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: Thermal Power Plant Manauara CDM Project Activity (hereafter referred to as "*TPP Manauara*").

PDD Version number: 1.

Date: November 21th, 2007.

A.2. Description of the project activity:

>>

The objective o *TPP Manaura* is about a construction of a Thermal Power Plant using Natural Gas as primary fuel and oil as second. But there wasn´t a Natural Gas Pipeline in the begging of the project, then the first phase was about the construction and operation of a TPP, with fuel oil, more efficient than the other similar power plants connected to the same grid. The new TPP efficiency is about 42% whereas the other is about 30%. The TPP started its commercial operation on September 2006.

The *TPP Manauara* has 85.38 MW of Power Capacity Installed, actually contracted just 60 MW effectively, generating around 525,600 MWh per year considering the availability of 100% and 8,760 hours per year.

The estimated specific consumption in the first phase is about 209 kg fuel oil/MWh.

The Isolated Brazilian Electric System, predominantly thermal and mainly situated and spread on the North of the Country, serves an area of 45% of Brazilian territory and around 3% of national population, approximately 1,4 million consumers.

The project activity is located in Manaus, Amazonas. The *TPP Manauara* is located in the Isolated Brazilian System, not connected to the SIN (National Interconnected System), but connected to a local grid with 10 Power Plants in the Manaus System.

The main positive impact of the *TPP Manauara* is the reduction of the instability of the electricity supply. It will benefit all the Manaus' population and the local companies.

The Engineering Administration of Eletrobras manages the "Grupo Técnico Operacional da Região Norte (North Region Operational Technical Group)" - GTON, responsible for the Accomplishment of the Isolated Systems Operation of the North Region. Its creation, through the regulation MINFRA nº 895, from November 29th ,1990, considers the need to assure to the consumers of the Isolated Systems of the following States: Acre, Amazonas, Pará, Rondônia, Roraima, Amapá e Mato Grosso, not pondered with the advantages offered by SIN (National Interconnected System), the electricity supply in suitable conditions of safety and quality.

Figure 1 – Thermal Power Plant Site

A.3. Project participants:

>>

The credit owner and Project CDM´s Focal Point of *TPP Manauara*, the private company *Companhia Energética Manauara* is the author and responsible entity for all the project activities related to management, approving, registering, monitoring, measurement and reporting.

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)	Private Entity: Companhia Energética Manauara	No
	Private Entity: C-Trade Comercializadora de Carbono Ltda	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Table 1 – Private and public parties and entities involved in the activity

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

This project was developed under the responsibility of *Manauara* with the support of *C-Trade Comercializadora de Carbono Ltda.* All the activities are being developed in and limited to Brazil.

The following is a brief description about the companies involved in the project:

COMPANHIA ENERGÉTICA MANAUARA

Companhia Energética Manauara is a PIE (Energy Independent Producer) since June 13th 2006, according to the ANEEL Authorizative Resolution nº 608, with the Construction and Operation of the *TPP Manauara*.

Companhia Energética Manauara is a private company with two shareholders: TEP – Termoelétrica Potiguar S.A (60%) and Petrobras Distribuidora S.A. (40%).

C-TRADE COMERCIALIZADORA DE CARBONO LTDA.

C-Trade is a private company created for the purpose of identifying, certifying and negotiating Carbon Credits. C-Trade develops studies and analyses aimed towards the development of greenhouse gas (GHG) emissions reduction projects. Not only the identification but also the validation and certification of CERs (Certified emission reductions) fall within the scope of these projects.

The C-Trade team is specialized in the identification and reduction development of GHG emissions that are effected directly or indirectly by each project, among these: Small Power Plants, Electric and Biomass Power Plants, Wind Power Plants, substitution of petroleum fuels, reforestation projects and landfills.

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.:

>>
Amazonas.

A.4.1.3. City/Town/Community etc:

>>
Manaus.

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

>>

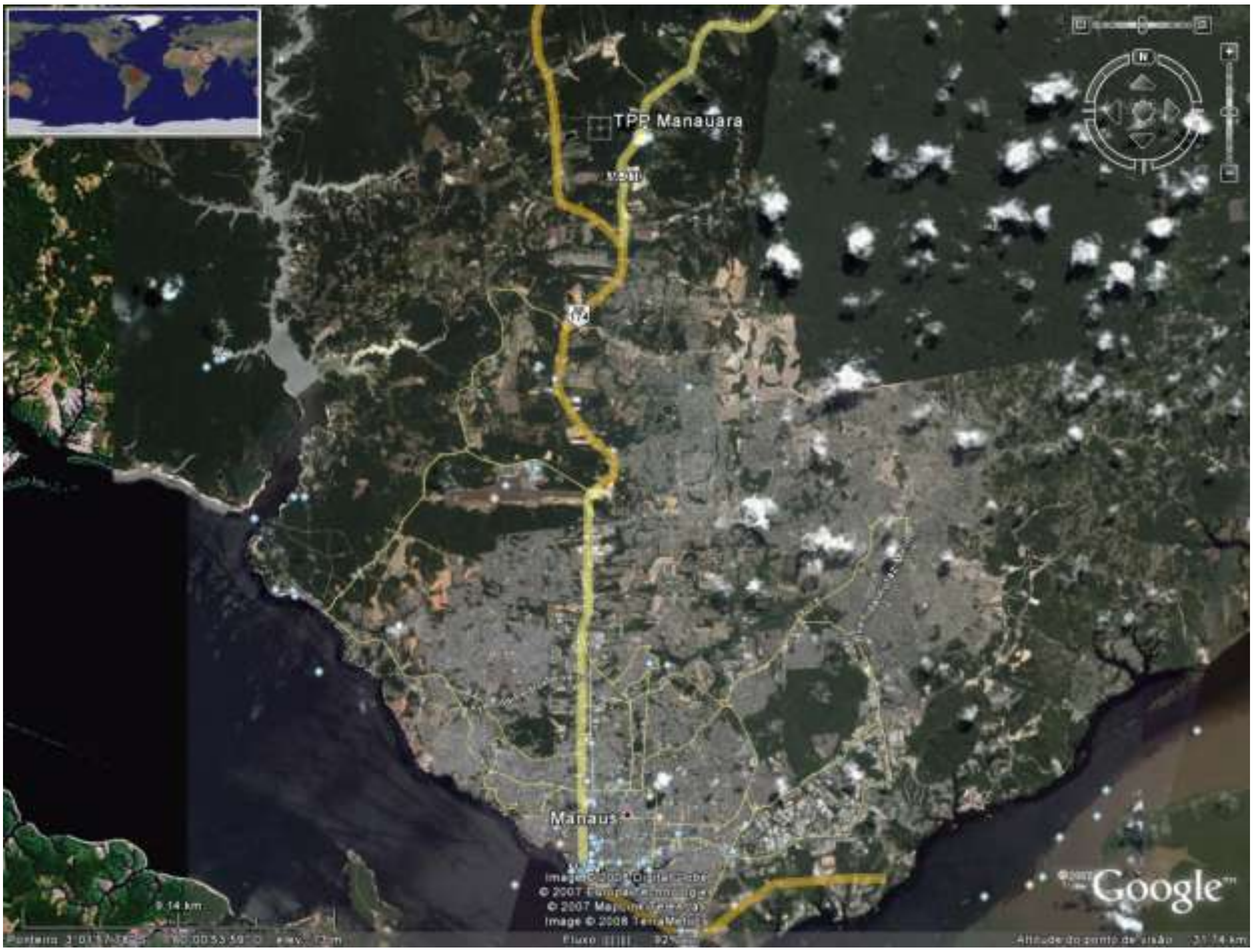


Figure2 – Location of TPP Manauara (Source: Google Earth)

The project activity is located in the North of Brazil, State of Amazonas. Manaus is an area far from the National Integrated Grid.

The Thermal Power Plant Manauara is located in the km 20 of the Highway AM10 in the Manaus City.

According to the ANEEL Empowered Resolution Nº 608, of June 13th 2006, the geographical coordinates are:

- Longitude: 60° 01’ 18.688’’East
- Latitude: 02° 56’ 27.316’’South
- Altitude: 80m

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

>>

Sectoral Scope 1 – Energy Industries (Non-Renewable Source)

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

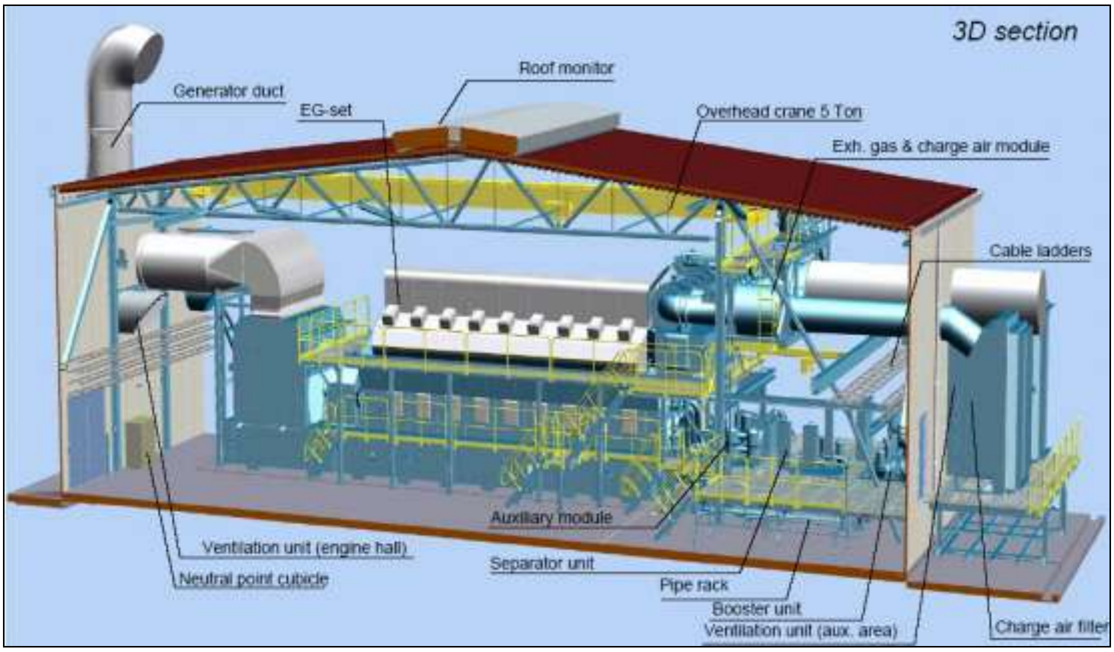
>>

TPP Manauara has 5 generators made by Wärtsilä, model 18V46, to achieve 85.38 MW.

The main fuel used is fuel oil type OCA1. The efficiency of Manauara's generators is better than the thermal power plants' generators located in same grid.

