	Jan-1980	2,280.0	1	0.0	0.0%	0.000
S-SE-CO	O	Igarapé	Jan-1978	131.0	0.3	20.7	99.0%	0.902
S-SE-CO	H	Itauba	Jan-1978	512.4	1	0.0	0.0%	0.000
S-SE-CO	H	A.Vermelha (Jose E. Moraes)	Jan-1978	1,396.2	1	0.0	0.0%	0.000
S-SE-CO	H	S.Simão	Jan-1978	1,710.0	1	0.0	0.0%	0.000
S-SE-CO	H	Capivara	Jan-1977	640.0	1	0.0	0.0%	0.000
S-SE-CO	H	S.Osório	Jan-1975	1,078.0	1	0.0	0.0%	0.000
S-SE-CO	H	Marimbondo	Jan-1975	1,440.0	1	0.0	0.0%	0.000
S-SE-CO	H	Promissão	Jan-1975	264.0	1	0.0	0.0%	0.000
S-SE-CO	C.	Pres. Medici	Jan-1974	446.0	0.26	26.0	98.0%	1.294
S-SE-CO	H	Volta Grande	Jan-1974	380.0	1	0.0	0.0%	0.000
S-SE-CO	H	Porto Colombia	Jan-1973	320.0	1	0.0	0.0%	0.000
S-SE-CO	H	Passo Fundo	Jan-1973	220.0	1	0.0	0.0%	0.000
S-SE-CO	H	Passo Real	Jan-1973	158.0	1	0.0	0.0%	0.000
S-SE-CO	H	Iha Solteira	Jan-1973	3,444.0	1	0.0	0.0%	0.000
S-SE-CO	H	Mascarenhas	Jan-1973	131.0	1	0.0	0.0%	0.000
S-SE-CO	H	Gov.Parigot de Souza - GPS	Jan-1971	252.0	1	0.0	0.0%	0.000
S-SE-CO	H	Chavantes	Jan-1971	414.0	1	0.0	0.0%	0.000
S-SE-CO	H	Jaguara	Jan-1971	424.0	1	0.0	0.0%	0.000
S-SE-CO	H	Sá Carvalho	Apr-1970	78.0	1	0.0	0.0%	0.000
S-SE-CO	H	Estreito (Luiz Carlos Barreto)	Jan-1969	1,050.0	1	0.0	0.0%	0.000
S-SE-CO	H	Ibitinga	Jan-1969	131.5	1	0.0	0.0%	0.000
S-SE-CO	H	Jupiá	Jan-1969	!,551.2	1	0.0	0.0%	0.000
S-SE-CO	O	Alegrete	Jan-1968	66.0	0.26	20.7	99.0%	1..40
S-SE-CO	G	Campos (Roberto Silveira)	Jan-1968	30.0	0.24	15.3	99.5%	0.837
S-SE-CO	G	Santa Cruz (RJ)	Jan-1968	766.0	0.31	15.3	99.5%	0.648
S-SE-CO	H	Paraibuna	Jan-1968	85.0	1	0.0	0.0%	0.000
S-SE-CO	H	Limoeiro (Armando Salles de Oliveira)	Jan-1967	32.0	1	0.0	0.0%	0.000
S-SE-CO	H	Caconde	Jan-1966	80.4	1	0.0	0.0%	0.000
S-SE-CO	C	J.Lacerda C	Jan-1965	363.0	0.25	26.0	98.0%	1.345
S-SE-CO	C	J.Lacerda B	Jan-1965	262.0	0.21	26.0	98.0%	1.602
S-SE-CO	C	J.Lacerda A	Jan-1965	232.0	0.18	26.0	98.0%	1.869
S-SE-CO	H	Bariri (Alvaro de Souza Lima)	Jan-1965	143.1	1	0.0	0.0%	0.000
S-SE-CO	H	Funil (RJ)	Jan-1965	216.0	1	0.0	0.0%	0.000
S-SE-CO	C	Figueira	Jan-1963	20.0	0.3	26.0	98.0%	1.121

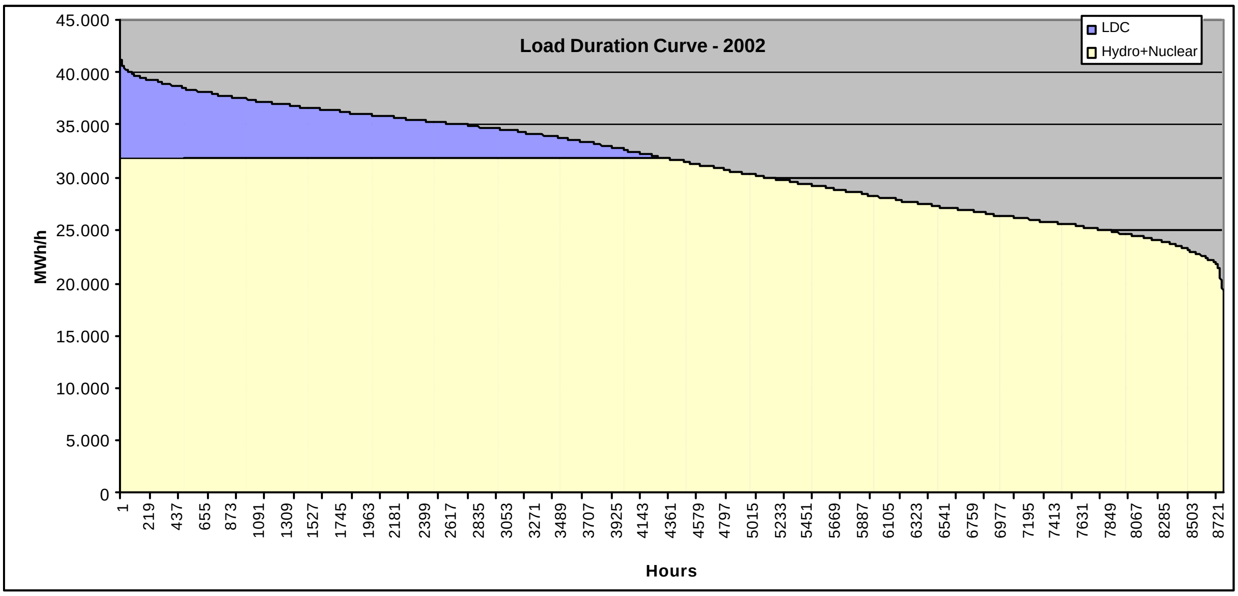
S-SE-CO	H	Furnas	Jan-1963	1,216.0	1	0.0	0.0%	0.000
S-SE-CO	H	Barra Bonita	Jan-1963	140.8	1	0.0	0.0%	0.000
S-SE-CO	C	Charqueadas	Jan-1962	72.0	0.23	26.0	98.0%	1.462
S-SE-CO	H	Jurumirim (Armando A. Laydner)	Jan-1962	97.7	1	0.0	0.0%	0.000
S-SE-CO	H	Jacui	Jan-1962	180.0	1	0.0	0.0%	0.000
S-SE-CO	H	Pereira Passos	Jan-1962	99.1	1	0.0	0.0%	0.000
S-SE-CO	H	Tres Marias	Jan-1962	396.0	1	0.0	0.0%	0.000
S-SE-CO	H	Euclides da Cunha	Jan-1960	108.8	1	0.0	0.0%	0.000
S-SE-CO	H	Camargos	Jan-1960	46.0	1	0.0	0.0%	0.000
S-SE-CO	H	Santa Branca	Jan-1960	56.1	1	0.0	0.0%	0.000
S-SE-CO	H	Cachoeira Dourada	Jan-1959	658.0	1	0.0	0.0%	0.000
S-SE-CO	H	Salto Grande (Lucas N. Garcez)	Jan-1958	70.0	1	0.0	0.0%	0.000
S-SE-CO	H	Salto Grande (MG)	Jan-1956	102.0	1	0.0	0.0%	0.000
S-SE-CO	H	Mascarenhas de Moraes (Peixoto)	Jan-1956	478.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itutinga	Jan-1955	52.0	1	0.0	0.0%	0.000
S-SE-CO	C	S. Jerônimo	Jan-1954	20.0	0.26	26.0	98.0%	1.294
S-SE-CO	O	Carioba	Jan-1954	36.2	0.3	20.7	99.0%	0.902
S-SE-CO	O	Piratininga	Jan-1954	472.0	0.3	20.7	99.0%	0.902
S-SE-CO	H	Canastra	Jan-1953	42.5	1	0.0	0.0%	0.000
S-SE-CO	H	Nilo Peçanha	Jan-1953	378.4	1	0.0	0.0%	0.000
S-SE-CO	H	Fontes Nova	Jan-1940	130.3	1	0.0	0.0%	0.000
S-SE-CO	H	Henry Borden Sub.	Jan-1926	420.0	1	0.0	0.0%	0.000
S-SE-CO	H	Henry Borden Ext.	Jan-1926	469.0	1	0.0	0.0%	0.000
S-SE-CO	H	I.Pombos	Jan-1924	189.7	1	0.0	0.0%	0.000
S-SE-CO	H	Jaguari	Jan-1917	11.8	1	0.0	0.0%	0.000
				TOTAL(MW) = 64,478.6				

