CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

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Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.

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

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

Braço Norte III Small Hydro Plant
CDM Small Scale Project
PDD Version 3
Date: July 20, 2006

A.2. Description of the small-scale project activity:

The Braço Norte III Plant is a small run of river hydro plant (14.16 MW), with a small reservoir, that generates almost no environmental impact. It is located in a remote region in the northern portion of the State of Mato Grosso.

Guarantã Energética Ltda is the sole owner of Braço Norte III and has a vast experience in generating electricity using alternative energy sources such as hydro and biomass. Braço Norte III had its project started during 2000, all construction and installations from May 2001 until September 2003. Commercial operation started in October 03, 2003. During 2004 it generated a total of almost 75 GWh.

The project is located more than 700 km from Cuiabá, the capital of the State of Mato Grosso, in the county of Guarantã do Norte. The region's main economical activities are agriculture (soya and rice), wood industry and cattle. This is one of the fastest growing regions in the country, mainly because of the activities of the export oriented agribusiness and the electricity market is deemed to grow at 5% pa.

The most important aspect of this project is the reduction of transmission losses and the stability of the system. The region has been integrated in the National Grid since 2003 and losses occur due to the very long distances between the gravity centre of the system and the regions towns. By adding local sources to the grid, transmission losses are reduced.

The Braço Norte III Project improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. Small scale hydropower run-of-river plants provide local distributed generation, in contrast with the business as usual large hydropower and natural gas fired plants built in the last 5 years.

This specially the case this Project where the region is developing at a very high rate when compared with the national average and where electric demand is also growing at a faster pace. Sustaining this rhythm requires new power supply sources especially by plants located in the region.

This indigenous and cleaner source of electricity will also have an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would be emitted in the absence of the project.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Private entity – Guarantã Energética Ltda.	NO
	Private entity – C-Trade Comercializadora de Carbono Ltda – project developer	

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

Braço Norte III uses water from the Braço Norte River to generate electricity with 14.16 MW installed capacity. It is located close to its sister plants, Braço Norte and Braço Norte II, to tap all the flow of the river. This run-of-river project has a small reservoir, 1.3 km^2, complying with Brazilian regulations for small hydro projects. Figure 1, below, shows the powerhouse and the middle section of the dam.

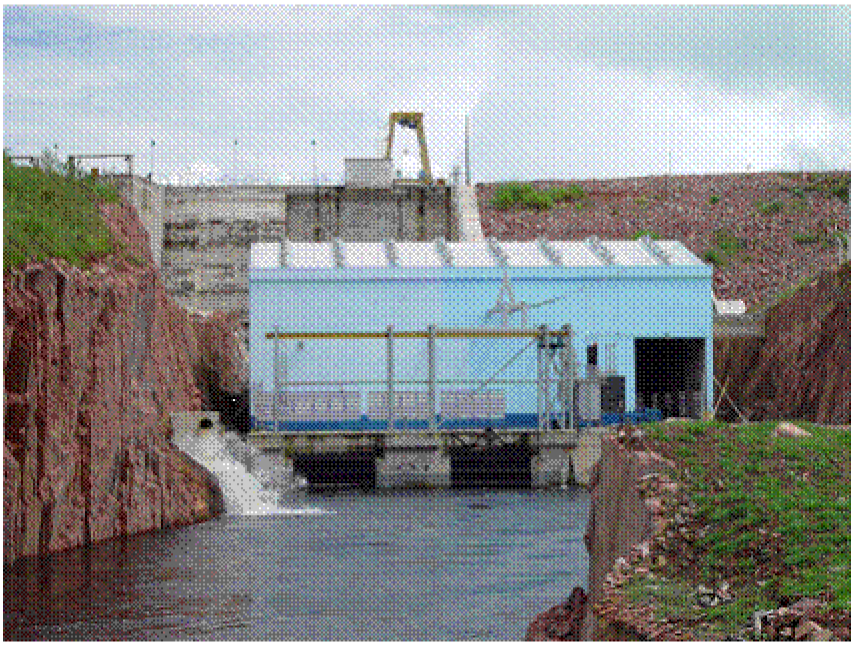

Figure 1 – Photograph of the plant: Braço Norte III

Braço Norte III has two sets of turbine-generators. The turbines are Kaplan S elbow type turbines, being the most adequate technology as of today.