The commercial operation started on September 22[th], 2006.

The table below shows the Thermal Power Plant design:



See in the table below the technology employed by the project activity:

Engine type	Rated power				
	50/60 Hz		500, 514 rpm 975 kW/cyl	500, 514 rpm 1050 kW/cyl	500, 514 rpm 1155 kW/cyl
	Power Plants		Marine & Power	Marine	Marine
	Eng. kW	Gen. kW	kW	kW	kW
6L46	5 850	5675	5 850	6 300	6 930
8L46	7 800	7565	7 800	8 400	9 240
9L46	8 775	8510	8 775	9 450	10 395
12V46	11 700	11350	11 700	12 600	13 860
16V46	15 600	15120	15 600	16 800	18 480
18V46*	17 550	17076	17 550	18 900	20 790

* Available only for power plants and diesel electric propulsion.

1 kW = 1.3596 hp (metric)

Source: Cia. Energética Manauara and Wärtsilä

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

>>

Using the ex-post emission factor of the baseline calculated presented at the item B.7.1, the complete implementation of the *TPP Manauara Project*, connected to the North Isolated Brazilian Grid (Interconnected Manaus Grid), will generate an yearly average estimated reduction of **85,348 tCO_{2e}** and a total reduction of **597,437 tCO_{2e}** during the first 7-year-period, described in the table 4 below:

Year	Estimated Annual Emission Reduction (tCO2)
2008	85,348
2009	85,348
2010	85,348
2011	85,348
2012	85,348
2013	85,348
2014	85,348
TOTAL	597,437
Total of Crediting Year	7
Annual Average durante the first period of Credit	85,348

Table 4 – Estimation of emissions reductions of the *TPP Manauara* Project

A.4.5. Public funding of the project activity:

>>

There weren’t any public funding on this project activity.

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:

>>
The **approved baseline and monitoring methodology** of the project activity are based on the Proposed of Revision on the methodology: ACM0013 – "Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology"

It was already used the following documents:

- "Tool for demonstration and assessment of additionality", version 4;
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", version 1;

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

>>
The *TPP Manauara* follows the methodology ACM0013 applicability conditions:

- The project activity is the construction and operation of a new fossil fuel fired grid-connect electricity generation plant that uses a more efficient power generation technology than what would otherwise be used with the given fossil fuel:
    - The *TPP Manauara*'s efficiency is about 42% while the other similar plants efficiency connected to the same grid is about 30%;
- The project activity is not a co-generation power plant;
- Data on fuel consumption and electricity generation of recently constructed power plant is available;
- The identified baseline fuel was used in more than 50% of total generation by utilities in the geographical area in the last three years.
    - There is just one Hydro Power Plant connected to the same grid. All the Thermal Power Plants consumptions are of Oil.

This methodology is only applicable to new electricity generation plants. For project activities involving retrofit of existing facilities with the installation of highly efficient technologies, project proponents are encouraged to submit new methodologies. For project activities involving a switch to a less GHG intensive fossil fuel in existing power plants, project participants may use approved methodology ACM0011. For project activities involving construction and operation of a new power plant with less GHG intensive fossil fuel, project participants may use approved methodology AM0029.

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

>>

	Source	Gas	Included?	Justification / Explanation
Baseline	Power generation in baseline	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	On-site fuel combustion in the project plant	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification.

Project Boundaries

The project boundaries are defined by the emissions directed or directly affected by the project activities, construction and operation. It encompasses the geographic and physical site of the hydropower generation source, which is represented by the corresponding basin to the river of each project, close to the power plant and the interconnected grid.

Brazil is a country with great territorial dimensions and it is divided in five geographical macro-areas: North, Northeast, Southeast, South and Midwest. Thus electric energy generation, and consequently, transmission are concentrated in four subsystems: South, Southeast/Midwest and Northeast. Electric energy expansion was concentrated in two specific areas:

- North (Interconnected Systems)/northeast: This region's electricity is basically supplied by the São Francisco River. There are seven hydropower plants on the river, with a total installed capacity of approximately 10.5 GW. Eighty percent of the Northern region is supplied by diesel fueled power plants;

- South/Southeast/Midwest: The majority of the electricity generated in the country is concentrated in this subsystem. These regions also concentrate 70% of GDP generation in Brazil. There are more than 50 hydropower plants generating electricity for it.

- North (Isolated Systems): It is formed by Isolated Systems and also by the Manaus Interconnected System where the *TPP Manauara* is connected.

The boundaries of the subsystems are defined by the transmission capacity. The transmission lines between the subsystems are defined by the transmission capacity. The lack of transmission lines forces the concentration of generated electricity in each of the subsystems.

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

>>

Identification of the baseline scenario

Project participants shall use the following steps to define the baseline scenario:

Identify plausible baseline scenarios

The identification of alternative baseline scenarios should include all possible realistic and credible alternatives that provide outputs or services comparable with the proposed CDM project activity (including the proposed project activity without CDM benefits), i.e., all type of power plants that could be constructed as alternative to the project activity within the grid boundary (as defined in ACM0002).

Alternatives to be analyzed should include, inter alias:

- The project activity not implemented as a CDM project;
- The construction of one or several other power plant instead of the proposed project activity, including
  - Power generation using the same fossil fuel type as in the project activity, but technologies other than that used in the project activity;
  - Power generation using fossil fuel types other than that used in the project activity;
  - Other power generation technologies, such as renewable power generation;
- Import electricity from connected grids, including the possibility of new interconnections.

The methodology is based on the approach of "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment" and needs financial data of the project activity and its alternatives. For detailed baseline analysis, above-mentioned methodology is applied as under for the evaluation of selected project as a CDM project and calculation of emission reductions as per the baseline.

The project activity increases the installed capacity of the Southern electricity grid, thereby reducing the energy and power demand shortage. Also, it further avoids / delays the capacity addition of equivalent project size and reduces the carbon intensity of the grid mix. Therefore, the project activity needs the data/information of the grid mix regarding the baseline emissions for further evaluation of project activity as a CDM project and same data/information was collected from government/non-government organizations and other authentic sources.

The following paragraphs describe in a step by step manner how the methodology is applied in the context of the project activity.

Identification of baseline scenario for the project activity:
Baseline selection guideline as mentioned in the methodology has been applied.

Step1. Identification of alternatives to the project activity consistent with current laws and regulations

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

As per the selected methodology, the project proponent is required to establish that the GHG reductions due to project activity are additional to those that would have occurred in absence of the project activity as per the 'Tool for the demonstration and assessment of additionality (Version 03)'.

Additionality of project activity is discussed further.

The project activity is under the second case, construction and operation of a Thermal Power Plant.

The alternatives for this activity are:

1) The project activity not implemented as a CDM projects

One of the points the activity was implement was considering it as a CDM project, according to the less emissions of GHG from it. The revenue from it was also important for the decision of constructing a new power plant due to the lower IRR.

2) Continuing on the old condition

As it was answered on the item above, the less environmental impacts were one of the most important regarding. The investor would let the money in the bank due to the SELIC was higher than the project IRR.

3) Power generation with natural gas

Considering a recent study of Eletronorte, the NG pipelines would be just implemented in the Manaus up to 2010. The main objective of the Project Manauara is this option. But while it is not possible to use Natural Gas as fuel it will be used the fuel oil OCA1.

4) Power generation technologies using energy sources other than natural gas

There is just one Hydro Power Plant in the Manaus Interconnected System. A Construction of a Hydro Power Plant depends on the rivers. In the Amazonas region a construction of a Hydro Power Plant is difficult considering the rivers' quality for generation and considering the environmental impacts.

5) Conditions of Construction of Interconnections Power Lines to the grid

The project studies are under development according to Eletrobras. The main point is constructing the Interconnection Power Lines with the less environmental impacts, that is why it is planned to construct the Interconnections Power Lines through the SIN (National Interconnect System) up to 2012.

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):

>>

From the Version 4 of "Tool of assessment and demonstration of additionality":

Following are the steps necessary for the demonstration and assessment of Manauara Project additionality.

Starting date of the project activity:

The starting date of the project activity is August 3rd, 2005 (construction start), i.e., after January 1, 2000.

Evidence that the incentive from he CDM was seriously considered in the decision to proceed with the project activity:

The project sponsor started assessing the potential of the carbon market for the bid process of the Manauara Thermal Power Plant potential. Manaus Energia advising companies and specialists to assess the potential CDM revenues, during 2004.

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

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

1. The identified realistic alternatives to the project activity are:

- The project activity not implemented as a CDM projects
- Continuing on the old condition
- Power generation with natural gas
- Power generation technologies using energy sources other than natural gas
- Conditions of Construction of Interconnections Power Lines to the grid

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

Both the project activity and the alternative scenarios are in compliance with all regulations.

All the alternatives are observed in the Manaus interconnected System and there is no obligation of following any of the alternatives.

1b.2. The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions.

Legislation

Both alternatives are according to the Brazilian norms and regulations of the mentioned institutions above. There is not an imposition by any of these legislation and regulations obligating the construction of a Thermal or a Hydroelectric Power Plant.

Conclusions:

The project activity and the alternative scenarios follow all the Brazilian norms and regulations and them can also be observed as being tendencies of Brazilian market.

1b.3. If an alternative does not comply with all mandatory applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that noncompliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration.

Not applicable.

1b.4. If the proposed project activity is the only alternative amongst the ones considered by the project participants that is in compliance with mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional.

Not applicable

SATISFIES/PASSES – Go to Step 2

Step 2. Investment analysis

Determine whether the proposed project activity is economically or financially less attractive than at least one other alternative, identified in step 1, without the revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, use the following sub-steps:

Sub-step 2a. Determine appropriate analysis method

Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (sub-step 2b). If the CDM project activity generates no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).

Benchmark analysis (Option III) will be used to analyse the *TPP Manauara* Project Activities.

Sub-step 2b – Option III. Apply benchmark analysis

Identify the financial indicator:

- Shareholders IRR will be used as project financial indicator and as reference to represent the standard returns in the market the Brazilian interest rate will be used, known as *SELIC* (Special System of Clearance sale and of Custody).

SELIC description

SELIC - Special System for Settlement and Custody (Sistema Especial de Liquidação e de Custódia)

SELIC is a great computerized system, under the responsibility of the Central Bank of Brazil and of the National Association of the Institutions of the Open Markets, since 1980, when it was created. The Committee of National Monetary Politics (COPOM) stipulates SELIC Target that can be defined as the average rate of the daily financings, with ballast in federal titles, select in the Selic System, which is in force for the whole period among ordinary meetings of the Committee.

The SELIC rate is cleaned in the SELIC System and obtained by the calculation of the considered and adjusted medium tax of the financing operations by one day, ballasted in federal public titles and studied in referred him system or in clearing house and clearance sale of assets. The operators of the institutions transfer SELIC, on line, the relative businesses to public titles involving banks that buy and that you/they sell those titles. Therefore, the Selic rate is the rate that remunerates the investors in the purchase business and sale of public titles.

