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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Project title: "Celpa, Celtins and Cemat grid connection of isolated systems" (for simplicity hereafter referred to simply as the "Grupo Rede CDM Project").

PDD version number: 01

Date: December 26, 2006.

A.2. Description of the project activity:

The purpose of the project activity is the expansion of the Brazilian interconnected grid to isolated systems in the Brazilian states of Mato Grosso, Pará and Tocantins. The interconnection will result in the complete displacement of the previous fossil fuel power generation in the isolated systems by more efficient, less carbon intensive power generation from the interconnected grid.

Celpa, Celtins and Cemat are aware about the biodiversity of the region's ecosystems. This is an important reason why the company is committed with sustainable development. Specifically for this project activity, project participant contributes to sustainable development through the following aspects:

- Reliable electricity supply for the communities that can be translated in, for example, longer conservation food and medicine, more economic opportunities for the communities, etc.
- Lowering the risk of diesel spills during fuel transportation from its origin and final use situated in distant locations.
- Reduction of local and global air pollution.
- Creation of new jobs as a consequence of increased economic development.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	CELPA - Centrais Elétricas do Pará S.A.	No
	CELTINS - Companhia de Energia Elétrica do Estado do Tocantins	
	CEMAT - Centrais Elétricas Mato-Grossenses S. A.	
	Ecoinvest Carbon Brasil	

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

Table 1 – Party(ies) and private/public entities involved in the project activity

Detailed contact information on party(ies) and private/public entities involved in the project activity is listed in Annex 1.

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.:

Mato Grosso and Pará

A.4.1.3. City/Town/Community etc:

City	Interconnected in	Geographical coordinates from http://pt.wikipedia.org/wiki/Mato_Grosso
Claudia	June-2000	11º30'54" S - 54º53'27" W
Paranaita	January-2001	09º39'54" S - 56º28'37" W
Vila Bela	January-2001	15º00'28" S - 59º57'03" W
União do Sul	April-2001	11º31'58" S - 54º21'10" W
Tapurah	July-2001	12º46'19" S - 56º33'14" W
Castanheira	September-2001	11º07'58" S - 58º36'10" W
Marcelândia	September-2001	11º07'58" S - 54º35'49" W
Canarana	May-2002	13º33'00" S - 52º09'57" W
Brasnorte	June-2003	12º09'18" S - 57º58'44" W
Sapezal	December-2005	12º59'20" S - 58º45'50" W

Table 2 – Cities/town/community interconnected in the CEMAT grid

City	Interconnected in	Geographical coordinates from http://pt.wikipedia.org/wiki/Pará
Viseu	June-2000	01º11'49" S - 46º08'24" W
Tucumã	September-2000	06º44'52" S - 51º09'39" W
São Félix do Xingu	September-2000	06º38'42" S - 51º59'42" W

Table 3 – Cities in the State of Pará

City, town, community	Interconnected in	Geographical coordinates from http://pt.wikipedia.org/wiki/Tocantins http://www.fallingrain.com/world/index.html
São Francisco	June-2000	
Principe	July-2000	11° 58' 34" S - 47° 32' 35" W
Apinajé	August-2000	11° 31' 26" S - 48° 18' 06" W
Barra das Aroeiras	October-2000	
Retiro	November-2000	11° 03' 00" S - 48° 36' 00" W
Lagoa do Tocantins	December-2000	10° 22' 40" S - 47° 33' 03" W
Porto Lemos	January-2001	
Mansinha	January-2001	09° 28' 36" S - 47° 10' 22" W
Serranópolis	January-2001	12° 06' 12" S - 47° 46' 02" W
Mateiros	February-2001	10° 32' 52" S - 46° 25' 15" W
Santa Maria	February-2001	08° 47' 49" S - 47° 47' 42" W
Trevo da Praia	February-2001	
Lizarda	March-2001	09° 35' 38" S - 46° 40' 22" W
São Félix do Tocantins	June-2001	10° 10' 04" S - 46° 39' 32" W
Centenário	June-2001	08° 57' 03" S - 47° 20' 09" W
Recursolândia	June-2001	08° 44' 13" S - 47° 14' 49" W

Table 4 – Cities in the State of Tocantins

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

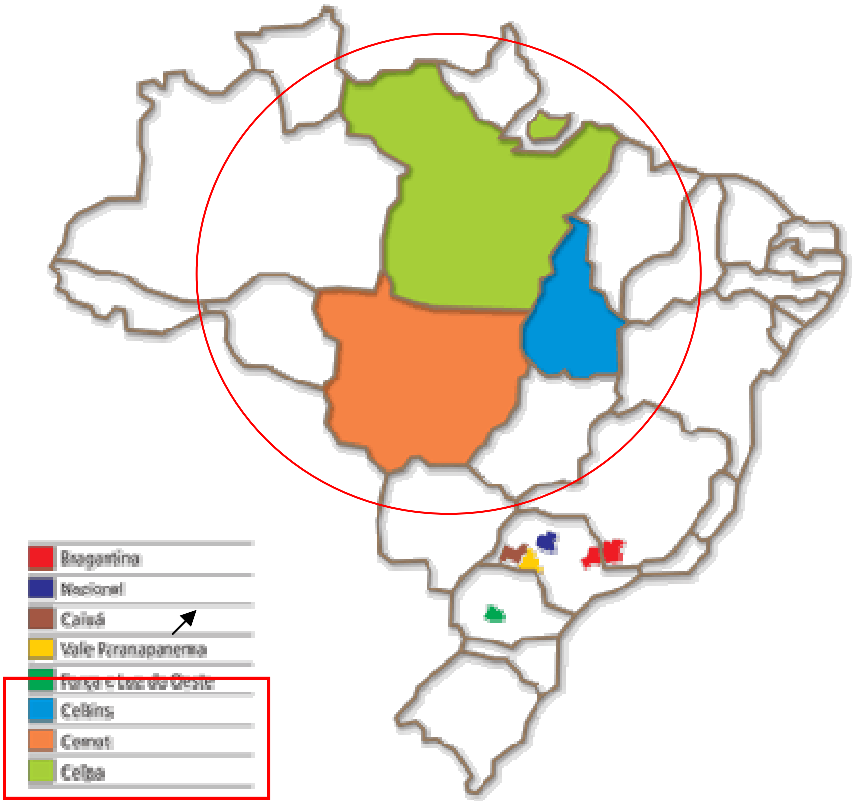

Figure 1 – Physical location of the project activity

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

Sectoral scope: 1 – Energy industries (renewable -/ non-renewable sources)

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

The Celpa, Celtins and Cemat project uses straight grid expansion technologies: high voltage (13.8 kV to 138 kV), high-strength composite conductors, power transformers, etc.

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

The estimate amount of emission reductions over crediting period is roughly 530,000 tCO_2 (Table 5).

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 1 - (2001)	11,296
Year 2 - (2002)	29,930
Year 3 - (2003)	57,476
Year 4 - (2004)	69,177
Year 5 - (2005)	69,477
Year 6 - (2006)	67,571
Year 7 - (2007)	64,454
Year 8 - (2008)	60,069
Year 9 - (2009)	55,551
Year 10 - (2010)	48,272
Total estimated reductions over the first crediting period (tonnes of CO_2e)	533,273
Length of first crediting period (years)	10
Annual average over the first crediting period of estimated reductions (tonnes of CO_2e)	53,327

Table 5 – Estimated emission reduction of the project activity

A.4.5. Public funding of the project activity:

No public funding was and will be used in the Grupo Rede CDM Project.

SECTION B. Application of a baseline and monitoring methodology

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

Grid connection of isolated electricity systems.

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

The chosen methodology is applicable to grid connection of isolated systems, as is the case of the Grupo Rede CDM Project. In this case, several isolated "mini-grids" (off-grid power generation) operating in communities in the states of Mato Grosso, Pará and Tocantins (North and Midwest Brazil) are being connected to the national grid. All fossil fuel fired power plants in the isolated systems are displaced while renewable energy based electricity generation in the respective isolated systems is not significantly affected. Historical data of power generation and fuel consumption in the isolated systems is available to accurately estimate the most likely scenario in the absence of the project activity. The calculation of the project emissions, i.e., emissions for power generation in the grid that will displace off-grid power generation, is based on available official information.

For the case of the project activity there is no actively-enforced laws mandating the interconnection of the isolated systems.

