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

CONTENTS

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:

Alto Benedito Novo Small Hydroelectric Project – Small Scale CDM Project
PDD Version Number: 03
Date: 28/08/2006

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

The project is a small hydroelectric plant with installed capacity of 15MW, located in the Benedito River, Santa Catarina State, Brazil. The purpose of the project activity is to dispatch renewable electricity to the members of an agricultural community and export the surplus to the S-SE-CO interconnected grid, offsetting thermal generation with renewable electricity generation. Since the project consists of a run-of-river hydropower plant, it presents significantly less negative environmental impacts than large hydropower facilities, mainly because the project does not have a flooded area.

The project activity reduces emissions of greenhouse gases (GHGs) by avoiding the use of fossil fuel, based on thermal units connected to the grid.

Alto Benedito Novo Small Hydroelectric Project is helping Brazil fulfill its goals of promoting sustainable development. Specifically, the project is in line with host-country specific CDM requirements because it:

- Contributes to local environmental sustainability since it will decrease the use of fossil energy, based on diesel sources. Therefore, the project contributes to the better use of local natural resources. In addition, the project uses clean and efficient technologies.
- Contributes towards better working conditions and increases employment opportunities in the area where the project is located – the new plant will require employees for operation, management and repair services.
- Contributes towards better local economy conditions since the use of a renewable fuel decreases dependence on fossil fuels; decreases the amount of associated pollution and therefore the social costs related to this. In addition, the project diversifies sources of electricity generation and decentralizes energy generation.
- Contributes to technological and capacity development – all technology, labour and technical maintenance will be provided inside Brazil. The whole project system, including turbines and generators, represents high efficiency technology. This type of project can stimulate further innovative initiatives inside the Brazilian energy sector: it acts as a clean technology demonstration project, encouraging the development of modern and more efficient renewable energy units throughout Brazil.

A.3. Project participants:

Name of Party involved	Private and/or public entity (ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	CEESAM Geradora S/A	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Ltd.	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.		

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

Alto Benedito Novo Small Hydro is a run-of-river project that consists of the use of water, directly from the river, to generate electricity. The water's gravitational power is used to move the turbine, and by doing so generates electric power. It is a clean and renewable source of energy that has minimum impact on the environment.

A run-of-river project is the project where the river's dry season flow rate is the same or higher than the minimum required for the turbine. According to the Brazilian Power Regulatory Agency ANEEL resolution 652 of 9/12/2003, to be considered a Small Hydro, the area of the reservoir must be less than 3 Km^2 and generation capacity must be between 1MW and 30 MW. In the case of the Alto Benedito Novo Small Hydro there is no reservoir and the installed capacity is 15 MW.

Alto Benedito Novo small hydro unit will use Brazilian Francis type turbines with a horizontal axis (Hydraulic reactor turbine in which the flow exits the turbine blades in a radial direction) and Brazilian generators. Francis turbines are common in power generation and are used in applications where high flow rates are available at medium hydraulic head. Water enters the turbine through a volute casing and is directed onto the blades by wicket gates. The low momentum water then exits the turbine through a draft tube.

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 Santa Catarina.

A.4.1.3. City/Town/Community etc:

Benedito Novo City.

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

Alto Benedito Novo Small Hydro – located on the Benedito River, 26° 46' 00" S, 49° 26' 00" W, in the State of Santa Catarina (SC), in the south of Brazil.

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

Type: Type I – Renewable Energy Projects.
Category: I.D. – Grid connected renewable electricity generation.

The project conforms with this category because it is a small hydroelectric station that will supply electricity to a grid. The project installed capacity will not increase beyond 15 MW for any year over the 21-year project period; complying with the limits for small-scale project activities.

Alto Benedito Novo Small Hydro is a run-of-river project that consists of the use of water, directly from the river, to generate electricity. The water's gravitational power is used to move the turbine, and by doing so generates electric power. It is a clean and renewable source of energy that has minimum impact on the environment.