The qualified financial institutions, such as banks, savings banks, society's brokers of titles and values furniture, distributing societies of titles are capable to make this kind of operation.

The most liquid government bond is the LFT (floating rate bonds based on the daily reference rate of the Central Bank of Brazil). As of January 2006, 37% of the domestic federal debt was in LFTs and had duration of one day (Source: Tesouro Nacional; www.tesouro.fazenda.gov.br). This bond rate almost follows the CDI rate, which is influenced by the SELIC rate, defined by COPOM.

The SELIC rate has been oscillating since 1999, from a minimum of 11.73% a.a. in July 2007 up to a maximum of 43.25% a.a. in January 2003 (Figure 5).

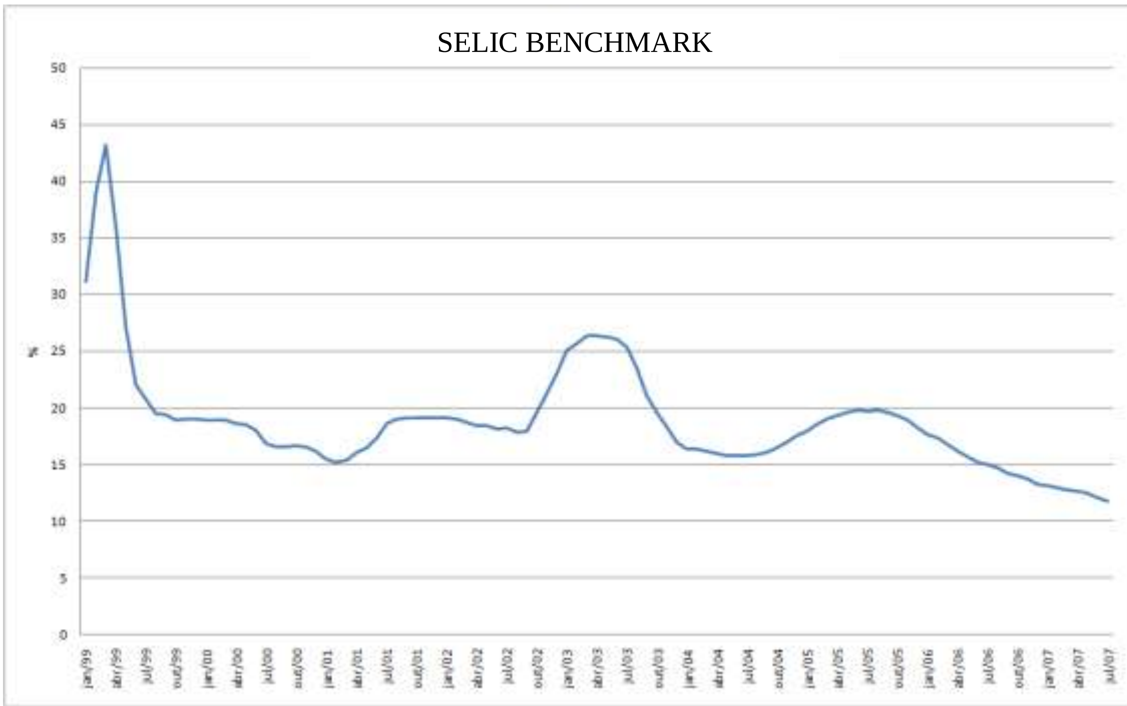


Figure 5 - SELIC rate evolution 1999 to 2007 (Source: Banco Central do Brasil)

The Manauara´s project analysis was made in during 2004.

It will be considered the average from January 2002 to December 2004 for the SELIC of 16.29%.

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

CDM's "Tool for the demonstration and assessment of additionality" was approved after the project started operations. In order to comply with that Tool, the financial analysis shown below was performed using the original assumptions for investment, revenues from sales of electricity and operational costs for the scenario without CDM related revenues.

For the following calculations the assumptions were:

Investment	79,590,894	US$ thousand	171,720,422	R$ thousand
Electricity Price	215.88	US$/MWh	464.15	R$/MWh
Operational Costs	6.94	US$/MWh	14.93	R$/MWh
Administrative Costs	2,558,140	US$/year	5,500,000	R$/year

Table 6 - Cash Flow Assumptions – Exchange Rate 2.15 R$/US$

The table below show the Cash Flow, according to the assumptions on table 6:

CIA ENERGÉTICA MANAUARA
Cash Flow - R$ (Thousand)
Period: 2006 - 2025

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
01 - INITIAL BALANCE	0	6,111	222	14,542	4,406	14,887	26,604	31,578	29,238	29,219	31,078	35,094	35,788	37,757	42,172	41,509	49,194	59,279	69,792	76,950
02 - OPERATIONAL ACTIVITIES	0	9,544	45,838	27,864	28,101	31,833	24,977	18,178	26,263	31,826	41,845	29,880	39,859	40,314	27,588	48,913	48,069	58,466	49,275	23,672
EARNINGS	0	99,080	154,289	136,801	140,521	143,740	147,137	149,989	153,880	157,916	162,439	167,086	171,603	176,812	182,573	188,094	193,885	200,215	206,696	92,642
GUARANTEE ENERGY	0	44,424	72,268	62,632	67,203	69,995	72,796	75,707	78,735	81,885	85,160	88,566	92,109	95,793	99,625	103,610	107,755	112,065	116,547	53,172
CONTRACTED ENERGY	0	10,489	17,613	15,431	16,605	17,246	17,936	18,653	19,399	20,175	20,982	21,822	22,694	23,602	24,546	25,528	26,549	27,611	28,716	13,108
ENC. CONNECTION	0	42,552	64,407	58,738	56,613	56,501	56,406	55,629	55,746	55,856	56,297	56,698	56,880	57,416	58,402	58,956	59,581	60,639	61,433	27,362
OTHER REVENUES	0	274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCIAL REVENUES	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PAYMENTS	0	-85,536	-109,250	-113,938	-112,420	-111,910	-122,159	-131,811	-127,616	-126,089	-121,395	-137,206	-131,825	-136,498	-159,993	-139,181	-145,816	-141,849	-157,421	-70,020
FUEL	0	-37,776	-54,191	-51,317	-49,883	-49,686	-49,620	-48,967	-49,023	-49,126	-49,497	-49,853	-50,024	-50,477	-51,324	-51,835	-52,278	-53,289	-54,002	-25,731
PERSONNEL COSTS	0	-1,925	-1,808	-1,890	-1,944	-2,113	-2,199	-2,286	-2,378	-2,473	-2,617	-2,677	-2,785	-2,896	-3,012	-3,133	-3,251	-3,381	-3,516	-1,699
SERVICES COSTS	0	-3,118	-1,763	-1,880	-1,698	-1,766	-1,836	-1,910	-1,986	-2,065	-2,148	-2,234	-2,323	-2,416	-2,513	-2,613	-2,718	-2,827	-2,940	-1,399
MATERIAL COSTS	0	-132	-62	-65	-69	-72	-75	-78	-81	-84	-88	-91	-95	-99	-103	-107	-111	-115	-120	-54
GENERAL COSTS	0	-1,933	-1,866	-3,730	-1,915	-1,971	-2,030	-2,091	-2,155	-2,221	-2,290	-2,362	-2,436	-2,514	-2,594	-2,678	-3,212	-3,340	-3,474	-1,523
OPERATIONAL EXPENSES	0	-14,098	-16,803	-19,114	-20,288	-16,729	-25,418	-34,250	-28,344	-24,993	-18,048	-31,728	-24,152	-26,304	-46,743	-22,187	-30,024	-23,150	-35,595	-11,556
TAXES	0	-26,369	-29,353	-33,210	-31,336	-33,881	-35,124	-36,203	-37,430	-38,704	-40,067	-41,476	-42,917	-44,464	-46,101	-47,761	-49,493	-51,341	-53,228	-23,787
IRPJ / CSLL	0	-3,188	-3,405	-3,033	-5,287	-5,682	-5,858	-6,025	-6,220	-6,422	-6,639	-6,864	-7,093	-7,338	-7,603	-7,868	-4,629	-4,407	-4,547	-4,336
03 - INVESTMENT ACTIVITIES	0	3,780	0	-24,363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INVESTMENTS	0	-450	0	-29,363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAPITAL INPUT	0	4,230	0	5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04 - FINANCING ACTIVITIES	0	-19,213	-30,718	-8,637	-17,620	-20,115	-20,003	-20,518	-26,283	-29,968	-37,028	-29,106	-37,890	-35,898	-23,244	-41,228	-37,984	-47,953	-42,117	-49,519
LOANS	0	19,191	4,620	27,434	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMORTIZATION - BASA ROTATIVE	0	0	-9,820	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMORTIZATION - FDA	0	0	-3,369	-5,143	-5,488	-5,855	-6,248	-6,666	-7,112	-7,588	-8,097	-8,640	-9,219	-9,835	-10,493	-11,196	-11,946	-12,748	-13,600	-39,158
AMORTIZATION - FNO	0	-581	-3,527	-3,527	-3,527	-3,527	-3,527	-3,527	-3,527	-3,527	-3,527	-3,527	-3,527	-1,176	0	0	0	0	0	0
AMORTIZATION - FNO NATURAL GAS CONVERSION	0	0	0	-1,211	-2,492	-2,252	-2,022	-1,766	-1,531	-1,291	-1,054	-753	-629	-329	-92	0	0	0	0	0
AMORTIZATION - PONTE USINA BASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMORTIZATION - PONTE MIDDLE TERM	0	-20	-5,193	-5,666	-5,666	-5,666	-5,666	-472	0	0	0	0	0	0	0	0	0	0	0	0
AMORTIZATION - GAS CONVERSION BASA	0	0	0	-9,788	9,788	9,788	9,788	0	0	0	0	0	0	0	0	0	0	0	0	0
AMORTIZATION - BR	0	-823	-641	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMORTIZATION - MUTUAL	0	-10,018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTEREST - FDA	0	0	-1,172	-1,819	-1,591	-1,600	-1,607	-1,599	-1,587	-1,567	-1,542	-1,497	-1,443	-1,376	-1,297	-1,193	-1,074	-934	-772	-579
INTEREST - FNO	0	-1,583	-3,651	-3,306	-2,972	-2,637	-2,308	-1,967	-1,632	-1,297	-965	-628	-293	-23	0	0	0	0	0	0
INTEREST - FNO NATURAL GAS CONVERSION	0	0	0	-632	-2,530	-2,530	-2,530	-2,530	-2,530	-2,530	-2,530	-2,319	-2,741	-2,530	-2,108	0	0	0	0	0
INTEREST - PONTE USINA BASA	0	-17,347	-680	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTEREST - PONTE MIDDLE TERM	0	0	-3,711	-3,186	-2,313	-1,437	-593	-6	0	0	0	0	0	0	0	0	0	0	0	0
INTEREST - GAS CONVERSION BASA	0	-105	-1,367	-347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTEREST - BR	0	-38	-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTEREST - MUTUAL	0	-4,945	0	-142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER FINANCING	0	-2,948	-2,168	-1,203	-830	-842	-909	-956	-922	-905	-866	-974	-937	-954	-1,117	-961	-1,033	-968	-1,083	-506
DIVIDENDS	0	0	0	0	0	-3,558	-4,421	-1,028	-7,440	-11,262	-18,447	-10,768	-19,101	-19,675	-8,136	-27,877	-23,930	-33,304	-26,662	-9,275
05 - CASH TOTAL GENERATION	6,111	-5,889	14,320	-10,136	10,481	11,717	4,974	-2,340	-19	1,858	4,817	694	1,969	4,416	-664	7,685	10,085	10,513	7,157	-25,897
06 - FINAL BALANCE	6,111	222	14,542	4,406	14,887	26,604	31,578	29,238	29,219	31,078	35,094	35,788	37,757	42,172	41,509	49,194	59,279	69,792	76,950	51,053
		-5,889	14,320	-10,136	10,481	15,279	9,599	-1,312	7,421	13,120	22,464	11,462	21,070	24,090	7,473	35,562	34,015	43,817	33,820	-16,621