Turbines	
	Kaplan S Upstream Elbow type
Quantity	2
Capacity (kW)	7,500
Revolutions (rpm)	300.0

Generator	
ATI	Type ATI
Quantidade	2
Frequency (Hz)	60
Nominal Voltage (V)	6900
Capacity (kVA)	8850

Table 1 – Turbine and Generator Specifications

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

A.4.1.1. Host Party(ies):

Brazil

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

State of Mato Grosso

A.4.1.3. City/Town/Community etc:

County of Guarantã do Norte

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):

The project is located in the mid-west of Brazil, state of Mato Grosso, near the city of Guarantã do Norte (latitude 09° 40' South and longitude 54º 58' West).

The Braço Norte is part of the Teles Pires basin and is subsidiary of Tapajós, tributary of Amazon River.

As of today, the Brazilian Integrated Grid has one of its terminations at Matupá. SHP Braço Norte III is connected to the substation located at Matupá.

The maps below locate the project in Brazil, Mato Grosso and in the northern part of the state:

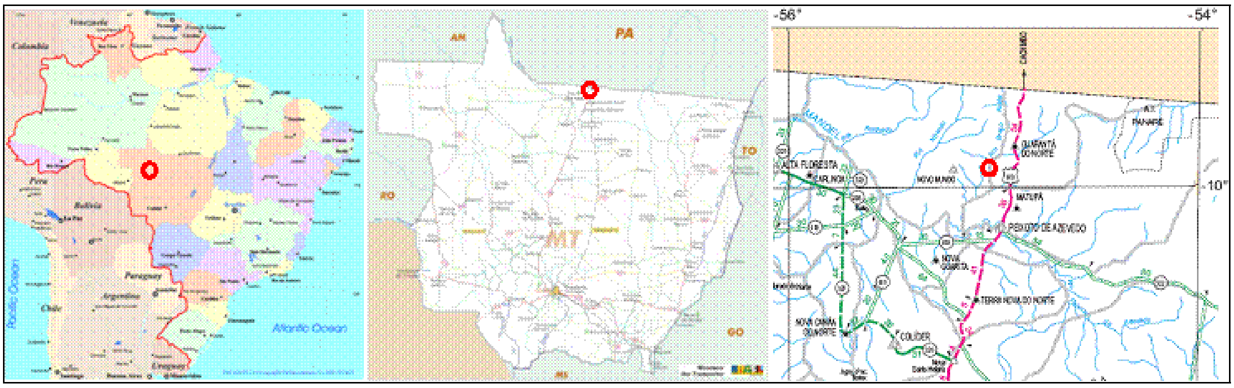

Figure 2 – Location maps of the project

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

Small-scale project activity.
Type 1: Renewable energy projects.
Category I.D.: Renewable energy generation for a grid.
Braço Norte III uses the renewable hydro potential of the Braço Norte River to supply electricity to the small regional grid around Guarantã do Norte.
It has an installed capacity of 14.16 MW (below the eligibility limit of 15 MW for small scale projects).
Most of the equipment used in the project was developed and manufactured in Brazil.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

Braço Norte III generates electricity using hydropower without emitting greenhouse gases, will result in GHG emissions reductions as the result of the displacement of generation from the fossil-fuel thermal plants that, eventually, would have otherwise supplied the region.

Kartha et al. (2002) stated that, "the crux of the baseline challenge for electricity projects clearly resides in determining the 'avoided generation', or what would have happened without the CDM or other GHG-mitigation project. The fundamental question is whether the avoided generation is on the 'build margin' (i.e. replacing a facility that would have otherwise been built) and/or the 'operating margin' (i.e. affecting the operation of current and/or future power plants)."

As the plant is linked to the National Grid, the baseline reflects the whole Brazilian South-Southeast-Midwestern Grid must be taken into account. The map below shows the existing National Grid termination at Matupa and the approximate location of the project.

