CONTENTS

PROJECT DESIGN DOCUMENT (CDM-PDD)

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Repowering Small Hydro Plants in the State of São Paulo, Brazil
Version 01
July, 2005

A.2. Description of the project activity:

CPFL Energia is a holding company that, through its subsidiaries, distributes, generates and commercializes electricity in Brazil. In 2003, it was one of the three largest electricity distributors in Brazil, based on the 33,669 GWh of electricity delivered to more than 5.3 million customers in the richest region in the country.

In 2003, the installed capacity of its generation subsidiary, CPFL Geração de Energia S.A., or Geração, was 812 MW of which its 19 SHP contributed with 15% of the total. Starting in 2000, CPFL is increasing its capacity by upgrading some of the older generation SHPs and participating in the construction of six new large hydroelectric generation facilities in several points of the country.

This project encompasses the upgrade of CPFL's SHPs in the State of São Paulo, south-eastern Brazil. In this region, all major hydropower potential have long been tapped, together with most of the smaller ones as well. Expanding generation in the region brings the advantage of increasing energy supply in the country's richest region with lower transmission losses and thus avoiding the more environmentally damaging thermal plants and hydropower plants in the Amazon region. As the plants were built in the early 1900s and have been running basically with the original turbines and generators, that have long past their due lifetime. Therefore, the only other option would have been to shut down the plants.

All the repowering projects maintained the same reservoir area and were authorized to run with the same head, meaning that no additional environmental impact will be brought by these projects. The whole gain is an efficiency upgrade by using modern generation technology.

Annex 7 presents a description of the plants. They all still have the original buildings and workers quarters as in the time they where built and are regarded as a historical testimony of the early stages of industrial development in Brazil. Preserving these sites adds to the memory of a country where this value is much too often neglected, and keeping the plants running is the best way to preserve them.

As of today, three SHP have been repowered between 2001 and 2003, namely – Esmeril, Dourados and São Joaquim. One of the plants, Gavião Peixoto, has federal authorization to start the project and will start operations during 2006. Two other plants, Chibarro and Capão Preto, have been approved by CPFL's board of directors and are now seeking legal permits. The remaining two, Buritis and Três Saltos, are planned for 2008 and are now waiting for approval from the board of directors. They are included in this PDD as they are part of the same program, use the same methodology for obtaining emission reduction equivalents and will follow the same monitoring methodology. Nevertheless there is the possibility that, due to economical situation and changes in the company's strategic plans, that they may be further postponed. The repowering of these eight plants will raise their total installed capacity

from 27.1 MW to 37.9 MW, adding more than 84 GWh per year to the grid. All these plants were originally built between 1910 and 1930 when turbine-generator efficiency was significantly lower than today. So, the extra power is being tapped without any change to the existing reservoirs and therefore without adding any environmental impact.

Under the same modernization program, still a ninth SHP was repowered – SHP Salto Grande. Due to the expansion of the water supply system to the São Paulo-Campinas metropolitan areas, federal offices authorized a lower operating head and flow to the plant so that it is now generating less energy than before the repowering project.

Although most of Brazil's electric generation stems from large hydro plants (around 90%), national expansion plans calls for an ever larger participation of gas-fired thermal plants. The actual 10-year plan forecasts expanding thermal plants participation to 15% of the total installed capacity (more than 15 GW). In this sense, all extra power generated from renewable sources in Brazil would have the effect of delaying GHG emissions from the planned gas-fired plants.

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be in indicated using the following tabular format.		
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 - CIMCG (host)	Public entity – Brazilian DNA	NO
CPFL Energia – Companhia Paulista de Força e Luz	Private entity	YES
IUEP - International Utility Efficiency Partnerships	Private entity	YES
Clean Air S.A. – project developer	Private entity	YES
(*) 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.		
Note: When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

The official contact for this project is Clean Air.
This project was developed under the responsibility of CPFL Energia with the support by IUEP and Clean Air. IUEP is an American tax-exempt company and Clean Air is the Brazilian branch of Clean Air S.A., an offshore public limited company located in Uruguay. All activities are being developed and limited to Brazil.

CPFL Energia (Companhia Paulista de Força e Luz):
CPFL Energia is the controlling holding of the energy companies of VBC Energia S.A. (Bradespar, Grupo Camargo Corrêa and Grupo Votorantim), 521 Participações S.A. (Previ) and of Bonaire Participações S.A. (Funcesp, Sistel, Petros e Sabesprev). All these companies are listed among the largest in Brazil.
As of today CPFL Energia is the largest private group of the Brazilian electric sector with 100% of its capital owned by Brazilian companies.
In 2004, CPFL launched stocks in both NYSE and São Paulo's Bovespa (São Paulo Stock Market).
Following modern trends and with the directives established by Bovespa's 'New Market', CPFL Energia is adopting a set of Differentiated Practices of Corporate Governance.
The main objective of these practices is to increase the transparency of the set of principles, rules, norms and procedures that guide its business to its public and the several social agents.
CPFL Energia adhered to the international accepted principles of Corporate Governance: Fairness – Disclosure – Accountability.
The internal management systems where modified in order to comply with the accounting principles ruled by Bovespa's New Market as well as by US GAAP (General Accepted Accounting Practices) and American legislation, including the Sarbanes Oxley Act.
CPFL received certification in the following four categories: ISO 9000, ISO 14001, OHSAS 18001 and SA 8000.

IUEP – International Utility Efficiency Partnerships
IUEP is acknowledged by Edison Electric Institute as was created in 1996 as a tax-exempt company, with the purpose of:

H. . Identifying international project development opportunities, in energy generation, planned to reduce emissions of greenhouse gases (GHG);

ii) Sponsoring investments and development of the aforementioned projects, including acknowledgement of such projects from the United States Initiative on Joint Implementation ("USIJI") of the United Nations Framework Convention on Climate Change, signed by the United States and other 149 countries in 1992 (at "Rio Convention"), and
iii) Demonstrating spontaneous approach of energy generation companies to international programs of reduction of GHG emissions.
IUEP is engaged in the development of certain projects related to the implementation of CO2 emission control in accordance with the determinations of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and subsequent developments.
It has obtained certain rights and privileges in order to operate the Projects on behalf of the Government of the United States of America under the U.S. Initiative on Joint Implementation ("USIJI") to trade, sell, convey, transfer, deliver sign, quitclaim and deposit greenhouse gases ("GHG") mitigation benefits;
Furthermore, IUEP seeks partnership with local companies in order to mutually cooperate to implement projects of GHG mitigation in developing nations, and also to contribute to develop the market of acquisition, exchange and trade of CO2 credits.
Besides assisting the developing of all documents related with the Certification process, IUEP' main role is to assist the acquisition of CTOs (Certified Tradable Offsets) and/or ER (Emissions Reductions), and/or VER (Verified Emission Reductions), obtained as a result of the implementation of CO2 control and mitigation projects in Brazil.

CLEAN AIR S.A.
Clean Air was created in 2000 with the purpose of identifying, certifying and negotiating Carbon Credits.
Clean Air is an associate member of IUEP.

Clean Air developed studies and analysis leading to the development of greenhouse gas (GHG) emission reduction projects. Within in the scope of these projects both identification and certification of Carbon Credits are comprised. Clean Air is a consulting company in the areas of renewable energy sources, natural gas and oil products.
Clean Air's staff is specialized in identifying and developing greenhouse gas emission reductions stemming directly or indirectly from each project, including small power plants, biomass-fuelled power plants, wind power, displacement of oil fuels, reforestation and landfill projects.

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.:

State of São Paulo, south-eastern region

A.4.1.3. City/Town/Community etc:

Patrocínio Paulista, Nuporanga, Guará, Gavião Peixoto, Araraquara, São Carlos, Buritizal and Torrinha.