NPV - R$ Thousand
BASE: CASH GENERATION

TAXA:	13.60%	11.40%	12.00%	16.00%
	R$ 21,178	R$ 23,885	R$ 23,095	R$ 18,745

NPV - R$ Thousand
BASE: INITIAL INPUT/ DIVIDENDS

TAXA:	13.60%	11.40%	12.00%	16.00%
	R$ 29,248	R$ 39,922	R$ 36,674	R$ 20,792

INITIAL INPUT 29,892

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
-29,892	0	-4,230	0	-5,000	0	3,558	4,421	1,028	7,440	11,262	18,447	10,768	19,101	19,675	8,136	27,877	23,930	33,304	26,662	9,275

IRR 13.45%

Table 7 - The 20 year analysis period corresponds to the average length of analysis in the electric sector.

Results:

INTERNAL RATE OF RETURN (IRR)	**13.45%**
SELIC (AVERAGE OF 2002-2004)	**19.57%**
DIFFERENCE	**-6.12%**

Table 8 – Project Results IRR x Benchmark

The cash flow above was made on June 2007. According to the results the TPP Manauara, the Shareholders IRR was under the benchmark SELIC. The difference between them was about 3%, considering that the average of the SELIC in the period between 2002 and 2004 was about 16%.

This shows that without CER revenues, the project would reach lower rates of return than the benchmark rate, concluding that:

- Sub-step 2.c – 8b: The financial benchmark, if Option III (benchmark analysis) is used. If the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity *cannot be considered as financially attractive*.

Sub-step 2d. Sensitivity analysis

The three main variables that might affect the project's finance are:

- Electricity revenues
- Operational Costs
- Administrative costs

Even when increasing the electricity revenues 10% over and decreasing the operational and administrative costs 10% down the IRR achieves just 15%.

According to the sensitivity analysis the CDM project are unlikely to be financially attractive due to its IRR are lower than benchmark. The average SELIC for the period (Jan/2002 – Dec/2004) was 19.57%.

According to the Addicionality Tool, the expected outcome from the step 2 is the follow:

"If after the sensitivity analysis is concluded that the proposed CDM project activity is unlike to be the most financially attractive (as per step 2c -8a) or is unlikely to be financially attractive (as per step 2c – 8b), then proceed to Step 4 (Common practice analysis). If the project participants so wish, they may apply the step 3 (Barrier Analysis) as well."

SATISFIED/PASS – Proceed to Step 4

Step 4. Common practice analysis

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

There were similar activities to *TPP Manauara* but they were less efficient due to the technology. They have an higher specific consumption than *TPP Manauara*.

There were 10 Thermal Power Plants connected to the grid as July 2005 and the average of efficiency was around 30%, while TPP Manaura efficiency is around 42%, according to the calculation in the item B.6.3.

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

There weren´t Thermal Power Plants being constructed in the begging of the project. There were just studies of new Thermal Power Plants.

The risks and barriers of the projects is obtaining financing from the Brazilian banks. Project feasibility requires a PPA contract with a utility company, but the utilities do not have the incentives or motivation to buy electricity directly from independent power producers.

The TPP Manauara had difficulties in the agreements with FDA (Amazonia Development Fund) and FNO (Constitutional North Fund). And even with the agreements signed, the *TPP Manauara* had to wait more time than the expected to receive the money. That was one of the risks and one of the reasons why the IRR was lower than the initially expected.

SATISFIED/PASS – Project is ADDITIONAL

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
Project activity adopted the procedures mentioned in the approved methodology (ACM0013) to calculate project emissions, baseline emissions, leakage emissions and emission reductions.

The procedures used for calculating these emissions are described below, according to the ACM0013:

Baseline emissions:

Baseline emissions are calculated by multiplying the electricity generated in the project plant ($EG_{PJ,y}$) with a baseline CO_2 emission factor ($EF_{BL,CO2,y}$), as follows:

$$BE_y = EG_{PJ,y} \times EF_{BL,CO2,y} \quad \textbf{(1)}$$

Where:

- BE_y : baseline emissions in year *y* (tCO2)
- $EG_{PJ,y}$ is the net quantity of electricity generated in the project plant in year *y* (MWh)
- $EF_{BL,CO2,y}$ is the baseline emission factor in year *y* (tCO2/MWh)

$EF_{BL,CO2}$ will be determined using the lower value between the emission factor of the technology and fuel type that has been identified as the most likely baseline scenario and a benchmark emission factor determined based on the performance of the top 15% power plants that use the same fuel as the project plant and any technology available in the geographical area as defined in Step 2 below.

Project participants shall use for $EF_{BL,CO2,y}$ the lowest value among the following two options:

Option 1: The emission factor of the technology and fuel identified as the most likely baseline scenario under "Identification of the baseline scenario" section above, and calculated as follows:

$$EF_{BL,CO2,y} = \frac{MIN(EF_{FF,BL,CO2,y}; EF_{FF,PJ,CO2,y})}{\eta_{BL}} \times 3.6\ GJ/MWh \quad \textbf{(2)}$$

Where:

- $EF_{BL,CO2,y}$ is the baseline emission factor in year *y* (tCO2/MWh)
- $EF_{FF,BL,CO2,y}$ is the CO2 baseline emission factor of the baseline fossil fuel type that has been identified as the most likely baseline scenario (tCO2 / Mass or volume unit)
- $EF_{FF,PJ,CO2,y}$ is the average CO2 emission factor of the fossil fuel type used in the project plant in year *y* (tCO2 / Mass or volume unit)
- η_{BL} is the energy efficiency of the power generation technology that has been identified as the most likely baseline scenario

Option 2: The average emissions intensity of all power plants *j*, corresponding to the power plants whose performance is among the top 15 % of their category, as follows:

$$EF_{BL,CO2,y} = \frac{\sum_{j} FC_{j,x} * NCV_{j,x} * EF_{CO2,j,x}}{\sum_{j} EG_{j,x}} \quad \textbf{(3)}$$

Where:

- $EF_{BL,CO2,y}$ is the baseline emission factor in year *y* (tCO2/MWh)
- $FC_{j,x}$ is the amount of fuel consumed by power plant *j* in year *x* (Mass or volume unit)
- $NCV_{j,x}$ is the net calorific value of the fossil fuel type consumed by power plant j in year *x* (GJ / Mass or volume unit)
- $EF_{CO2,j,x}$ is the CO2 emission factor of the fossil fuel type consumed by power plant *j* in year *x* (tCO2 / Mass or volume unit)
- $EG_{j,x}$ is the net electricity generated and delivered to the grid by power plant *j* in year *x*
- x is the most recent year prior to the start of the project activity for which data is available
- j the top 15% performing power plants (excluding cogeneration plants and including power plants registered as CDM project activities), as identified below, among all power plants in a defined geographical area that have a similar size, are operated at similar load and use the same fuel type as the project activity

NOTE: that in case of option 2, *EBBL,CO2,y* is not monitored annually but only calculated once at the start of the crediting period and updated at the renewal of a crediting period.

For determination of the top 15% performer power plants *j*, the following step-wise approach is used:

Step 1: Definition of similar plants to the project activity

- The sample group of similar power plants should consist of all power plants (except for cogeneration power plants) that use the same fossil fuel type as the project activity, where fuel types are defined in the following categories:
    - Coal
    - Oils (e.g. diesel, kerosene, residual oil)
    - Natural gas;

- That have been constructed in the previous five years;
- That have a comparable size to the project activity, defined as the range from 50% to 150% of the rated capacity of the project plant;
- That are operated in the same load category, i.e. at peak load (defined as a load factor of less than 3,000 hours per year) or base load (defined as a load factor of more than 3,000 hours per year) as the project activity; and
- That has operated (supplied electricity to the grid) in the year prior to the start of the project activity.

As the Manaus Interconnected System has no Thermal Power Plants constructed in the previous five years (considering the moment of analysis – July 2006) it will be considered all the Power Plants connected to that grid which are similar considering the other items.

Step 2: Definition of the geographical area

The geographical area to identify similar power plants should be chosen in a manner that the total number of power plants "N" in the sample group comprises at least 10 plants. As a default, the grid3 to which the project plant will be connected should be used. If the number of similar plants, as defined in Step 1, within the grid boundary is less than 10, the geographical area should be extended to the country. If the number of similar plants is still less than 10, the geographical area should be extended by including all neighboring non-Annex I countries. If the number remains to be less than 10, all non-Annex I countries in the continent should be considered.

If the necessary data on power plants of the sample group in the relevant geographical area are not available, or if there are less than 10 similar power plants in all non-Annex I countries in the continent, then data from power plants annex I or OECD countries can be used instead.

The geographical area is the Manaus Interconnected System. See the annex B for more details.

Step 3: Identification of the sample group

Identify all power plants *n* that are to be included in the sample group. Determine the total number "N" of all identified power plants that use the same fuel as the project plant and any technology available within the geographical area, as defined in Step 2 above.

The sample group should also include all power plants within the geographical area registered as CDM project activities, which meet the criteria defined in Step 1 above.

As the Power Plants connected through the Manaus System are few all the Power Plants will be considered to the calculations.