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

Only carbon dioxide emissions from combustion of fossil fuels required to operate power plant.

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

The baseline scenario is determined though the following steps:

- Identification of realistic and credible alternative scenarios that are consistent with applicable mandatory laws and regulations
- Identification of barriers and assessment of alternative scenarios that are not prevented by the barriers.
- Investment analysis

All the steps are carried out using the guidance provided in the latest version of the "*Tool for the demonstration and assessment of additionality*" (see its application in item B.5 below).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The project activity does not benefit from any different policy incentives or public subsidies granted to the present isolated fossil-fuel-fired power generation being displaced.

The “additionality tool” shall be applied conjunction with the proposed baseline methodology to describe how the anthropogenic emissions of GHG are reduced below those that would have occurred in the absence of the Grupo Rede CDM Project. The additionality tool provides a general step-wise framework for demonstrating and assessing additionality. These steps, numbered from 0 to 5, include:

0. Preliminary screening
1. Identification of alternatives to the project activity
2. Investment analysis AND/OR
3. Barrier analysis
4. Common practice analysis
5. Impact of CDM registration

The application of the additionality tool to the Cemat Project follows.

Step 0. Preliminary screening based on the project start date.

Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of registration of a first CDM project activity.

The project activity has been extending the grid and phasing out Diesel generators in these communities from June 2000 onwards. The evidence of deactivation schedule can be found in various available official documents from ANEEL (National Electricity Agency), MME (Ministry of Mines and Energy) and Eletrobras (federally-owned Brazilian Power Utility). For example, in Eletrobras (2000) and Eletrobras (2001).

Provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity.

Due to high costs of grid extension, any incentive was seriously considered. The possibility to obtain CDM incentives was assessed by CEMAT in the beginning of 2000. Official company’s internal documentation as well as third party proposal (from Sinerconsult) to develop the CDM assessment are available upon request (board meeting’s minutes, project’s financial spreadsheet calculations with and without CERs incentives, correspondence with experts on the subject, etc.).

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

Sub-step 1a. Define alternatives to the project activity.

There are some realistic and credible alternatives for the project activity (Table 6).

Realistic and Credible Alternative	Pros	Cons

1. Project Activity not undertaken – Project participants would keep installed diesel generators.	There are financial incentives for fossil fuel power generation in the isolated systems.	Air pollution, potential water and land contamination. Not steadily supply.
2. Project Activity not undertaken now and implemented at a later point in time	Project participants would not invest their capital, would receive financial incentives for fossil fuel generation in isolated systems, and could wait for a new investment decision at least up to the end of the lifetime of the existing plants.	Air pollution, potential water and land contamination. Not steadily supply.
3. Generation of power using other energy sources than grid extension, such as wind, solar, biomass…	No direct GHG emission related.	Difficult maintenance, high cost of investment, and not steadily supply.

Table 6 - Project activity alternatives assessment

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

2. All the alternatives and the project activity are in compliance with all applicable and regulatory requirements.

3. Not applicable.

4. Non-applicable. Both the project activity and the alternative scenario are in compliance with all applicable legal and regulatory requirements.

Step 2. Investment Analysis

Follows a brief description of the financing and institutional arrangements in place in the country to facilitate the expansion of the interconnected grid to isolated systems.

The Fuel Consumption Account - CCC ("Conta de Consumo de Combustível"), in force since 1993, was implemented in Brazil, aiming the reduction of the cost differences between the two systems (grid and isolated). Through the CCC part of the financial resources collected from the energy supply in the grid system is used to reduce the cost differences in the energy production in isolated systems. Initially the CCC was used to subsidize the cost of fossil-fuel-based power generation in isolated systems but today it can be used, under special conditions, for other power supply options (for example, renewable energy based power generation, interconnection of isolated systems to the national grid, etc). Nevertheless, power generation using fossil fuels are eligible under the CCC to remain receiving the incentives from CCC at least up to 2020. It should be noted that there is already a history of postponement of deadline, which was originally applicable until 2013.

Sub-step 2a. Determine the appropriate analysis method

The CDM project activity generates no financial or economic benefits other than the CDM related income. For that reason simple cost analysis will be applied.

Sub-step 2b. – Option I - Simple cost analysis

It shall be noted that the implementation of the project activity as well as alternatives three would require additional investment, while alternatives one and two do not require any additional investment from the project participants. For that reason it is straightforward that the implementation of the project activity as well as alternative 3 produce no economic benefit other than the CDM related revenues while compared with alternatives one and two.

Step 3. Barrier Analysis.

Sub-step 3a. Identify barriers that would prevent a wide spread implementation of the proposed project activity.

As stated before, the choice for the project activity implied important changes and additional costs facing an uncertain scenario. These changes represented barriers for the project to happen in the absence of the incentives of the Clean Development Mechanism.

High up front cost / "Investment Barriers" – Due to Brazilian continental dimensions, grid extension requires high upfront investments; this is intensified since the grid extension would occur in areas with have rich biodiversities, and high environmental compensation costs.

High and unstable interest rate for the available credit / "Interest Rate Barriers" – In order to develop an accurate investment analysis in Brazil the Brazilian Prime Rate, known, as SELIC rate, as well as the CDI – Interbank Deposit Certificate that leads the short-term credit market need to be taken into account. Real interest rates have been extraordinarily high since the Real plan stabilized inflation in 1994.

As a consequence of the long period of inflation, the Brazilian currency experienced a strong devaluation, effectively precluding commercial banks from providing any long-term debt financing. The lack of a long-term debt market has had a severely negative direct impact on the financing of energy projects in Brazil.

Interest rates for local currency financing are significantly higher than for US Dollar financing. The National Development Bank – BNDES is basically the only supplier of long-term loans. Debt financing from BNDES are made primarily through commercial banks. The credit market is dominated by shorter maturities (90-days to 1-year) and long-term credit lines are available only to the strongest corporate borrowers and for special government initiatives. Credit is, thus, restricted to the short-term in Brazil or the long-term in dollars offshore.

Financial domestic markets with a maturity of greater than 1 year is practically non-existent in Brazil. Experience has shown that in moments of financial stress the duration of savings instruments have contracted drops to levels close to one day by massive concentration in overnight banking deposits. Savers do not hold long-term financial contracts due to the inability to price-in the uncertainty involved in the preservation of purchasing power value (Arida, Bacha & Lara Resende, 2004).

The lack of a local long-term market results not from a disinterest of financial investment opportunities, but from the reluctance of creditors and savers to lengthen the term of their placements. It has made savers opt for the most liquid form and to place their money in short-term government bonds instead of investing in long-term opportunities that could finance infrastructure projects.

The most liquid government bond is the LFT (floating rate bonds based on the daily Central Bank reference rate). As of January 2004, 51.1% of the domestic federal debt was in LFTs and has duration of one day. This bond rate is almost the same as the CDI - Interbank Deposit Certificate rate that is influenced by the SELIC rate, defined by COPOM[1] (Figure 2).

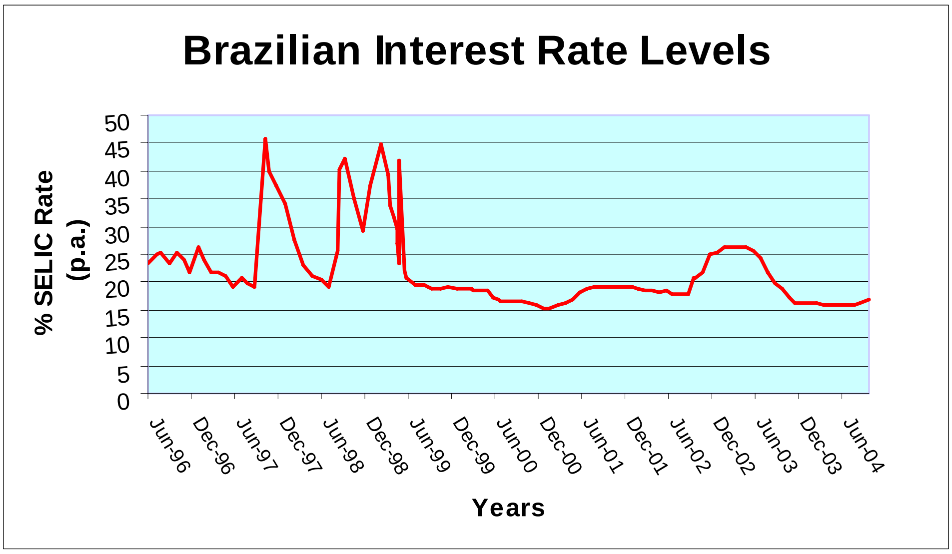

Figure 2 - SELIC rate (Source: Banco Central do Brasil)

The SELIC Rate has been very volatile ranging from a minimum of 15% p.a. in January 2001 to a maximum of 45% p.a. in March 1999.

