



**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	<ul style="list-style-type: none">• 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
Date: November 08, 2005

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, 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 divide between the counties of Guarantã do Norte and Mundo Novo. The region's main economical activities are agriculture (soy and rice), wood industry and diary. 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 CO₂ emissions), which would be emitted in the absence of the project.

A strong indication that projects similar to Braço Norte III contributes to the country's sustainable development goals is that the project is in accordance with the April 2002 federal law 10,438 that created PROINFA (Programa de Incentivo as Fontes Alternativas de Energia Elétrica). PROINFA is a Brazilian

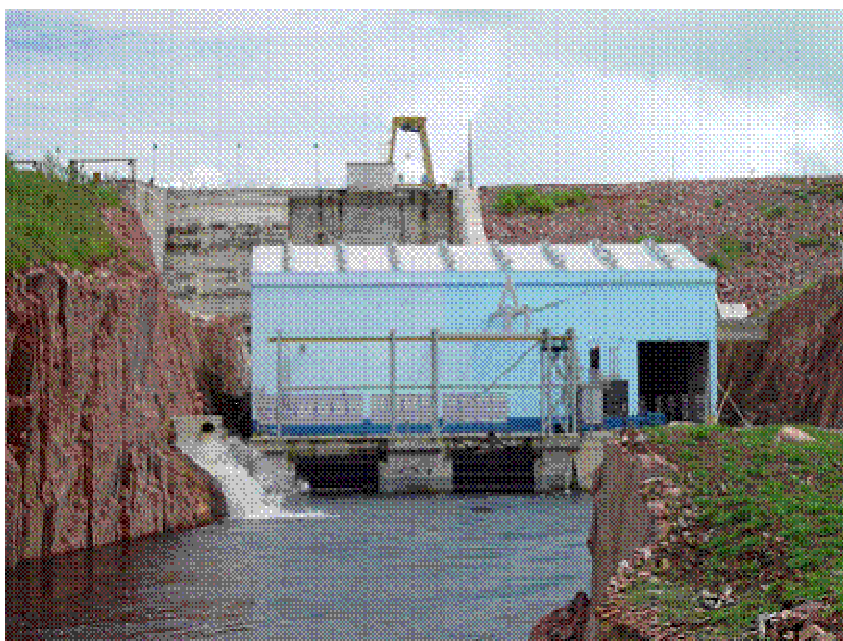
federal program that incentives alternative sources of electricity (wind energy, biomass cogeneration, and small hydropower plants). These incentives include access to a special financial line in the government’s development bank (BNDES) and a PPA with Eletrobrás (state-owned holding in the electric sector) at better-than-market prices. Among other factors, the plan’s goal is to increase the renewable energy source share in the Brazilian electricity matrix in order to contribute to a greater environmental sustainability by supporting these renewable energy sources with economic advantages. In order to develop this plan, the Brazilian government has allocated resources from a compulsory end-user tariff.

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 - CIMCG (host)	Private entity – Guarantã Energética Ltda.	NO
	Private entity – IUEP - International Utility Efficiency Partnerships	
	Private entity – Clean Air S A – 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 km², 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:

Counties of Guarantã do Norte and Novo Mundo

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 54° 58' West).

The Braço Norte is part of the Teles Pires basin and is subsidiary of Tapajós and Amazon Rivers.

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

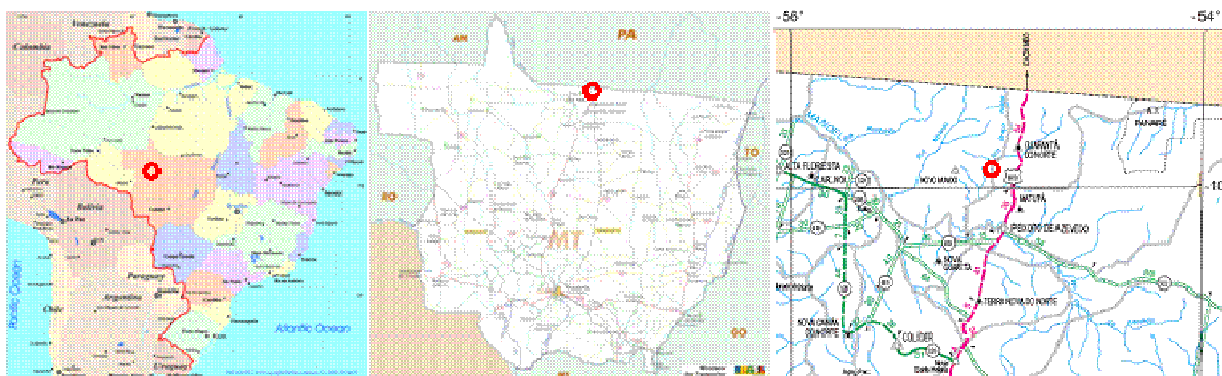


Figure 2 – Location maps of the project

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 and Mundo Novo.