** Subsystem: S – South, SE-CO – Southeast-Midwest*
*** Fuel source(C, bituminous coal; D, diesel oil; G, natural gas; H, hydro; N, nuclear; O , residual fuel oil)*

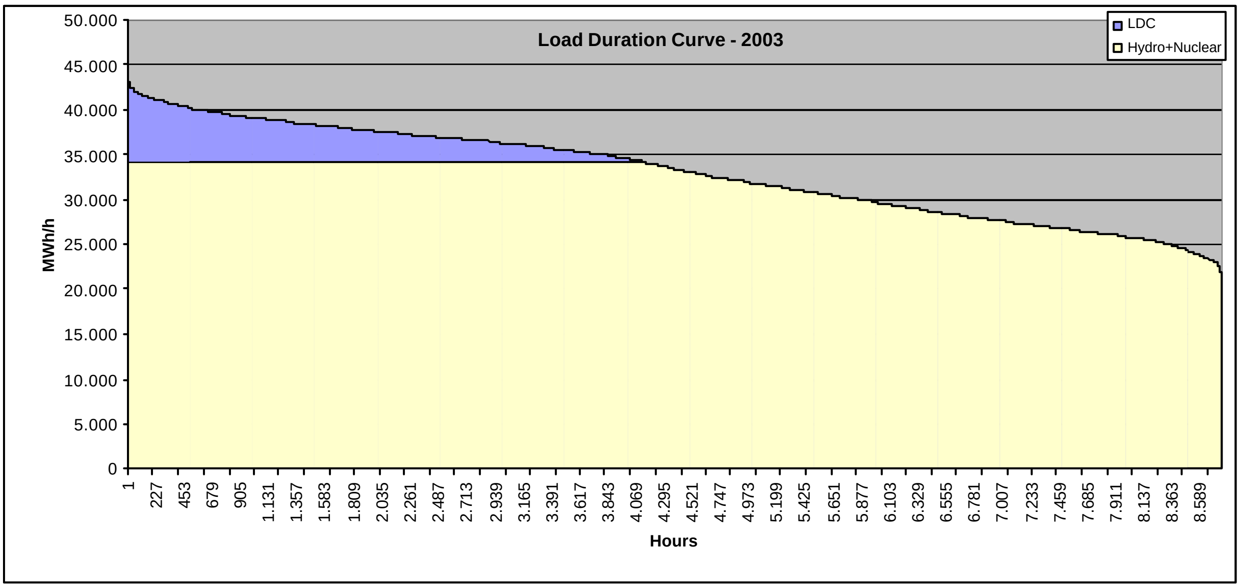
[1] Agência Nacional de Energia Elétrica. Database on generation data (http://www.aneel.gov.br/, data collected in November 2004)
[2] Bosi.M, A.Laurence, P. Maldonado, R. Schaeffer, A.F.Simoes, H. Winkler e J. M.Lukamba. Road testing baselines for GHG mitigation projects in the electric power sector. OECD/IEA October 2002.
[3] Intergovernamental Panel on Climate Change. Revised 1996 Guidelines for National Greenhouse Gas Inventories.
[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. Acompanhamento Diário da Operação do SIN (daily reports, 1 Jan. to 31 Dec. 2003)
[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. Resumo Geral dos Novos Emprendimentos de Geração (http://www.aneel.gov.br/, data collected in November 2004)

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid

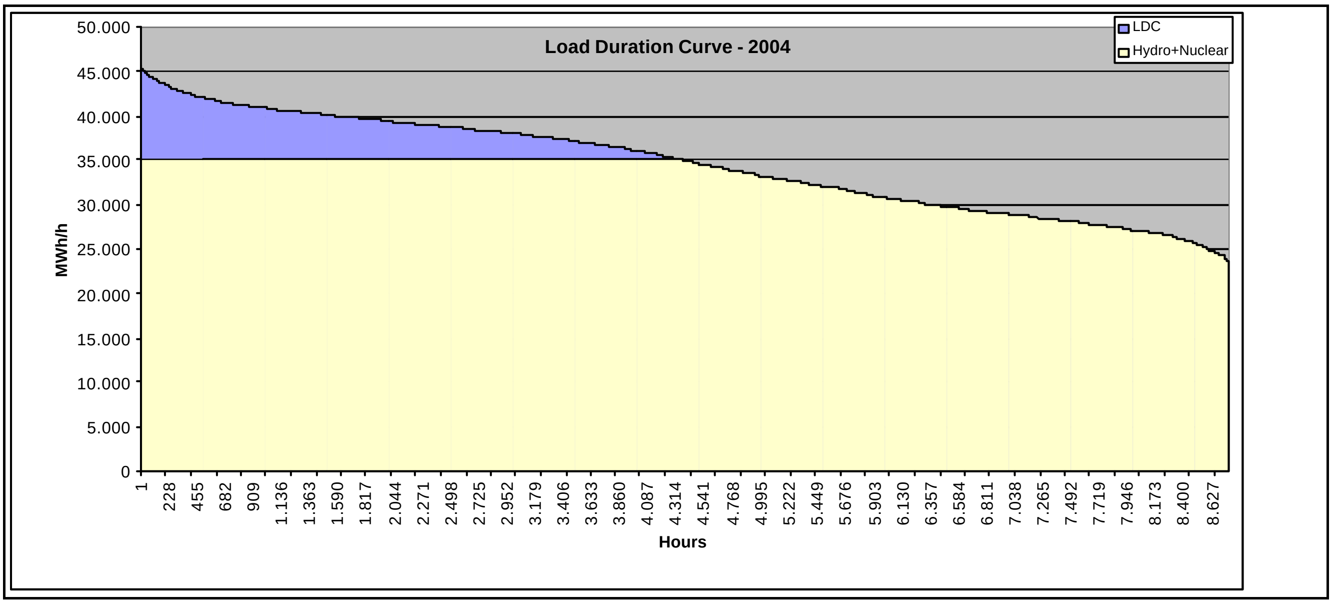
Baseline (including imports)	**EF_{OM} [tCO2/MWh]**	**Load [MWh]**	**LCMR [GWh]**	**Imports [MWh]**
2002	0,8504	275.402.896	258.720	1.607.395
2003	0,9378	288.493.929	274.649	459.586
2004	0,8726	297.879.874	284.748	1.468.275
	Total (2001-2003) =	**861.776.699**	**818.118**	**3.535.256**
	$EF_{OM, simple-adjusted}$ [tCO2/MWh]	**$EF_{BM,2004}$**	**Lambda**	
	0,4310	0,1256	l_{2002}	
	Alternative weights	**Default weights**	0,5053	
	w_{OM} = 0,75	w_{OM} = 0,5	l_{2003}	
	w_{BM} = 0,25	w_{BM} = 0,5	0,5312	
	EF_{CM} [tCO2/MWh]	**Default EF_{OM} [tCO2/MWh]**	l_{2004}	
	0,3547	0,2783	0,5041	



Load curve for SIN SSECO, 2002



Load curve for SIN SSECO, 2003



Load curve for SIN SSECO, 2004

B 5.1. Date of completion of the final text of this baseline section (DD/MM/YYYY)

16/09/2005.

B 5. 2. Name of the person/entity determining the baseline

Corporate Name:	CST – Companhia Siderúrgica de Tubarão
Address:	Av. Brigadeiro Eduardo Gomes, 930 – Jardim Limoeiro
CEP / City:	29.163-970 - Serra – ES
Country:	Brasil
Contact:	Luiz Antonio Rossi
Position:	Manager, Environment Division
Telephone:	0-XX-27-3348-2065
Fax::	0-XX-27-3348-2002
E-mail:	lrossi@tubarao.com.br

Corporate Name:	PricewaterhouseCoopers
Address:	Av. Francisco Matarazzo, 1400; Torre Torino
CEP / City:	05.001-903 – São Paulo – SP
Country:	Brasil
Contact:	Marco Antônio Fujihara
Position:	Manager, Sustainability Area
Telephone:	0-XX-11-3674-2000
Fax::	0-XX-11-3674-2000
E-mail:	marco.fujihara@br.pwc.com

B 6. Limits of the Project:

Actions to be implemented by the project will take place in the industrial area of Companhia Siderúrgica Tubarão, located in the municipality of Serra, state of Espírito Santo, Brazil
Considering that the project is based on displacing the power trend due to the increase of power co-generation in the corporation, and that the Brazilian system is interconnected, we assume the electric interconnected system of region South, Southeast and Midwest Brazil as the limits of the project.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of project activity

Recovery of LDG / Thermoelectrical Plant 4 – 01 / September / 2004.