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The plant consists of two sets of turbine-generators. The turbines are Francis type turbines with 7.500KW:

- Generator: ASALDO – SIG11N14; serial number 8005158; 6592, 5 kVA; 1981.
- Generator: WEG, 10.000kVA (will be installed).

Characteristics of the project activities are specified in the table below:

Plant Main Characteristics	
Turbine Type	Francis
Installed Capacity	15 MW
Efficiency	95%

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:

The Project activity creates, uses and supplies renewable energy to a grid, .The grid is supplied mainly by large hydro plants, but fossil fuel-fired thermal-plants are used as the system margin. The renewable energy produced by the Project will displace electricity produced in the system margin which has a higher electricity dispatching cost and are solicited only over the hours that base load sources cannot supply the grid.

The proposed activity, with its 15 MW installed capacity and effective annual electricity generation of 73,584 MWh, will directly reduce the greenhouse gas emissions from existing and future generation facilities in the Brazilian S-SE-CO electricity grid that use fossil fuels for thermal generation by 38,691tCO_2/yr. Under the business as usual scenario, there would be continuing growth in thermal generation, primarily fossil fuel-based electricity generation.

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

Estimated amount of emissions reductions over the chosen crediting period	
Please indicate the chosen crediting period and the total emissions reductions as well as annual estimates for the chosen crediting period. Information on the emissions reductions shall be indicated using the following tabular format	
Years	Annual estimation of emissions reductions in tonnes of CO2
2007 (9months)	29 125
2008	38 691
2009	38 691
2010	38 691
2011	38 691
2012	38 691
2013	38 691
2014 (3 months)	9 566
Total estimated reductions (tonnes of CO2)	270 837
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	38 691

*** the crediting period starts in April 2007 and ends in March 2014.**

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

The project will not receive any public funding from Parties included in Annex I.

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

Based on the information provided in Appendix C of the simplified modalities and procedures for small-scale CDM activities, this small-scale renewable energy project is not part of a larger emission-reduction project, i.e. is not a debundled component of a larger project or program, given that this is a unique CDM project proposed by the project developer. The project participants have not registered or operated (are not therefore engaged in any way) in any other small-scale CDM project activities in hydro power or by using any other technologies within the project boundary, and surrounding the project boundary.

SECTION B. Application of a baseline methodology:

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

Project Activity I.D. - Renewable electricity generation for a grid. Version 08, 03 March 2006.

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

According to the sectoral scope list presented by UNFCCC (http://cdm.unfccc.int/), the project is related to sectoral scope 1: Energy industries (renewable - / non-renewable sources).

The Project activity is applicable to small scale project type 1 (Renewable Energy), methodology I.D. - Renewable electricity generation for a grid - because it fits into the applicability requirements demanded by this category. This category comprises renewable sources such as hydro that supply electricity to an electricity distribution system that is supplied by at least one fossil fuel generating unit.

The following table shows the key information and data used to determine the baseline scenario:

Table: Key information and data used to determine the baseline scenario.

Variable	Data Source
Operating Margin Emissions Factor (EF_OM_y, in tCO_2/MWh)	ONS
Build Margin Emissions Factor (EF_BM_y, in tCO_2/MWh)	ONS
Grid Emissions factor (EF_y)	ONS
Electricity generated by the project (EG, in MWh)	Project Developer
Baseline Emissions (BE, in tCO_2)	Project Developer
Project emissions (PE, in tCO_2)	Project Developer

The use of each reference will be detailed on “Section E - **Calculation of GHG emission reductions by sources”.**

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:

According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities, evidence as to why the proposed project is additional can be shown by conducting an analysis of the following: (a) investment barriers, (b) technological barriers, (c) prevailing practice and (d) other barriers. The result is a matrix that summarizes the analyses, providing an indication of the barriers faced by each scenario. The most plausible scenario will be the one with the fewest barriers.
The first step in the process is to list the likely future scenarios. Two scenarios were considered:

- Scenario 1: The continuation of current activities – This scenario represents the continuation of current practices, which is electricity generation with significant participation of diesel units on S-SE-CO interconnected grid, and non implementation of the Project Activity.