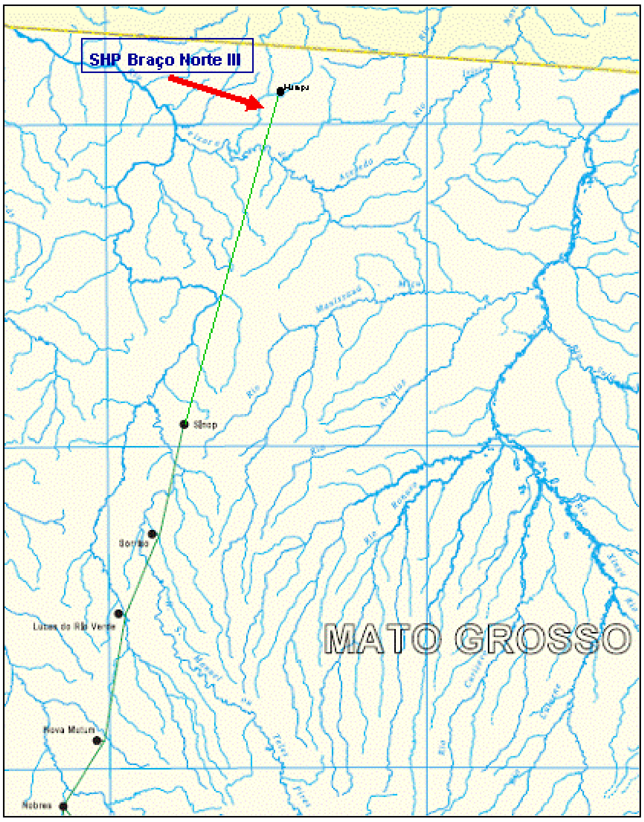

Figure 3 – National Grid termination at Matupá, close to the project location

For the purpose of determining the build margin and the operating margin emission factors, the 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 is defined as one that is connected by transmission lines to the project and in which power plants can be dispatched without significant transmission constraints.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO2 e
2003 (out)	8,997
2004	39,859
2005	40,230
2006	40,230
2007	40,230
2008	40,230
2009	40,230
2010 (set)	30,173
Total (tCO_2e)	280,179
Total number of crediting years	21 y (3x7 years)
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 e)	40,026

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

No public funding from Annex I parties were sought for project activities.

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

Braço Norte III is not part of a larger project activity.

SECTION B. Application of a baseline methodology:

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

AMS type I, renewable energy projects. Category I.D – grid connected renewable electricity generation, version 08, 03 March 2006.
Braço Norte III employs renewable energy technology to supply electricity to a grid.

B.2 Project category applicable to the small-scale project activity:

Category I.D – 'Grid connected renewable electricity generation'.
Braço Norte III employs renewable energy technology to supply electricity to a local.

> *"**Technology/measure:***
> *1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal, and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit."*

Braço Norte III displaces energy generation from the thermal plants of the National Integrated System.

Baseline calculations are done according to Appendix B of the simplified modalities and procedures for small-scale CDM project activities (Type I - Renewable Energy Projects - I.D. 'Grid connected renewable electricity generation'):

Being linked to the National Grid, baseline must be calculated so as to reflect operating and built margins for the South-Southeast-Midwest subsystem.

> *"The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO2e/kWh) calculated in a transparent and conservative manner:*
>
> *(a) The average of the "approximate operating margin" and the "build margin", where:*
>
> *(i) The "approximate operating margin" is the weighted average emissions (in kgCO2e/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;*
>
> *(ii) The "build margin" is the weighted average emissions (in kgCO2e/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants";*
>
> *or*
>
> *(b) The weighted average emissions (in kgCO2e/kWh) of the current generation mix.*

This project uses option (a) since the expansion of Brazilian electric system calls for an ever increasing share of fossil-fuelled thermal plants.

As of today, the emission coefficient is 0.5364 kgCO_2e / kWh.

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 small-scale CDM project activity:

The region comprising Guarantã do Norte and neighbouring counties is supplied by the National Integrated Grid. All the electricity produced by SHP Braço Norte III would have been otherwise generated by thermal plants connected to the grid, therefore increasing anthropogenic emissions. The plant, with an installed capacity of 14.16 MW, fulfils all requisites of a Small-scale CDM project.

To prove the project's additionality, CDM / EB' "*Tool for the demonstration and assessment of additionality"*. UNFCCC, CDM Executive Board 16th Meeting Report, 22 October 2004, Annex 1, will be used.

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

The project of Braço Norte III started in 2001, construction lasted from May, 2001 to September, 2003 and commercial operation started in October 03, 2003, therefore after January 1st, 2000.

Guarantã Energética S.A. is part of a holding company with several agricultural, industrial and logistic activities in the central and north-western regions of the country. The holding company has closely followed the evolution of the negotiations within UNFCCC and, specially, the succession of the CDM meetings.