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

Name	Code	Location		County	River	Basin
		latitude	longitude			
Esmeril	USES	20º50’23	47º18’07	Patrocínio Paulista	Esmeril	Sapucaí Mirim
Dourados	USDO	22º22’40	48º10’27	Nuporanga	Sapucaí	Sapucaí Mirim
São Joaquim	USJO	20º34’25	47º46’58	Guará	Sapucaí Mirim	Sapucaí Mirim
Gavião Peixoto	USPE	21º50’53	47º42’20	Gavião Peixoto	Jacaré-Guaçu	Tietê
Chibarro	USCH	21º53’17	48º08’50	Araraquara	Chibarro	Tietê
Capão Preto	USCP	21º53’54	47º47’04	São Carlos	Conxim, Negros, Itaúna, Quilombos	Mogi-Guaçú
Buritis	USBU	20º12’53	47º42’20	Buritizal	Ribeirão Bandeira	Grande
Três Saltos	USTR	22º22’40	48º10’27	Torrinha	Pinheirinho	Tietê

Table A4-1 – List of SHPs covered by this project

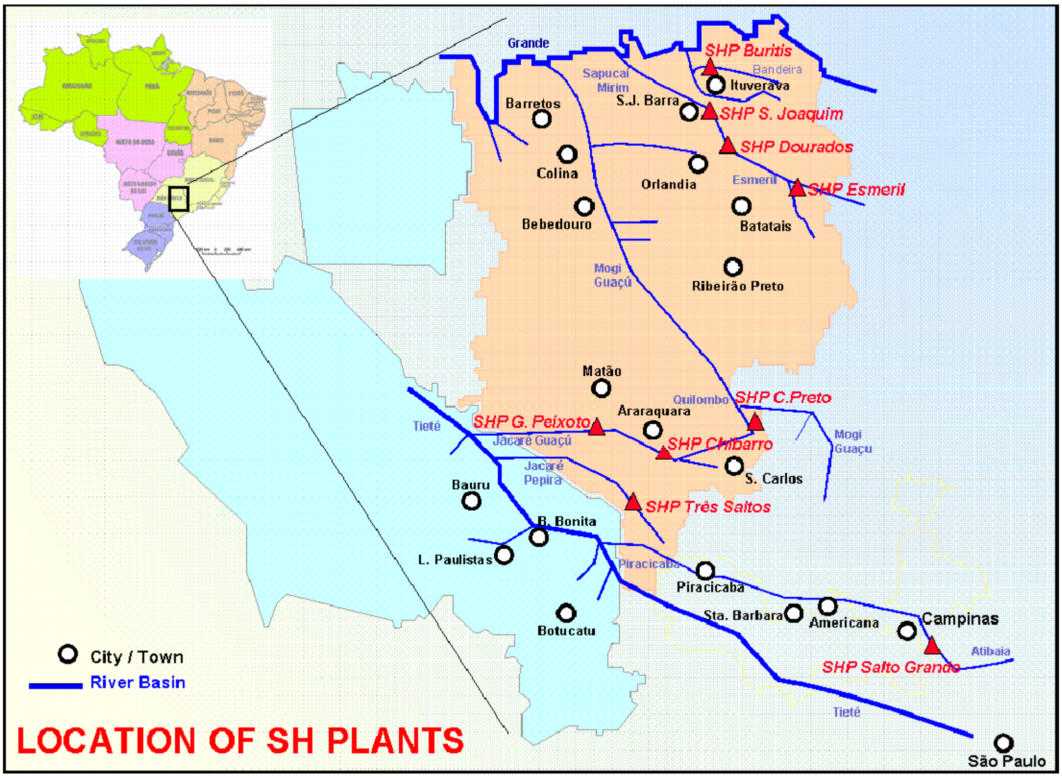

Figure A4-1 – Location of CPFL’ plants covered by this Project

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

The project activity is grid-connected electricity generation from renewable energy source.

These are run-of-river hydro power projects with existing reservoirs where the volume of the reservoir is not increased.

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

This project groups eight SHP that were or will be repowered. The table below lists physical characteristics of the reservoirs (unchanged by project activities):

SHP	dam height (m)	flooded area (km2)	head (m)	penstocks
Esmeril	non existent	0.28	59.0	2
Dourados	5.00	0.54	29.1	1
São Joaquim	4.50	0.83	17.0	4
Gavião Peixoto	8.00	0.17	17.0	4
Chibarro	5.00	0.02	73.0	1
Capão Preto r1	6.00	2.80	73.0	2
r2	5.00			
r3	7.00			
r4	6.00			
Buritis	2.10	0.00	140.0	1
Três Saltos	non existent	0.01	80.8	1

Table A4-2 – Physical Characteristics of Reservoirs

Table A4-3, below, shows the characteristics of the turbo-generators before the project and after completion.

SHP	startup	equip	type	turbine capacity (MW)	flow rate (m^3/s)	generator voltage (kV)
Esmeril	1912	Turbine 1	Francis	0.58	1.12	2.20
		Turbine 2	Francis	0.58	1.12	2.20
		Turbine 3	Francis	0.61	1.86	2.20
	2001	Turbine 1	Francis	2.52	4.88	6.90
		Turbine 2	Francis	2.52	4.88	6.90
Dourados	1926	Turbine 1	Francis	6.40	33.00	6.30
	2002	Turbine 1	Francis	10.80	42.10	6.90
São Joaquim	1911	Turbine 1	Francis	0.84	7.35	2.20
		Turbine 2	Francis	0.84	7.35	1.05
		Turbine 3	Francis	1.92	16.20	2.20
		Turbine 4	Francis	1.92	15.89	2.20
	2002	Turbine 1	Kaplan Tube "S"	2.86	18.50	6.90
		Turbine 2	Kaplan Tube "S"	2.86	18.50	6.90
		Turbine 3	Kaplan Tube "S"	2.86	18.50	6.90
Gavião Peixoto	1913	Turbine 1	Francis	0.70	6.00	6.50
		Turbine 2	Francis	0.70	6.00	6.50
		Turbine 3	Francis	0.98	6.00	6.30
		Turbine 4	Francis	1.73	13.2	6.50
	2005	Turbine 1	Francis	2.00	-	-
		Turbine 2	Francis	2.00	-	-
		Turbine 4	Francis	1.73	-	-
Chibarro	1912	Turbine 1	Francis	1.21	2.09	2.20
		Turbine 2	Francis	1.08	2.06	2.20
	2006	Turbine 1	Francis	1.21	2.09	2.20
		Turbine 2	Francis	1.50	-	-
Capão Preto	1911	Turbine 1	Francis	1.76	2.60	2.20
		Turbine 2	Francis	1.76	3.20	2.20
		Turbine 3	Francis	2.00	3.60	2.20
	2006	Turbine 1	Francis	2.20	-	-
		Turbine 2	Francis	2.00	3.60	2.20
Buritis	1922	Turbine 1	Francis	0.80	0.95	2.20
	2008	Turbine 1	Francis	1.30	-	-
Três Saltos	1928	Turbine 1	Francis	0.64	1.10	2.20
	2008	Turbine 1	Francis	1.00	-	-

Table A4-3 – SHP turbo-generators before and after project completion

And the following table shows the additional power and the projected amount of energy to be generated for each plant.

SHP	Start	Previous Capacity MW	Project Capacity MW	Added Power MW	Previous Generation Mwh(y)	Project Generation Mwh(y)	Added Energy Mwh(y)
Esmeril	2001	1,76	5,04	3,3	8.298	29.022	20.724
Dourados	2002	6,40	10,80	4,4	38.039	84.321	46.282
São Joaquim	2002	5,52	8,05	2,5	31.368	60.700	29.332
subtotal 2002		*13,68*	*23,89*	*10,2*	*97.960*	*174.043*	*96.338*
Gavião Peixoto	2005	4,12	4,80	0,7	24.654	38.000	13.346
Chibarro	2006	2,29	2,71	0,4	11.112	13.394	2.282
Capão Preto	2006	5,52	4,20	-1,3	15.544	20.236	5.911
Buritis	2008	0,80	1,30	0,5	4.259	9.487	5.002
Três Saltos	2008	0,64	1,00	0,4	3.908	6.678	2.932
subtotal 2008		*13,37*	*14,01*	*0,6*	*59.476*	*87.795*	*29.473*
Total		27,05	37,90	10,9	157.436	261.838	125.811

Table A4-4 – Additional capacity and energy generation

The plants were built between 1910 and 1930 during the expansion of coffee plantations in the state of São Paulo and of the railway system built to transport production to the sea port at Santos. The then projected capacity reflected the state-of-technology at the beginning of the 20th century. Efficiency of power generation during the last decade averaged around 65%. Using modern technology, with efficiencies greater than 80%, enables CPFL to increase it's power capacity using water flow and therefore without having to accrue reservoir sizes: neither in dam height nor in the flood area. Furthermore, CPFL was concerned with the existing buildings in each site. All of them, powerhouses and workers quarters, were conserved as originally built and are considered historical sites. All repowering projects were limited to tapping additional power without any modifications to the sites, but by basically replacing old turbo-generators by more efficient ones, reinforcing foundations and, eventually, by increasing the capacity of the water adduction channels.
The modifications in each plant are described below:

1. Usina Hidrelétrica Esmeril:
   The three old turbo-generators were replaced with two new 2.5 MW ones.
   Old penstocks were replaced with one new one.
   Canal section was broadened in 3.0 m maintaining previous characteristics of velocity and rugosity coefficient, doubling its capacity.
   The new machinery was installed in the same place as the previous ones.
   Basic reinforcement of foundations and structure of the powerhouse were carried out.