- Scenario 2: The construction of the new renewable energy plant – In this scenario, a new source of low carbon emissions electricity will be available and will displace the higher carbon intensity electricity in the baseline scenario. For this project scenario, the alternative source is hydro, considered neutral in terms of greenhouse gases emissions.

The barriers are as follows:

- Financial/economical – This barrier evaluates the viability, attractiveness, and financial and economic risks associated with each scenario, considering the overall economics of the project and/or economic conditions in the country.

- Technical/technological – This barrier evaluates whether the technology is currently available, if there are indigenous skills to operate it, if the application of the technology is of regional, national or global standard, and generally if there are technological risks associated with the particular project outcome being evaluated.

- Prevailing business practice – This evaluates whether the project activity represents prevailing business practice in the industry. In other words, it assesses whether in the absence of regulations it is a standard practice in the industry, if there is experience to apply the technology and if there tends to be high-level management priority for such activities.

- Other barriers - This barrier evaluates whether, without the project activity, emissions would have been higher, for any other reason identified, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies.

General Context:

CEESAM Geradora S.A (COOPERATIVA DE ENERGIA ELÉTRICA SANTA MARIA LTDA, from the Portuguese Cooperative of Electrical Energy of Santa Maria), is a new company that was created by a group of small farmers in order to generate electricity for use in their activities.

This community consists of 672 small farmers with agriculture as their core business. All members of this community are family-based farmers, who are very traditional and conservative in the way they handle their business.

With respect to **financial/economical** barriers:

The Project Activity (scenario 2) faces financial and economical barriers. In Brazil the interest rates for local currency financing are significantly higher than US Dollar rates. The National Development Bank, BNDES, is the only supplier of long-term loans. Debt financing from BNDES is made primarily through commercial banks. The credit market is dominated by shorter maturities (90-days to 1-year) and long-term credit lines are available only to the strongest corporate borrowers and for special government initiatives, which is not the position of a community of small farmers. Credit is restricted to the short-term in Brazil.

Financial domestic markets with maturity of one year or greater practically do not exist in Brazil. Experience has shown that in moments of financial stress the duration of savings instruments contracted drops to levels close to one day with a massive concentration in overnight banking deposits. Savers do not hold long-term financial contracts due to the inability to price-in the uncertainty involved in the preservation of purchasing power value[1] .

The lack of local long-term financing is the result of the reluctance of financing institutions to extend the term of their investments. It has made savers opt for the most liquid investments and to place their money in short-term government bonds instead of investing in long-term opportunities that could finance infrastructure projects.

Due to all the difficulties shown above, the Cooperative was obligated to gather from all members the amount of R$6,000,000.00 so it could initiate all the procedures required to have an approved project from ANEEL (Electricity Regulatory Agency). During that period, the revenues of a CDM project activity were seriously considered as a means to relieve that expense.

Conversely, scenario 1 faces no financial difficulty, the Cooperative will continue to use electricity from the grid and to pay a certain amount of money to the local concessionaire.

With respect to **Technical/technological** barriers**:**

The project activity (scenario 2) faces technical/technological barriers. Despite small hydro being a well known technology in Brazil, the technological knowledge is not available to a community of farmers. This has posed additional perceived risks for investors lending to the project, and has necessitated that CEESAM Geradora S/A must meet additional costs for third party technical expertise. Training and studying were required so the group of farmers could understand about equipment and the electricity generation process as to invest their own capital. Specialized engineers will be hired so the plant can be properly operated.

Other barrier inherent to the technology is the hydrological risk. Since this is a run of river project with no flooded area, it is subject to hydrological fluctuations and therefore cannot produce energy on demand, or produce enough energy at certain times of the year, unlike a fossil fuel fired plant. Also the project is at risk from hydrological factors such as flooding or erosion over its operating lifespan.

Regarding scenario 1, there is no technical or technological barrier as the continuation of the current electricity generation mix involves use of tried-and-tested technology.