As it can be noticed, in Brazil, due to the facts listed above, the most reasonable way to finance infrastructure projects – witch required a large amount of money in the initial investment - is the National Development Bank (BNDES).

Since the project activity demands high initial investments the SELIC rate gains extra importance. The distribution companies have been dealing with financial agents in order to get better rates.

Also, the companies there are no access to international capital markets due to real or perceived risks associated with domestic or foreign direct investment in Brazil.

Environmental license / "License Barriers" – Since the peculiarities of the area where the electric grids extensions take place, several environmental studies have to be carried out. The distribution companies are concerned about that and they have been developing all the studies required. This demands resources such as time and money.

Technology requirements / "Technological Barriers" – The technology to extend grids is already known in Brazil however, in order to maximally mitigate environmental impacts, best available technology is necessary. The companies are aware about that and they have been dedicating studies to accomplish it. Also, educate communities' inhabitants to rationally use electricity may need some expertise.

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives.

The influence of each one of the barriers is shown in Table 7 .

[1] COPOM – Comitê de Politica Monetária (Monetary Policy Commitee)

Barriers	(1) - Project Activity not undertaken	(2) - Project Activity not undertaken now and implemented at a later point in time	(3) - Generation of power using other energy sources than grid extension, such as wind, solar, biomass…	(4) - Project Activity
(1) - Invest. Barrier	Do not prevent implementation	Prevent implementation	Strongly prevent implementation	Prevent implementation
(2) - Interest Rate Barrier	Do not prevent implementation	Prevent implementation	Strongly Prevent implementation	Strongly Prevent implementation
(3) - License Barriers	Do not prevent implementation	Prevent implementation	Prevent implementation	Prevent implementation
(4) – Technical Barriers	Do not prevent implementation	Prevent implementation	Strongly Prevent implementation	Prevent implementation
Result	Barriers do not prevent implementation	Barriers prevent implementation	Barriers prevent implementation	Barriers prevent implementation

Table 7 - Influence of barriers in the alternatives to the project activity.

Step 4. Common practice analysis

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

To the best of the project proponent’s knowledge all similar activities are being implemented either with CDM incentives or 100% financed with government funds.

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

To the best of the project proponent’s knowledge all similar activities are being implemented either with CDM incentives or 100% financed with government funds.

Step 5 – Impact of CDM Registration

Diesel oil consumed for electricity generation in isolated areas is subsidized through the Fuel Consumption Account - CCC (Conta de Consumo de Combustível). Without absolutely any change in the previous configuration of the isolated systems under evaluation, the existing diesel-fired power generation is eligible to remain receiving the incentives from CCC without any risk up to 2020 (the incentives are calculated to make the generation with diesel feasible).

The barriers mentioned above demonstrated that the investment in the project activity without the incentive of the CDM is a risky entrepreneurship. With the incentive of the CDM it still is. In other words, without the incentives from the CDM the most likely scenario is to keep the diesel power plants in operation and the system isolated.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions are calculated based on the isolated system at the time of the interconnection to the grid. The lifetime decrease of the existing equipments and potential demand increase must be taken into account.

The methodology considers for the calculation of the project emissions the determination of the emission factor for the relevant grid to which the project activity is connected as the core data to be determined according to the concept of combined margin emission factor (ACM0002, 2006). Emission related to SF6 use and potentially higher transmissions losses are taken into account.

Leakage related to deforestation in the construction of interconnection lines is estimated and, if higher than 1% of the estimated emission reduction of the project activity in the first crediting period must be taken into account.

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

Data / Parameter:	1 - EG_y
Data unit:	MWh
Description:	electricity supplied by the grid to the project activity
Source of data used:	Project activity
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Directly measured data. Double check by receipt of sales/payment.
Any comment:	

Data / Parameter:	2 - EF_p
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data used:	Project activity (calculated based on information from producers, dispatch centers, electricity agencies or literature).
Value applied:	S-SE-MW grid: EF_p = 0.261 tCO_2/MWh N-NE grid: EF_p = 0.077 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Raw data made available by the Brazilian dispatch center (ONS).
Any comment:	

Data / Parameter:	3 - $EF_{OM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 operating margin emission factor of the grid
Source of data used:	Project activity (calculated based on information from producers, dispatch centers, electricity agencies or literature).
Value applied:	S-SE-MW grid: $EF_{OM,p}$ = 0.435 tCO_2/MWh N-NE grid: $EF_{OM,p}$ = 0.104 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Raw data made available by the Brazilian dispatch center (ONS).
Any comment:	

Data / Parameter:	4 - $EF_{BM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 build margin emission factor of the grid
Source of data used:	Project activity (calculated based on information from producers, dispatch centers, electricity agencies or literature).
Value applied:	S-SE-MW grid: $EF_{BM,p}$ = 0.087 tCO_2/MWh N-NE grid: $EF_{BM,p}$ = 0.049 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Raw data made available by the Brazilian dispatch center (ONS).
Any comment:	

Data / Parameter:	5 - $F_{i,j}$
Data unit:	Mass of volume
Description:	Amount of fossil fuel consumed by each power plant
Source of data used:	Latest local statistics
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Raw data made available by the Brazilian dispatch center (ONS).
Any comment:	

Data / Parameter:	6 - $COEF_i$

Data unit:	tCO_2/mass or volume unit
Description:	CO_2 emission coefficient of each fuel type *i*
Source of data used:	Latest local statistics
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Publicly available official data. Default data and literature statistics are used to check the local data.
Any comment:	

Data / Parameter:	7 - $GEN_{i/j/k,y}$
Data unit:	MWh/a
Description:	Electricity generation of each power plant
Source of data used:	Latest local statistics
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Publicly available official data.
Any comment:	

Data / Parameter:	10 - $GEN_{i/j/k,y\ IMPORTS}$
Data unit:	MWh
Description:	Electricity imports quantity to the project electricity system
Source of data used:	Latest local statistics
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Publicly available official data.
Any comment:	

Data / Parameter:	11 - $COEF_{i,IMPORTS}$
Data unit:	tCO_2/mass or volume unit
Description:	CO_2 emission coefficient of each fuel type *i*
Source of data used:	Latest local statistics

Value applied:	0 (zero)
Justification of the choice of data or description of measurement methods and procedures actually applied :	For conservative reasons.
Any comment:	

Data / Parameter:	12 - $M_{SF6, y}$
Data unit:	tonnes of SF_6
Description:	CF_6 leaks in the equipments during year y in
Source of data used:	Project activity
Value applied:	0.030 tonnes of SF_6
Justification of the choice of data or description of measurement methods and procedures actually applied :	The average annual quantity of SF_6 leaks in the equipments during year y in tonnes of SF_6 informed by the manufactures of equipments is of around 1% of its charge. For the project the inventory of project indicate a total amount of around 1100 kg of SF_6 in the operating equipments. Therefore, an estimated yearly leak of around 11 kg of SF_6 (0.011 tonnes) is assumed.
Any comment:	

Data / Parameter:	13 - $A_{,def}$
Data unit:	hectares
Description:	Area of land deforested in the construction of the interconnection lines.
Source of data used:	Project activity
Value applied:	130 ha
Justification of the choice of data or description of measurement methods and procedures actually applied :	Deforestation of area not exploited for commercial use has to be officially requested.
Any comment:	

Data / Parameter:	14 - *TL*
Data unit:	%

Description:	Additional transmission losses
Source of data used:	Project activity
Value applied:	1 %
Justification of the choice of data or description of measurement methods and procedures actually applied :	Directly measure data.
Any comment:	

Data / Parameter:	15 - Public policies
Data unit:	
Description:	Verification and evaluation of financial and institutional arrangements that could help the implementation of the project.
Source of data used:	Project activity
Value applied:	All policies applicable to the project activity is also applicable to the existing diesel-fired power generation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Publicly available official data.
Any comment:	

Data / Parameter:	16 - $S_{ini\text{-}ig}$
Data unit:	MW_{med}
Description:	Power supply capacity of the interconnected grid that is to be extended is determined at the beginning of the project activity.
Source of data used:	Latest local statistics
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Publicly available official data.
Any comment:	Based on the most recent statistics available at the time of CDM-PDD

	submission. Obtained from producers, dispatch centers, electricity agencies or literature.