The decision to build Braço Norte III took into account the possibility of obtaining revenues from the carbon market. Back in 2001, there were only tentative analysis on how such market would operate and what would be the level of prices. Nevertheless, there are internal documents proving that the company seriously considered this possibility in order to reach the decision to move forward with the project.

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

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

SHP Braço Norte III is a plant built close to two other plants on the same river Braço Norte: Braço Norte, Braço Norte II and, in a near future, Braço Norte IV. The group owns the all except Braço Norte.

The most likely alternative would have been not to build Braço Norte III since the region could have been supplied from the electricity generation in the rest of the country.

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

Both the project activity and the alternative scenario are in compliance with all applicable laws and regulations.

Step 2. Investment analysis

The proposed project activity is the economically or financially less attractive than the other alternative without the revenue from the sale of certified emission reductions (CERs).

Sub-step 2a. Determine appropriate analysis method

Benchmark analysis (Option III) will be used.

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

Identify the financial indicator:

- IRR will be used.

The benchmark is to represent standard returns in the market:

- Brazilian Prime Rate, known as SELIC (Sistema Especial de Liquidação e de Custódia – Special System of Settling and Custody) will be used.

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 so, in order to comply with the 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 scenario that includes the revenues from sales of CERs, the emission coefficient used in this PDD was applied as well as an average market price for CER of US$ 10.00 / tCO_2.

The table below shows the assumptions:

Braço Norte III Project - Assumptions			
description	value	unit	comments
Investment	18.302	thou USD	1/3 in 2002 and 2/3 in 2003
Annual Operational Cost	183	thou USD	1% of investiment
Average generation output	80.6	GWh	
Eletricity price	42.6	USD/MWh	R$ 115/MWh
Average exchange rate	2.7	R$/USD	
Period	20	years	
Emission coefficient	0.5364	tCO2/MWh	
CER Price	10	USD/tCO2	

Table 2 – Financial analysis: assumptions

Investment value was obtained from EPC bids for the plant.
Operational costs follow regional practices.
The 20 year analysis period corresponds to the average length of analysis in the electric sector.

Electricity price was projected from official estimates. It must be recalled that during 2001, Brazil passed through a severe rationing of electricity. A long draught and the lack of investments in the sector due to instabilities in the economy made the government force an overall cut of 15% in demand. During this period, projected electricity prices reached an average of 45 USD/MWh compared with an average of less than half during the previous period. The value used in the analysis should be seen as a conservative projection during that time.

The upper limit of 80.6 GWh/y is the plant maximum output at a 65% capacity factor. As a matter of fact, during 2004, Braço Norte III generated 74.3 GWh.

These assumptions render IRR values of 15.0% without CER revenues and 16.6% including them.

The benchmark rate employed is called SELIC, the Brazilian Prime Rate, which is the rate used in the short-term capital market. The government has maintained a very high value for this reference rate as a monetary tool to stabilize the economy. The average annual SELIC value during 2001 was 17.38%.

This shows that without CER revenues, the project would reach lower rates of return than the benchmark rate. Including these revenues, the project is still worst than the benchmark.

Full documentation and spreadsheets are available for the validation team and project participants but not to the public.

Sub-step 2d. Sensitivity analysis

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

- Electricity revenues
- CER revenues
- Operational Costs

Investment was not analysed because the adopted value was the actual investment made.
Electricity generation growth has an upper limit given by the plant's capacity. Actual market grew at about the same rate that was predicted, so the first few years do not affect the analysis.

The table below summarizes the sensitivity results:

Sensitivity	base	-10% electricity price	10% electricity price	-10% carbon price	10% carbon price	-10% oper. costs	10% oper. costs
electricity price	42.59	38.33	46.85	42.59	42.59	42.59	42.59
carbon price	10.00	10.00	10.00	9.00	11.00	10.00	10.00
operational costs	183	183	183	183	183	165	201
IRR without	0.150	0.131	0.169	0.150	0.150	0.152	0.149
IRR with carbon	0.166	0.148	0.184	0.165	0.168	0.168	0.165
diff	0.016	0.017	0.015	0.014	0.018	0.016	0.016

As expected, the project is more affected by the electricity price, reducing the IRR from 15.0% to 13.1% when prices fall 10%. Even then, CER revenues increase IRR by about 2%. Although an IRR value of 14.8% with the CER revenues is lower than the benchmark could rate (SELIC 17.38%), the project is still much more attractive than without them. As CER prices raise in the next years, and compensate a less likely scenario of loss of revenues from electricity sales.