With respect to **Prevailing business practice** barriers**:**

Common practice in Brazil has been the construction of large – scale hydroelectric plants and, more recently, of thermal fossil fuel plants, with natural gas, which also receive incentives from the government. Already 21.48% of the power generated in the country comes from thermal power plants, and this number tends to increase in the next years, since 40.77% of the projects approved between 1998

[1] Arida et al., 2004

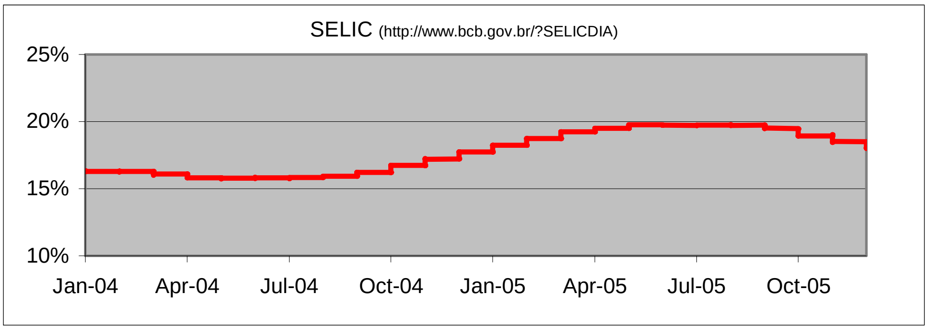
and 2005 are thermal power pants (compared to only 14.59% of SHPs). Only 1.39% of Brazil's installed capacity comes from small hydro sources (1.40 GW out of a total of 100.61 GW). Also, from the 3,489 MW under construction in the country, only 738 MW are small hydro[2].

Furthermore, it is not a prevalence practice in Brazil to have a community of small farmers investing in the energy business. Although small hydro power projects are constructed in Brazil, the financing, construction and operation of these plants by cooperatives, particularly those without experience in power generation, is not common practice. Usually the system of small farmer cooperatives is used for different purposes, such as for obtaining a better selling price for products.

Scenario 1 faces no barriers.

With respect of **other** barriers:

Scenario 2 faces a strong barrier in this situation. The establishment of a cooperative by a group of small, family-based farmers represents people in the same community with different interests and objectives, which are not their prime business. The nature of this organization presents a barrier of its own, and is probably the most difficult one to overcome. In Brazil, as a developing country, people are not used to being gathered in a community group in order to combine their forces to reach a collaborative goal such as raising money for building a small hydro project. It is very hard to convince each farmer to put the extra money from their core business into a high risk project, considering they could alternatively invest this money in mutual funds. The lowest interest rate for Brazil (SELIC) between 2004 and 2005 is 15.73%[3], so a farmer could easily put his money in the bank to obtain safer and equally good revenue. By doing this the idea of each farmer contributing with a small amount is ruined and the project activity would not be implemented. Therefore the financing and construction of the project has required a significant improvement in the capacity of the cooperative, over and above its normal activities and competencies. This represents a barrier to the project development that CDM revenues, which increase the perceived investment security of the project and help to fund increased institutional capacity, will help to overcome.



Scenario 1 would be the mostly likely to happen because working together as a community is not a common practice in Brazil and without the contribution of each farmer the electricity would be purchased by each one from the interconnected grid.

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[2] ANEEL – *Agência Nacional de Energia Elétrica* (Brazilian power regulatory agency) (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp)

[3] BCB - *Banco Central do Brasil*. (http://www.bcb.gov.br/?SELICDIAvisited in 10/04/2006)

Table: Summary of Barriers Analysis.

Barrier Evaluated		Scenario 1 Continuation of current activities	Scenario 2 Construction of a new plant
1.	Financial / Economical	No	**Yes**
2.	Technical / Technological	No	**Yes**
3.	Prevailing Business Practice	No	**Yes**
4.	Other Barriers	No	**Yes**

To conclude, the barrier analysis above has clearly shown that the most plausible scenario is the continuation of current practices (continuation of use of electricity from the S-SE-CO interconnected grid system). Therefore, the project scenario is not the same as the baseline scenario, and these are defined as follows:

- The **Baseline Scenario** is represented by the continued use of electricity from the S-SE-CO interconnected grid system.
- The **Project Scenario** is represented by the construction of a new hydroelectric plant of 15 MW. The new plant will displace grid electricity from a more carbon-intensive source, thus resulting in significant GHG emission reductions.