Data / Parameter:	17 - $D_{ig\text{-}yp}$
Data unit:	MW_{med}
Description:	Demand of the interconnected grid in the baseline scenario, i.e., without the interconnection of the isolated system.
Source of data used:	Latest local statistics
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Publicly available official data. Electricity demand increase rate of 5% a. a. assumed (33,000 MW_{med} in 2001).
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

For the calculation of the project emissions, the possible development scenarios for the interconnected grid have to be evaluated. The applicable scenario is the following:

There is a surplus generation capacity in the interconnected grid. Nevertheless additional generation capacity will be needed during the crediting period. To monitor the situation, the power supply capacity, $S_{ini\text{-}ig}$ (in MW_{med}[2]), of the interconnected grid that is to be extended is determined at the beginning of the project activity as well as its demand in the baseline scenario, $D_{ig\text{-}yp}$ (in MW_{med}), i.e., without the interconnection of the isolated system. The demand of the previously isolated system, D_{yp} (in MW_{med}), is monitored during the crediting period. The scenario is applicable if: at the befinning of the project $S_{ini\text{-}ig} > D_{ig\text{-}yp} + D_y$ and $S_{ini\text{-}ig} < D_{ig\text{-}yp} + D_{yp}$ at the end of the crediting period. In this case, the emission factor of the project to be used is the combined margin emission factor of the interconnected grid. From the data available shown above (item B.6.2, data/parameter 16 and 17), that there will be surplus generation until 2004 ($S_{ini\text{-}ig} > D_{ig\text{-}yp} + D_y$). From 2005 onwards on the other hand there will be no surplus generation anymore ($S_{ini\text{-}ig} < D_{ig\text{-}yp} + D_{yp}$).

According to the methodology, the project is to determine the Simple Adjusted OM Emission Factor ($EF_{OM,\ simple\ adjusted,\ y}$, in tCO_2e/GWh). Therefore, the following equation is to be solved:

[2] In the calculation of the power supply capacity the specifics of each technology (hydrology for hydropower, fuel availability for thermal power plants, etc) must be taken into account.

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}}$$ **Equation 1**

It is assumed here that all the low-cost/must-run plants produce zero net emissions.

$$\frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} = 0 \text{ (tCO}_2\text{e/GWh)}$$ **Equation 2**

Please refer to ACM0002 (2004) for the explanations on the variables mentioned above.

The ONS data as well as the spreadsheet data with the calculation of emission factors have been provided to the DOE. In the spreadsheet, the dispatch data is treated as to allow calculation of the emission factor for the most three recent years with available information, which are 2003, 2004 and 2005.

The Lambda factors were calculated according to the methodology guidance. Electricity generation for each year needs also to be taken into account.

According to the methodology used, a Build Margin emission factor also needs to be determined.

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_m GEN_{m,y}}$$ **Equation 3**

Electricity generation in this case means 20% of total generation in the most recent year (2005), as the 5 most recent plants built generate less than such 20%.

Finally, the electricity emission factor is calculated through a weighted-average formula, considering both the OM and the BM, being the weights 50% and 50% by default.

Total project emissions (PE_y in tCO_2) are:

$$PE_y = (EG_y \cdot EF_p) \cdot (TL+1) + PE_{SF6,y} + PE_{def}$$

The average annual quantity of SF_6 leaks in the equipments during year y in tonnes of SF_6 informed by the manufactures of equipments is of around 1% of its charge. For the project the inventory of project indicate a total amount of around 1100 kg of SF_6 in the operating equipments. Therefore, an estimated yearly leak of around 11 kg of SF_6 (0.011 tonnes) is assumed.

$$PE_{SF6,y} = M_{SF6,y} \cdot GWP_{SF6}$$

For the present project, the project participants estimated additional transmission losses higher than the grid average of around 1% (TL = 0.01).

Possible emissions potentially giving rise to leakage in the context of electrification projects are emissions arising due to transmission lines construction.

Regarding deforestation, the net change in aboveground biomass is the difference between the density (t dm/ha) of aboveground biomass on the forest prior to the conversion, and the density of aboveground living biomass (t dm/ha) remaining as living vegetation, after clearing. The climatic zone of the project area is classified as "savana arbórea aberta" according to Brazilian National Communication In this case, $L_C = 15.39\ tC/ha = 15.39 \cdot (44/12) = 56.43\ tCO_2e/ha$. For the present project a total of 2,600 km of transmission lines were installed, needing an average corridor of 10 m. The lines were constructed preferentially over existing roads and areas already under commercial/agricultural use (for example, pasture) exactly to avoid unnecessary deforestation. Under the previous assumptions the project participants were are to design the project with an average of 5% of the needed are being deforested.

In the first crediting period estimated emission reductions are of roughly 500,000 tCO_2e. Therefore, the leakage due to deforestation is above 1 % of the estimated emission reductions (around 1.4%). It will be fully deducted from the emissions reductions in the first project year.

The baseline emission factor ($EF_{bl,\ ini}$) of the isolated system at the time of the interconnection to the grid is calculated as the generation weighted average emissions per electricity unit (tCO_2/MWh) in the most recent three years before the connection to the grid of all generating units displaced in the isolated system using **Error! Reference source not found.**:

$$EF_{bl,ini} = \frac{\sum_{i,j} F_{i,j,bl} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,bl}}$$ **Equation 4**

Where:

- $\sum_{i,j} F_{i,j,bl}$ is the amount of fuel *i* (in mass or volume unit) consumed by relevant power sources *j* in year(s) *y* in the baseline scenario,
- $COEF_{i,j}$ is the CO_{2e} coefficient of fuel *i* (tCO_2e/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y* in the baseline scenario and,
- $\sum_{j} GEN_{j,bl}$ is the electricity (MWh) delivered to the isolated system by source *j* in the baseline scenario.

The $EF_{bl,\ ini}$ is a fixed *EF* per MWh and remains constant for every year in the crediting period. The *EF* should be calculated using a 3-year average, based on the most recent statistics available at the time of CDM-PDD submission.

$$S_{yp} = S_{ini} - S_{ini} \div \left(2 \cdot LT_{avg}\right) \cdot yp \text{ , if } yp < 2 \cdot LT_{avg}$$ **Equation 5**

$$S_{yp} = 0 \text{ , if } yp \geq 2 \cdot LT_{avg}$$ **Equation 6**

Where:

- S_{yp} *is the electricity supplied to previously isolated system (in* MW_{med}*) if its equipments were not replaced at the end of their lifetime in project year yp,*
- S_{ini} *is the supply capacity of the isolated system (in* MW_{med}*) at the time of the interconnection to the grid,*
- yp *is the number of years since the interconnection to the grid (project year)*

- LT_{avg} *is the average remaining lifetime of the equipments used in the isolated system at the time of the interconnection,*

The technology used in all the displaced isolated systems is internal combustion engines using diesel as fuel. For the used technology, it is assumed:

- $EF_{bl,BAT} = 0.6\ tCO_2/MWh$

For the calculation of the baseline emission factor, the following equations have to be used.

$$EF_{bl,yp} = EF_{bl} \text{ , if } S_{yp} > 0 \text{ and } S_{yp} > D_{yp}$$ **Equation 7**

$$EF_{bl,yp} = [EF_{bl} \times S_{yp} + EF_{BAT} \times (D_{yp} - S_{yp})] \div D_{yp} \text{ , if } S_{yp} > 0 \text{ and } S_{yp} < D_{yp}$$ **Equation 8**

$$EF_{bl,yp} = EF_{BAT} \text{ , if } S_{yp} = 0$$ **Equation 9**

Where:

- $EF_{bl,yp}$ *is the baseline emission factor (in tCO_{2e}/mass or volume unit of the fuel) of the project (previously isolated system at year* yp*),*
- D_{yp} *is the electricity demand of the project (previously isolated system at year* yp*)*
- EF_{BAT} *is the baseline emission factor (in tCO_{2e}/mass or volume unit of the fuel) for the kind of technology displaced in the isolated system*

The baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor ($EF_{bl,yp}$ in tCO_2/MWh), times the electricity supplied by the grid to the project activity (EG_y in MWh).

$$BE_y = EG_y \cdot EF_{bl,yp}$$ **Equation 10**

The project activity mainly reduces carbon dioxide through substitution of isolated systems electricity generation with fossil fuel fired power plants by electricity supplied by an interconnected grid. The emission reduction (ER_y, in tCO_2) by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y - L_y$$ **Equation 11**

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

Years	**Estimation of project activity emissions** (tonnes of CO_2e)	**Estimation of baseline emissions** (tonnes of CO_2e)	**Estimation of leakage** (tonnes of CO_2e)	**Estimation of emission reductions** (tonnes of CO_2e)
Year 1 - (2001)	1,980	20,617	7,341	11,296
Year 2 - (2002)	12,257	53,483	0.0	29,930
Year 3 - (2003)	20,119	77,595	0.0	57,476
Year 4 - (2004)	26,267	95,444	0.0	69,177
Year 5 - (2005)	27,109	96,586	0.0	69,477
Year 6 - (2006)	27,443	95,014	0.0	67,571
Year 7 - (2007)	27,443	91,897	0.0	64,454
Year 8 - (2008)	27,443	87,512	0.0	60,069
Year 9 - (2009)	27,443	82,994	0.0	55,551
Year 10 - (2010)	27,443	75,715	0.0	48,272
Total (tonnes of CO_2e)	224,947	776,857	7,341	533,273

Table 8 – Estimation of GHG emission by sources

Table 5 was prepared assuming a yearly electricity demand increase rate of 5%.

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

B.7.1 Data and parameters monitored:

Data / Parameter:	1 - EG_y
Data unit:	MWh
Description:	electricity supplied by the grid to the project activity
Source of data to be used:	Project activity
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of measurement methods and procedures to be applied:	Electricity meter. Double check by receipt of sales/payment.
QA/QC procedures to be applied:	Directly measured or publicly available official data. Double check by receipt of sales/payment. Default data and literature statistics are used to check the local data.
Any comment:	

Data / Parameter:	2 - EF_p
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data to be used:	Project activity (calculated based on information from producers, dispatch centers, electricity agencies or literature).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of measurement methods and procedures to be applied:	Raw data made available by plant operators, dispatch centers, electricity agencies or literature, therefore, no detailed information on measurement methods available.
QA/QC procedures to be applied:	Directly measured or publicly available official data. Default data and literature statistics are used to check the local data.
Any comment:	

Data / Parameter:	3 - $EF_{OM,y}$

Data unit:	tCO_2/MWh
Description:	CO_2 operating margin emission factor of the grid
Source of data to be used:	Project activity (calculated based on information from producers, dispatch centers, electricity agencies or literature).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of measurement methods and procedures to be applied:	Raw data made available by plant operators, dispatch centers, electricity agencies or literature, therefore, no detailed information on measurement methods available.
QA/QC procedures to be applied:	Directly measured or publicly available official data. Default data and literature statistics are used to check the local data.
Any comment:	

Data / Parameter:	4 - $EF_{BM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 build margin emission factor of the grid
Source of data to be used:	Project activity (calculated based on information from producers, dispatch centers, electricity agencies or literature).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of measurement methods and procedures to be applied:	Raw data made available by plant operators, dispatch centers, electricity agencies or literature, therefore, no detailed information on measurement methods available.
QA/QC procedures to be applied:	Directly measured or publicly available official data. Default data and literature statistics are used to check the local data.
Any comment:	

Data / Parameter:	5 - $F_{i,j}$
Data unit:	Mass of volume
Description:	Amount of fossil fuel consumed by each power plant
Source of data to be used:	Latest local statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of	Raw data made available by plant operators, dispatch centers, electricity agencies

measurement methods and procedures to be applied:	or literature, therefore, no detailed information on measurement methods available.
QA/QC procedures to be applied:	Directly measured or publicly available official data.
Any comment:	

Data / Parameter:	6 - $COEF_i$
Data unit:	tCO_2/mass or volume unit
Description:	CO_2 emission coefficient of each fuel type *i*
Source of data to be used:	Latest local statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of measurement methods and procedures to be applied:	Raw data made available by plant operators, dispatch centers, electricity agencies or literature, therefore, no detailed information on measurement methods available.
QA/QC procedures to be applied:	Publicly available official data. Default data and literature statistics are used to check the local data.
Any comment:	

Data / Parameter:	7 - $GEN_{i/j/k,y}$
Data unit:	MWh/a
Description:	Electricity generation of each power plant
Source of data to be used:	Latest local statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of measurement methods and procedures to be applied:	Obtained from producers, dispatch centers, electricity agencies or literature.
QA/QC procedures to be applied:	Directly measured or publicly available official data.
Any comment:	

Data / Parameter:	8 -
Data unit:	text

Description:	Plant name
Source of data to be used:	Latest local statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each plant of the grid, raw data available for validation.
Description of measurement methods and procedures to be applied:	Obtained from producers, dispatch centers, electricity agencies or literature.
QA/QC procedures to be applied:	Not applicable.
Any comment:	

Data / Parameter:	10 - $GEN_{i/j/k,y\ IMPORTS}$
Data unit:	MWh
Description:	Electricity imports quantity to the project electricity system
Source of data to be used:	Latest local statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Massive amount of data, individual values for each day, raw data available for validation.
Description of measurement methods and procedures to be applied:	Obtained from producers, dispatch centers, electricity agencies or literature.
QA/QC procedures to be applied:	Directly measured or publicly available official data.
Any comment:	

Data / Parameter:	11 - $COEF_{i,IMPORTS}$
Data unit:	tCO_2/mass or volume unit
Description:	CO_2 emission coefficient of each fuel type *i* (if imports occur)
Source of data to be used:	Latest local statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Carbon emission coefficients from imports are considered zero.
Description of measurement methods	Raw data made available by plant operators, dispatch centers, electricity agencies or literature, therefore, no detailed information on measurement methods

and procedures to be applied:	available.
QA/QC procedures to be applied:	Publicly available official data. Default data and literature statistics are used to check the local data.
Any comment:	

Data / Parameter:	12 - $M_{SF6, y}$
Data unit:	tonnes of SF_6
Description:	SF_6 leaks in the equipments during year y in
Source of data to be used:	Project activity
Value of data applied for the purpose of calculating expected emission reductions in section B.5	11 kgSF_6/year
Description of measurement methods and procedures to be applied:	Directly measured data. Double check by receipt of purchase.
QA/QC procedures to be applied:	Directly measured data.
Any comment:	

Data / Parameter:	13 - $A_{,def}$
Data unit:	hectares
Description:	Area of land deforested in the construction of the interconnection lines.
Source of data to be used:	Project activity
Value of data applied for the purpose of calculating expected emission reductions in section B.5	25 ha
Description of measurement methods and procedures to be applied:	Deforestation of area not exploited for commercial use has to be officially requested.
QA/QC procedures to be applied:	Directly measured data.
Any comment:	

Data / Parameter:	14 - *TL*
Data unit:	%
Description:	Additional transmission losses

Source of data to be used:	Project activity
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1 %
Description of measurement methods and procedures to be applied:	Directly measure data or latest local statistics.
QA/QC procedures to be applied:	Directly measured data.
Any comment:	

B.7.2 Description of the monitoring plan:

In order to adequately calculate project and baseline emissions, the methodology requires from the project participants monitoring of the following data:

- From the project activity: electricity generation, SF_6 use (injected in the equipments to maintain their operation standards), deforested area for the construction of the transmission lines, as well as the operation (or not) of the plants that server the isolated system before the implementation of the 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).

All necessary operational and management structures necessary to monitor emissions reductions and any leakage effects generated by the project activity are common practice in the operation of the Grupo Rede CDM Project.

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

Company:	Ecoinvest Carbon
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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/06/2000

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

30y-0m

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

C.2.1. Renewable crediting period

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

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2000

C.2.2.2. Length:

10y-0m

SECTION D. Environmental impacts

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

The main environmental impacts of grid extension are related to clearing-road activities and transmission line construction. In the Grupo Rede CDM Project transmission lines are being preferably built using existing roadways to minimize environmental impacts.