Step 4: Determination of the plant efficiencies

Calculate the operational efficiency of each power plant *n* identified in the previous step. The most recent one-year data available shall be used. The operational efficiency of each power plant *n* in the sample group is calculated as follows:

$$\eta_{n,x} = \frac{EG_{n,x}}{FC_{n,x} * NCV_{n,x} * 277.8} \quad \textbf{(4)}$$

Where:

- $EG_{n,x}$ is the net electricity generated and delivered to the grid by the power plant *n* in the year *x* (MWh)
- $FC_{n,x}$ is the quantity of fuel consumed in the power plant *n* in year *x* (Mass or volume unit)
- $NCV_{n,x}$, is the net calorific value of the fuel type fired in power plant *n* in year *y* (GJ / mass or volume unit)
- 277.8 is a conversion factor from TJ to MWh
- n are all power plants in the defined geographical area that have a similar size, are operated at similar load and use the same fuel types as the project activity
- x is the most recent year prior to the start of the project activity for which data are available

Step 5: Identification of the top 15% performer plants j

Sort the sample group of *N* plants from the power plants with the highest to the lowest operational efficiency. Identify the top 15% performer plants *j* as the plants with the 1st to Jth highest operational efficiency, where the *J* (the total number of plants *j*) is calculated as the product of N (the total number of plants *n* identified in step 3) and 15%, rounded down if it is decimal.4 If the generation of all identified plants *j* (the top 15% performers) is less than 15% of the total generation of all plants n (the whole sample group), then the number of plants *j* included in the top 15% performer group should be enlarged until the group represents at least 15% of total generation of all plants *n*.

All Steps should be documented transparently, including a list of the plants identified in Steps 3 and 5, as well as relevant data on the fuel consumption and electricity generation of all identified power plants.

As the Manaus Interconnected System had just 10 Thermal Power Plants in December 2005, the average of the thermal power plants' efficiency was considered to calculate the η_{BL}.

Leakage

No leakage emissions are to be considered according to the methodology.

Project Emissions:

The procedures used for calculating these emissions are described below, according to the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion":

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y} \quad (6)$$

Where:

- $PE_{FC,j,y}$ are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2 /yr);
- $FC_{i,j,y}$ is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr);
- $COEF_{i,y}$ is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2 / mass or volume unit);
- *i* are the fuel types combusted in process *j* during the year *y*.

The CO_2 emission coefficient $COEF_{i,y}$ can be calculated following two procedures, depending on the available data on the fossil fuel type *i*, as follows:

Option A: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type *i*, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $$COEF_{i,y} = w_{C,i,y} \times 44/12 \quad \textbf{(7)}$$

If $FC_{i,j,y}$ is measured in a volume unit: $$COEF_{i,y} = w_{C,i,y} \times \rho_{i,y} \times 44/12 \quad \textbf{(8)}$$

Where:

- COEFi,y is the CO2 emission coefficient of fuel type i (tCO2 / mass or volume unit);

- wC,i,y is the weighted average mass fraction of carbon in fuel type i in year y (tC / mass unit of the fuel);
- ρi,y is the weighted average density of fuel type i in year y (mass unit / volume unit of the fuel);
- i are the fuel types combusted in process j during the year y.

Option B: The CO2 emission coefficient COEFi,y is calculated based on net calorific value and CO2 emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$ **(9)**

Where:

- COEFi,y is the CO2 emission coefficient of fuel type i in year y
- (tCO2 / mass or volume unit);
- NCVi,y is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit);
- EFCO2,i,y is the weighted average CO2 emission factor of fuel type i in year y (tCO2/GJ);
- i are the fuel types combusted in process j during the year y.

Option A should be the preferred approach, if the necessary data is available.

<u>Emission reductions</u>

To calculate the emission reductions the project participant shall apply the following equation:
Where:

$$ER_y = BE_y - PE_y$$ **(5)**

- ERy are the emission reductions in year *y* (tCO2)
- BEy are the baseline emissions in year *y* (tCO2)
- PEy are the project emissions in year *y* (tCO2)

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

Data / Parameter:	**NCV_y**
Data unit:	GJ/kg
Description:	Net Calorific Value
Source of data used:	MME (Mines and Energy Ministry)
Value applied:	0.040
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$EF_{CO2,f,y}$**
Data unit:	tCO_2/GJ
Description:	Emission Factor of fuel oil
Source of data used:	IPCC
Value applied:	0.077
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**OXIDf**
Data unit:	
Description:	Oxidation factor of fuel oil
Source of data used:	IPCC
Value applied:	0.99
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**η_{BL}**
Data unit:	%
Description:	Baseline Efficiency of the Thermal Power Plants
Source of data used:	Estimated according to the Eletrobras Reports.
Value applied:	32.87
Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimated according to the average of the efficiency of the Thermal Power Plants of the grid.
Any comment:	

Data / Parameter:	**$COEF_{BL}$**
Data unit:	$tCO2/GJ$
Description:	Emission factor of fuel oil
Source of data used:	IPCC
Value applied:	0.074
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$EG_{PJ,y}$**
Data unit:	MWh
Description:	Estimated Yearly Electricity Generation
Source of data used:	Eletrobras
Value applied:	525.600
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

- Expected Fuel Consumption: 109,805.4 ton fuel oil/year.
- Expected Energy Generation: 525,600 MWh/year.
- Specific Consumption: 0.209 ton /MWh (according Contract with ANEEL).

Project Emission:

According to the Formulas (6) and (9) from this PDD, the project emissions are the following:

(9) $COEF_{i,j} = NCV_{i,j} \times EF_{CO2,i,j}$ = 3.108 tCO2/ton

$NCV_{i,j}$ = 40,1514 GJ/ton

$EF_{CO2,i,j}$ = 0,0774 tCO2/GJ

(6) $PE_{FC,j,y} = FC_{i,j,y} \times COEF_{i,j}$ = 341,244 tCO2/year

$FC_{i,j,y}$ = 109,805.4 ton/year

$COEF_{i,j}$ = 3.108 tCO2/ton

Baseline Emission:

The Thermal Power Plant Manauara started operation on September 2006. So it will be analyzed the three years before 2006 to calculate the Efficiency and Baseline Emission Factor. The TPPs' fuels are: fuel oil and diesel. As the Carbon Content Factor of them is closer both of them will be used for the calculation.

According to the Grid Profile and the analysis in the Annex 2, the Thermal Power Plants had the following fuel consumption and electricity generation:

Fuel Consumption						
TYPE	NAME	FUEL TYPE	UNIT	2003	2004	2005
HPP	Balbina	hydro		-	-	-
TPP	Aparecida	diesel	m3	207,010	121,277	234,153
TPP	Mauá	fuel oil	ton	153,115	189,833	189,238
TPP	Electron	diesel	m3	58,302	33,379	6,796
TPP	PIE El Paso A	diesel	m3	90,299	100,138	85,561
TPP	PIE El Paso B	diesel	m3	267,135	271,047	294,861
TPP	PIE El Paso D	diesel	m3	203,276	168,653	166,510
TPP	PIE El Paso W	fuel oil	ton	231,466	222,962	229,099
TPP	Cidade Nova	diesel	m3	-	17,322	15,768
TPP	São José	diesel	m3	-	64,958	39,420
TPP	Flores	diesel	m3	-	-	70,562

- TPP (Thermal Power Plant)
- HPP (Hydropower Plant)

Electricity Generation										
TYPE	*NAME*	*UNIT*	2003	2004	2005		*UNIT*	2003	2004	2005
HPP	Balbina	MWaverage	82.70	100.10	86.60		MWh/year			
TPP	Aparecida	MWaverage	67.50	40.60	83.50		MWh/year	591,300.00	355,656.00	731,460.00
TPP	Mauá	MWaverage	49.90	65.50	65.50		MWh/year	437,124.00	573,780.00	573,780.00
TPP	Electron	MWaverage	17.50	10.00	2.00		MWh/year	153,300.00	87,600.00	17,520.00
TPP	PIE El Paso A	MWaverage	27.10	30.00	25.70		MWh/year	237,396.00	262,800.00	225,132.00
TPP	PIE El Paso B	MWaverage	80.20	81.20	88.60		MWh/year	702,552.00	711,312.00	776,136.00
TPP	PIE El Paso D	MWaverage	66.30	60.00	63.40		MWh/year	580,788.00	525,600.00	555,384.00
TPP	PIE El Paso W	MWaverage	120.10	120.90	127.60		MWh/year	1,052,076.00	1,059,084.00	1,117,776.00
TPP	Cidade Nova	MWaverage	-	6.80	6.70		MWh/year	-	59,568.00	58,692.00
TPP	São José	MWaverage	-	25.50	16.70		MWh/year	-	223,380.00	146,292.00
TPP	Flores	MWaverage	-	-	29.80		MWh/year	-	-	261,048.00
						Total	MWh/year	3,754,536.00	3,858,780.00	4,463,220.00

- TPP (Thermal Power Plant)
- HPP (Hydropower Plant)

Resulting in an average **Efficiency** of:

TYPE	*NAME*	2005
HPP	Balbina	
TPP	Aparecida	31.66%
TPP	Mauá	27.18%
TPP	Electron	26.13%
TPP	PIE El Paso A	26.67%
TPP	PIE El Paso B	26.68%
TPP	PIE El Paso D	33.80%
TPP	PIE El Paso W	43.74%
TPP	Cidade Nova	37.72%
TPP	São José	37.61%
TPP	Flores	37.49%
	AVERAGE	32.87%

- TPP (Thermal Power Plant)
- HPP (Hydropower Plant)

The Baseline Efficiency value is 32.87%, the average of 2005.

The calculation above was done using the Formula (4) from this PDD. η_{BL}= 32.87%

Option 1:

$EF_{FF,BL,CO2,y}$ = 0.0741 tCO2/GJ
$EF_{FF,PJ,CO2,y}$ = 0.0774 tCO2/GJ

From the Formula (2) the result is:

$EF_{BL,CO2,y} = MIN (EF_{FF,BL,CO2,y;}\ EF_{FF,PJ,CO2,y}) \times 3.6\ GJ/MWh \div \eta_{BL}$
$EF_{BL,CO2,y} = 0.0741 \times 3.6 \div 0.3287 = 0.8116$ tCO2/MWh

Option 2:

$EF_{BL,CO2,y}$ = 0.8134 tCO2/MWh

It must be considered the lower number between the Option 1 and Option 2.

$EF_{BL,CO2,y}$ = 0.8116 tCO2/MWh

From the Formula (1) of this PDD the BE_y is:

$BEy = EG_{PJ,y} \times EF_{BL,CO2,y}$ = 426,592 tCO2/year.