The Project Scenario is environmentally additional in comparison to the baseline scenario, and therefore eligible to receive Certified Emissions Reductions (CERs) under the CDM.

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 project boundary for the baseline encompasses the physical, geographical site of the renewable generation source and is defined as the electricity grid supplied by the project, the S-SE-CO interconnected grid system, and will include all the direct emissions related to the electricity generation.

Conforming to the guidelines and rules for small-scale project activities, the emissions related to production, transport and distribution of the fuel used in the power plants in the baseline are not included in the project boundary, as these do not occur at the physical and geographical site of the project. For the same reason the emissions related to the transport and distribution of electricity are also excluded from the project boundary.

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

Date of completion of baseline development is 11/04/2006.
EcoSecurities Ltd is the entity determining the baseline and is participating in the project as the Carbon Advisor. Advisors in charge of its development are:

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

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

21y-00m

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

01/08/2005

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

Over 21 y–00 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:

01/04/2007

C.2.1.2. Length of the first crediting period:

07 y – 00 m

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:

The project shall use the monitoring methodology as described in methodology 1.D. of the Simplified Modalities and Procedures for Small Scale CDM project activities. Version 08, 03 March 2006.

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

As a renewable energy project that supplies electricity to an electricity distribution system that is supplied by at least one fossil fuel fired generating unit, it is eligible to use Small Scale Methodology 1.D (Renewable electricity generation for a grid). Under this methodology, monitoring shall consist of measuring the electricity generated by the renewable technology.

The methodology consists of using measuring equipment to register and verify the energy generated by the units, which is essential to verify and monitor the GHG emission reductions. This monitoring plan permits calculation of GHG emissions generated by the project activity in a straightforward manner, applying the baseline emission factor.

Concerning leakage, no sources of emission were identified. The electricity generating equipment is not transferred from or to any other activity.

D.3 Data to be monitored:

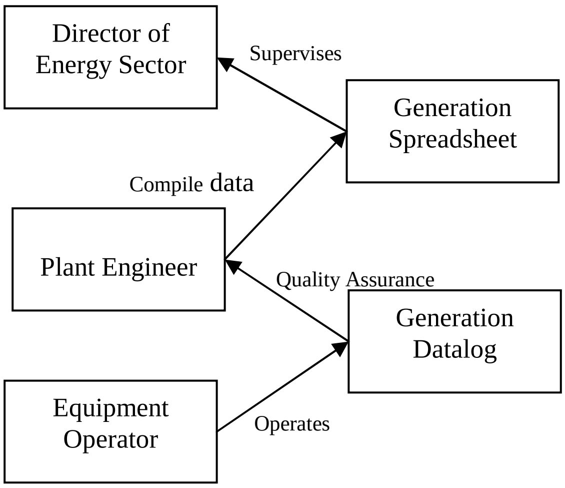
Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:									
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	How long will data be archived	Comments
D.3.1	energy	Electricity supplied to the grid by the project	MWh	M	Measured each 15 minutes and monthly recorded	100%	Electronic and paper	Project lifetime + 2 years	
D.3.2	CO2 emission factor	CO2 emission factor of the grid	tCO2/ MWh	C	Once at the beginning of each crediting period	100%	Electronic	Project lifetime + 2 years	Since 3 years worth of baseline data are used, this variable is fixed ex-ante
D.3.3	CO2 operating margin	CO2 operating margin of the grid	tCO2/ MWh	C	Once at the beginning of each crediting period	100%	Electronic	Project lifetime + 2 years	Since 3 years worth of baseline data are used, this variable is fixed ex-ante
D.3.4	CO2 build margin	CO2 build margin of the grid	tCO2/ MWh	C	Once at the beginning of each crediting period	100%	Electronic	Project lifetime + 2 years	Since 3 years worth of baseline data are used, this variable is fixed ex-ante