CEMAT is aware about all environmental laws and regulations and they have been fulfilling all environmental demands. All necessary environmental and operation licenses are already issue and are available upon request.

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

Brazil, the host Party of this project, is fully aware about the importance of environmental impact studies as well as Grupo Rede CDM Project that actually states social corporate responsibility is part of its activities. It is also committed to the environment, which has a huge biodiversity in their areas of actuation, and to the people of these communities through social programs.

Mitigation plans were/are/will be developed in order to deal with any environmental impact which was/is/will be expected in environmental impact studies for this project activity.

Actually, some benefits were observed after mitigation measures were implemented. Transmission lines used to be built without any protection/signalization. After the lines installation birds deaths were reported. After some changes in the line, such as better protection/signaliztion, there are no registered bird death. Documents and statistics related to Cemat’s environmental programs are available under request.

SECTION E. Stakeholders' comments

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

The Brazilian Designated National Authority for the CDM ("Comissão Interministerial de Mudanças Globais de Clima"), under other requirements, demands the translation of the PDD into Portuguese, the compulsory invitation of selected local stakeholders, the validation report issued by an authorized DOE (CIMGC resolution number 1, September 11, 2003), under other requirements, in order to provide the letter of approval.

The proponent of the project will send letters to the important stakeholders in order to invite their comments while the PDD of the project is open for comments in the validation stage in the United Nations Framework Convention on Climate Change.

E.2. Summary of the comments received:

Brazilian DNA for the CDM requests project activities to be open for comments prior to validation. Thus, in addition to UNFCCC global stakeholders' comments process this project will be open for inputs from local stakeholders at the same time. Any comments will be disclosed after validation.

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

All demands received in the context of the environmental licensing and operation permits process were carefully evaluated and finally incorporated to the implementation of the project.

Brazilian DNA for the CDM requests project activities to be open for comments prior to validation. Thus, in addition to UNFCCC global stakeholders' comments process this project will be open for inputs from local stakeholders at the same time. Any comments will be disclosed after validation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was and will be used in the present project.

Annex 3

BASELINE INFORMATION

The Brazilian electricity system (Figure 3) has been historically divided into two subsystems: the North-Northeast (N-NE) and the South-Southeast-Midwest (S-SE-CO, From the Portuguese *Sul-SudEste-Centro-Oeste*). 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.

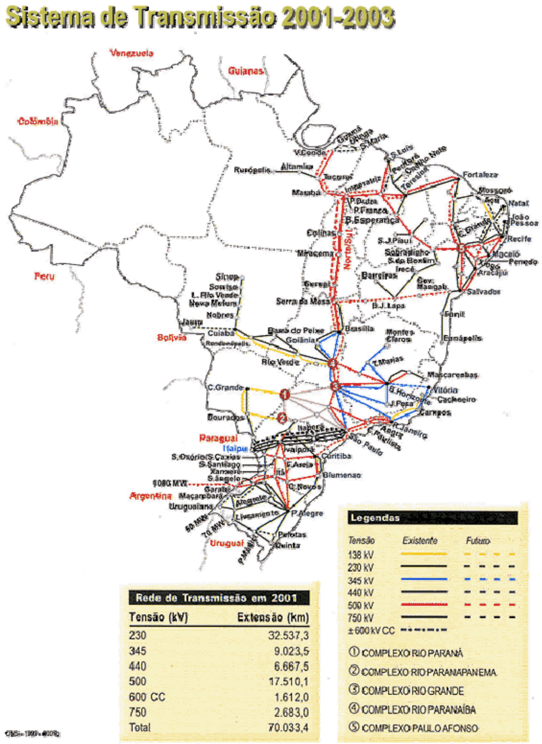

Figure 3 - Brazilian Interconnected System (Source: ONS)

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

"… 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 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 ACM0002 asks project proponents to account for "all generating sources serving the system". In that way, when applying the methodology, 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. 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 from Bosi *et al.* (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 (Table 9).

Year	$EF_{OM\ non\text{-}low\text{-}cost/must\text{-}run}$ [tCO_2/MWh]		EF_{BM} [tCO_2/MWh]	
	Ex-ante	Ex-post	Ex-ante	Ex-post
2001-2003	0.719	0.950	0.569	0.096

Table 9 – Ex ante and ex-post operating and build margin emission factors (ONS-ADO, 2004; Bosi et al., 2002).

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 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. The figures below show the load duration curves for the three considered years, as well as the lambda calculated.

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

Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [MWh]	Imports [MWh]
2003	0.9823	288,933,290	274,670,644	459,586
2004	0.9163	302,906,198	284,748,295	1,468,275
2005	0.8086	314,533,592	296,690,687	3,535,252
	Total (2003-2005) =	906,373,081	856,109,626	5,463,113
	$EF_{OM,\ simple\text{-}adjusted}$ [tCO2/MWh]	$EF_{BM,2005}$	Lambda	
	0.4349	0.0872	λ_{2003}	
	Alternative weights	Default weights	0.5312	
	w_{OM} = 0.75	w_{OM} = 0.5	λ_{2004}	
	w_{BM} = 0.25	w_{BM} = 0.5	0.5055	
	Alternative EF_y [tCO2/MWh]	Default EF_y [tCO2/MWh]	λ_{2005}	
	0.3480	0.2611	0.5130	

Emission Factor for the Brazilian North-Northeast Interconnected grid

Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [MWh]	Imports [MWh]
2003	0.1264	76,935,819	75,994,843	7,632,626
2004	0.3289	81,199,780	78,248,786	3,826,422
2005	0.2702	85,818,478	83,269,838	4,790,635
	Total (2003-2005) =	243,954,076	237,513,467	16,249,684
	$EF_{OM,\ simple\text{-}adjusted}$ [tCO2/MWh]	$EF_{BM,2005}$	Lambda	
	0.1044	0.0491	λ_{2003}	
	Alternative weights	Default weights	0.7192	
	w_{OM} = 0.75	w_{OM} = 0.5	λ_{2004}	
	w_{BM} = 0.25	w_{BM} = 0.5	0.5330	
	Alternative EF_{CM} [tCO2/MWh]	Default EF_{CM} [tCO2/MWh]	λ_{2005}	
	0.0906	0.0767	0.5572	

Table 10 - Emission factors for the Brazilian South-Southeast-Midwest and N-NE interconnected grids (simple adjusted operating margin factor).