2. Usina Hidrelétrica Dourados:
   The old turbo-generator was replaced by a new and more powerful one.
   The buildings, adduction channel and penstocks suffered no modifications.

3. Usina Hidrelétrica São Joaquim:
   The four older turbo-generators were replaced by three new ones, adding 2.5 MW to the plant.
   The buildings, adduction channel and penstocks suffered no modifications.

4. Usina Hidrelétrica Gavião Peixoto:
   The older set of turbo-generators will be replaced by a new 5.7 MW set, adding an additional 1.6 MW to the plant.
   The new machines will be installed in the same place as the older ones.
   Basic reinforcement of foundations and structure of the powerhouse will be carried out.

The buildings, adduction channel and penstocks suffered no modifications.

5. Usina Hidrelétrica Chibarro
   Replace the older 1.2 MW turbo-generator with a new 1.5 MW one.
   The water adduction channel will be broadened.
   Basic reinforcement of foundations and structure of the powerhouse will be carried out.
   No changes will be carried out to the remaining facilities.

6. Usina Hidrelétrica Capão Preto
   The two older 1.76 MW turbo-generator will be replaced by a new 2.2 MW one, adding 500 kW to the plant capacity.
   The junction of the existing penstocks will be revised in order to reduce head losses.

7. Usina Hidrelétrica Buritis
   The older turbo-generator will be replaced by a new 1.3 MW one, adding 500 kW to the plant capacity.
   A minor change to the powerhouse will be carried out in order to accommodate the new machinery, without changes to overall layout.
   No changes to the adduction channel and penstock are required.

8. Usina Hidrelétrica Três Saltos
   The older turbo-generator will be replaced by a new 1.0 MW one, adding 360 kW to the plant capacity.
   Basic reinforcement of foundations and structure of the powerhouse will be carried out.
   The buildings, adduction channel and penstocks will not suffer any modifications.

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:

The electric sector in Brazil has been traditionally supplied by large hydropower plants, as illustrated by the figure below. Although the country still has a large unexplored hydro potential, most of it is located in the Amazon region where the environmental constrains will impose severe limitations for the amount of power to be tapped in the next few years [*MME – Plano Decenal 2003-12*]. Furthermore, these sources are far removed from the main consumption centres located in south-eastern region.

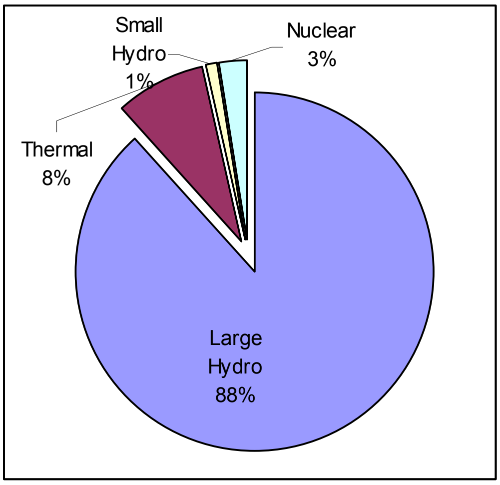

Figure A4-2 – Electric Generation by Source – 2003
source: Sumário Executivo do Plano Decenal de Expansão 2003/2012, CCPE, Ministério de Minas e Energia

In 2001, due a series of years of underinvestment in power generation, Brazil suffered a major shortage in supply, leading the government to implement a rationing program that deeply affected the economy. It then speeded up the approval of a plan calling for the implementing thermal plants fired with natural gas. According to this plan, by 2012, thermal sources will grow from 8% to more than 14%, adding another 7.5 GW of capacity.

The present project achieves emission reductions by generating over 10 MW using renewable sources located close to the large consumption centres and thereby, theoretically, delaying the entry of gas-fired thermal plants. Thus, anthropogenic emissions of GHG by sources are reduced below those that would have occurred in its absence.

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

Year	Estimation of project activity emisson reductions (tonnes of CO_2e)	Estimation of baseline emisson reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2003	23.734	17.929	-	5.805
2004	58.476	35.123	-	23.354
2005	64.421	35.123	-	29.299
2006	79.428	46.266	-	33.162
2007	93.841	58.315	-	35.526
2008	94.098	58.315	-	35.783
2009	93.841	58.315	-	35.526
2010	93.841	58.315	-	35.526
2011	93.841	58.315	-	35.526
2012	94.098	58.315	-	35.783
2013	93.841	58.315	-	35.526
2014	93.841	58.315	-	35.526
2015	93.841	58.315	-	35.526
2016	94.098	58.315	-	35.783
2017	93.841	58.315	-	35.526
2018	93.841	58.315	-	35.526
2019	93.841	58.315	-	35.526
2020	94.098	58.315	-	35.783
2021	93.841	58.315	-	35.526
2022	93.841	58.315	-	35.526
2023	93.841	58.315	-	35.526
Total (tonnes of CO_2e)	1.822.378	1.125.790		696.588
Total number of crediting years				21y (3 x 7y)
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)				33.171

A.4.5. Public funding of the project activity:

No public funding was or will be sought.

SECTION B. Application of a baseline methodology

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

This project applies the entirely the consolidated methodology ACM002 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

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

All plants are small run-of-river plants, with no increase in reservoir volume and, therefore, comply with the applicability conditions stated in the methodology ACM002.

This methodology must be complemented to account for energy generation before repowering each of the plant. This energy output is, then, subtracted from the annual energy generation after repowering to calculate the emission reductions. In ACM002, no "older energy" exists and, therefore, "new" energy is multiplied by the emission conversion factor directly.

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

Brazil's electric generation system has been mostly supplied by large hydro power plants for the last 50 years. Even though there is still a big untapped potential, the major projects are located in the Amazon Region where environmental impacts are estimated to be heavy and the distance from major markets are huge. In the country's South-eastern region, where most of the consumption takes place, there are no more large (>100 MW) potential sites. The National Expansion Plans of the last few years call for a growth of share of fossil-fuelled thermal plants up to 15% by 2012, from the 5% today.

Therefore, emission reductions are achieved by generating more power from renewable sources and thus postponing GHG emissions from future fossil-fuelled thermal power plants. During the last years, several papers were published dealing with this issue applied to the Brazilian scenario (e.g. *Bosi – 2001, Kartha and Lazarus – 2002, Bosi and Laurence – 2002*).
Central to this argument is obtaining an emission coefficient that reflects the relevance of thermal plants in the Brazilian grid.

The consolidated project methodology was approved by CDM (*ACM002 – Consolidated baseline methodology for grid-connected electricity generation from renewable sources*) and several bagasse cogeneration projects are moving through validation / registration process (e.g. *Alta Mogiana, Campo Florido, Cerradinho Bagasse Cogeneration Projects - Econergy, 2005*) and, more recently, new small hydro plants are applying the same methodology.

This project uses the same assumptions for emission factor calculations, based on the same operating margin and built margin for the south-south-eastern grid in Brazil. As a matter of fact, some of these biomass projects are located in the same region and are connected to the same grid and sell its energy to CPFL.

The emission coefficient used in this project is 0,452 tCO2e / MWh.