$EG_{PJ,y}$ = 525,600 MWh/year

$EF_{BL,CO2,y}$ = 0.8116 tCO2/MWh

Considering the Formula (5) the CERs resulting from the 1st Phase of the Project are:

Emission Reductions:

ERy = BEy – PEy = 426,592 – 341,244 = 85,348 tCO2/year

BEy = 426,592 tCO2/year

PEy = 341,244 tCO2/year

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

Year	Estimation of project activity emissions	Estimation of baseline emissions	Estimation of leakage	Estimation of overall emission reductions
	(tones of CO_2e)	(tones of CO_2e)	(tones of CO_2e)	(tones of CO_2e)
2008	341,244	426,592	0	85,348
2009	341,244	426,592	0	85,348
2010	341,244	426,592	0	85,348
2011	341,244	426,592	0	85,348
2012	341,244	426,592	0	85,348
2013	341,244	426,592	0	85,348
2014	341,244	426,592	0	85,348
Total (tones of CO2e)	**2,388,711**	**2,986,147**	**0**	**597,437**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	Estimated Yearly Electricity Generation
Source of data to be used:	Eletrobras
Value of data applied for the purpose of calculating expected emission reductions in section B.5	525,600
Description of measurement methods and procedures to be applied:	Measured by Manaus Energia with metering devices and with the Eletrobras procedures.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$FC_{i,j,y}$
Data unit:	tons
Description:	Estimated Yearly Fuel Consumption
Source of data to be used:	BR Distribuidora invoices
Value of data applied for the purpose of calculating expected emission reductions in section B.5	109,850
Description of measurement methods and procedures to be applied:	Delivered fuel or natural gas consumption.
QA/QC procedures to be applied:	
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The project activity meets the methodology applicability criteria as under:

- The project activity is the construction and operation of a new Thermal Power Plant, more efficient than the other similar power plants connected the same grid, and
- A fuel substitution from Fuel Oil to Natural Gas.

- The geographical/ physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available.

- Fuels are sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity.

All the data to be monitored to estimate project, baseline and leakage emissions for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

It will be followed the procedures to monitor the electricity and fuel quantity. The SCD (Operational Data Collection System) and further documentation of Eletrobras will be used to read all the necessary data.

For the fuel monitoring it will be used the invoices of the fuel oil suppliers.

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)

>>

Date of completion of baseline study and monitoring methodology: November 21th 2007

C-Trade Comercializadora de Carbono has determined the baseline and monitoring methodology for the project activity. The entity is a project participant listed in Annex-I where the contact information has also been provided.

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:

>>
22/September/2006

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

>>
30 years

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

C.2.1. Renewable crediting period

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

>>
01/January/2008

C.2.1.2. Length of the first crediting period:

>>
7 years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

SECTION D. Environmental impacts

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

>>

The growing global concern on sustainable use of resources is driving a requirement for more sensitive environmental management practices. Increasingly this is being reflected in countries' policies and legislation. In Brazil the situation is not different. Environmental rules and licensing policies are very demanding in line with the best international practices.

In Brazil, the sponsor of any project that involves construction, installation, expansion or operation of any polluting or potentially polluting activity or any other capable to cause environmental degradation is obliged to secure a series of permits from the relevant environmental agency (federal and/or local, depending on the project).

In order to obtain all environmental licenses every the process starts with a previous analysis (preliminary studies) by the local environmental department.

After that, if the project is considered environmentally feasible, the sponsors have to prepare the Environmental Assessment, which is basically composed by the following information:

- Reasons for project implementation;
- Project description, including information regarding the reservoir;
- Preliminary Environmental Diagnosis, mentioning main biotic, and anthropic aspects;
- Preliminary estimation of project impacts; e
- Possible mitigating measures and environmental programs.

The result of those assessments is the Preliminary License (LP), which reflects the environmental local agency positive understanding about the environmental project concepts.

Following the history of Licenses:

Previous License (LP)

- Previous License (LP) – by IPAAM for the Transmission Lines – N^{o} 144/05
    - Signed: October 9th 2005
    - Validity: 365 days

- Previous License (LP) – by IPAAM for the Plant – N^{o} 144/05
    - Signed: October 9th 2005
    - Validity: 365 days

Installation License (LI)

- Installation License (LI) – by IPAAM for the Plant – N^{o} 138/05
    - Signed: November 28th 2005
    - Validity: 60 days

- Installation License (LI) – by IPAAM for the Plant – N° 138/05–01
    - Signed: February 6th 2006
    - Validity: 60 days

- Installation License (LI) – by IPAAM for the Plant – N° 138/05–02
    - Signed: April 26th 2006
    - Validity: 60 days

- Installation License (LI) – by IPAAM for the Transmission Lines – N° 074/06
    - Signed: May 4th 2006
    - Validity: 365 days

Operation License (LO)

- Operation License (LO) – by IPAAM for the Plant – N° 262/06–01 – Electricity Generation
    - Signed: August 26th 2006
    - Validity: 365 days

- Operation License (LO) – by IPAAM for the Plant – N° 369/06 – Electricity Transmission
    - Signed: August 26th 2006
    - Validity: 365 days

- Operation License (LO) – by IPAAM for the Plant – N° 262/06–02 – Electricity Generation
    - Signed: October 25th 2007
    - Validity: 365 days

- Operation License (LO) – by IPAAM for the Plant – N° 369/06–01 – Electricity Transmission
    - Signed: August 14th 2007
    - Validity: 365 days

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:

>>

The environmental impact of the project activity is considered small.

The forecast is that the project activity will contribute to improve the provisioning of electricity and, at the same time, it will contribute to the sustainability environmental, social and economical.

The project has all of the environmental licenses and necessary installation satisfying several demands of the state environmental legislation - IPAAM (State Foundation of Environmental Protection of Amazonas) - and of the Brazilian electric section - ANEEL (National Agency of Electric power).

In the processes of licenses obtainment, reports were prepared containing the investigation of the following aspects, among others:

- Impacts in the climate and in the quality of the air.

- Geological impacts and in the soil.
- Impacts in the hydrology (underground water and of surface).
- Impacts in the flora and in the animal life.
- Socioeconomic (necessary infrastructure, legal and institutional aspects, etc.).

SECTION E. Stakeholders' comments

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

>>

In addition to the stakeholders' comments, solicited for obtaining environmental licenses, the Brazilian Designated National Authority, "*Comissão Interministerial de Mudanças Globais do Clima*", solicits stakeholders' comments based on a translated version of the PDD and the validation report emitted by an authorized DOE according to Resolution No. 1, issued on September 11th, 2003, in order to provide the letter of approval.

The project proponents sent these letters to the stakeholders to solicit their comments while the project PDD remained open to comments during the validation stage on the CDM – Executive Board's website (http://cdm.unfccc.int/), since anyone can have access to the document mentioned coming from a legitimate source.

E.2. Summary of the comments received:

>>

The Brazilian DNA asks that the CDM projects stay obligatory open for comments before the validation. Besides the international public comments process of UNFCCC, the project will be open for comments at the same time of local interested parties. Any comments will be presented after the validation.

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

>>

The Brazilian DNA asks that the CDM projects stay obligatory open for comments before the validation. Besides the international public comments process of UNFCCC, the project will be open at the same time for comments of local interested parties. Any comments will be presented after the validation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	C-TRADE COMERCIALIZADORA DE CARBONO LTDA.
Street/P.O.Box:	Avenida Rio Branco, nº 1, 9º andar, Bloco B (parte)
Building:	
City:	Rio de Janeiro
State/Region:	Rio de Janeiro
Postfix/ZIP:	
Country:	Brazil
Telephone:	+55 21 2114-1707
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	Lawyer
Salutation:	Sir.
Last Name:	Schmidt
Middle Name:	Guerra
First Name:	Guilherme
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	gschmidt@svmfa.com.br

Organization:	Companhia Energética Manauara
Street/P.O.Box:	Rod.AM10, km 20
Building:	
City:	Manaus
State/Region:	Amazonas
Postfix/ZIP:	69049-970
Country:	Brazil
Telephone:	+55 92 3652-9200
FAX:	
E-Mail:	
URL:	www.utemanauara.com.br
Represented by:	
Title:	Financial Director
Salutation:	Sir.
Last Name:	Pelegrini
Middle Name:	
First Name:	Osmir
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	osmirpelegrini@utemanauara.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There won’t be any public funding on this project activity.

Annex 3

BASELINE INFORMATION

In the next picture it's shown the Brazilians Grid. Manauara is located in the Isolated North. There is no connection to the SIN (National Integrated System) yet, the *TPP Manauara* is just connected to the Interconnected Manaus System.

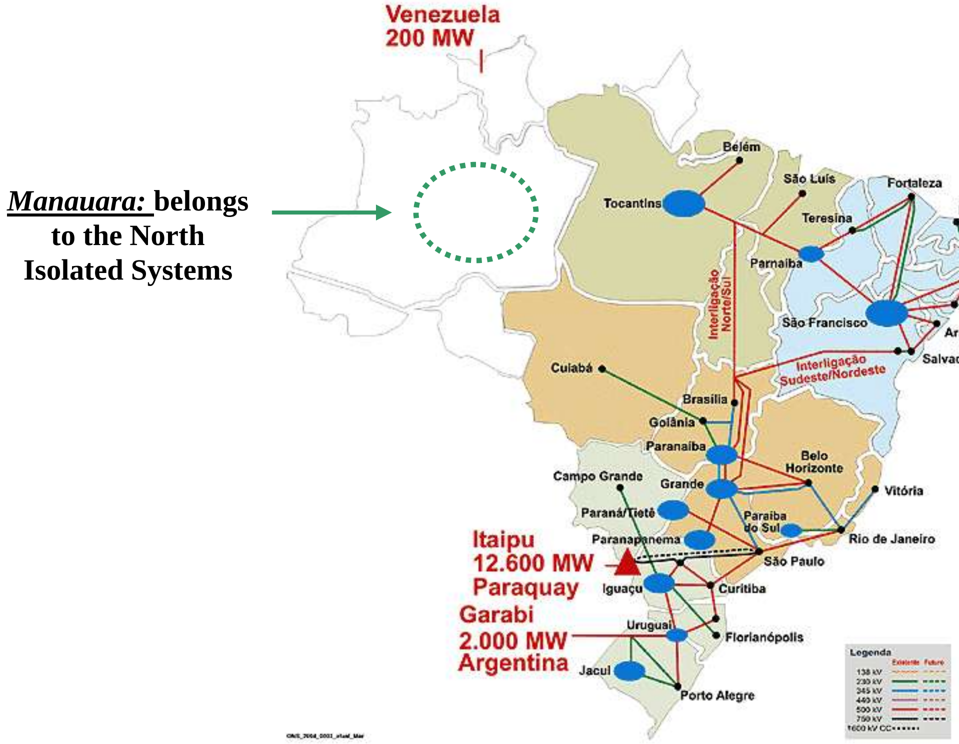


Figure 1 - National Integrated Grid and the North Isolated System

Source: ONS (www.ons.org.br)