C.1.2. Expected operational lifetime of project activity

Recovery of LDG / Thermoelectrical Plant 4 – 15 years.

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:

N/A.

C.2.1.2. Length of the first crediting period:

N/A.

C.2.2. Fixed crediting period

C.2.2.1. Starting date:

01/09/2004.

C.2.2.2. Length:

10 years.

SECTION D Application of a monitoring methodology and plan

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

"Consolidated baseline methodology for waste gas and/or heat for power generation"
Approved and consolidated monitoring methodology ACM0004.

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

Monitoring methodology as chosen applies to the project, as it permits to collect and to track data as required for calculating reductions of GHG emissions and comparison with the assumptions made in the study of the baseline.
As for project activities, monitored data consist of:

- Total power as generated by LDG recovery

- Auxiliary power
- CO_2 Emission Rate in National Interconnected System
- CO_2 Emission Rate Operational Margin in National Interconnected System
- CO_2 Emission Rate Building Margin in National Interconnected System
- Quantity of each fossil fuel consumed by each power plant (NIS)
- Emission rate of each kind of fossil fuel for each power plant (NIS)
- Power generated by each power plant (NIS)
- Fossil fuel emission rate for each power plant (NIS)
- Power efficiency of each power plant (NIS)

D.2.1 Option 1: Monitoring of the emissions in the project scenario and in the baseline scenario

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

Not applicable, project emission is equal to 0. No complementary fuel is used.

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

Not applicable, project emission is equal to 0. No complementary fuel is used.

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

For Electricity Generation by Project Activity

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1. EGgen	Quantitative	Total Electricity Generated	MWh/ yr	online measurement	Continuously	100%	Electronic	Credit period + 2 yrs	Monitoring location: meters at plant and DCS will measure the data. Manager Incharge would be responsible for regular calibration of the meter.
2. EGaux	Quantitative	Auxiliary Electricity*	MWh/ yr	online measurement	Continuously	100%	Electronic	Credit period + 2 yrs	Monitoring location: meters at plant and DCS will measure the data. Manager Incharge would be responsible for regular calibration.
3. EGy	Quantitative	Net Electricity supplied to facility	MWh/ yr	calculated (EGGEN - EGAUX)	Continuously	100%	Electronic	Credit period + 2 yrs	Calculated from the above measured parameters. Algorithm for project emission calculations given in baseline methodology.

For Electricity Generation by Project Activity

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
4. Q_{LDG}	Flow	Volumetric Flow of the Recovered Gas	Nm^3/h	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a flow meter associated to the project.
5. NCV_{LDG}	Quantitative	Net Calorific Value	Kcal/ Nm^3	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a calorimeter associated to the project.
6. Hr	Heat Rate	Power Plant Heat Rate	Gcal/ MWh	calculated	Monthly	100%	Eletronic	Credit period + 2 yrs	Determined from the electric energy output and the input fuels on the power plants. It is the Heat Rate average from power plant #1, #2, #3 and #4 for the considered period.
7. Q_i	Flow	Volumetric Flow of Consumed Fuels	Nm^3/h	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a flow meter associated to the project. Total flow for each consumed fuel at power plants.
8. NCV_i	Quantitative	Net Calorific Value of Fuels	Kcal/ Nm^3	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a calorimeter associated to the project. NCV for each fuel consumed at power plants.

For Baseline emission factor - captive power: The project doesn't use captive power or other energy source, thus the captive power is considered equal to zero.

For Baseline emission factor: grid power

ID number	Data type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
9. EFy	Emission factor	CO2 emission factor of the grid	tCO2 /MWh	calculated	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as a weighted sum of the OM and BM emission factors
10. EFom,y	Emission factor	CO2 Operating Margin emission factor of the grid	tCO2 /MWh	calculated	Simple OM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as indicated in the relevant OM baseline method above
11. EFbm,y	Emission factor	CO2 Build Margin emission factor of the grid	tCO2 /MWh	calculated	BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as [? i Fi,y*COEFi] / [? m GENm,y] over recently built power plants defined in the baseline

For Baseline emission factor: grid power

ID number	Data type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
12. Fi,j,y	Fuel quantity	Amount of each fossil fuel consumed by each power source / plant	t or m3/yr	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.
13. COEFi,k	Emission factor coefficie nt	CO2 emission coefficient of each fuel type and each power source	tCO2 / t or m3	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Plant or countryspecific values to calculate COEF are preferred to IPCC default values.
14. GENj,y	Electricit y quantity	Electricity generation of each power source / plant	MWh/ yr	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.

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

References for variables as mentioned below can be found in the text of the methodology as used. If needed, please refer to methodology.
According to the methodology, it is required to determine the simple adjusted operational margin emission factor ($EF_{OM,\ simple\_adjusted,\ y}$). For such purpose it will be used the equation

$$EF_{OM,simple\_adjusted,y} = (1-l_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + l_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} (tCO_2e/GWh)$$

It is assumed that all low operating cost plants (hydroelectrical plants) having mandatory dispatch in the regulamentation of Brazilian electrical sector, and that nuclear plants produce no emissions:

$$\frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} = 0\ (tCO_2e/GWh)$$

The Lambda Factor was calculated according to all requirements as indicated in the methodology used.

Year	Lambda
2002	0,5053
2003	0,5312
2004	0,5041

It was also necessary to consider electric power generated by NIS-SSECW each year.

Year	Electric load(MWh)
2002	275.402.896
2003	288.493.929
2004	297.879.874

Using, therefore, adequate information for $F_{i,j,y}$ and $COEF_{i,j}$, the operational factor of the operational margin of each year can be determined as follows

$$EF_{OM,simple\_adjusted,2002} = (1-l_{2002})\frac{\sum_{i,j} F_{i,j,2002}COEF_{i,j}}{\sum_j GEN_{j,2002}} \therefore EF_{OM,simple\_adjusted,2002} = 0,4207\ tCO_2/MWh$$

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

$$EF_{OM,simple\_adjusted,2004} = (1 - l_{2004}) \frac{\sum_{i,j} F_{i,j,2004} . COEF_{i,j}}{\sum_{j} GEN_{j,2004}} \therefore EF_{OM,simple\_adjusted,2004} = 0,4327 \text{ tCO}_2\text{/MWh}$$

It is, finally, calculated the average of the three years, determining $EF_{OM,simple\_adjusted}$

$$EF_{OM,simple\_adjusted_{2002\_2004}} = 0,4310 \text{ tCO}_2\text{/MWh}$$

According to the methodology used, it must be calculated the building margin (BM) emission factor, to be determined per the formula as follows:

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

In this case, according to the methodology, generation of electric power is 20% of the total generated in the most recent year, i.e., 2004, as well as the 5 most recently built generating plants less 20%. By calculating it will be found:

$$EF_{BM,2004} = 0,1256 \text{ tCO}_2\text{/MWh}$$

Finally, NIS-SSECW baseline emission factor is calculated as the arithmetic average of operational margin (OM) and building margin (BM), therefore:

$$EF_{electricity,2002-2004} = 0,5 * 0,4310 + 0,5 * 0,1256 = 0,2783 \text{ tCO}_2\text{/MWh}$$

Emissions in NIS-SSECW baseline will be proportional to power generated by the co-generation project as presented above in this document during its lifetime, therefore it can be stated that baseline emissions ($BE_{electricity,\ y}$) are calculated by multiplying the emission rate of NIS-SSECW baseline ($EF_{electricity,2002-2004}$) by the electric power generated by the project activity .

$BE_{electricity,y} = EF_{electricity,2002-2004} . EG_{year}$

Baseline emissions will therefore be calculated according to the formula:

$$\mathbf{BE_{electricity,y} = 0{,}2783\ tCO_2/MWh\ .\ EG_{year}} \quad \text{(in } tCO_2e\text{)}$$

Determination of EG_{year} is made by the formula:

$$EG_{year} = (Q_{LDG}\ .\ NCV_{LDG}\ .\ 8760) / (Hr\ .\ 10^6)$$

Where:
Q_{LDG} = Amount of LDG recovered (Nm^3/h)
NCV_{LDG} = Net Calorific Value of LDG ($kcal/Nm^3$)
Hr = Average Power Plants Efficiency (Gcal/MW).

Hr is obtained by:

$$Hr = \Sigma\ (Q_i\ .\ NCV_i)\ .\ 8760 / (EG_{total,year}\ .\ 10^6)$$

Where:

Q_i = Annual amount of individual fuels consumed at the power plants (Nm^3/h)
NCV_i = Net Calorific Value annual average for each individual consumed fuels ($kcal/Nm^3$)
$EG_{total,year}$ = Total annual energy produced at the power plants. (MWh/year)

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

Not applicable.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

Not applicable.

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

Not applicable

D.2.3 Treatment of leakages in the monitoring plan

Since project initiatives are based on use of gases from CST process (LDG), by using them in corporate thermoelectrical power plants to generate power, there are no leakages expected.