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

Table: Quality Control (QC) and quality assurance (QA) procedures being undertaken for data monitored

Data	Uncertainty level of data: (high, medium, low)	Are QA/QC procedures planned for these data?	Explain QA/QC procedures planed for these data, or why such procedures are not necessary
D.3.1	Low	Yes	Measuring instruments will be maintained regularly. The measurements of the project developer will be double checked with the electric system operator.
D.3.2	Low	Yes	Calculation will be based on public and official data
D.3.3	Low	Yes	Calculation will be based on public and official data
D.3.4	Low	Yes	Calculation will be based on public and official data

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:



CEESAM Geradora S/A has not hired all people that will be monitoring the project yet. But all information that needs to be monitored is also important for the company's billing system. And it will be monitored and calibrated according to the section D.4.

No leakage is considered in this project activity

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

Date of completion of monitoring development is 11/04/2006.
EcoSecurities Ltd is the entity determining the monitoring plan and participating in the project as the Carbon Advisor. Advisors in charge of its development are:

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SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

This is not applicable. See section E.1.2 below.

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

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:

No formula is needed. Emissions by sources are nil since renewable energy is either a zero CO_2 or CO_2 - neutral source of energy.

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

This is not applicable as the renewable energy technology used is not going to be transferred from another activity. Therefore, as per the Simplified Procedures for SSC Project Activities, no leakage calculation is required.

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

Zero emissions (0 t CO2e) for the electricity generation component.

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 methodology used for the calculation of baseline emissions from the use of grid electricity follows paragraph 9.a of the simplified modalities for small-scale projects, which uses the Combined Margin (CM) approach.

The baseline emissions (BE_y) resulting from the electricity supplied and/or not consumed from the grid is calculated as follows, where EG_y is the annual net electricity generated from the Project.

$$BE_y = EG_y * EF_y$$

The baseline emissions factor (EF_y) is a weighted average of the EF_OM_y and EF_BM_y:

$$EF_y = (\omega_{OM} * EF\_OM_y) + (\omega_{BM} * EF\_BM_y)$$

where:

EF_OM_y is the operating margin carbon emissions factor
EF_BM_y is the build margin carbon emissions factor
and the weights ω_{OM} and ω_{BM} are by default 0.5.

The Operating Margin emission factor (EF_OM_y) is calculated using the following equation:

$$EF\_OM_y\,(tCO_2/MWh) = \frac{\sum_{i,j} F_{i,j,y} * COEF_{i,j}}{\sum_j GEN_{j.y}]}$$

Where:

$F_{i,j,y}$ is the amount of fuel i (in GJ) consumed by power source j in year y;
j is the set of plants delivering electricity to the grid, not including low-cost or must-run plants and carbon financed plants;
$COEF_{i,j,y}$ is the carbon coefficient of fuel i (tCO_2/GJ);
$GEN_{j.y}$ is the electricity (MWh) delivered to the grid by source j.

The Build Margin emission factor (EF_BM_y) is the weighted average emission factor of a sample of power plants m. This sample includes either the last five plants built or the most recent plants that combined account for 20% of the total generation, whichever is greater (in MWh). The equation for the build margin emission factor is:

$$EF\_BM_y\,(tCO_2/MWh) = \frac{[\sum_{i,m} F_{i,m,y} * COEF_{i,m}]}{[\sum_m GEN_{m.y}]}$$

Where:

$F_{i.m,y}$, $COEF_{i,m}$ *and* GEN_m are analogous to the *OM* calculation above.

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 for the electricity component of the proposed project are calculated using the formulas described in sections E.1.2.4 and E.1.2.3 above. The expected annual emission reduction from the total grid-electricity displacement component is detailed in the table below.