The sensitivity analysis demonstrates the importance of CER revenues in the feasibility of the project.

Step 3. Barrier analysis

(not used)

Step 4. Common practice analysis

Brazilian electric sector expansion was created during the 60's and 70's fundamentally based on state-owned large hydro plants. It was only during the 90's, with the privatization of the sector that central planning started to loose force. Central planning, as carried out in Brazil, always sought the large plants as means of keeping control of the system and allocating scarce resources (monetary and workforce) in best projects. As of now, less than 1.5% of the country's installed capacity is located in small (less than 30MW) plants. One of the side effects was the absence of market driven players seeking alternative sources. It is felt that the traditional players (privatized utilities) are still seeking larger plants and that both the new player and the regulatory agencies are still in the learning process of dealing with a more decentralized system. By the end of 2004, only 9 new small-hydro projects were authorized by the regulatory agency.

In order to stimulate other alternatives, Brazilian government launched a program called Proinfa (Programa de Incentivo as Fontes Alternativas de Energia Elétrica – Alternative Sources for Electric Energy Incentive Program) that sought to increase the share of small hydro, biomass cogeneration and wind plants. Basically, it offers a better-than-market purchase price and long-term contracts for electricity and lower interest rates in loans from the federal development bank (BNDES). Even with these conditions, the program attracted fewer projects than intended to. Even now, part of the projects that were included in the program is retracting from it, basically due to the cumbersome process in obtaining finance from BNDES. As other similar projects, despite its attractiveness, the Braço Norte III project did not apply for participation in Proinfa.

It must also be said that several of the projects being developed have included CER revenues in their feasibility studies. As of now, there are more than 15 plants with CDM projects in different stages of development showing that CER revenues are an important aspect of these projects.

In this sense, it is possible to affirm the projects such as Braço Norte III are not widely observed and commonly carried out in the country.

Step 5. Impact of CDM registration

It is clear from the Investment Analysis shown in Step 2, above, that CER revenues are one of the crucial points in the project's feasibility.

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

The immediate boundary where environmental impacts may occur is defined by the plant site, on the Braço Norte River.

The boundary comprises the South-Southeast-Midwest part of the National Integrated System. The national grid is divided in two main subsystems, as shown in the figure below. Transmission constraints in the link between these two systems limit the energy throughput between them so that they must been seen as separate systems.