D.2.3.1. If applicable, please describe data and information to be collected to enable monitoring leakages effects of the project activity:

Not applicable.

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

Not applicable

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

Calculation of emissions reductions is made by the formula:

$ER_{year} = BE_{electricity,\ year} - PE_{year}$

Where:
ER_{year} = Reduction of emissions in a year with the project activity
$BE_{electricity,\ year}$ = Displacement of baseline emissions
PE_{year} = Project emissions in a defined year

As it was previously demonstrated that PE_{year} is zero (0), it is possible to infere that emissions reduced by project activity in a year correspond to the displacement of baseline emissions, therefore:

$ER_{year} = BE_{electricity,\ year}$

ER = 0,2783.EGy (tCO_2/MWh)

D.3. Quality control (QC) and quality assurance (QA) procedures being applied to monitored data:

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
01 -, 08	Low	Yes	This data will be used for the calculation of project electricity generation.
09 -, 11	Low	No	This data is calculated, so does not need QA procedures
12 -, 14	Low	No	This data will be required for the calculation of baseline emissions (from grid electricity) and will be obtained through published and official sources.

So as to obtain consistency with activities within the project monitoring in CST Quality Management System certified by ISO9001 and ISO14001, a Technical Standard is being prepared, under the name *"Monitoramento da Geração de Créditos de Carbono – Procedimentos Básicos para Obtenção, Gerenciamento e Armazenamento dos Dados"* (Monitoring of Carbon Credits Generation – Basic Procedures for Obtaining, Management, and Storing Data). This Technical Standard will be issued by the Environment Division, and updated from time to time, as needed, or upon insertion of future projects for obtaining carbon credits.

D.4 Please describe the operational and management structure the project operator will implement in order to enable monitoring emission reductions and any leakage effect generated by the project activity:

The emissions reductions are calculated by direct measurements in the process, related to the amount of LDG that will be destinated to electric energy co-generation at the thermoelectrical plants. Also, the informations obtained at Brazilian electric energy matrix (NIS-SSECW) are support for these calculations. The data management will be supported by CST Quality Management System certified by ISO9001 and ISO14001. According to stated on D.2.1.3, the project has no leakages to be monitored.

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

Corporate Name:	CST – Companhia Siderúrgica de Tubarão
Address:	Av. Brigadeiro Eduardo Gomes, 930 – Jardim Limoeiro
CEP / City:	29.163-970 - Serra – ES
Country:	Brasil
Contact:	Luiz Antonio Rossi
Position:	Manager, Environment Division
Telephone:	0-XX-27-3348-2065
Fax::	0-XX-27-3348-2002
E-mail:	lrossi@tubarao.com.br

Corporate Name:	PricewaterhouseCoopers
Address:	Av. Francisco Matarazzo, 1400; Torre Torino
CEP / City:	05.001-903 – São Paulo – SP
Country:	Brasil
Contact:	Marco Antônio Fujihara
Position:	Manager, Sustainability Area
Telephone:	0-XX-11-3674-2000
Fax::	0-XX-11-3674-2000
E-mail:	marco.fujihara@br.pwc.com

SECTION E Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

Project scenario follows the same logics as established upon the construction of the baseline scenario.
Thus, in the implementation of the gas recovery system in steel making plant (LDG) the electric power generated from gases originating in CST processes will no longer be acquired from the Brazilian energy matrix, and this will reduce GHG emissions.
Power generation by recovering LDG does not need complementary fossil fuels, so that the calculation of Project Emissions by Year (PE_{year}) as described in the baseline methodology of ACM00004 is not necessary for this project.
Therefore the formula to calculate the reduction of GHG emissions for this project is to be simplified, containing just the amount of electric power generated by the project (MWh) multiplied by the emission rate of the National Interconnected System in the sub-system SSECW, as represented by the formula below:

$$BE_{electricity,\ year} = EG_{year} \ .\ EF_{electricity,\ year}$$

where:
$BE_{electricity,\ year}$ = Displacement of baseline emissions
EG_{year} = Amount of electric power produced by the thermoelectrical plant
$EF_{electricity,\ year}$ = CO_2 emission rate by NIS sub-system SSECW

Determination of EG_{year} is made by the formula:

$$EG_{year} = (Q_{LDG} \ .\ NCV_{LDG} \ .\ 8760) / (Hr \ .\ 10^6)$$

Where:
Q_{LDG} = Amount of LDG recovered (Nm^3/h)
NCV_{LDG} = Net Calorific Value of LDG ($kcal/Nm^3$)
Hr = Average Power Plants Efficiency (Gcal/MW).

Hr is obtained by:

$$Hr = \Sigma\ (Q_i \ .\ NCV_i) \ .\ 8760 / (EG_{total,year} \ .\ 10^6)$$

Where:

Q_i = Amount of individual fuels consumed at the power plants (Nm^3/h)
NCV_i = Net Calorific Value for each individual consumed fuels ($kcal/Nm^3$)
$EG_{total,year}$ = Total annual energy produced at the power plants. (MWh/year)

Calculation of emissions reductions is made by the formula:

$$ER_{year} = BE_{electricity,\ year} - PE_{year}$$

Where:
ER_{year} = Reduction of emissions in a year with the project activity
PE_{year} = Project emissions in a defined year

As it was previously demonstrated that PE_{year} is zero (0), it is possible to infere that emissions reduced by project activity in a year correspond to the displacement of baseline emissions, therefore:

$ER_{year} = BE_{electricity, year}$

E.2. Estimated leakage:

As previously stated, no significant leakage is expected in this project.

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

N/A

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

The baseline calculations were done based on "option 2" of the approved and consolidated methodology ACM0004, i.e. *"If baseline scenario is grid power imports"*. Therefore, the emission factor for the grid is calculated according to approved and consolidated methodology ACM0002.
Baseline methodology determines CO_2 emission factor for NIS-SSECW, which the project is connected to.
The chosen method to calculate the operational margin (OM) for the baseline emission factor is option (b) *"Simple Adjusted OM"*, since option (c), *"Dispatch Data Analysis OM"*, that could also be a way to determine the factor, has barriers for collection and validation of the necessary data.
For calculating the operational margin (OM) it was required to obtain with National System Operator (NSO) information on NIS daily power dispatch. This kind of information is not regularly provided by NSO, and direct contact with the entity was required for such purpose.
Information as received includes the years 2002, 2003, and 2004, and presently are the latest available at this stage.

Calculation of the emission factor of simple adjusted operational margin (OM)

References for variables as mentioned below can be found in the text of the methodology as used. If needed, please refer to methodology.
According to the methodology, it is required to determine the simple adjusted operational margin emission factor ($EF_{OM,\ simple\_adjusted,\ y}$). For such purpose it will be used the equation:

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

It is assumed that all low operating cost plants (hydroelectrical plants) having mandatory dispatch in the regulamentation of Brazilian electrical sector, and that nuclear plants produce no emissions:

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

The Lambda Factor was calculated according to all requirements as indicated in the methodology used.

Year	Lambda
2002	0,5053
2003	0,5312
2004	0,5041

It was also necessary to consider electric power generated by NIS-SSECW each year.

Year	Electric load(MWh)
2002	275.402.896
2003	288.493.929
2004	297.879.874

Using, therefore, adequate information for $F_{i,j,y}$ and $COEF_{i,j}$, the operational factor of the operational margin of each year can be determined as follows

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

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

$$EF_{OM,simple\_adjusted,2004} = (1 - l_{2004}) \frac{\sum_{i,j} F_{i,j,2004} . COEF_{i,j}}{\sum_{j} GEN_{j,2004}} \therefore EF_{OM,simple\_adjusted,2004} = 0{,}4327 \text{ tCO}_2\text{/MWh}$$

It is, finally, calculated the average of the three years, determining $EF_{OM,simple\_adjusted}$

$$EF_{OM,simple\_adjusted_{2002\_2004}} = 0{,}4310 \text{ tCO}_2\text{/MWh}$$

According to the methodology used, it must be calculated the building margin (BM) emission factor, to be determined per the formula as follows:

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

In this case, according to the methodology, generation of electric power is 20% of the total generated in the most recent year, i.e., 2004, as well as the 5 most recently built generating plants less 20%. By calculating it will be found:

$$EF_{BM,2004} = 0{,}1256\ tCO_2/MWh$$

Finally, NIS-SSECW baseline emission factor is calculated as the arithmetic average of operational margin (OM) and building margin (BM), therefore:

$$EF_{electricity,2002-2004} = 0{,}5 * 0{,}4310 + 0{,}5 * 0{,}1256 = 0{,}2783\ tCO_2/MWh$$

Emissions in NIS-SSECW baseline will be proportional to power generated by the co-generation project as presented above in this document during its lifetime, therefore it can be stated that baseline emissions ($BE_{electricity,\ y}$) are calculated by multiplying the emission rate of NIS-SSECW baseline ($EF_{electricity,2002-2004}$) by the electic power generated by the project activity .