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

Summary Table 1D		
Electricity generation emission reductions	**Per year**	**Source**
Operating Margin Emissions Factor (EF_OM_y, in tCO_2/MWh)	0.9472	ONS
Build Margin Emissions Factor (EF_BM_y, in tCO_2/MWh)	0.1045	ONS
Baseline Emissions factor (EF_y)[4]	0.5258	ONS
Electricity generated by the project (EG, in MWh)	73,584	Project developer
Estimation of baseline reductions per year (tonnes of CO2e)	38,691	Calculated
Project emissions (PE, in tCO_2)	0	Calculated
Emission reductions from electricity generation (tCO_2/year)	38,691	Calculated

The ex post calculation of baseline emission rates may only be used if proper justification is provided. Notwithstanding, the baseline emission rates shall also be calculated ex ante and reported in the CDM-PDD. The result of the application of the formulae above shall be indicated using the following tabular format.

Years	**Estimation of project activity emission reductions (tonnes of CO_2e)**	**Estimation of baseline reductions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of emission reductions (tonnes of CO_2e)**
2007	0	29 125	0	29 125
2008	0	38 691	0	38 691
2009	0	38 691	0	38 691
2010	0	38 691	0	38 691
2011	0	38 691	0	38 691
2012	0	38 691	0	38 691
2013	0	38 691	0	38 691
2014	0	9 566	0	9 566

[4] Information regarding the emission factor calculation can be seen in Annex 3 of this document.

SECTION F.: Environmental impacts:

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

Documentation:

The hydro plant has received an official license number LAI-016/05 from the local official authority (FATMA) in order to implement the project. The project proponent developed an Environmental Control Plan as requested by the license, which evaluates the environmental aspects:

1) Physical environment
- Control of deforestation
- Control of erosion
- Degraded areas
- Reforestation
- Monitoring of the waters shed

2) Biological environment
- Monitoring water quality
- Monitoring the fish and animal life in the river
- Consolidation of a conservation unit

The environmental impact assessment examined environmental and regional aspects. The environmental mitigation measures, such as reforestation, will help to preserve the remaining conserved area. It represents significant positive effects since regional economic development is mainly based on intensive agriculture and farming, and the land occupation process had been destroying the natural vegetation cover.

Considering regional aspects, due to the small scale of the project activity, no serious environmental impacts were detected. Positive feeling by local population about the project activity was identified. In this context, there is expected to be an ongoing interaction with them regarding the opportunities for enhancing the positive effects. By fulfilling these mitigative measures, it would contribute in sense of extending the knowledge and consciousness of environmental aspects in this community and will allow a natural recovery of degraded area.

Table: Potencial Environmental impacts and prevention measures.

IMPACT	PREVENTION
Slope instability and erosion	Slope conservation by planting vegetals, covering in grass and native forest species, during construction.
Water and soil pollution, Sedimentation of water courses	Fully preventable, basically care, good housekeeping and good outdoor behavior. Small escavation should not carry any suspension material to the river. Among the measures to be taken in transporting excavation material are accesses irrigation to avoid formation of dust and cover truck's cart to avoid loss of the transported material. Remove vegetal covery and superficial soil layer, with high content of organic matter, to avoid reservoir's eutrofization. The area of the dam will be restricted to the construction of a 3m high threshold, with the construction in the maximum time of 20 days.
Job opportunities	Positive impact. No need for prevention.
Drowned forest	No flooded area. No need for prevention.
Increase of the need for goods and services and of the local income and public levy.	Positive impact. Temporarialy increase of the local economy (opening of bars and small restaurants) improving formal and informal job opportunities, mainly nearby the site. No need for prevention.
Loss of fish habitat and spawning areas	Absence of migratory species, according to environmental study. This area is only for fish passage and is not a headspring. No need for prevention.
Loss of agricultural land, flooding of farms and dwellings.	Due to high declivity, there are no utilisation of reached land for agricultural use. Thus, no agricultural land will be lost. No need for prevention.
Alteration of terrestrial habitats and fauna's habits	Elaboration of degraded area recuperation programs, with production of native species moult and reforestation.
Loss of habitat in dried up channels.	River habitat around falls and rapids often unproductive, no mitigation required (or compensation water release).