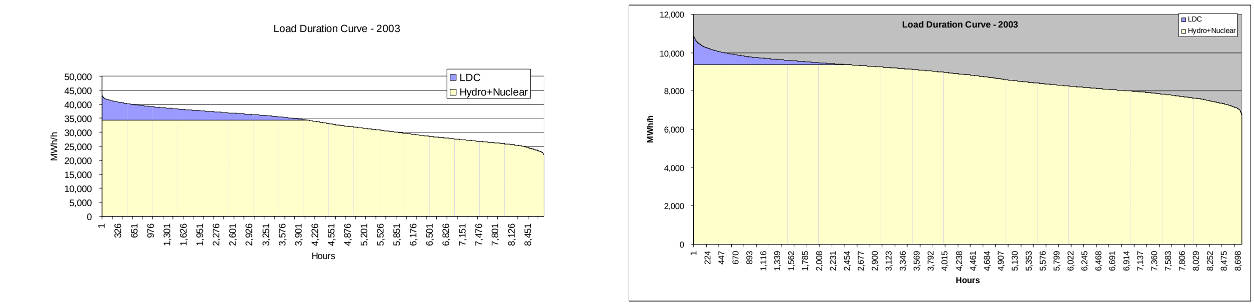

Figure 4 - Load duration curve for the S-SE-CO and N-NE systems, 2003

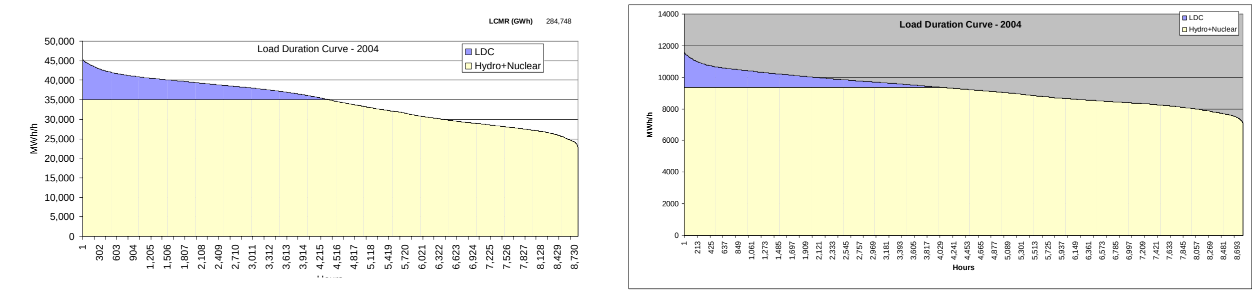

Figure 5 - Load duration curve for the S-SE-CO and N-NE systems, 2004

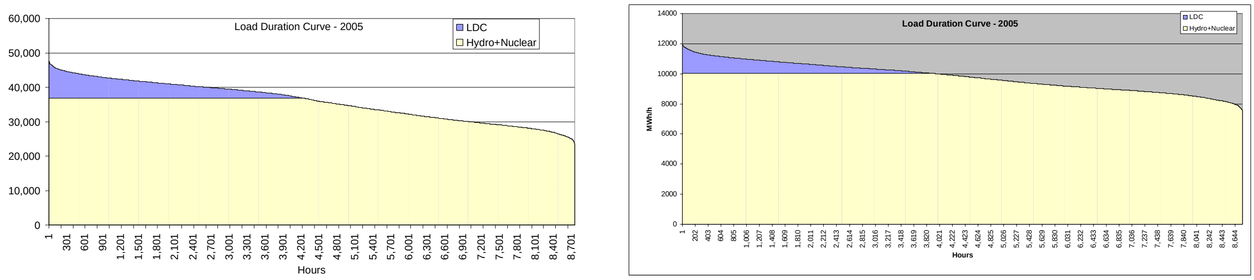

Figure 6 - Load duration curve for the S-SE-CO and N-NE systems, 2005

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
1	S-SE-CO	H	Jauru	Sep-2003	121.5	1	0.0	0.0%	0.000
2	S-SE-CO	H	Gauporé	Sep-2003	120.0	1	0.0	0.0%	0.000
3	S-SE-CO	G	Três Lagoas	Aug-2003	306.0	0.3	15.3	99.5%	0.670
4	S-SE-CO	H	Funil (MG)	Jan-2003	180.0	1	0.0	0.0%	0.000
5	S-SE-CO	H	Itiquira I	Sep-2002	156.1	1	0.0	0.0%	0.000
6	S-SE-CO	G	Araucária	Sep-2002	484.5	0.3	15.3	99.5%	0.670
7	S-SE-CO	G	Canoas	Sep-2002	160.6	0.3	15.3	99.5%	0.670
8	S-SE-CO	H	Piraju	Sep-2002	81.0	1	0.0	0.0%	0.000
9	S-SE-CO	G	Nova Piratininga	Jun-2002	384.9	0.3	15.3	99.5%	0.670
10	S-SE-CO	O	PCT CGTEE	Jun-2002	5.0	0.3	20.7	99.0%	0.902
11	S-SE-CO	H	Rosal	Jun-2002	55.0	1	0.0	0.0%	0.000
12	S-SE-CO	G	Ibirité	May-2002	226.0	0.3	15.3	99.5%	0.670
13	S-SE-CO	H	Cana Brava	May-2002	465.9	1	0.0	0.0%	0.000
14	S-SE-CO	H	Sta. Clara	Jan-2002	60.0	1	0.0	0.0%	0.000
15	S-SE-CO	H	Machadinho	Jan-2002	1,140.0	1	0.0	0.0%	0.000
16	S-SE-CO	G	Juiz de Fora	Nov-2001	87.0	0.28	15.3	99.5%	0.718
17	S-SE-CO	G	Macaé Merchant	Nov-2001	922.6	0.24	15.3	99.5%	0.837
18	S-SE-CO	H	Lajeado (ANEEL res. 402/2001)	Nov-2001	902.5	1	0.0	0.0%	0.000
19	S-SE-CO	G	Eletrobolt	Oct-2001	379.0	0.24	15.3	99.5%	0.837
20	S-SE-CO	H	Porto Estrela	Sep-2001	112.0	1	0.0	0.0%	0.000
21	S-SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	529.2	0.3	15.3	99.5%	0.670
22	S-SE-CO	G	W. Arjona	Jan-2001	194.0	0.25	15.3	99.5%	0.804
23	S-SE-CO	G	Uruguaiana	Jan-2000	639.9	0.45	15.3	99.5%	0.447
24	S-SE-CO	H	S. Caxias	Jan-1999	1,240.0	1	0.0	0.0%	0.000
25	S-SE-CO	H	Canoas I	Jan-1999	82.5	1	0.0	0.0%	0.000
26	S-SE-CO	H	Canoas II	Jan-1999	72.0	1	0.0	0.0%	0.000
27	S-SE-CO	H	Igarapava	Jan-1999	210.0	1	0.0	0.0%	0.000
28	S-SE-CO	H	Porto Primavera	Jan-1999	1,540.0	1	0.0	0.0%	0.000
29	S-SE-CO	D	Cuiaba (Mario Covas)	Oct-1998	529.2	0.27	20.2	99.0%	0.978
30	S-SE-CO	H	Sobragi	Sep-1998	60.0	1	0.0	0.0%	0.000
31	S-SE-CO	H	PCH EMAE	Jan-1998	26.0	1	0.0	0.0%	0.000
32	S-SE-CO	H	PCH CEEE	Jan-1998	25.0	1	0.0	0.0%	0.000
33	S-SE-CO	H	PCH ENERSUL	Jan-1998	43.0	1	0.0	0.0%	0.000
34	S-SE-CO	H	PCH CEB	Jan-1998	15.0	1	0.0	0.0%	0.000
35	S-SE-CO	H	PCH ESCELSA	Jan-1998	62.0	1	0.0	0.0%	0.000
36	S-SE-CO	H	PCH CELESC	Jan-1998	50.0	1	0.0	0.0%	0.000
37	S-SE-CO	H	PCH CEMAT	Jan-1998	145.0	1	0.0	0.0%	0.000
38	S-SE-CO	H	PCH CELG	Jan-1998	15.0	1	0.0	0.0%	0.000
39	S-SE-CO	H	PCH CERJ	Jan-1998	59.0	1	0.0	0.0%	0.000
40	S-SE-CO	H	PCH COPEL	Jan-1998	70.0	1	0.0	0.0%	0.000
41	S-SE-CO	H	PCH CEMIG	Jan-1998	84.0	1	0.0	0.0%	0.000
42	S-SE-CO	H	PCH CPFL	Jan-1998	55.0	1	0.0	0.0%	0.000
43	S-SE-CO	H	S. Mesa	Jan-1998	1,275.0	1	0.0	0.0%	0.000
44	S-SE-CO	H	PCH EPAULO	Jan-1998	26.0	1	0.0	0.0%	0.000
45	S-SE-CO	H	Guilmam Amorim	Jan-1997	140.0	1	0.0	0.0%	0.000
46	S-SE-CO	H	Corumbá	Jan-1997	375.0	1	0.0	0.0%	0.000
47	S-SE-CO	H	Miranda	Jan-1997	408.0	1	0.0	0.0%	0.000
48	S-SE-CO	H	Noav Ponte	Jan-1994	510.0	1	0.0	0.0%	0.000
49	S-SE-CO	H	Segredo (Gov. Ney Braga)	Jan-1992	1,260.0	1	0.0	0.0%	0.000
50	S-SE-CO	H	Taquaruçu	Jan-1989	554.0	1	0.0	0.0%	0.000
51	S-SE-CO	H	Manso	Jan-1988	210.0	1	0.0	0.0%	0.000
52	S-SE-CO	H	D. Francisca	Jan-1987	125.0	1	0.0	0.0%	0.000
53	S-SE-CO	H	Itá	Jan-1987	1,450.0	1	0.0	0.0%	0.000
54	S-SE-CO	H	Rosana	Jan-1987	369.2	1	0.0	0.0%	0.000
55	S-SE-CO	N	Angra	Jan-1985	1,874.0	1	0.0	0.0%	0.000
56	S-SE-CO	H	T. Irmãos	Jan-1985	807.5	1	0.0	0.0%	0.000
57	S-SE-CO	H	Itaipu 60 Hz	Jan-1983	6,300.0	1	0.0	0.0%	0.000
58	S-SE-CO	H	Itaipu 50 Hz	Jan-1983	5,375.0	1	0.0	0.0%	0.000
59	S-SE-CO	H	Emborcação	Jan-1982	1,192.0	1	0.0	0.0%	0.000
60	S-SE-CO	H	Nova Avanhandava	Jan-1982	347.4	1	0.0	0.0%	0.000
61	S-SE-CO	H	Gov. Bento Munhoz - GBM	Jan-1980	1,676.0	1	0.0	0.0%	0.000

* 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. *Banco de Informações da Geração* (http://www.aneel.gov.br/, data collected in november 2004).