Description of Amazonas State

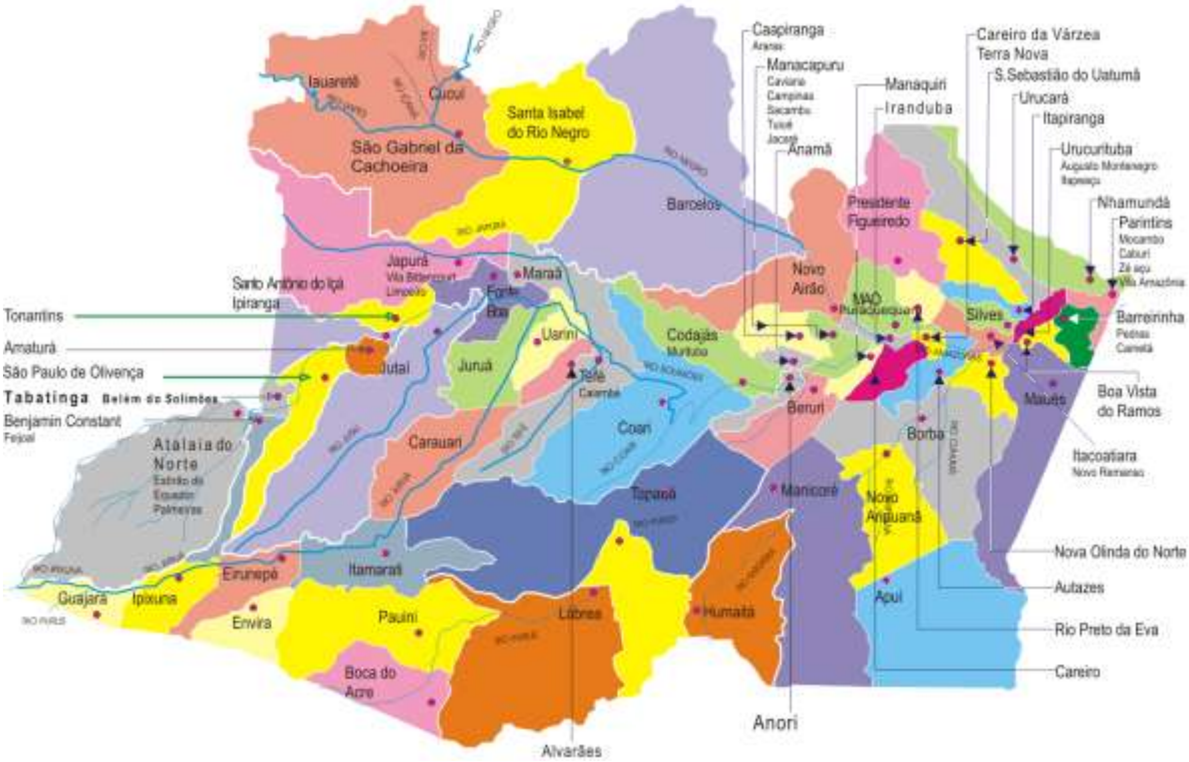
STATE OF THE AMAZONAS

CEAM is the responsible Utility for the generation and electric power distribution inside the State of Amazon in 91 Isolated Systems with thermal generation, predominantly of diesel oil.

MANAUS ENERGIA is the responsible Utility for the generation, transmission and electric power distribution in the city of Manaus, besides accomplishing the supply to three places of the countryside assisted by CEAM: President Figueiredo, Puraquequara and Iranduba. Also the supply is foreseen Manacapuru starting from June/2006.

The illustration below presents the geographical distribution of the Isolated Systems of the State of Amazon.

System of Amazonas State



The Manaus System is the largest among the isolated ones Brazilian, representing 46% of the total of the market of electric power of the Isolated Systems approximately. Manaus System's foreseen own load for 2006 is of 5,587,162 MWh (637.8 MW average), corresponding to a maximum demand of 879 MW.

Configuration of the Generating Park

The Manaus System has a hydrothermal generating park with effective power of 1,264.5 MW, constituted of UHE Balbina with 250 MW and of 1,014.5 MW regarding the thermal generating units own, of the PIES El Paso, CGE, Aggreko and Breitener Energética S.A. Those 1,014.5 MW consider 40 MW rented to Aggreko even March/2006, 120 MW of the PIES Breitener and PEEP even CGE June/2006 an increment of 185 MW is foreseen regarding the entrance in operation of the thermal plants of the he/she PIES Rio Amazonas Energia (UTE Cristiano Rocha), Cia. Energética Manauara (UTE Manauara) and Serv. Tec. Facilities and Integrated Systems (UTE Ponta Negra), totaling 1,449.5 MW.

Thermal Power Plants - Installed Power Capacity of the Isolated North System

Estado	Concessionária	Nº de Unidades		Potência Nominal (kW)	
		2006	2007	2006	2007
ACRE	ELETRONORTE	24	24	94.407	94.407
	ELETROACRE	66	78	32.571	44.159
AMAPÁ	ELETRONORTE	39	39	178.100	168.000
	CEA	15	13	18.045	17.645
AMAZONAS	MANAUS ENERGIA	190	91	1.692.300	1.318.600
	CEAM	451	407	298.713	287.799
PARÁ	CELPA	161	159	88.402	86.682
	JARI CELULOSE	12	12	70.415	15.415
RONDÔNIA	ELETRONORTE	12	12	614.100	614.100
	CERON	141	141	87.364	87.364
RORAIMA	BOA VISTA ENERGIA	3	3	62.000	62.000
	CER	84	86	24.192	26.534
BAHIA	COELBA	5	5	1.578	1.578
MARANHÃO	CEMAR	3	3	872	872
MATO GROSSO	CEMAT	231	157	121.254	65.050
PERNAMBUCO	CELPE	3	6	2.730	4.295
TOTAL PARQUE TÉRMICO		1.440	1.236	3.387.043	2.894.500

Notas: 1- Foram considerados os maiores valores entre as potências autorizadas e as solicitadas, constantes do Ofício SFG/ANEEL nº 468/2006, de 06/10/2006.

2- As diferenças entre os valores de 2007 e os de 2006 devem-se, basicamente, a:

⇨ CEMAT: 5 interligações no ano de 2006 (Juara, Juina, Tabaporã, Sapezal, Aripuanã) e a integração de Colniza ao sistema isolado de Aripuanã atendido pela PCH Faxinal II;

⇨ MANAUS ENERGIA: Desativação da UTE Mauá II e redução da potência das UTE São José, Cidade Nova e Flores;

Source: Eletrobras (www.eletrobras.gov.br)

Hydropower Plants - Installed Power Capacity of the Isolated North System

Estado	Concessionária	Nº de Unidades		Potência Nominal (kW)	
		UHE	PCH	UHE	PCH
AMAZONAS	MANAUS ENERGIA	5	-	250.000	-
RONDÔNIA	ELETRONORTE	5	-	216.000	-
	CERON	-	28	-	94.774
RORAIMA	CER	-	2	-	5.000
AMAPÁ	ELETRONORTE	3	-	78.000	-
MATO GROSSO	CEMAT	-	4		3.460
TOTAL PARQUE HIDRÁULICO		**13**	**34**	**544.000**	**103.234**

Source: Eletrobras (www.eletrobras.gov.br)

Forecast of Thermal Power Plants and Oil consumption by Utility for 2007

Geração Térmica e Consumo de Óleo por Empresa com Cobertura da CCC-ISOL para 2007

Empresa		Tipo de Óleo	Geração (MWh)	Quantidade de Óleo com Cobertura da CCC-ISOL
CEA		Diesel	78.937	22.649
CEAM		Diesel	807.365	233.757
CELPA		Diesel	348.301	99.339
CEMAT		Diesel	157.964	46.392
CER		Diesel	49.240	14.739
CERON		Diesel	237.038	67.415
ELETROACRE		Diesel	182.013	50.675
ELETRONORTE	P.Velho	Diesel	248.591	62.078
	P.Velho	PTE	1.072.958	403.765
	R. Branco	Diesel	8.760	2.865
	Macapá	Diesel	521.031	141.387
MANAUS ENERGIA		PTE	424.230	133.541
		PGE	1.117.557	223.997
		Combustível	530.438	165.884
		Diesel	287.533	80.578
PIE BREITENER UTE Tambaqui		Combustível	516.665	107.466
PIE BREITENER UTE Jaraqui		Combustível	516.665	107.466
PIE RIO AMAZONAS UTE C. Rocha		Combustível	559.720	116.982
PIE MANAUARA UTE Manauara		Combustível	516.665	107.983
PIE GERA UTE Ponta Negra		Combustível	516.665	108.500
CELPE		Diesel	11.198	3.254
CEMAR		Diesel	486	146
COELBA		Diesel	834	250
JARI CELULOSE		Diesel	18.574	5.425
		Combustível	6.721	2.554
TOTAL		Diesel	2.957.865	830.948
		PTE	1.497.188	537.306
		PGE	1.117.557	223.997
		Combustível	3.163.539	716.835
TOTAL DE GERAÇÃO TÉRMICA			**8.736.149**	-

Nota: Diesel e PTE em 1000 l; PGE e Combustível em toneladas.

Source: Eletrobras (www.eletrobras.gov.br)

Historical of Fuel Consumption and Generated Energy

2003

Previsão de Geração	Hidráulica	82,7 MW médios			
		Empresa	UHE		Previsão de Geração
		MANAUS ENERGIA	BALBINA		**82,7 MW médios**
	Térmica	428,8 MW médios			
		Empresa	UTE		Previsão de Geração
		Manaus Energia	APARECIDA		67,5 MW médios
			MAUÁ		49,9 MW médios
			ELECTRON		17,5 MW médios
		PIE EL PASO	Planta A		27,1 MW médios
			Planta B		80,2 MW médios
			Planta D		66,3 MW médios
		PIE RIO NEGRO	WÄRTSILÄ		120,1 MW médios
Previsão de Consumo de Óleo	Combustível	384.581 toneladas			
		EMPRESA	UTE	TIPO	PREVISÃO DE CONSUMO
		MANAUS ENERGIA	MAUÁ	OC1A	153.115 toneladas
		PIE RIO NEGRO	WÄRTSILÄ	PGE	231.466 toneladas
	Leve	826.022 mil litros			
		Empresa	UTE	TIPO	PREVISÃO DE CONSUMO
		MANAUS ENERGIA	APARECIDA	PTE	207.010 mil litros
			ELECTRON	PTE	58.302 mil litros
		PIE EL PASO	Planta A	PTE	90.299 mil litros
			Planta B	PTE	267.135 mil litros
			Planta D	PTE	203.276 mil litros