As the emission reductions are associated only with the additional energy generation, there is the need of establishing energy generation prior to project implementation. Approved methodology AM-0015 – "Bagasse-based cogeneration connected to an electricity grid" states that:

> ***"Where the project activity involves a capacity addition, the net quantity of electricity generated due to the project activity (Egy) should be determined as the difference of the electricity generated by the plant after project implementation and the quantity of electricity that has been generated prior to project implementation, based on the average electricity generation of the last three years before project implementation."***

In the current project, as plants are old and therefore due for number of programmed and non-programmed stops, instead of using the average energy generation of the last three years prior to project implementation, it is here proposed that is quantity should be calculated as:

1. **collect a 10-year span of monthly energy generation, prior to project activities;**
2. **employ Planned and Unplanned Unavailability Factors (PUF / UUF)[1] in order to ignore the unavailable fraction of energy generation for the period;**
3. **calculate average energy production discarding the unavailable fraction.**

The average obtained in this manner is higher than a simple direct average and therefore more conservative. Furthermore, as after the repowering project, with new turbines and generators in place, the plants will remain available for longer times when compared with a short three-year period prior to implementation. Annex 5 shows the monthly energy generation curves from 1987 to either the start of project or December, 2004 and plotting the average calculated according to the steps above.

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:

CPFL's concern with emission reductions is part of its commitment with global environmental standards stated in their Institutional Profile and part of several corporate guidelines. As part of this concern, in 2001 it hired a consultancy company, CarboNetwork, to perform a study that, besides updating CPFL on the state of negotiations within UNFCCC, sought the company's opportunities and weaknesses from the climate change perspective and proposed a strategic plan to face those challenges. This study found that repowering SHPs presented an obvious line of action.

Additionality will be demonstrated using "Tool for the demonstration and assessment of additionality":

Step 0. Preliminary screening of projects started after 1 January 2000 and prior to 31 December 2005

CPFL's concern with emission reductions is part of its commitment with global environmental standards stated in their Institutional Profile and part of several corporate guidelines. As part of this concern, in 2001 it hired a consultancy company, CarboNetwork, to perform a study that, besides updating CPFL on

[1] See, e.g., Spiegelberg-Planer, R. et al, *Performance of Generating Plant* for a definition of unavailability factors.

the state of negotiations within UNFCCC, sought the company's opportunities and weaknesses from the climate change perspective and proposed a strategic plan to face those challenges. This study found that repowering SHPs presented a possible line of action.

As of today, CPFL has the concession of 19 SHPs of which two are not operating and a third remained closed during almost ten years. The decision to run or not a plant is taken at the highest level of the company based fundamentally on economics and considering the related social and environmental impacts.

The main studies carried out in 2001 served as base of the decision of CPFL's Board to approve the repowering of the plants included in this project.

Step 1. Identification of alternatives to the project activity

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

All plants under this project were built between 1910 and 1930 and turbines and generators are still the original equipments. Since 1990, as maintenance interventions increased, reports pointed to the fact that they would need to be replaced in a short time. The only alternative would be to shut down the plants and buy the same amount of energy from the market. In this case, instead of adding an extra amount of 71 GWh/year to the grid (), closing the plants would create an extra demand of more than 200 GWh/year and part of this energy would come from the future fossil-fuelled thermal plants. Instead of reducing emissions, the absence of this project would lead to an increase in national emissions.

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

Both scenarios, repowering and plant shut-down, comply with existing legal framework.

Step 3. Barrier Analysis

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

The 2001 studies included a thorough financial feasibility study that included:

- EPC quotes for construction costs (including new turbines and generators);
- O & M costs based on historical figures;
- Presumed revenues from the sales of electricity;
- Taxes;
- Depreciation on investments and on existing installations.

The analysis then carried out calculated the energy tariff for desired values of IRR.

The feasibility analysis carried out, sought the energy tariffs that would render two levels of IRR: 15% and 18%. At that time, 15% IRR was considered the lowest acceptable value by shareholders when fully financing projects with own capital. This value can be compared with the average SELIC rate (Monetary Policy Committee reference rate) of 19% in 2001.

The energy tariff obtained at a 15% IRR, was R$ 42.44 / MWh (US$ 15.56 @ 2.709 RS$/US$ - 09/19/01). This value can be compared with the average energy price of R$ 42.56 / MWh that CPFL paid for the more than 35,000 GWh it commercialized that year.

As a further point, the project as a whole suffered a delay in 2002-03 as the national economy suffered a recession period and the economics wouldn't allow for diverting much needed capital. It was only last year, as Brazilian economy started to recover and with it, CPFL' revenues, that the project was, once again, further pursued.

Therefore, the decision of repowering the SHPs does not configure a classical BAU situation, as it was not a business opportunity moved only by high returns on investment. It is more of a necessity in face of the alternative of shutting down the plants, and one that renders only a small rate of return according to its internal standards.

It must be emphasized once more, that shutting down the plants would mean removing 25.6 MW (or more than 200 GWh/year) from the grid or that this capacity would have to be supplied from other sources, likely from thermal plants.

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

The boundaries used in the methodology are defined as:

1. Project Boundary defined by the non-contiguous set of plant sites encompassing their respective reservoirs.

2. Baseline Calculation Boundary defined by the region covered by the Southeastern and Mid-Western Integrated Electric Grid as all plants are connected to this grid and baseline calculations use the electric generation data from this region.

Brazilian electric grid is subdivided in four systems (see map below). Also shown are the imports from Venezuela, Argentina and Paraguay, through the Itaipu plant. The northwestern non-shaded area is not connected to the national grid and is supplied, basically, by local thermal plants. Transmission capacity of the lines between subsystems is growing, but still limits power transfer between them. In this sense, each subsystem can be seen as a project boundary for OM and BM calculations.

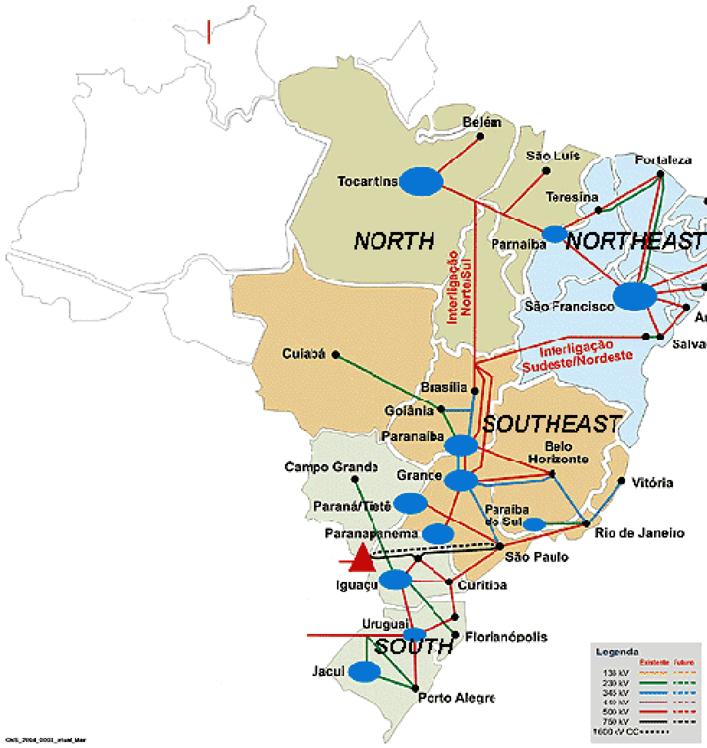

Figure B-1 – National Electric Grid – 2004
source: ONS – National Electric System Operator

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:

Baseline information: (please refer to Section E for baseline information)

Date of completion of the baseline study: 30 / 04 / 2005

Persons/entities determining the baseline:
Sergio Augusto Weigert Ennes / Clean Air S.A. and Shigueo Watanabe Jr. / Clean Air S.A.
(project developers/participants listed in Annex 1 with contact information)

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 / 01 / 2002

note: as each plant had or will have a different start-up date, all calculations were made assuming a few months to stabilize operations after start-up. As discussed above, baseline reference period is different for each plant. The two last plants, Buritis and Três Saltos, are, as of today, still waiting for final approval from the Board of Directors. They are included in this PDD as they follow exactly the same justifications as the other plants and, therefore, should not require an additional and costly registration process.

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

30y – 0m (average plant lifetime)

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:

01 / 01 / 2003

C.2.1.2. Length of the first crediting period:

7y – 0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Application of a monitoring methodology and plan

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

This project applies the consolidated methodology ACM0002 – "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources"

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

This monitoring methodology is to be used together with the consolidated baseline methodology ACM-002 and consists in monitoring of the following:

- Electricity generation from the proposed project activity;
- Data needed to recalculate the operating margin emission factor, 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);

As discussed in Section B-2, above, net electricity generation will be calculated from the difference between measured annual electricity generation and a reference pre-repowering energy output. The later is obtained from the 10-year monthly historical data and taking into account an average unavailability factor in order to discard low-end data.