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

Baseline emissions will therefore be calculated according to the formula:

$BE_{electricity,y}$ = 0,2783 tCO_2/MWh . EG_y (in tCO_2e)

E.5. Difference between E.4 and E.3 representing the emissions reduction of the project activity:

Reduction of emissions in this project is:

$ER = BE_{electricity,\ year} - (L_{year} + PE_{year}) = (0{,}2783.\ EG_{year}) - 0$

ER = 0,2783.EGy (tCO_2/MWh)

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

According to the description of methodology as made, calculation of emission reductions will be made as per the equation presented above. The following table presents estimated gain upon electric power generation and resulting reduction of GHG emissions. With the implementation of the initiative CST is estimated to reach a reduction of 457.696 **tons of equivalent CO_2** in ten years.

Year	Estimation of Project Activity Emission Reductions (tonnes of CO_2e)	Estimation of baseline emissions reductions (tonnes of CO_2e)	Estimation of Leakage(tonnes of CO_2e)	Annual estimation of emission reductions in tonnes of CO_2eq
2004	0	21.379	0	21.379
2005	0	85.516	0	85.516
2006	0	91.090	0	91.090
2007	0	96.664	0	96.664
2008	0	96.664	0	96.664
2009	0	11.545	0	11.545
2010	0	11.545	0	11.545
2011	0	11.545	0	11.545
2012	0	11.545	0	11.545
2013	0	11.545	0	11.545
2014	0	8.659	0	8.659
Total (tonnes of CO_2e)	0	457.696	0	457.696

Conversion Rate: 0,2783 tCO_2/MWh
Production of Electric Power from LDG started in September 2004

SECTION F Environmental impacts

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

Environmental impacts resulting from implementation of LDG recovery system and co-generation for the production of electric power have been considered in the document named "*Declaração de Impacto Ambiental Fase 5,0 Mt*" (Environmental Impact Statement, Phase 5.0 Mt) relative to optimization of CST production (phase of 5.0 million tons). The optimization has its environmental licenses (LI 150/2002 of June 2002 and LO GAI 011/2002 of December 2002) and the study is available for consultation in the corporate facilities and in the local environmental agency (*Instituto Estadual de Meio Ambiente/ Secretaria Estadual para Assuntos de Meio Ambiente*). The action plans resulting from implementation of this initiative, as determined in the referenced statement, have been routinely followed by CST.

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

Environmental aspects as identified in the projects and included to the document *"Declaração de Impacto Ambiental Fase 5,0 Mt"* include mitigating and potentiating measures that will enable their proper management, without resulting significant negative environmental impacts. It should be noted that the study has already been approved by competent environmental agencies, and that mitigating measures are in course.

SECTION G Stakeholders´ comments

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

The present project for generating carbon credits has been announced in seminars and congresses, and systematic event follow-up, issues arisen and explanations provided are all stored in a specific file, under the responsibility of the Environmental Division. By this moment, the following project presentations were conducted:

ENTITY	EVENT/DATE	ISSUES ROSEN	EXPLANATIONS PROVIDED
Plantar	Plantar Technical Meeting February 2003	There is a possibility that the scenario of Brazilian thermal expansion does not come about as expected	The scenario was projected based on Brazilian Government documentation The project however provides for periodical revision of the scenario (at least once in a year) along the length of the crediting period.
Alston	CST Technical Meeting July/2003		
Arcelor Group	Inhouse Workshop CST May/2003		
IBC	Seminar Carbon Market IBC June/2003	No relevant issues	-
Instituto Latino Americano do Ferro e do Aço ILAFA	ILAFA Technical Seminar	Carbon market is likely not to consolidated due to US position	Kyoto apart, world carbon market tends to exist This is also reinforced by American companies investing in the future of this market.
Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável CEBDS	CEBDS Meeting Climate Change Technical Chamber	No relevant issues	-
Cenibra	CST Technical Meeting September 2003	The improvement proposed could be considered as "business as usual"	CST project consists of the search for energy excellence, which makes it different from most integrated steelmakers.
International	ENCO 41	When trade of	It was informed that the process

Iron and Steel Institute IISI	October 2003 .	carbon credits would start	had still not begun.
CST	Official presentation to local interested parties during the 3rd Technical Environment Seminar October 2003	Brazilian energetic matrix tends to increase the share of thermal plants Should alternative sources as eolian power be also considered?	The need to use a thermal base matrix by the government is mainly due to the Brazilian scenario, as rapid implementation, energy efficiency and technological consolidation all lead to this option.
Brasken	CST Technical Meeting July 2004	No relevant issues	-
Arcelor Group	CST Technical Meeting September 2004	No relevant issues	-
Instituto Brasileiro de Relações com Investidores (Brazilian Institute of Relations with Investors) IBRI	Technical Seminar on Sustainability May 2005	No relevant issues	-
IV Simpósio Internacional da Qualidade do Ar	May 2004	No relevant issues	-
World Bank Side Event	Power Grid and CDM Methodologies December 2004	No relevant issues	-
Internews	Internews Seminar April 2005	No relevant issues	-
IBC	Seminar Carbon Market IBC June/2005	No relevant issues	-
International Iron and Steel Institute IISI	Kyoto Protocol and the Steel Industry Forum June 2005	No relevant issues	-

As can be observed, official announcement for local interested parties (representatives of communities, universities, and environmental agencies) took place in October 2003, during the 3rd Technical Seminar on Environment. Records of such events are in electronic files referred to the same table of register of interested parties. Information to local communities, representatives of scientific institutions and environmental agencies after the completion of the process of project validation are also scheduled. In the meanwhile, the project has been made available on CST website for public access,, and a direct channel via CST homepage will permit management of opinions and comments by the interested parties.

G.2. Summary of comments received:

The comments received by stakeholders are basically related with the project nature, operational structure, and brazilian grid future scenario. It can be highlighted the following points, with the explanations supplied by project participants:

- The possibility of the Brazilian thermal expansion scenario doesn't come about as expected: This situation was supported by the calculation of the carbon emission factor based on real data concerning the years 2002, 2003 and 2004.
- The project activities proposed could be considered as "business as usual: This possibility is considered within the discussion of "non common practice" in the steel making sector, as described at B3 Step 4.
- Questions concerning the trade of carbon credits: It is not formally considered yet by CST.

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

All clarifications were addressed during the presentations done by the participants.

Annex 1

CONTACT DATA OF PARTICIPANTS IN PROJECT ACTIVITY

Organization	CST – Companhia Siderúrgica de Tubarão
Street/ PO box	Av. Brigadeiro Eduardo Gomes, 930 – Jardim Limoeiro
Building:	-
City.	Serra
State / Region	ES
Postfix/ZIP:	29.163-970
Country:	Brasil
Telephone:	0-XX-27-3348-2065
FAX::	0-XX-27-3348-2002
E-mail:	-
URL:	http://www.cst.com.br
Represented by:	Luiz Antonio Rossi
Title:	Manager, Environment Division
Salutation	-
Name:	Luiz Antonio Rossi
Department:	Environment Division
Mobile:	-
FAX, direct	0-XX-27-3348-2002
Direct telephone	0-XX-27-3348-2065
Personal e-mail	lrossi@tubarao.com.br

Annex 2

ANNEX 2: INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved with this project

Annex 3

ANNEX 3: BASELINE INFORMATION

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

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

Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000)[1]:

"… where the Brazilian Electricity System is divided into three separate subsystems:

(i) The South/Southeast/Midwest Interconnected System;
(ii) The North/Northeast Interconnected System; and
(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

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

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

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

The Brazilian electricity system nowadays comprises of around 91,3 GW of installed capacity, in a total of 1.420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5,3% are diesel and fuel oil plants, 3,1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1,4% are coal plants, and there

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

are also 8,1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6,3 GW of the Paraguayan part of *Itaipu Binacional*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

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

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

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

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75.547 MW of installed capacity by 31/12/2004, out of the total 98.848,5 MW installed in Brazil by the same date (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Such capacity in fact is constituted by plants with 30 MW installed capacity or above, connected to the system through 138kV power lines, or at higher voltages. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76,4% of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23,6% are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

In an attempt to include all generating sources, project developers considered the option to research for available, but non-official data, to supply the existing gap. The solution found was the International Energy Agency database built when carrying out the study "Road-Testing Baselines For Greenhouse Gas Mitigation Projects in the Electric Power Sector", published in October 2002. Merging ONS data with the IEA data in a spreadsheet, project proponents have been able to consider all generating sources connected to the relevant grids in order to determine the emission factor. The emission factor calculated was found more conservative when considering ONS data only, as the table below shows the build margin in both cases.

IEA / ONS Build margin (tCO_2 / MWh)	ONS Build margin (tCO_2 / MWh)
0,205	0,1256

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

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

From the mentioned reference:

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

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

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

On the following pages, a summary of the analysis is provided. First, the table with the 122 plants dispatched by the ONS are provided. Then, a table with the summarized conclusions of the analysis, with the emission factor calculation displayed. Finally, the load duration curves for the S-SE-CW system are presented.