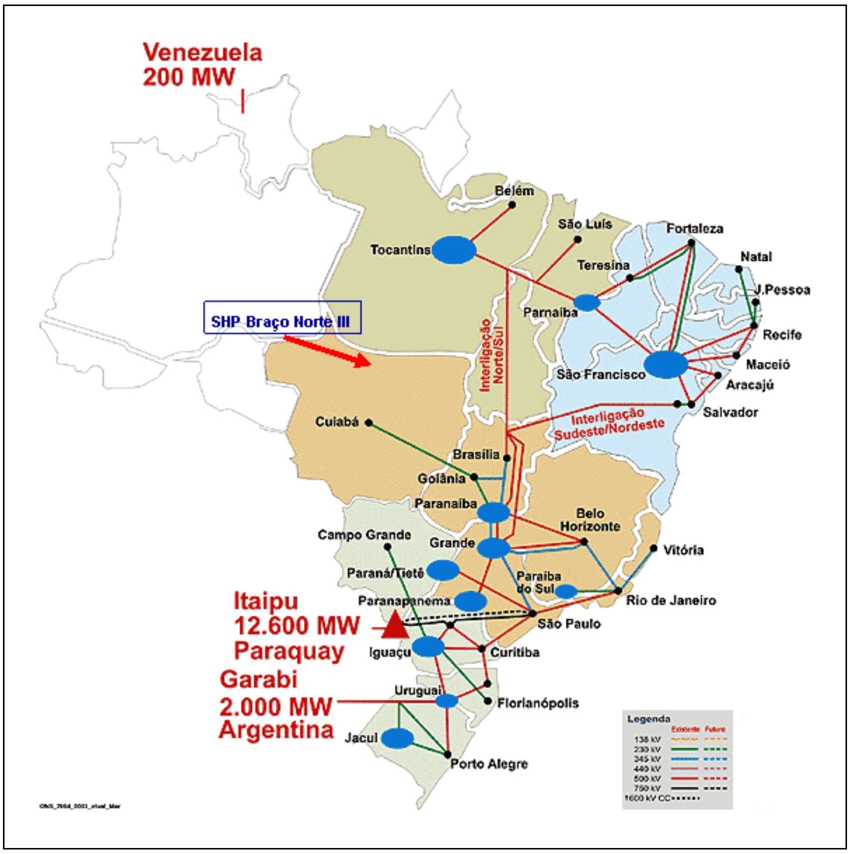

Figure 4 – Brazilian National Integrated Grid showing the two subsystems

B.5. Details of the baseline and its development:

Baseline calculations are done according to Appendix B of the simplified modalities and procedures for small-scale CDM project activities (Type I - Renewable Energy Projects - I.D. 'Grid connected renewable electricity generation'):

Being linked to the National Grid, baseline must be calculated so as to reflect operating and built margins for the South-Southeast-Midwest subsystem.

"The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO2e/kWh) calculated in a transparent and conservative manner:

(a) The average of the "approximate operating margin" and the "build margin", where:

(ii) The "approximate operating margin" is the weighted average emissions (in kgCO2e/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

(ii) The "build margin" is the weighted average emissions (in kgCO2e/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants";

or

(b) The weighted average emissions (in kgCO2e/kWh) of the current generation mix.

This project uses option (a) since the expansion of Brazilian electric system calls for an ever increasing share of fossil-fuelled thermal plants.

As thermal plants use fossil, these plants will have higher operational costs than hydro plants and will be most likely displaced by the latter.

Date of completion of baseline calculations: 26/04/2006.
Responsible for baseline calculations:
Sergio A. W. Ennes
C-Trade Comercializadora de Carbono Ltda
(project participant – contact information listed in Annex 1).

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

Commercial operations started in October 03, 2003.

C.1.2. Expected operational lifetime of the small-scale project activity:

30 y – 0 m

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

C.2.1. Renewable crediting period:

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

03/10/2003

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 small-scale project activity:

Monitoring methodology follows the guidelines of Appendix B of the simplified modalities and procedures for small-scale CDM project activities: Type I - Renewable Energy Projects - I.D. 'Grid connected renewable electricity generation'. Monitoring consists in measuring the electricity generated by the plant.

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

Project is a small run-of-river hydro plant, with 14.16 MW of installed capacity (below the 15 MW threshold) small-scale CDM projects, AMS type I, renewable energy projects. Category I.D – grid connected renewable electricity generation, that displaced fossil fuel build margin and operating margin of integrated grid.

D.3 Data to be monitored:

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	Electricity Generation	Electricity generation of the Project delivered to grid	MWh	M	15 minutes measurement and monthly recording	100%	Electronic and paper	During the credit period and two years after	The electricity delivered to the grids monitored such by the project (seller) as the energy buyer. Energy metering connected to the grid and receipt of sales
2	CO_2 emission factor	CO_2 emission factor of the grid	tCO_2/ MWh	C	Annually	0%	Electronic	During the credit period and two years after	Data will be archived according to internal procedures.
3	CO_2 emission factor	CO_2 operating margin emission factor of the grid	tCO_2/ MWh	C	Annually	0%	Electronic	During the credit period and two years after	Data will be archived according to internal procedures.
4	CO_2 emission factor	CO_2 built margin emission factor of the grid	tCO_2/ MWh	C	Annually	0%	Electronic	During the credit period and two years after	Data will be archived according to internal procedures.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

Data *(Indicate table and ID number)*	Uncertainty level of data (High /Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.3.1	*low*	*Measured value according to internal procedures and validated by ONS*
D.3.2	*low*	*Calculated (no monitoring necessary)*
D.3.3	*low*	*Calculated from official ONS data (no monitoring necessary)*
D.3.5	*low*	*Calculated from official ONS data (no monitoring necessary)*

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

No additional structure is necessary to monitor emission reductions. Electricity generation is the core business of SHP Braço Norte III. All measurements comply with national regulations for the electric sector that describe the technical specifications of measuring, reporting and storing the data. The most important value used to determine emission reductions is the amount of electricity being generated. This value passes through a double check (one automated and one manual reading by the operator in the control room).