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

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

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated annual or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
								Hydro plants have no direct emissions (PE_y = 0)

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

Hydro plants have no direct emissions (PE_y = 0).

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

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated annual, estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

1. $EG_{y,old}$	*Electricity supplied to the grid prior to project implementation*	*Energy metering connected to the grid and Receipt of Sales*	*MWh*	*M*	*At Validation*	*100%*	*Electronic*	*10-year monthly historical registers prior to project implementation.*
2. $EG_{y,new}$	*Electricity supplied to the grid by the project*	*Energy metering connected to the grid and Receipt of Sales*	*MWh*	*M*	*Hourly measurement and monthly recording*	*100%*	*Electronic*	*Energy output is registered by generator and controlled by ONS (*).*
3. EG_y	*Net electricity generated due to project activities*	*Calculated as the difference between $EG_{y,new}$ and $EG_{y,old}$*	*MWh*	*C*	*Performed monthly*	*100%*	*Electronic*	*To be multiplied by emission factor (EF_y) to obtain emission reductions for the period*
4. PUF	*Planned Unavailable Factor*	*Factor provided by ONS (*)*	*%*	*E*	*At Validation*	*n.a.*	*Electronic*	*Official factor used in National Energy Plan 2004*
5.UUF	*Unplanned Unavailable Factor*	*Factor provided by ONS (*)*	*%*	*E*	*At Validation*	*n.a.*	*Electronic*	*Official factor used in National Energy Plan 2004*
6. Efy	*CO_2 emission factor of the grid*	*Data provided by ONS (*). Calculated as per ACM0002*	*tCO_2/MWh*	*C*	*At Validation*	*n.a.*	*Electronic*	*Calculated as a weighted sum of the OM and BM emission Archived during crediting period.*
7. $EF_{OM,y}$	*CO_2 Operating emission factor of the grid*	*Data provided by ONS (*). Calculated as per ACM0002*	*tCO_2/MWh*	*C*	*At Validation*	*n.a.*	*Electronic*	*Archived during crediting period.*

8. $EF_{BM,y}$	*CO_2 Build Margin emission factor of the grid*	*Data provided by ONS (*). Calculated as per ACM0002*	*tCO_2/MWh*	*C*	*At Validation*	*n.a.*	*Electronic*	*Archived during crediting period.*
9. λ_y	*Fraction of time during which low-cost / must-run sources are on the margin*	*Data provided by ONS (*). Calculated as per ACM0002*	*number*	*C*	*At Validation*	*n.a.*	*Electronic*	*Archived during crediting period.*

(*) ONS – Operador Nacional do Sistema Elétrico – National Electric System Operator

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

Consolidated methodology ACM-002 states that:

> *A baseline emission factor (Efy) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source.*
>
> ***STEP 1.*** *Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$) based on one of the four following methods:*
> *(a) Simple OM, or*
> *(b) Simple adjusted OM, or*
> *annual Dispatch Data Analysis OM, or*
> *(d) Average OM.*

For this project, calculations will be made using “simple adjusted OM”.

> *(b) Simple Adjusted OM: This emission factor (EF_{OM}, simple adjusted, y) is a variation on the Simple OM method, where the power sources (including imports) are separated in low-cost/must-run power sources (k) and other power sources (j):*

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y).\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_{j} GEN_{j,y}} + \lambda_y.\frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_{k} GENk_{k,y}} \qquad (3)^{*}$$

where:

$F_{i,k,y}$ = *the amount of fuel annual (in a mass or volume unit) consumed by relevant power sources j in year(s) y (j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid),*

$COEF_{i,j\,y}$ = *the CO2 emission coefficient of fuel annual (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y,*

$GEN_{j,y}$ = *the electricity (MWh) delivered to the grid by source j, and*

$$\lambda_y = \frac{number\ of\ hours\ per\ year\ for\ which\ low-cost/must-run\ sources\ are\ on\ margin}{8760\ hours\ per\ year} \qquad (4)$$

where λ_y should be calculated from annual Load Duration Curves.

STEP 2. *Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants m, as follows:*

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (8)$$

where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described above for plants ***m****.*

For this project, calculations of the BM, will be made using “Option 1”.

* equation numbers are not in order of appearance and were taken directly from ACM-002

Option 1. Calculate the Build Margin emission factor EFBM,y ex ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of either
• the five power plants that have been built most recently, or
• the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

STEP 3. *Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):*

$$Efy = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (9)$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

Besides calculating baseline emission factor EF_y, it is necessary to determine energy generation prior to project activities. As pointed in Section B-2, approved methodology AM-0015 determines the calculation of the:

"net quantity of electricity generated due to the project activity (EG_y)… determined as the difference of the electricity generated by the plant after project implementation and the quantity of electricity that has been generated prior to project implementation, based on the average electricity generation of the last three years before project implementation."

Instead of using a three-year average, the following steps will be taken to determine a more conservative and technically sound average:

STEP 4a. Collect a 10-year span of monthly energy generation, prior to project activities;
STEP 4b. Use Planned and Unplanned Unavailability Factors (PUF / UUF) in order to ignore the unavailable fraction of energy generation for the period;
STEP 4c. Calculate average energy production ($EG_{y,old}$) discarding the unavailable fraction.

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:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated annual, estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable

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

Not applicable

D.2.3. Treatment of leakage in the monitoring plan :

All existing reservoirs will remain with the same volume as prior to project activities and, therefore, there are no additional leakages in the form of carbon dioxide or methane emissions.
As the repowering involved minor changes to the existing facilities, leakages due to construction material and transport of equipments were not considered significant.

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated annual or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable

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

Not applicable

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

Hydro plants have no direct emissions (PE_y = 0).

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.3 – 1	*low*	*Historical values validated by ONS*
D.2.1.3 – 2	*low*	*Measured value in compliance with internal procedures and validated by ONS*
D.2.1.3 – 3	*low*	*Calculated*

D.2.1.3 – 4	*low*	*Standard national value (ONS)*
D.2.1.3 – 5	*low*	*Standard national value (ONS)*
D.2.1.3 – 6	*low*	*Calculated*
D.2.1.3 – 7	*low*	*Calculated from official ONS data*
D.2.1.3 – 8	*low*	*Calculated from official ONS data*
D.2.1.3 – 9	*low*	*Calculated from official ONS data*

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

Not applicable

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

Sergio Augusto Weigert Ennes / Clean Air S.A. and Shigueo Watanabe Jr. / Clean Air S.A.
(project developers and participants listed in Annex 1 with contact information)

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

GHG emissions from project activities are zero ($PE_y = 0$).

E.2. Estimated leakage:

The repowering projects do not change reservoir volume nor include major construction activities, therefore no significant leakage is accounted for.

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

Emissions from overall project activities are zero.

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

Consolidated methodology ACM-002 states that:

> *For the purpose of determining the build margin (BM) and operating margin (OM) emission factor, as described below, a (regional) project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly, a connected electricity system, e.g. national or international, is defined as a (regional) electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints.*

Brazilian integrated electrical system is divided in four subsystems, as shown in Figure B-1. All CPFL plants are connected to the South-eastern – Midwestern system. This subsystem is strongly linked to the Southern system and dispatch operations are coordinated jointly. These two systems cover about 70% of the country's installed capacity. Emission factor will be calculated from dispatch data from these two systems.

> *A baseline emission factor (Efy) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source.*
>
> ***<u>STEP 1.</u>*** *Calculate the Operating Margin emission factor(s) (EFOM,y) based on one of the four following methods:*
> *(a) Simple OM, or*
> *(b) Simple adjusted OM, or*
> *annual Dispatch Data Analysis OM, or*
> *(d) Average OM.*

For this project, calculations will be made using "simple adjusted OM" since:

(a) – Simple OM: ACM002 states that this method "*can only be used where low-cost/must-run resources constitute less than 50% of total grid generation*". In both the national average and the

South – South-eastern – Midwestern system, hydro power accounts for much more than this limit during the last five years and in all expansion plans for the future.

annual – Dispatch Data Analysis: this is the preferred method but public available data is insufficient for performing the calculations;

(d) – Average OM: should be used only when none of the three other methods are feasible.