Plants dispatched by ONS

Subsystem*	Fuel	Plant	Operation start-up (2, 4, 5)	Installed capacity (MW) (1)	Conversion efficiency (%) of fossil fuel (2)	Carbon Emission Rate (tC/TJ) (3)	Carbon Oxidation Fraction (3)	Emission (tCO_2/MWh)
S-SE-CO	H	Jauru	Set-2003	121,5	1	0.0	0.0%	0.000
S-SE-CO	H	Guaporé	Set-2003	120.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Três LAugas	Aug-2003	306	0.3	15.3	99.5%	0.670
S-SE-CO	H	Funil (MG)	Jan-2003	180.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itiquira I	Set-2002	156.1	1	0.0	0.0%	0.000
S-SE-CO	G.	Araucária	Set-2002	484.5	0.3	15.3	99.5%	0.670
S-SE-CO	G.	Canoas	Set-2002	160.6	0.3	15.3	99.5%	0.670
S-SE-CO	H	Piraju	Set-2002	81.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Nova Piratininga	Jun-2002	384.9	0.3	15.3	99.5%	0.670
S-SE-CO	O	PCT CGTEE	Jun-2002	5.0	0.3	20.7	99.0%	0.902
S-SE-CO	H	Rosal	Jun-2002	55.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Ibirité	Mai-2002	226.0	0.3	15.3	99.5%	0.670
S-SE-CO	H	Cana Brava	Mai-2002	465.9	1	0.0	0.0%	0.000
S-SE-CO	H	Sta. Clara	Jan-2002	60.0	1	0.0	0.0%	0.000
S-SE-CO	H	Machadinho	Jan-2002	1,140.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Juiz de Fora	Nov-2001	87.0	0.28	15.3	99.5%	0.718
S-SE-CO	G.	Macaé Merchant	Nov-2001	922.6	0.24	15.3	99.5%	0.837
S-SE-CO	H	Lajeado (ANEEL res.402/2001	Nov-2001	902.5	1	0.0	0.0%	0.000
S-SE-CO	G.	Eletrobolt	Oct-2001	379.0	0.24	15.3	99.5%	0.837
S-SE-CO	H	Porto Estrela	Sep-2001	112.0	1	0.0	0.0%	0.000
S-SE-CO	G.	Cuiaba (Mario Covas)	Aug-2001	529.2	0.3	15.3	99.5%	0.670
S-SE-CO	G.	W.Arjona	Jan-2001	194.0	0.25	15.3	99.5%	0.804
S-SE-CO	G.	Uruguaiana	Jan-2000	639.9	0.45	15.3	99.5%	0.447
S-SE-CO	H	S. Caxias	Jan-1999	1,240.0	1	0.0	0.0%	0.000
S-SE-CO	H	Canoas I	Jan-1999	82.5	1	0.0	0.0%	0.000
S-SE-CO	H	Canoas II	Jan-1999	72.0	1	0.0	0.0%	0.000
S-SE-CO	H	Igarapava	Jan-1999	210.0	1	0.0	0.0%	0.000
S-SE-CO	H	Porto Primavera	Jan-1999	1,540.0	1	0.0	0.0%	0.000
S-SE-CO	D.	Cuiaba (Mario Covas)	Jan-1998	529.2	0.27	20.2	99.0%	0.978
S-SE-CO	H	Sobragi	Set-1998	60.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH EMAE	Jan-1998	26.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEEE	Jan-1998	25.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH ENERSUL	Jan-1998	43.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEB	Jan-1998	15.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH ESCELSA	Jan-1998	62.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CELESC	Jan-1998	50.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEMAT	Jan-1998	145.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CELG	Jan-1998	15.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CERJ	Jan-1998	59.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH COPEL	Jan-1998	70.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CEMIG	Jan-1998	84.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH CPFL	Jan-1998	55.0	1	0.0	0.0%	0.000
S-SE-CO	H	S.Mesa	Jan-1998	1,275.0	1	0.0	0.0%	0.000
S-SE-CO	H	PCH EPAULO	Jan-1998	26.0	1	0.0	0.0%	0.000
S-SE-CO	H	Guilmam Amorim	Jan-1997	140.0	1	0.0	0.0%	0.000
S-SE-CO	H	Corumbá	Jan-1997	375.0	1	0.0	0.0%	0.000
S-SE-CO	H	Miranda	Jan-1997	408.0	1	0.0	0.0%	0.000
S-SE-CO	H	Nova Ponte	Jan-1994	510.0	1	0.0	0.0%	0.000
S-SE-CO	H	Segredo(Gov.Ney Braga)	Jan-1992	1,260.0	1	0.0	0.0%	0.000

S-SE-CO	H	Taquaruçu	Jan-1989	554.0	1	0.0	0.0%	0.000
S-SE-CO	H	Manso	Jan-1988	210.0	1	0.0	0.0%	0.000
S-SE-CO	H	D. Francisca	Jan-1987	125.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itá	Jan-1987	1,450.0	1	0.0	0.0%	0.000
S-SE-CO	H	Rosana	Jan-1987	369.2	1	0.0	0.0%	0.000
S-SE-CO	N	Angra	Jan-1985	1,874.0	1	0.0	0.0%	0.000
S-SE-CO	H	T. irmãos	Jan-1985	807.5	1	0.0	0.0%	0.000
S-SE-CO	H	Itaipú 60 Hz	Jan-1983	6,300.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itaipú 50 Hz	Jan-1983	5,375.0	1	0.0	0.0%	0.000
S-SE-CO	H	Emborcação	Jan-1982	1,192.0	1	0.0	0.0%	0.000
S-SE-CO	H	Nova Avanhandava	Jan-1982	347.4	1	0.0	0.0%	0.000
S-SE-CO	H	Gov.Bento Munhoz - GBM	Jan-1980	1,676.0	1	0.0	0.0%	0.000
S-SE-CO	H	S.SantiAug	Jan-1980	1,420.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itumbiara	Jan-1980	2,280.0	1	0.0	0.0%	0.000
S-SE-CO	O	Igarapé	Jan-1978	131.0	0.3	20.7	99.0%	0.902
S-SE-CO	H	Itauba	Jan-1978	512.4	1	0.0	0.0%	0.000
S-SE-CO	H	A.Vermelha (Jose E. Moraes)	Jan-1978	1,396.2	1	0.0	0.0%	0.000
S-SE-CO	H	S.Simão	Jan-1978	1,710.0	1	0.0	0.0%	0.000
S-SE-CO	H	Capivara	Jan-1977	640.0	1	0.0	0.0%	0.000
S-SE-CO	H	S.Osório	Jan-1975	1,078.0	1	0.0	0.0%	0.000
S-SE-CO	H	Marimbondo	Jan-1975	1,440.0	1	0.0	0.0%	0.000
S-SE-CO	H	Promissão	Jan-1975	264.0	1	0.0	0.0%	0.000
S-SE-CO	C.	Pres. Medici	Jan-1974	446.0	0.26	26.0	98.0%	1.294
S-SE-CO	H	Volta Grande	Jan-1974	380.0	1	0.0	0.0%	0.000
S-SE-CO	H	Porto Colombia	Jan-1973	320.0	1	0.0	0.0%	0.000
S-SE-CO	H	Passo Fundo	Jan-1973	220.0	1	0.0	0.0%	0.000
S-SE-CO	H	Passo Real	Jan-1973	158.0	1	0.0	0.0%	0.000
S-SE-CO	H	Iha Solteira	Jan-1973	3,444.0	1	0.0	0.0%	0.000
S-SE-CO	H	Mascarenhas	Jan-1973	131.0	1	0.0	0.0%	0.000
S-SE-CO	H	Gov.Parigot de Souza - GPS	Jan-1971	252.0	1	0.0	0.0%	0.000
S-SE-CO	H	Chavantes	Jan-1971	414.0	1	0.0	0.0%	0.000
S-SE-CO	H	Jaguara	Jan-1971	424.0	1	0.0	0.0%	0.000
S-SE-CO	H	Sá Carvalho	Apr-1970	78.0	1	0.0	0.0%	0.000
S-SE-CO	H	Estreito (Luiz Carlos Barreto)	Jan-1969	1,050.0	1	0.0	0.0%	0.000
S-SE-CO	H	Ibitinga	Jan-1969	131.5	1	0.0	0.0%	0.000
S-SE-CO	H	Jupiá	Jan-1969	!,551.2	1	0.0	0.0%	0.000
S-SE-CO	O	Alegrete	Jan-1968	66.0	0.26	20.7	99.0%	1..40
S-SE-CO	G	Campos (Roberto Silveira)	Jan-1968	30.0	0.24	15.3	99.5%	0.837
S-SE-CO	G	Santa Cruz (RJ)	Jan-1968	766.0	0.31	15.3	99.5%	0.648
S-SE-CO	H	Paraibuna	Jan-1968	85.0	1	0.0	0.0%	0.000
S-SE-CO	H	Limoeiro (Armando Salles de Oliveira)	Jan-1967	32.0	1	0.0	0.0%	0.000
S-SE-CO	H	Caconde	Jan-1966	80.4	1	0.0	0.0%	0.000
S-SE-CO	C	J.Lacerda C	Jan-1965	363.0	0.25	26.0	98.0%	1.345
S-SE-CO	C	J.Lacerda B	Jan-1965	262.0	0.21	26.0	98.0%	1.602
S-SE-CO	C	J.Lacerda A	Jan-1965	232.0	0.18	26.0	98.0%	1.869
S-SE-CO	H	Bariri (Alvaro de Souza Lima)	Jan-1965	143.1	1	0.0	0.0%	0.000
S-SE-CO	H	Funil (RJ)	Jan-1965	216.0	1	0.0	0.0%	0.000
S-SE-CO	C	Figueira	Jan-1963	20.0	0.3	26.0	98.0%	1.121
S-SE-CO	H	Furnas	Jan-1963	1,216.0	1	0.0	0.0%	0.000