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 location of the project.

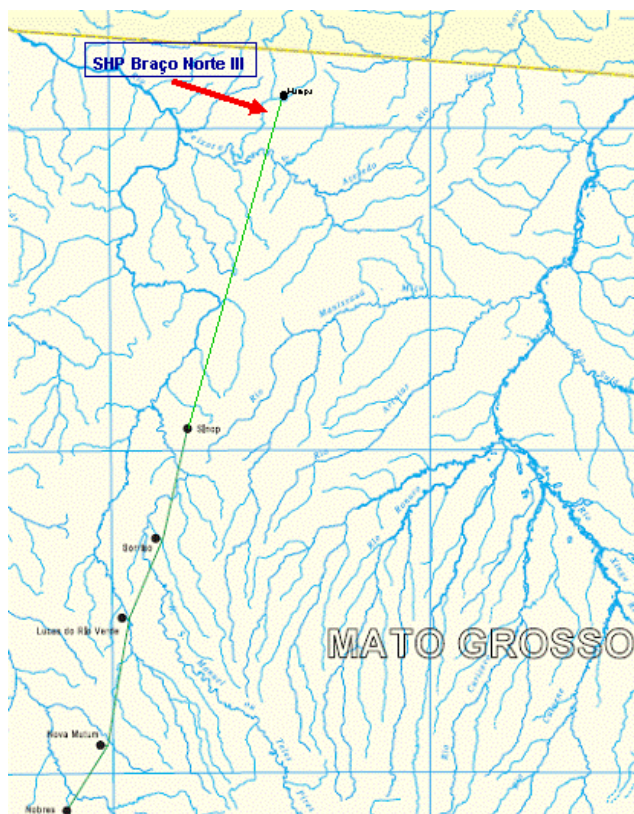


Figure 3 – National Grid termination at Matupá, close to the project location

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 CO ₂ e
2004	38,722
2005	39,083
2006	39,083
2007	39,083
2008	39,083
2009	39,083
2010	39,083
2011	39,083
2012	39,083
2013	39,083
2014	39,083
2015	39,083
2016	39,083
2017	39,083
2018	39,083
2019	39,083
2020	39,083
2021	39,083
2022	39,083
2023	39,083
2024	39,083
Total (tCO₂e)	820,372
Total number of crediting years	21 y (3x7 years)
Annual average of estimated emission reductions over the crediting period (tonnes of CO ₂ e)	39,065

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.

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 0.5211 kgCO₂e / 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, Novo Mundo 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"* EB 16 Meeting Report – 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 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 II and, in a near future, Braço Norte IV. The group owns the all except the first plant. All plants were projected to supply the group's activities throughout the country.

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. Not building Braço Norte III would have spared the Group's much needed financial resources for other activities.

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 / tCO₂.

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 investment
Average generation output	75	GWh	
Electricity price	42.6	USD/MWh	R\$ 115 / MWh
Average exchange rate	2.7	R\$/USD	
Period	20	years	
Emission coefficient	0.5211	tCO ₂ /MWh	
CER price	10	USD/tCO ₂	

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 75 GWh/y is the plant maximum output at a 65% capacity factor. As a matter of fact, during 2004, Braço Norte III generated 74,309 MWh.

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 measure of value of value in the short-term credit 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% (as of today, this rate is 18.50%).

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

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 16.6% with the CER revenues is below the benchmark rate (SELIC 17.38%), the project is still much more attractive than without them. As CER prices raise in the next years, this will fully compensate an unlikely 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.

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 <u>baseline methodology</u> selected is applied to the <u>small-scale project activity</u>:
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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 be seen as separate systems according to large-scale approved CDM consolidated methodology ACM002.