ACM002 describes the calculation procedure for the Simple Adjusted Operational Margin as:

(b) Simple Adjusted OM:. This emission factor (EF_{OM}, simple adjusted, y) is a variation on the Simple OM method, where the power sources (including imports) are separated in low-cost/must-run power sources (k) and other power sources (j):

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

where:

$F_{i,k,y}$ = *the amount of fuel annual (in a mass or volume unit) consumed by relevant power sources j in year(s) y (j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid),*

$COEF_{i,j\,y}$ = *the CO2 emission coefficient of fuel annual (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y,*

$GEN_{j,y}$ = *the electricity (MWh) delivered to the grid by source j, and*

λ_y = *time fraction in which low-cost/must-run sources are on the margin*

The CO2 emission coefficient, $COEF_{i,}$ is obtained as:

$$COEF_{i,} = NCV_i \,.\, EF_{i,CO2} \,.\, OXID_i;$$

where:
NCV_i = *net calorific value per unit mass or volume of a fuel* **annual***;*
$OXID_i$ = *oxidation factor of fuel* **annual** *according to IPCC 1996;*
$EF_{i,CO2}$ = *CO_2 emission factor for fuel* **annual** *according to IPCC 1996.*

The low-cost/must-run plants, indicated by subscript *k*, are hydro and nuclear power plants with no emissions associated with operations. Therefore the rightmost term of the equation is zero.

STEP 2. *Calculate the Build Margin emission factor (EF_{BM},y) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants m, as follows:*

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

where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described above for plants ***m***.

STEP 3. *Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):*

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

In a 2002 OECD paper (Bosi and Laurence, 2002), based on an analysis of dispatch data of 1479 plants in Brazil, the authors estimated the values of $EF_{OM,y}$ and $EF_{BM,y}$ as being 0,719 and 0,569 tCO_2e / MWh.

There has been a strenuous debate around these values and comments were posted during the validation period of some PDDs concerning the need of more recent data. During the last months, major Brazilian project developers updated these values using dispatch data from ONS (Operador Nacional do Sistema Elétrico) calculated these values as being 0,950 and 0.096 tCO_2e / MWh, respectively.

Furthermore, in PDDs presented by Ecoinvest (Brascan Project Activity, CatLeo Project Activity), currently in their validation period, argue that the Brazilian scenario is a typically determined by the operating margin, with $w_{OM} = 1$ and $w_{BM} = 0$.

The argument comes from the fact that small capacity projects, such as the ones presented in Ecoinvest's PDDs and the current CPFL project, have insignificant impact in future power plant investments. As stated in another OECD's paper (Kartha et al, 2002):

> *"The choice of baseline for electricity projects often revolves around the choice between operating margin versus build margin, and the question of which best represents the source(s) of avoided generation.*
> *Some baseline scenarios or methodologies reflect the belief that a given project will have no effect on other power sector investments, either because it is too small or because it brings additional investment to a sector that is short on capital for new power plant investments. These scenarios are operating margin scenarios, in that they assume the principal effect of a new project would be on the operation of current or future power plants."*

Using the weight factors for an operating margin scenario, the baseline emission factor is:

$EF = 0{,}452\ tCO_2e/MWh$

Besides calculating baseline emission factor EF_y, it is necessary to determine energy generation prior to project activities. As pointed in Section B-2, approved methodology AM-0015 determines the calculation of the:

> ***"net quantity of electricity generated due to the project activity (EG_y)… determined as the difference of the electricity generated by the plant after project implementation and the quantity of electricity that has been generated prior to project implementation, based on the average electricity generation of the last three years before project implementation."***

Instead of using a three-year average, the following steps will be taken to determine a more conservative and technically sound average:

STEP 4a. Collect a 10-year span of monthly energy generation, prior to project activities;
STEP 4b. Use Planned and Unplanned Unavailability Factors (PUF / UUF) in order to ignore the unavailable fraction of energy generation for the period;
STEP 4c. Calculate average energy production ($EG_{y,old}$) discarding the unavailable fraction.

Unavailability factors where taken from the 2004 National Operation Plan (Planejamento Annual da Operação Energética – Ano 2004) published by ONS as the mean values for Brazilian hydro plants. Again, as the plants included in this project are older than the average and, therefore, more likely to suffer stoppages and breakdowns, using these (lower) values is more conservative than determining the individual factors for each plant. The adopted values are:

PUF = 6,86%
UUF = 2,33%

The overall unavailable factor is then:

$UF = 1 - (1-PUF).(1-UUF) = 9,03\%$

The table below shows three different averages:

1. last three-year average, according to approved methodology ACM-0015;
2. ten-year average, without discarding fraction associated with the unavailability factor;
3. ten-year average, discarding unavailability fraction (baseline).

	ACM0015 three-year average	without unavailability factor	Baseline
	MWh	MWh	MWh
Esmeril	6.123	7.810	8.298
Dourados	26.620	34.869	38.039
Salto Grande	16.673	19.230	20.255
São Joaquim	29.918	30.090	31.368
Gavião Peixoto	21.298	23.253	24.654
Chibarro	9.806	10.699	11.112
Capão Preto	10.814	14.549	15.544
Buritis	259	3.904	4.259
Três Saltos	5.767	3.582	3.908

Table E-1 – Baseline and other average energy outputs

The adopted baseline is the most conservative average and is a technically more sound measure.

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

The net energy generated by project activities in year *y* in plant *j* is, thus:

$$\Delta EG_{j,y} = EG_{j,y} - EGB_j$$

where:

$EG_{j,y}$ = *energy output of plant* **j** *during year* **y**;

EGB_j = *baseline energy output of plant* **j** *taken from* 3^{rd} *column of table E-1.*

As direct project emissions are zero, emission reductions of the project activity are given by the product of the baseline emission factor by the net energy output of the plant:

$$ER_{j,y} = EF_y \, . \, \Delta EG_{j,y}$$

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

The tables below shows: the added capacity for each plant; total energy output of each plant; net additional energy output of each plant and associated estimate of emission reductions. Values from 2002 – 2004 are actual measurements and from 2005 onwards, the expected energy output.

Installed Capacity (MW)

SHP	2001	2002	2003	2004	2005	2006	2007	2008
Esmeril	1,76	5,04						
Dourados		6,40	10,80					
São Joaquim	5,52	8,05						
Gavião Peixoto					4,12	4,80		
Chibarro						2,29	2,71	
Capão Preto						5,52	4,20	
Total	25,61							35,60

Energy Output (GWh)

SHP	baseline	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Esmeril	8,30	0,00	17,31	26,75	25,23	25,23	25,23	25,30	25,23	25,23	25,23	25,30	25,23	25,23	25,23	25,30	25,23	25,23	25,23	25,30	25,23	25,23	25,23	25,30	25,23	25,23
Dourados	38,04		22,99	54,81	67,98	67,98	67,98	68,16	67,98	67,98	67,98	68,16	67,98	67,98	67,98	68,16	67,98	67,98	67,98	68,16	67,98	67,98	67,98	68,16	67,98	67,98
São Joaquim	31,37	12,69	35,20	47,81	49,32	49,32	49,32	49,45	49,32	49,32	49,32	49,45	49,32	49,32	49,32	49,45	49,32	49,32	49,32	49,45	49,32	49,32	49,32	49,45	49,32	49,32
Gavião Peixoto	24,65					33,20	33,20	33,29	33,20	33,20	33,20	33,29	33,20	33,20	33,20	33,29	33,20	33,20	33,20	33,29	33,20	33,20	33,20	33,29	33,20	33,20
Chibarro	11,11						13,32	13,35	13,32	13,32	13,32	13,35	13,32	13,32	13,32	13,35	13,32	13,32	13,32	13,35	13,32	13,32	13,32	13,35	13,32	13,32
Capão Preto	15,54						18,57	18,62	18,57	18,57	18,57	18,62	18,57	18,57	18,57	18,62	18,57	18,57	18,57	18,62	18,57	18,57	18,57	18,62	18,57	18,57

Net Energy Output (GWh)