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

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

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Table 11 - Power plants database for the Brazilian South-Southeast-Midwest interconnected grid, part 1

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
62	S-SE-CO	H	S.Santiago	Jan-1980	1,420.0	1	0.0	0.0%	0.000
63	S-SE-CO	H	Itumbiara	Jan-1980	2,280.0	1	0.0	0.0%	0.000
64	S-SE-CO	O	Igarapé	Jan-1978	131.0	0.3	20.7	99.0%	0.902
65	S-SE-CO	H	Itauba	Jan-1978	512.4	1	0.0	0.0%	0.000
66	S-SE-CO	H	A. Vermelha (Jose E. Moraes)	Jan-1978	1,396.2	1	0.0	0.0%	0.000
67	S-SE-CO	H	S.Simão	Jan-1978	1,710.0	1	0.0	0.0%	0.000
68	S-SE-CO	H	Capivara	Jan-1977	640.0	1	0.0	0.0%	0.000
69	S-SE-CO	H	S.Osório	Jan-1975	1,078.0	1	0.0	0.0%	0.000
70	S-SE-CO	H	Marimbondo	Jan-1975	1,440.0	1	0.0	0.0%	0.000
71	S-SE-CO	H	Promissão	Jan-1975	264.0	1	0.0	0.0%	0.000
72	S-SE-CO	C	Pres. Medici	Jan-1974	446.0	0.26	26.0	98.0%	1.294
73	S-SE-CO	H	Volta Grande	Jan-1974	380.0	1	0.0	0.0%	0.000
74	S-SE-CO	H	Porto Colombia	Jun-1973	320.0	1	0.0	0.0%	0.000
75	S-SE-CO	H	Passo Fundo	Jan-1973	220.0	1	0.0	0.0%	0.000
76	S-SE-CO	H	Passo Real	Jan-1973	158.0	1	0.0	0.0%	0.000
77	S-SE-CO	H	Ilha Solteira	Jan-1973	3,444.0	1	0.0	0.0%	0.000
78	S-SE-CO	H	Mascarenhas	Jan-1973	131.0	1	0.0	0.0%	0.000
79	S-SE-CO	H	Gov. Parigot de Souza - GPS	Jan-1971	252.0	1	0.0	0.0%	0.000
80	S-SE-CO	H	Chavantes	Jan-1971	414.0	1	0.0	0.0%	0.000
81	S-SE-CO	H	Jaguara	Jan-1971	424.0	1	0.0	0.0%	0.000
82	S-SE-CO	H	Sá Carvalho	Apr-1970	78.0	1	0.0	0.0%	0.000
83	S-SE-CO	H	Estreito (Luiz Carlos Barreto)	Jan-1969	1,050.0	1	0.0	0.0%	0.000
84	S-SE-CO	H	Ibitinga	Jan-1969	131.5	1	0.0	0.0%	0.000
85	S-SE-CO	H	Jupiá	Jan-1969	1,551.2	1	0.0	0.0%	0.000
86	S-SE-CO	O	Alegrete	Jan-1968	66.0	0.26	20.7	99.0%	1.040
87	S-SE-CO	G	Campos (Roberto Silveira)	Jan-1968	30.0	0.24	15.3	99.5%	0.837
88	S-SE-CO	G	Santa Cruz (RJ)	Jan-1968	766.0	0.31	15.3	99.5%	0.648
89	S-SE-CO	H	Paraibuna	Jan-1968	85.0	1	0.0	0.0%	0.000
90	S-SE-CO	H	Limoeiro (Armando Salles de Oliviera)	Jan-1967	32.0	1	0.0	0.0%	0.000
91	S-SE-CO	H	Caconde	Jan-1966	80.4	1	0.0	0.0%	0.000
92	S-SE-CO	C	J.Lacerda C	Jan-1965	363.0	0.25	26.0	98.0%	1.345
93	S-SE-CO	C	J.Lacerda B	Jan-1965	262.0	0.21	26.0	98.0%	1.602
94	S-SE-CO	C	J.Lacerda A	Jan-1965	232.0	0.18	26.0	98.0%	1.869
95	S-SE-CO	H	Bariri (Alvaro de Souza Lima)	Jan-1965	143.1	1	0.0	0.0%	0.000
96	S-SE-CO	H	Funil (RJ)	Jan-1965	216.0	1	0.0	0.0%	0.000
97	S-SE-CO	C	Figueira	Jan-1963	20.0	0.3	26.0	98.0%	1.121
98	S-SE-CO	H	Furnas	Jan-1963	1,216.0	1	0.0	0.0%	0.000
99	S-SE-CO	H	Barra Bonita	Jan-1963	140.8	1	0.0	0.0%	0.000
100	S-SE-CO	C	Charqueadas	Jan-1962	72.0	0.23	26.0	98.0%	1.462
101	S-SE-CO	H	Jurumirim (Armando A. Laydner)	Jan-1962	97.7	1	0.0	0.0%	0.000
102	S-SE-CO	H	Jacui	Jan-1962	180.0	1	0.0	0.0%	0.000
103	S-SE-CO	H	Pereira Passos	Jan-1962	99.1	1	0.0	0.0%	0.000
104	S-SE-CO	H	Tres Marias	Jan-1962	396.0	1	0.0	0.0%	0.000
105	S-SE-CO	H	Euclides da Cunha	Jan-1960	108.8	1	0.0	0.0%	0.000
106	S-SE-CO	H	Camargos	Jan-1960	46.0	1	0.0	0.0%	0.000
107	S-SE-CO	H	Santa Branca	Jan-1960	56.1	1	0.0	0.0%	0.000
108	S-SE-CO	H	Cachoeira Dourada	Jan-1959	658.0	1	0.0	0.0%	0.000
109	S-SE-CO	H	Salto Grande (Lucas N. Garcez)	Jan-1958	70.0	1	0.0	0.0%	0.000
110	S-SE-CO	H	Salto Grande (MG)	Jan-1956	102.0	1	0.0	0.0%	0.000
111	S-SE-CO	H	Mascarenhas de Moraes (Peixoto)	Jan-1956	478.0	1	0.0	0.0%	0.000
112	S-SE-CO	H	Itutinga	Jan-1955	52.0	1	0.0	0.0%	0.000
113	S-SE-CO	C	S. Jerônimo	Jan-1954	20.0	0.26	26.0	98.0%	1.294
114	S-SE-CO	O	Carioba	Jan-1954	36.2	0.3	20.7	99.0%	0.902
115	S-SE-CO	O	Piratininga	Jan-1954	472.0	0.3	20.7	99.0%	0.902
116	S-SE-CO	H	Canastra	Jan-1953	42.5	1	0.0	0.0%	0.000
117	S-SE-CO	H	Nilo Peçanha	Jan-1953	378.4	1	0.0	0.0%	0.000
118	S-SE-CO	H	Fontes Nova	Jan-1940	130.3	1	0.0	0.0%	0.000
119	S-SE-CO	H	Henry Borden Sub.	Jan-1926	420.0	1	0.0	0.0%	0.000
120	S-SE-CO	H	Henry Borden Ext.	Jan-1926	469.0	1	0.0	0.0%	0.000
121	S-SE-CO	H	I. Pombos	Jan-1924	189.7	1	0.0	0.0%	0.000
122	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. *Banco de Informações da Geração* (http://www.aneel.gov.br/, data collected in november 2004).

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

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Table 12 - Power plants database for the Brazilian South-Southeast-Midwest interconnected grid, part 2

Annex 4

MONITORING INFORMATION

As of the procedures set by the "Approved consolidated monitoring methodology ACM0002" – "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources".

The project will proceed with the necessary measures for the power control and monitoring. Together with the information produced by both ANEEL and ONS, it will be possible to monitor the power generation of the project and the grid power mix.

Annex 5

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