2004

Previsão de Geração (MW médio)	Hidráulica	100,1 MW médio			
		Empresa	UHE		Previsão de Geração
		MANAUS ENERGIA	**BALBINA**		100,1
	Térmica	440,5 MW médios			
		Empresa	UTE		Previsão de Geração
		MANAUS ENERGIA	APARECIDA		40,6
			MAUÁ		65,5
			ELECTRON		10,0
		PIE EL PASO	PLANTA A		30,0
			PLANTA B		81,2
			PLANTA D		60,0
			WÄRTSILÄ		120,9
		PIE CGE	UTE CIDADE NOVA		6,8
			UTE SÃO JOSÉ		25,5
Previsão de Consumo de Óleo	Pesado (toneladas)	412.795 toneladas			
		Empresa	UTE	TIPO	PREVISÃO DE CONSUMO
		MANAUS ENERGIA	MAUÁ	COMB.	189.833
		PIE EL PASO	WÄRTSILÄ	PGE	222.962
	Leve (mil litros)	776.774 mil litros			
		Empresa	UTE	TIPO	PREVISÃO DE CONSUMO
		MANAUS ENERGIA	APARECIDA	PTE	121.277
			ELECTRON	PTE	33.379
		PIE EL PASO	PLANTA A	PTE	100.138
			PLANTA B	PTE	271.047
			PLANTA D	PTE	168.653
		PIE CGE	UTE C. NOVA	DIESEL	17.322
			UTE SÃO JOSÉ	DIESEL	64.958

<u>2005</u>

Previsão de Geração (MW médio)	Hidráulica Térmica	**86,6 MW médio**			
		Empresa	UHE		Previsão de Geração
		MANAUS ENERGIA	**BALBINA**		86,6
		509,4 MW médios			
		Empresa	UTE		Previsão de Geração
		MANAUS ENERGIA	APARECIDA		83,5
			MAUÁ		65,5
			ELECTRON		2,0
		PIE EL PASO	PLANTA A		25,7
			PLANTA B		88,6
			PLANTA D		63,4
			WÄRTSILÄ		127,6
		PIE CGE	UTE CIDADE NOVA		6,7
			UTE SÃO JOSÉ		16,7
			UTE FLORES		29,8
Previsão de Consumo de Óleo	Pesado (toneladas)	**418.337 toneladas**			
		Empresa	UTE	TIPO	PREVISÃO DE CONSUMO
		MANAUS ENERGIA	MAUÁ	COMB.	189.238
		PIE EL PASO	WÄRTSILÄ	PGE	229.099
	Leve (mil litros)	**913.630 mil litros**			
		Empresa	UTE	TIPO	PREVISÃO DE CONSUMO
		MANAUS ENERGIA	APARECIDA	PTE	234.153
			ELECTRON	PTE	6.796
		PIE EL PASO	PLANTA A	PTE	85.561
			PLANTA B	PTE	294.861
			PLANTA D	PTE	166.510
		PIE CGE	UTE C. NOVA	DIESEL	15.768
			UTE SÃO JOSÉ	DIESEL	39.420
			FLORES	DIESEL	70.562

Assumptions: Data from IPCC

TABLE 2.2
DEFAULT EMISSION FACTORS FOR STATIONARY COMBUSTION IN THE ENERGY INDUSTRIES
(kg of greenhouse gas per TJ on a Net Calorific Basis)

Fuel		CO_2			CH_4			N_2O		
		Default Emission Factor	Lower	Upper	Default Emission Factor	Lower	Upper	Default Emission Factor	Lower	Upper
Crude Oil		73 300	71 100	75 500	r 3	1	10	0.6	0.2	2
Orimulsion		r 77 000	69 300	85 400	r 3	1	10	0.6	0.2	2
Natural Gas Liquids		r 64 200	58 300	70 400	r 3	1	10	0.6	0.2	2
Gasoline	Motor Gasoline	r 69 300	67 500	73 000	r 3	1	10	0.6	0.2	2
	Aviation Gasoline	r 70 000	67 500	73 000	r 3	1	10	0.6	0.2	2
	Jet Gasoline	r 70 000	67 500	73 000	r 3	1	10	0.6	0.2	2
Jet Kerosene		r 71 500	69 700	74 400	r 3	1	10	0.6	0.2	2
Other Kerosene		71 900	70 800	73 700	r 3	1	10	0.6	0.2	2
Shale Oil		73 300	67 800	79 200	r 3	1	10	0.6	0.2	2
Gas/Diesel Oil		74 100	72 600	74 800	r 3	1	10	0.6	0.2	2
Residual Fuel Oil		77 400	75 500	78 800	r 3	1	10	0.6	0.2	2
Liquefied Petroleum Gases		63 100	61 600	65 600	r 1	0.3	3	0.1	0.03	0.3
Ethane		61 600	56 500	68 600	r 1	0.3	3	0.1	0.03	0.3
Naphtha		73 300	69 300	76 300	r 3	1	10	0.6	0.2	2
Bitumen		80 700	73 000	89 900	r 3	1	10	0.6	0.2	2
Lubricants		73 300	71 900	75 200	r 3	1	10	0.6	0.2	2
Petroleum Coke		r 97 500	82 900	115 000	r 3	1	10	0.6	0.2	2
Refinery Feedstocks		73 300	68 900	76 600	r 3	1	10	0.6	0.2	2
Other Oil	Refinery Gas	n 57 600	48 200	69 000	r 1	0.3	3	0.1	0.03	0.3
	Paraffin Waxes	73 300	72 200	74 400	r 3	1	10	0.6	0.2	2
	White Spirit and SBP	73 300	72 200	74 400	r 3	1	10	0.6	0.2	2
	Other Petroleum Products	73 300	72 200	74 400	r 3	1	10	0.6	0.2	2
Anthracite		98 300	94 600	101 000	1	0.3	3	r 1.5	0.5	5
Coking Coal		94 600	87 300	101 000	1	0.3	3	r 1.5	0.5	5
Other Bituminous Coal		94 600	89 500	99 700	1	0.3	3	r 1.5	0.5	5
Sub-Bituminous Coal		96 100	92 800	100 000	1	0.3	3	r 1.5	0.5	5
Lignite		101 000	90 900	115 000	1	0.3	3	r 1.5	0.5	5
Oil Shale and Tar Sands		107 000	90 200	125 000	1	0.3	3	r 1.5	0.5	5
Brown Coal Briquettes		97 500	87 300	109 000	n 1	0.3	3	r 1.5	0.5	5
Patent Fuel		97 500	87 300	109 000	1	0.3	3	n 1.5	0.5	5
Coke	Coke Oven Coke and Lignite Coke	r 107 000	95 700	119 000	1	0.3	3	r 1.5	0.5	5
	Gas Coke	r 107 000	95 700	119 000	r 1	0.3	3	0.1	0.03	0.3
Coal Tar		n 80 700	68 200	95 300	n 1	0.3	3	r 1.5	0.5	5
Derived Gases	Gas Works Gas	n 44 400	37 300	54 100	n 1	0.3	3	0.1	0.03	0.3
	Coke Oven Gas	n 44 400	37 300	54 100	r 1	0.3	3	0.1	0.03	0.3
	Blast Furnace Gas	n 260 000	219 000	308 000	r 1	0.3	3	0.1	0.03	0.3
	Oxygen Steel Furnace Gas	n 182 000	145 000	202 000	r 1	0.3	3	0.1	0.03	0.3
Natural Gas		56 100	54 300	58 300	1	0.3	3	0.1	0.03	0.3

NCV and Conversion Units: Data from MME (Brazilian Mines and Energy Ministry)

Tabela 36 : : Densidades e Poderes Caloríficos Inferiores

Fontes	Densidade kg/m³ [1]	Poder Calorífico Inferior kcal/kg	Fontes	Densidade kg/m³ [1]	Poder Calorífico Inferior kcal/kg
Petróleo[2]	874	10.200	Óleo Combustível	1.000	9.590
Gás Natural Úmido[3]	-	9.930	Gasolina Automotiva	740	10.400
Gás Natural Seco[3]	-	8.800	Gasolina de Aviação	720	10.600
Carvão Vapor			Gás Liquefeito de Petróleo	550	11.100
3.100 kcal/kg	-	2.950	Nafta	720	10.630
3.300 kcal/kg	-	3.100	Querosene Iluminante	790	10.400
3.700 kcal/kg	-	3.500	Querosene de Avião	790	10.400
4.200 kcal/kg	-	4.000	Gás de Coqueria[2]	-	4.300
4.500 kcal/kg	-	4.250	Gás Canalizado Rio de Janeiro[2]	-	3.800
4.700 kcal/kg	-	4.450	Gás Canalizado São Paulo[2]	-	4.500
5.200 kcal/kg	-	4.900	Coque de Carvão Mineral	-	6.900
5.900 kcal/kg	-	5.600	Eletricidade[4]	-	860
6.000 kcal/kg	-	5.700	Carvão Vegetal	250	6.460
Carvão Vapor sem Especificação	-	2.850	Álcool Etílico Anidro	791	6.750
Carvão Metalúrgico Nacional	-	6.420	Álcool Etílico Hidratado	809	6.300
Carvão Metalúrgico Importado	-	7.400	Gás de Refinaria	780	8.400
Energia Hidráulica[4]	-	860	Coque de Petróleo	1.041	8.390
Lenha Catada	300	3.100	Outros Energéticos de Petróleo	872	10.200
Lenha Comercial	390	3.100	Outras Secundárias – Alcatrão	-	8.550
Caldo de Cana	-	623	Asfaltos	1.040	9.790
Melaço	-	1.850	Lubrificantes	880	10.120
Bagaço de Cana[5]	-	2.130	Solventes	740	10.550
Lixívia	-	2.860	Outros Não-energéticos de Petróleo	873	10.200
Óleo Diesel	840	10.100			

[1] A temperatura de 20º C, para os derivados de petróleo e de gás natural.
[2] Poder calorífico inferior médio do petróleo nacional. Para poder calorífico do petróleo de referência para tep, ver Apêndice C.1.2.
[3] kcal/m³
[4] kcal/kWh
[5] Bagaço com 50% de umidade.

EPE Empresa de Pesquisa Energética

C.3 Fatores de Conversão

Tabela 34 : : Fatores de Conversão para Energia

	Para	J	BTU	cal	kWh
			Multiplicar por		
De	Joule (J)	1,0	947,8 x 10^{-6}	0,23884	277,7 x 10^{-9}
	BTU	1,055 x 10^{3}	1,0	252,0	293,07 x 10^{-6}
	calorias (cal)	4,1868	3,968 x 10^{-3}	1,0	1,163 x 10^{-6}
	quilowatt-hora (kWh)	3,6 x 10^{6}	3412,0	860,0 x 10^{3}	1,0
	tep	41,87 x 10^{9}	39,68 x 10^{6}	10,0 x 10^{9}	11,63 x 10^{3}
	bep	5,95 x 10^{9}	5,63 x 10^{6}	1,42 x 10^{9}	1,65 x 10^{3}

MME Ministério de Minas e Energia

Annex 4

MONITORING INFORMATION

Please see the information in the item B.7.2. No extra information is necessary.

- - - - -