On the control panel there are two redundant instruments, specified and audited by national regulators, which reads and records the amount of electricity being generated. Both are linked to CCEE (Câmara de Comercialização de Energia Elétrica – Electric Energy Commerce Chamber), a national clearinghouse for trades in the electric sector. Both instruments are also linked to the supervisor system, through which the operator controls the plant. The supervisor system also records generation and stores the information electronically. The supervisor system reports are used for emitting fiscal documents regarding electricity sales to clients.

The operator also performs manual readings directly from the instruments and checks them with the reports. All issues are solved by the plant manager.

As a countercheck measurement, energy generation data is collected at the Matupá substation. These values are the ones used for billing purposes by CEMAT (local utility), according to the PPA.

Maintenance and trouble-shooting procedures comply with national regulatory specifications.

Calibration procedures comply with national regulatory specifications by ONS.

D.6. Name of person/entity determining the monitoring methodology:

Sergio Augusto Weigert Ennes / C-Trade Comercializadora de Carbono Ltda
(Project developer and participant listed in Annex 1 with contact information)

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Being linked to the National Grid, baseline must be calculated so as to reflect operating and built margins for the South-Southeast-Midwest subsystem.

> *"The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO2e/kWh) calculated in a transparent and conservative manner:*
>
> *(a) The average of the "approximate operating margin" and the "build margin", where:*
>
> *(iii) The "approximate operating margin" is the weighted average emissions (in kgCO2e/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;*
>
> *(ii) The "build margin" is the weighted average emissions (in kgCO2e/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants";*

As of today, the emission coefficient would be 0. 5364 kgCO_2e / kWh.

E.1.2 Description of formulae when not provided in appendix B:

Not applicable.

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

Project emissions are zero.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

As the reservoir is small, complying with the World Commission on Dams guidelines, the methane and carbon dioxide emissions related to electricity generation, which are usually accounted as leakage in hydro plant projects, can be ignored.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

Zero.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

The emission coefficient (EF_y) is calculated as a weighted sum of the coefficients associated with the "approximate operation margin" and the "build margin" for the Brazilian South-Southeast-Midwest Grid, as described in Sections B.4 and B.5.

Using the same assumptions and the notation developed in the Consolidated Methodology ACM002 "*Consolidated Methodology for grid-connected electricity generation from renewable sources*", both coefficients are obtained as:

- Operation margin:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,k} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (1)$$

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 CO_2 emission coefficient of fuel annual (tCO_2 / 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*

The CO_2 emission coefficient, $COEF_{i,}$ is obtained as:

$$COEF_{i,} = NCV_i \,.\, EF_{i,CO2} \,.\, OXID_i; \qquad (2)$$

where:

NCV_i = *net calorific value (energy content) per mass or volume unit of a fuel i;*

$OXID_i$ = *oxidation factor of the fuel (1996 Revised IPCC Guidelines for default values);*

$EF_{i,CO2}$ = *CO2 emission factor per unit of energy of the fuel i.*

- Build margin:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (3)$$

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

The combined emission coefficient is weighted average of the operation and build margins:

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \qquad (4)$$

The baseline emission factor EF_y is the average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$),

$EF_y = 0.5 * EF_{OM,y} + 0.5 * EF_{BM,y}$

The National Dispatch Center (*Operador Nacional do Sistema Elétrico, Centro Nacional de Operação do Sistema, Acompanhamento Diário da Operação do Sistema Iterligado Nacional*, daily reports from Jan. 1, 2002 to Dec. 31, 2004) supplied the raw dispatch data for the whole Brazilian interconnected grid. The following data sources were relevant for the calculation of the baseline:

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

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

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

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

(i) The South/Southeast/Midwest Interconnected System;

(ii) The North/Northeast Interconnected System; and

(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

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

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

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

The Brazilian electricity system nowadays comprises of around 91.3 GW of installed capacity, in a total of 1,420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5.3% are diesel and fuel oil plants, 3.1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1.4% are coal plants, and there are also 8.1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (Aneel, 2005. http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6.3 GW of the Paraguayan part of Itaipu Binacional, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

The Small Scale Approved Methodology I.D asks project proponents to account for "all generating sources serving the system". In that way, when applying this methodology, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

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

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

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75,547 MW of installed capacity by 31/12/2004, out of the total 98,848.5 MW installed in Brazil by the same date (Aneel, 2005. http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76.4% (76.4%) of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23.6% (23.6%) are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in noninterconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

The amount of fuel consumed by relevant fossil-fuel-fired plants, are the ones collected in a research made by the International Energy Agency (Bosi et. al., 2002).