S-SE-CO	H	Barra Bonita	Jan-1963	140.8	1	0.0	0.0%	0.000
S-SE-CO	C	Charqueadas	Jan-1962	72.0	0.23	26.0	98.0%	1.462
S-SE-CO	H	Jurumirim (Armando A. Laydner)	Jan-1962	97.7	1	0.0	0.0%	0.000
S-SE-CO	H	Jacui	Jan-1962	180.0	1	0.0	0.0%	0.000
S-SE-CO	H	Pereira Passos	Jan-1962	99.1	1	0.0	0.0%	0.000
S-SE-CO	H	Tres Marias	Jan-1962	396.0	1	0.0	0.0%	0.000
S-SE-CO	H	Euclides da Cunha	Jan-1960	108.8	1	0.0	0.0%	0.000
S-SE-CO	H	Camargos	Jan-1960	46.0	1	0.0	0.0%	0.000
S-SE-CO	H	Santa Branca	Jan-1960	56.1	1	0.0	0.0%	0.000
S-SE-CO	H	Cachoeira Dourada	Jan-1959	658.0	1	0.0	0.0%	0.000
S-SE-CO	H	Salto Grande (Lucas N. Garcez)	Jan-1958	70.0	1	0.0	0.0%	0.000
S-SE-CO	H	Salto Grande (MG)	Jan-1956	102.0	1	0.0	0.0%	0.000
S-SE-CO	H	Mascarenhas de Moraes (Peixoto)	Jan-1956	478.0	1	0.0	0.0%	0.000
S-SE-CO	H	Itutinga	Jan-1955	52.0	1	0.0	0.0%	0.000
S-SE-CO	C	S. Jerônimo	Jan-1954	20.0	0.26	26.0	98.0%	1.294
S-SE-CO	O	Carioba	Jan-1954	36.2	0.3	20.7	99.0%	0.902
S-SE-CO	O	Piratininga	Jan-1954	472.0	0.3	20.7	99.0%	0.902
S-SE-CO	H	Canastra	Jan-1953	42.5	1	0.0	0.0%	0.000
S-SE-CO	H	Nilo Peçanha	Jan-1953	378.4	1	0.0	0.0%	0.000
S-SE-CO	H	Fontes Nova	Jan-1940	130.3	1	0.0	0.0%	0.000
S-SE-CO	H	Henry Borden Sub.	Jan-1926	420.0	1	0.0	0.0%	0.000
S-SE-CO	H	Henry Borden Ext.	Jan-1926	469.0	1	0.0	0.0%	0.000
S-SE-CO	H	I.Pombos	Jan-1924	189.7	1	0.0	0.0%	0.000
S-SE-CO	H	Jaguari	Jan-1917	11.8	1	0.0	0.0%	0.000
			TOTAL(MW) = 64,478.6					

** Subsystem: S – South, SE-CO – Southeast-Midwest*

*** Fuel source(C, bituminous coal; D, diesel oil; G, natural gas; H, hydro; N, nuclear; O , residual fuel oil)*

[1] Agência Nacional de Energia Elétrica. Database on generation data (http://www.aneel.gov.br/, data collected in November 2004)

[2] Bosi.M, A.Laurence, P. Maldonado, R. Schaeffer, A.F.Simoes, H. Winkler e J. M.Lukamba. Road testing baselines for GHG mitigation projects in the electric power sector. OECD/IEA October 2002.

[3] Intergovernamental Panel on Climate Change. Revised 1996 Guidelines for National Greenhouse Gas Inventories.

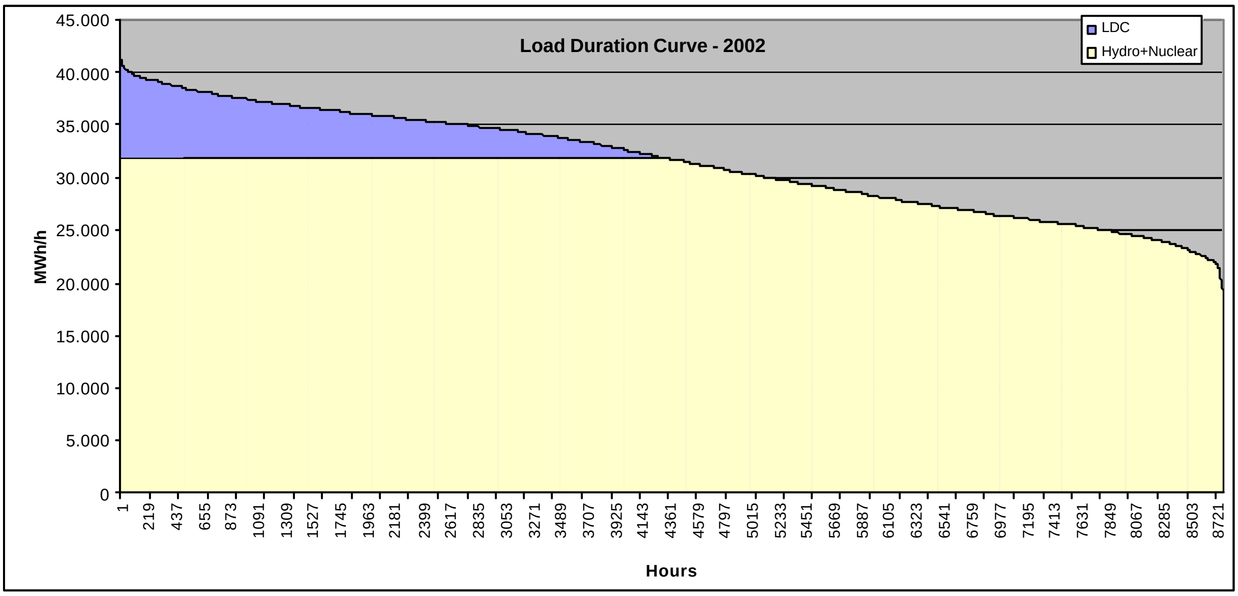
[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. Acompanhamento Diário da Operação do SIN (daily reports, 1 Jan. to 31 Dec. 2003)

[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. Resumo Geral dos Novos Emprendimentos de Geração (http://www.aneel.gov.br/, data collected in November 2004)