SECTION G. Stakeholders' comments:

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

According to Resolution #1, dated December 2nd 2003, from the Brazilian Inter-Ministerial Commission of Climate Change (Comissão Interministerial de Mudança Global do Clima -CIMGC), any CDM projects must send a letter with a description of the project and an invitation for comments by local stakeholders. In this case, letters were sent to the following local stakeholders:

- City Hall of Benedito Novo;
- Chamber of Deputy of all municipalities above;
- Environment agencies from the State and local authority;
- Brazilian Forum of NGOs;
- District Attorney (known in Portuguese as Ministério Público, i.e. the permanent institution essential for legal functions responsible for defending the legal order, democracy and social/individual interests) and;
- Local community associations.

Local stakeholders were invited to raise their concerns and provide comments on the project activity for a period of 30 days after receiving the letter of invitation. EcoSecurities Brasil Ltda. and the project developer addressed questions raised by stakeholders during this period.

G.2. Summary of the comments received:

To date, no comments have been received.

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

To date, no comments have been received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project will not receive any public funding from Parties included in Annex I.

Annex 3

INFORMATION REGARDING EMISSION FACTOR CALCULATION

For this project, data for combined margin calculation have been based on ONS – Operador Nacional do Sistema.

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-SECO 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)[5]:

"… 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.

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[5] Bosi, M. *An Initial View on Methodologies for Emission Baselines: Electricity Generation Case Study*. International Energy Agency. Paris, 2000.

The Brazilian electricity system nowadays comprises of around 91,3 GW of installed capacity, in a total of 1,420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5.3% are diesel and fuel oil plants, 3.1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1.4% are coal plants, and there are also 8,1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6,3 GW of the Paraguayan part of *Itaipu Binacional*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

Approved methodology AM0015 and ACM0002 asks project proponents to account for "all generating sources serving the system". In that way, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

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

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

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

In an attempt to include all generating sources, project developers considered the option to research for available, but non-official data, to supply the existing gap. The solution found was the International Energy Agency database built when carrying out the study "Road-Testing Baselines For Greenhouse Gas Mitigation Projects in the Electric Power Sector", published in October 2002. Merging ONS data with the IEA data in a spreadsheet, project proponents have been able to consider all generating sources connected to the relevant grids in order to determine the emission factor. The emission factor calculated was found more conservative when considering ONS data only, as the table below shows the build margin in both cases.

IEA/ONS Merged Data Build Margin (tCO_2/MWh)	ONS Data Build Margin (tCO_2/MWh)
0,205	0,1045

Therefore, considering all the rationale explained, project developers decided for the database considering ONS information only, as it was capable of properly addressing the issue of determining the emission factor and doing it in the most conservative way.

Efficiency data on fossil fuel plants were taken from IEA document. This was made after considering that there was no more detailed information on efficiency, from public, renowned, and reliable sources.

From the reference as mentioned, the efficiency of conversion (%) of fossil fuels to thermo electrical plants fed with fossil fuel was calculated based on the installed capacity of each plant and on the power effectively produced. For most thermo electrical plants under construction, a constant value of 30% was used to estimate its fossil fuel conversion efficiency.

This value was based on data as available in the literature and on observation of real conditions of this kind of plants operating in Brazil. It was assumed that the only 02 natural gas-combined cycle plants (amounting to 648 MW) have higher efficiency rate, i.e. 45%.

Also, only data relative to plants under construction in 2002 (starting operation in 2003) were estimated. All other efficiencies were calculated. As far as it is know, there has been no upgrade of the older thermo electrical plants as analyzed in the period (2002 to 2004).

Therefore project participants have concluded that the best option available was to use such numbers, although they are not well consolidated.

All this information was directed to the current CDM project validators and thoroughly discussed with them, with the purpose to clarify every item and every possible doubt.

The table below summarizes conclusions of the analysis, with the calculation of the emission factor as presented.

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

Small-scale baseline (without imports)	OM (tCO2e/MWh)	Total generation (MWh)
2002	0,9304	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)
	0,9472	0,1045
	OM*0.5+BM*0.5 (tCO2e/MWh)	
	0,5258	