The emission coefficients of each fuel are the ones indicated by the IPCC (1996).

Using the above mentioned data, the numbers in Table 2 (in section E.2) and Table 4 (below) arise from the calculation of the baseline and the amount of emission reduction over the chosen crediting period.

EFy=0.5x0.9472 + 0.5x0.1256=0.5364. (5)

Brazilian South-Southeast-Midwest interconnected system baseline calculation

SSC Emission Factors for the Brasilian South-Southeast-Midwest interconnected grid		
Small-scale baseline (without imports)	**OM (tCO2e/MWh)**	Total Generation (MWh)
2002	0.9394	276,731,024
2003	0.9680	295,666,969
2004	0.9431	301,422,617
	Average OM (2002-2004) tCO2e/MWh	Total = 873,820,610
		BM 2004 (tCO2e/MWh)
		0.1256
	0.9472	
	OM*0.5+BM*0.5(tCO2e/MWh)	
	0.5364	

Source: Operador Nacional do Sistema Elétrico, Centro Nacional de Operação do Sistema, Daily Reports from Jan. 1, 2002 to Dec. 31, 2004.

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

The emission reductions by the project activity, ER_y during a given year y is the product of the baseline emissions factor, EF_y , times the electricity supplied by the project to the grid, EG_y, as follows:

$ER_y = EF_y \,.\, EG_y$ (6)

E.2 Table providing values obtained when applying formulae above:

The table below shows the projected emission reduction values SHP Braço Norte III.

Years	Annual estimation of emission reductions in tonnes of CO2 e
2003 (out)	8,997
2004	39,859
2005	40,230
2006	40,230
2007	40,230
2008	40,230
2009	40,230
2010 (set)	30,173
Total (tCO_2e)	280,179

Table 3 – Projected emission reductions from project activities

SECTION F.: Environmental impacts:

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

As for the regulatory permits, Guarantã Energética received the authorization issued by ANEEL to operate as an independent power producer, which gives the right to operate SHP Braço Norte III. The documents related to this authorization are:

- Resolução no. 374, issued on Sep. 20, 2000 transferring exploration rights of Braço Norte III to its subsidiary Guarantã Energética;
- Despacho no. 603, issued on Sep. 30, 2002 changing the authorized installed capacity from 9.888 to 14.16 MW, and
- Despachos 715 (03.oct.03) and 854 (11.nov.03) liberating the plant to begin operations.

National legislation requires the issuance of the following permits:

- Preliminary permit (Licença Prévia or L.P.) – issued during the design phase of the project, containing basic requirements to be met during the construction and operation.
- Construction permit (Licença de Instalação or L.I.) and,
- Operating permit (Licença de Operação or L.O.).

The project has the necessary environmental licenses. The operating permits and licenses were issued by FEMA-MT, the state environmental agency of the State of Mato Grosso.

National legislation also requires the announcement of the issuance of the licenses (LP, LI and LO) in the local state official journal (*Diário Oficial do Estado*) and in the regional newspaper to make the process public and allow stakeholders' comments.

SECTION G. Stakeholders' comments:

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

The legislation requests the announcement of the issuance of the licenses (LP, LI and LO) in the local state official journal (*Diário Oficial do Estado*) and in a local newspaper to make the process public and allow stakeholders' comments.

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, just before the plant started to operate.

In order to comply with this resolution, Guarantã Energética issued letters to stakeholders, describing the project and inviting comments from the following stakeholders:

- Environment Secretary of the State of Mato Grosso;

- Fórum Brasileiro de Mudanças Climáticas;
- Fórum Brasileiro de ONGs e Movimentos Sociais para o Meio Ambiente e Desenvolvimento;
- Association of the county of Guarantã do Norte;
- Mayor, President of the County Hall of the county of Guarantã do Norte;
- Secretary in charge of Environment of the county of Guarantã do Norte and
- State Attorney for the Public Interest of the State of Mato Grosso

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 comments were received.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I parties were or will be sought for project activities.

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