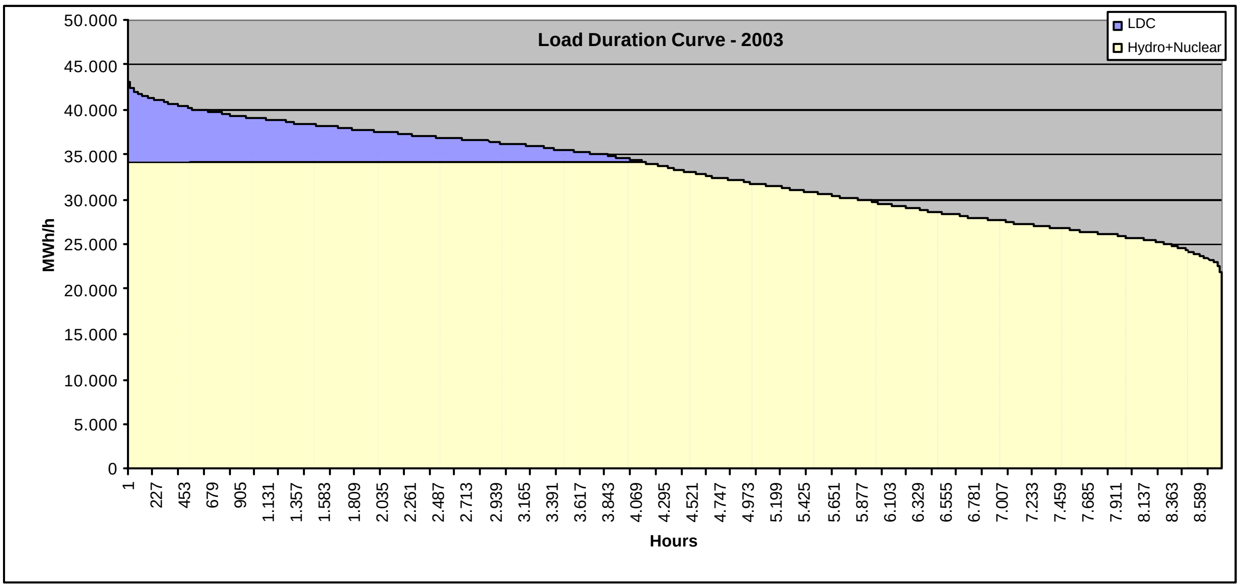
Summary table

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid

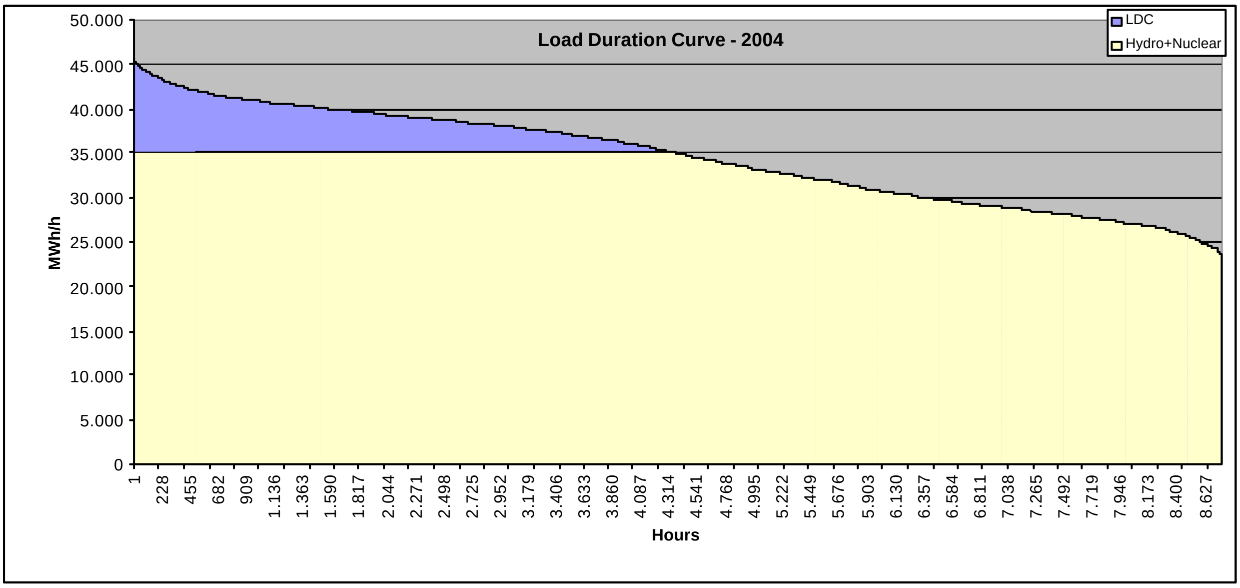
Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [GWh]	Imports [MWh]
2002	0,8504	275.402.896	258.720	1.607.395
2003	0,9378	288.493.929	274.649	459.586
2004	0,8726	297.879.874	284.748	1.468.275
	Total (2001-2003) =	**861.776.699**	**818.118**	**3.535.256**
	$EF_{OM, simple-adjusted}$ [tCO2/MWh]	**$EF_{BM,2004}$**	**Lambda**	
	0,4310	0,1256	l_{2002}	
	Alternative weights	**Default weights**	0,5053	
	w_{OM} = 0,75	w_{OM} = 0,5	l_{2003}	
	w_{BM} = 0,25	w_{BM} = 0,5	0,5312	
	EF_{CM} [tCO2/MWh]	**Default EF_{OM} [tCO2/MWh]**	l_{2004}	
	0,3547	0,2783	0,5041	



Load duration curve for the S-SE-CW system, 2002



Load duration curve for the S-SE-CW system, 2003



Load duration curve for the S-SE-CW system, 2004

Annex 4

ANNEX 4: MONITORING PLAN

Applicability

The ACM0004 Monitoring Methodology is applicable to project activities; (a) that displaces electricity generation with fossil fuels in the electricity grid or displaces captive electricity generation from fossil fuels, electricity; or (b) where no fuel switch is done in the process where the waste heat or the waste gas is produced after the implementation of the project activity.

The project activity is recovery waste gas (LDG) and use to co-generate electrical energy that will displace electricity generation from the SIN S-SE-CW.

The methodology covers both new and existing facilities. For existing facilities, the methodology applies to existing capacity, as well as to planned increases in capacity during the crediting period. If capacity expansion is planned, the added capacity must be treated as a new facility.

In this project activity there are no leakage and is not used any other auxiliary fuel, then it is not applicable and not used in this case the Monitoring Plan for project emission.

Monitoring Methodology

The methodology requires monitoring of the following:

- Net electricity generation from the proposed project activity;
- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);
- Data needed to recalculate the build margin emission factor, if needed, consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);
- Data needed to calculate the emissions factor of captive power generation.

The monitoring table is shown below.

For Electricity Generation by Project Activity

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1. EGgen	Quantitative	Total Electricity Generated	MWh/ yr	online measurement	Continuously	100%	Electronic	Credit period + 2 yrs	Monitoring location: meters at plant and DCS will measure the data. Manager Incharge would be responsible for regular calibration of the meter.
2. EGaux	Quantitative	Auxiliary Electricity*	MWh/ yr	online measurement	Continuously	100%	Electronic	Credit period + 2 yrs	Monitoring location: meters at plant and DCS will measure the data. Manager Incharge would be responsible for regular calibration.
3. EGy	Quantitative	Net Electricity supplied to facility	MWh/ yr	calculated (EGGEN - EGAUX)	Continuously	100%	Electronic	Credit period + 2 yrs	Calculated from the above measured parameters. Algorithm for project emission calculations given in baseline methodology.

* This will include electrical energy utilized by the power generating equipment in the project boundary.

For Electricity Generation by Project Activity

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
4. Q_{LDG}	Flow	Volumetric Flow of the Recovered Gas	Nm^3/h	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a flow meter associated to the project.
5. NCV_{LDG}	Quantitative	Net Calorific Value	Kcal/ Nm^3	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a calorimeter associated to the project.
6. Hr	Heat Rate	Power Plant Heat Rate	Gcal/ MWh	calculated	Monthly	100%	Eletronic	Credit period + 2 yrs	Determined from the electric energy output and the input fuels on the power plants. It is the Heat Rate average from power plant #1, #2, #3 and #4 for the considered period.
7. Q_i	Flow	Volumetric Flow of Consumed Fuels	Nm^3/h	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a flow meter associated to the project. Total flow for each consumed fuel at power plants.
8. NCV_i	Quantitative	Net Calorific Value of Fuels	Kcal/ Nm^3	online measurement	Continuously	100%	Eletronic	Credit period + 2 yrs	Measured by a calorimeter associated to the project. NCV for each fuel consumed at power plants.

For Baseline emission factor: grid power

ID number	Data type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
9. EFy	Emission factor	CO2 emission factor of the grid	tCO2 /MWh	calculated	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as a weighted sum of the OM and BM emission factors
10. EFom,y	Emission factor	CO2 Operating Margin emission factor of the grid	tCO2 /MWh	calculated	Simple OM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as indicated in the relevant OM baseline method above
11. EFbm,y	Emission factor	CO2 Build Margin emission factor of the grid	tCO2 /MWh	calculated	BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as [? i Fi,y*COEFi] / [? m GENm,y] over recently built power plants defined in the baseline

For Baseline emission factor: grid power

ID number	Data type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
12. Fi,j,y	Fuel quantity	Amount of each fossil fuel consumed by each power source / plant	t or m3/yr	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.
13. COEFi,k	Emission factor coefficie nt	CO2 emission coefficient of each fuel type and each power source	tCO2 / t or m3	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Plant or countryspecific values to calculate COEF are preferred to IPCC default values.
14. GENj,y	Electricit y quantity	Electricity generation of each power source / plant	MWh/ yr	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.

Quality Control (QC) and Quality Assurance (QA) Procedures

All measurements should use calibrated measurement equipment that is maintained regularly and checked for its functioning. QA/QC procedures for the parameters to be monitored are illustrated in the following table.

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
01 -, 08	Low	Yes	This data will be used for the calculation of project electricity generation.
09 -, 11	Low	No	This data is calculated, so does not need QA procedures
12 -, 14	Low	No	This data will be required for the calculation of baseline emissions (from grid electricity) and will be obtained through published and official sources.

Note on QA/QC: The parameters related to the performance of the project will be monitored using meters and standard testing equipment, which will be regularly calibrated following standard industry practices.