SHP	baseline	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Esmeril		0,00	9,01	18,45	16,93	16,93	16,93	17,00	16,93	16,93	16,93	17,00	16,93	16,93	16,93	17,00	16,93	16,93	16,93	17,00	16,93	16,93	16,93	17,00	16,93	16,93
Dourados			0,00	16,77	29,94	29,94	29,94	30,12	29,94	29,94	29,94	30,12	29,94	29,94	29,94	30,12	29,94	29,94	29,94	30,12	29,94	29,94	29,94	30,12	29,94	29,94
São Joaquim			3,83	16,45	17,95	17,95	17,95	18,09	17,95	17,95	17,95	18,09	17,95	17,95	17,95	18,09	17,95	17,95	17,95	18,09	17,95	17,95	17,95	18,09	17,95	17,95
Gavião Peixoto						8,55	8,55	8,64	8,55	8,55	8,55	8,64	8,55	8,55	8,55	8,64	8,55	8,55	8,55	8,64	8,55	8,55	8,55	8,64	8,55	8,55
Capão Preto							2,20	2,24	2,20	2,20	2,20	2,24	2,20	2,20	2,20	2,24	2,20	2,20	2,20	2,24	2,20	2,20	2,20	2,24	2,20	2,20
Chibarro							3,03	3,08	3,03	3,03	3,03	3,08	3,03	3,03	3,03	3,08	3,03	3,03	3,03	3,08	3,03	3,03	3,03	3,08	3,03	3,03
total additional energy		*0,0*	*12,8*	*51,7*	64,8	73,4	78,6	79,2	78,6	78,6	78,6	79,2	78,6	78,6	78,6	79,2	78,6	78,6	78,6	79,2	78,6	78,6	78,6	79,2	78,6	78,6
thousand tCO2e		*0,0*	*5,8*	*23,4*	29,3	33,2	35,5	35,8	35,5	35,5	35,5	35,8	35,5	35,5	35,5	35,8	35,5	35,5	35,5	35,8	35,5	35,5	35,5	35,8	35,5	35,5

	net additional output (GWh)	ER ($ktCO_2e$)	accumulated ER ($ktCO_2e$)
from 2003 - 2005	129	58	58
from 2003 - 2009	439	198	198
from 2010 - 2016	551	249	448
from 2017 - 2023	551	249	697

Table E-2 – Installed Capacity, Baseline and Power production, Net Energy Output and Emission Reductions during project lifetime

The table below summarizes these figures:

Year	Estimation of project activity emisson reductions (tonnes of CO_2e)	Estimation of baseline emisson reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2003	23.734	17.929	-	5.805
2004	58.476	35.123	-	23.354
2005	64.421	35.123	-	29.299
2006	79.428	46.266	-	33.162
2007	93.841	58.315	-	35.526
2008	94.098	58.315	-	35.783
2009	93.841	58.315	-	35.526
2010	93.841	58.315	-	35.526
2011	93.841	58.315	-	35.526
2012	94.098	58.315	-	35.783
2013	93.841	58.315	-	35.526
2014	93.841	58.315	-	35.526
2015	93.841	58.315	-	35.526
2016	94.098	58.315	-	35.783
2017	93.841	58.315	-	35.526
2018	93.841	58.315	-	35.526
2019	93.841	58.315	-	35.526
2020	94.098	58.315	-	35.783
2021	93.841	58.315	-	35.526
2022	93.841	58.315	-	35.526
2023	93.841	58.315	-	35.526
Total (tonnes of CO_2e)	1.822.378	1.125.790		696.588

Table E-3 – Project Activity Emission Reductions

SECTION F. Environmental impacts

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

All plants were built before 1930 and are, according to Brazilian law, exempt from environmental licenses as long as no modifications are made that might affect flooded area, reservoir size or significant changes to buildings. Annex 6 presents a copy of the official document from the State Environmental Secretary exempting the plants from needing licenses.

The activities of this project will cause no changes in the size of the reservoirs during project's lifetime. ANEEL – Agência Nacional de Energia Elétrica, the federal regulatory agency for the electric sector, carries annual inspections in all plants and reports on the physical and operational conditions of all site installations. Annex 7 presents the reports made after the latest inspections.

In 2001, CPFL submitted to the Environmental State Secretary (Secretaria Estadual do Meio Ambiente) reports on the project for each plant, specifying the scope of the works that where then planned to be carried out. These reports contain the necessary explanations of the zero-environmental impact stemming from each project.

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 impacts were not considered significant.

SECTION G. Stakeholders' comments

This project will cause no changes in existing sites and reservoirs.

The plant sites, being built in early 1900s, have historical value as a testimony of the social-economical development of the state of São Paulo and of the country, representing the early stages of the industrial boom that then took place. The sites still have the housings built for the employees that operated the plants that are in the same style of the housings used by railway workers that were built by English engineers. One of CPFL' concerns, following their commitment with the community they serve, was to preserve local and national heritage and therefore all improvements to be made should be carried in way as to not affect this cultural asset.

The repowering project presented here is part of a larger modernization program being developed by CPFL. One important part of this program deal with plant automation. By now, all plants (including other eight plants that are not being repowered or were before year 2000) are fully operated from the company's central command room located at the Campinas headquarters. As a consequence of the automation process, around 100 employees would no longer be needed as plant operators. Instead of simply dismissing them, CPFL developed a special plan where those who where near retiring age received an extra incentive that overcompensated early-retirement and the rest passed through retraining courses and were relocated to better posts.

Under these circumstances, no specific communications with stakeholders were held for the first three plants that were repowered and are in operation (Esmeril, Dourados and São Joaquim).

Brazilian DNA (Interministerial Commission on Global Climate Change – CIMGC/MCT) released Resolution #1 defining the necessary procedures of stakeholder communications for projects in Brazil. This Resolution was released in September, 2003, when these first three plants were in operation.

In order to comply with Resolution #01, steps are being taken to hold communications with stakeholders relative to the remaining plants.

Furthermore, this PDD will be open for comments through the DOE's site during the validation process.

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

G.2. Summary of the comments received:

No comments were received.

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

No actions were taken.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was or will be used in this project

Annex 3

BASELINE INFORMATION

All information presented in Section E.

Annex 4

MONITORING PLAN

Required information presented in Sections C and E.

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Annex 5

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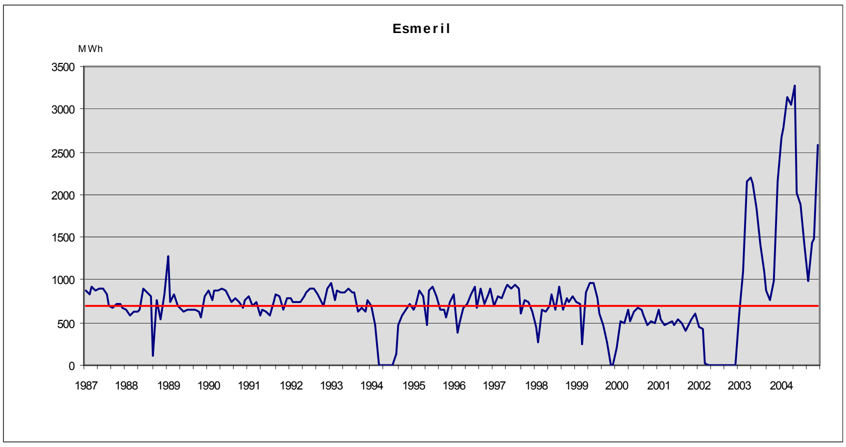
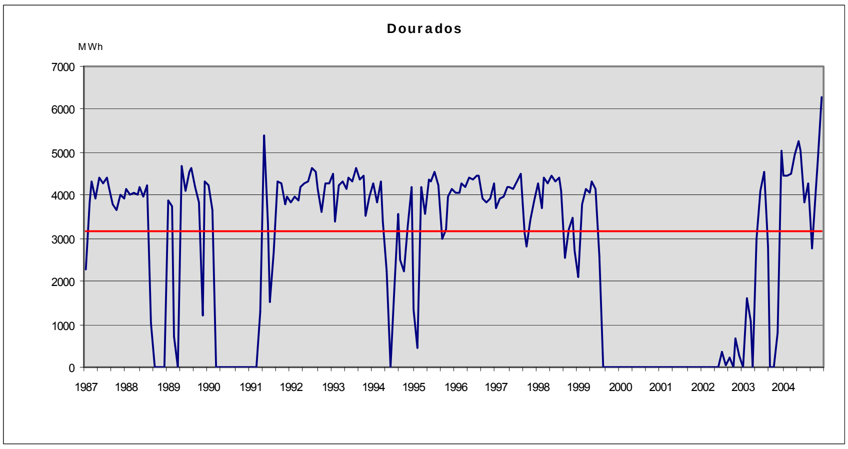
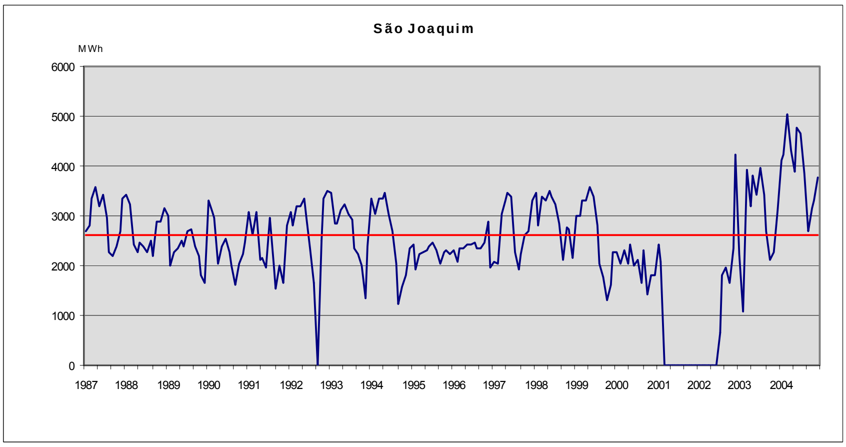
Annex 6