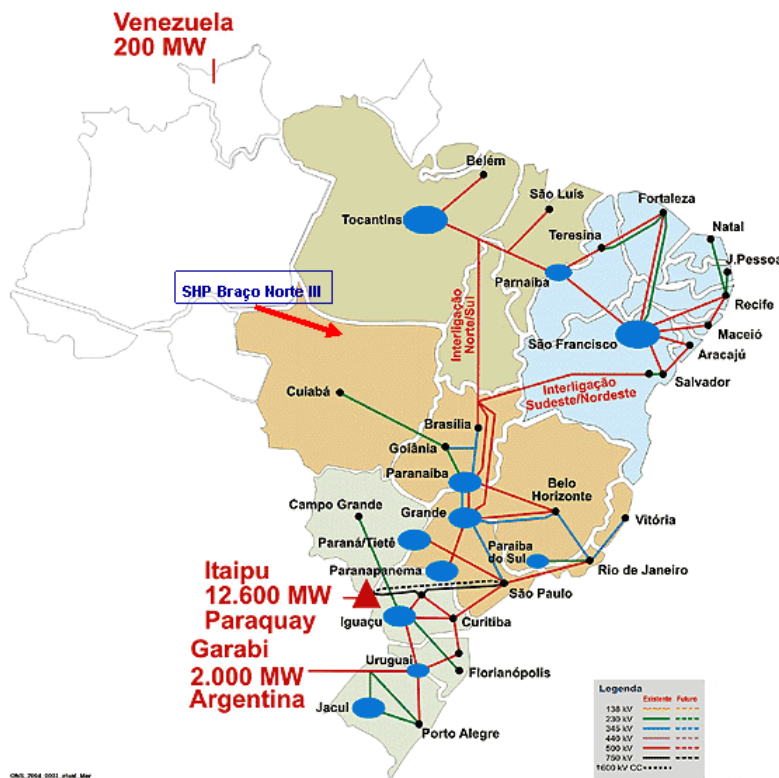


Figure 4 – Brazilian National Integrated Grid showing the two subsystems

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: 01/12/2005.

Responsible for baseline calculations:

Sergio A. W. Ennes

Clean Air S A

(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, 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:**

01/10/2003

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 of small-scale CDM projects), that displaced diesel fired electricity generation from thermal plants in the Brazilian National Integrated Grid. This fulfils requirements of Type I Category I.D. CDM small-scale projects.

**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.
<i>D.3.1</i>	<i>low</i>	<i>Measured value according to internal procedures and validated by ONS</i>
<i>D.3.2</i>	<i>low</i>	<i>Calculated (no monitoring necessary)</i>
<i>D.3.3</i>	<i>low</i>	<i>Calculated from official ONS data (no monitoring necessary)</i>
<i>D.3.5</i>	<i>low</i>	<i>Calculated from official ONS data (no monitoring necessary)</i>

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 in each plant. This value passes through a double check (one automated and one manual reading by the operator in the control room of each plant).

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 reports from in the supervisor system 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.

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

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

Sergio Augusto Weigert Ennes / Lumina Engenharia e Consultoria 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 0.5211 kgCO₂e / 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:

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

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:

$$COEF_i = NCV_i \cdot EF_{i,CO_2} \cdot OXID_i; \quad (2)$$

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,CO_2} = CO_2 emission factor per unit of energy of the fuel i .

- Build margin:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_m GEN_{m,y}} \quad (3)$$

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:

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

In a 2002 OECD paper (Bosi and Laurence, 2002), based on an analysis of dispatch data of 1479 plants in Brazil, the authors estimated the values of $EF_{OM,y}$ and $EF_{BM,y}$ as being 0,719 and 0,569 tCO₂e / MWh.

There has been a strenuous debate around these values and comments were posted during the validation period of some PDDs concerning the need of more recent data. During the last months, major Brazilian project developers (see Ecoinvest – PDD Jaguari/Furnas do Segredo) updated these values using dispatch data from ONS (Operador Nacional do Sistema Elétrico) calculated these values as being 0.9486 and 0.0937 tCO₂e / MWh, respectively.

Using the default values of 0.5 for the weights w_{OM} and w_{BM} :

$$EF_y = 0.5211 \text{ kgCO}_2\text{e/kWh} \quad (5)$$

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:

$$ER_y = EF_y \cdot EG_y \quad (6)$$

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 CO ₂ e
2004	38,722
2005	39,083
2006	39,083
2007	39,083
2008	39,083
2009	39,083
2010	39,083
2011	39,083
2012	39,083
2013	39,083
2014	39,083
2015	39,083
2016	39,083
2017	39,083
2018	39,083
2019	39,083
2020	39,083
2021	39,083
2022	39,083
2023	39,083
2024	39,083
Total (tCO₂e)	820,372

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:

- Despacho no. 67, issued on Feb. 8, 2000 authorizing Eletram S.A. to explore Braço Norte III with 9.888 MW of installed capacity;
- Resolução no. 374, issued on Sep. 20, 2000 transferring exploration rights of Braço Norte III to its subsidiary Guarantã Energética;
- Despacho no. 411, issued on Jun. 29, 2001 authorizing Guarantã Energética to explore Braço Norte III with 14.16 MW of installed capacity;
- 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;
- Fundação Estadual do Meio Ambiente (FEMA-MT);
- Mayor, President of the County Hall and Secretary in charge of Environment of the counties of Guarantã do Norte and Mundo Novo, in 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****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**
(project developer)

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(host)

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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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