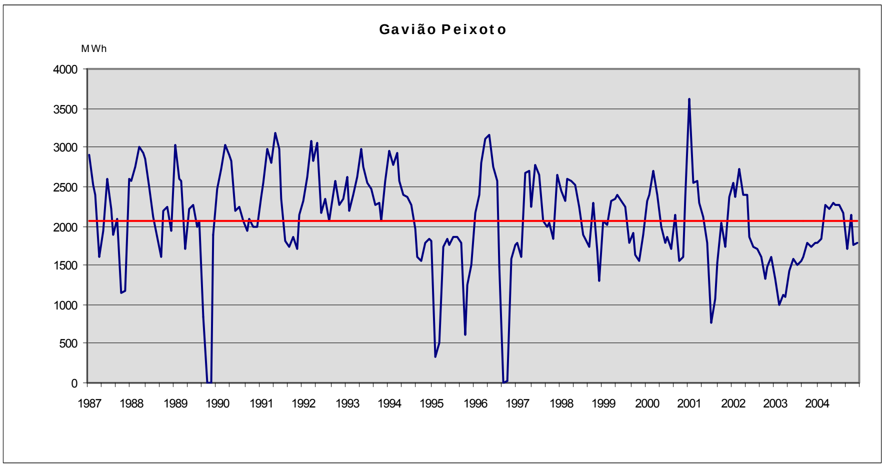
ENERGY GENERATION 1987 - 2004

The tables used in these graphs were used to calculate the average energy output prior to project activities ($EG_{y,old}$). These values are plotted on the graphs for comparison.





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3000
2500
2000
1500
1000
500
0
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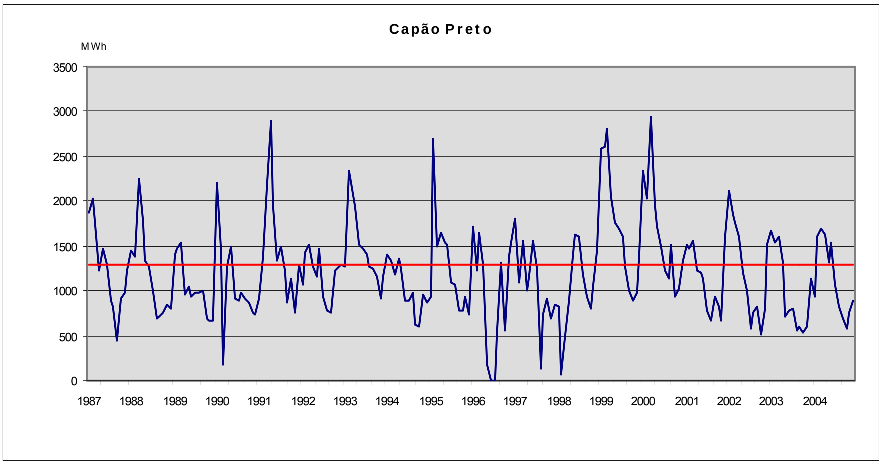
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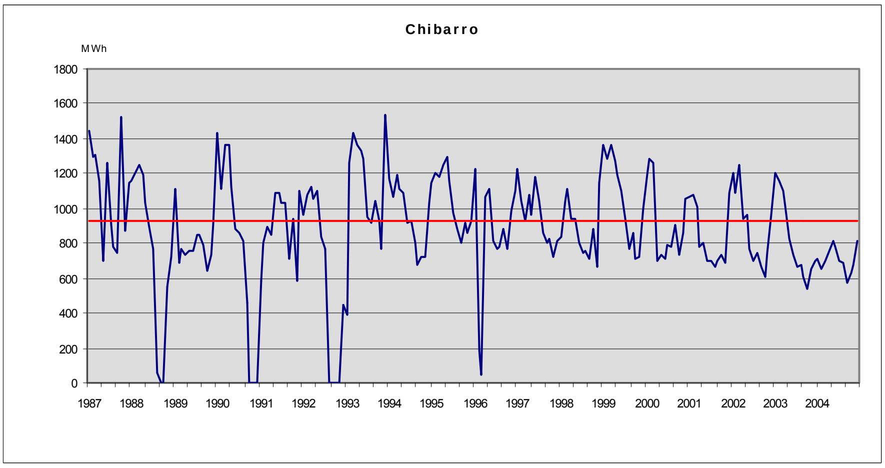
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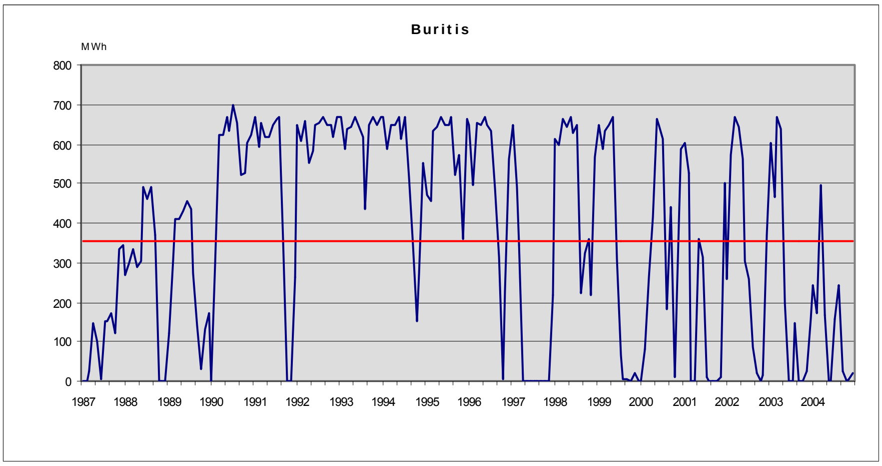
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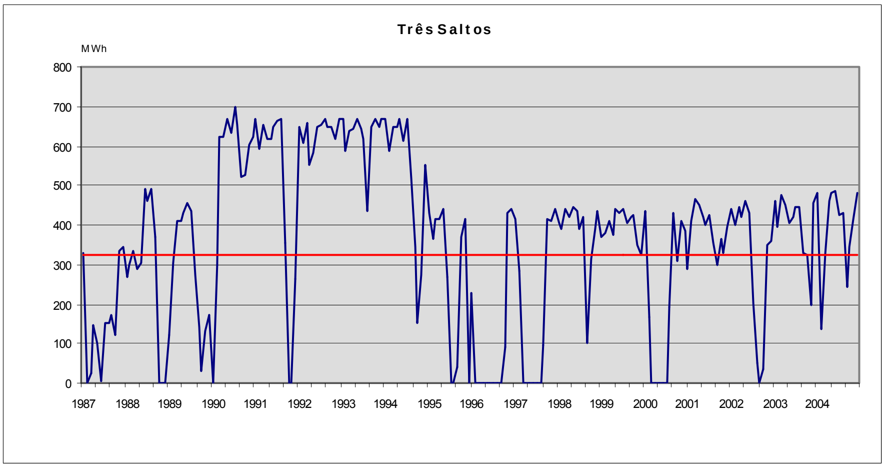
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