# 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.<br>• 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:

Martinuv Espigão Hydroelectric Project
Version 04
13/09/2006

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

The Martinuv Espigão Hydroelectric Project (hereafter, the Project) developed by Mauricio Martinuv Company together with Incomex – Indústria, Comércio e Exportação Ltda, as proponents and operators of the project, consists of a bundle of two small run-of-river hydroelectric projects:

- MARTINUV, located at Vilhena, in Pimenta Bueno River in Rondônia state with 2.4 MW installed capacity.
- ESPIGÃO, located at Espigão D'Oeste, in Preto River in Rondônia state with 1.5 MW installed capacity.

The units will be implemented in the following two phases:

- MARTINUV, phase 1 with 0.92 MW and phase 2 with 1.48 adding a total of 2.4 MW.
- ESPIGÃO, phase 1 with 0.90 MW and phase 2 with 0.60 adding a total of 1.5 MW.

The plants are connected to Rondônia-Acre isolated electricity systems, both located in Rondônia State, north region of Brazil.The Plants are located in very remote area, and bring electricity to develop these area socially and economically, which has always been a difficult issue to be solved . Frequently, the solution for the electricity supply problem, in this remote area, has been the implementation of an isolated electricity system based on thermal power plants, fired by fossil fuels. This project will increase the supply of electricity to the grid, offsetting thermal generation with a renewable source of energy, reducing $CO_2e$ emissions.

The participants of the project recognize that this Project activity is helping Brazil fulfil 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.
- Contributes towards better working conditions and increases employment opportunities in the area where the project is located.
- Contributes towards better revenue distribution since the use of a renewable energy souce decreases dependence on fossil fuels; decreases pollution and therefore the social costs related to this.
- Contributes to development of technological capacity because all technology, hand labour and technical maintenance will be provided inside Brazil. This type of project can stimulate further innovative initiatives inside the Brazilian energy sector and encourage the development of modern and more efficient renewable energy units throughout Brazil.

- Contributes to regional integration and connection with other sectors, the project facilitates the increase in small hydroelectricity as a generating source in the region and therefore may encourage other similar companies that want to replicate this experience.

**A.3. Project participants:**

**Table 1 - Marinuv Espigão Hydroelectric Project participants**

| **Name of Party involved ((host) indicates a host party)** | **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) | • Private entity Incomex – Indústria, Comércio e Importação Ltda<br>• Private entity Maurício Martinuv Company. | No |
| United Kingdom of Great Britain and Northern Ireland | EcoSecurities Ltd. | No |

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

**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.:**

Martinuv, located in North region, Rondônia State.
Espigão, located in North region, Rondônia State.

**A.4.1.3. City/Town/Community etc:**

Martinuv, located in the municipality of Vilhena.
Espigão, located in the municipality of Espigão D'Oeste.

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

1. Martinuv, located in the Pimenta Bueno river – 12 $^{o}$49’18” S and 60 $^{o}$17’45”W, in the State of Rondônia (RO), north region of Brazil.
2. Espigão, located in the Preto river - 11 $^{o}$28’47”S and 60 $^{o}$44’49”W, in the State of Rondônia (RO), north region of Brazil.

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

According to Annex A of the Kyoto Protocol, the project falls under sectoral scope (1), Energy industries (renewable - / non-renewable sources).

The project uses Small Scale Project Activity Type 1: Renewable energy projects, category I.D.: Renewable energy generation for a grid.

The project consists in a renewable electricity generation (run-of-river small hydro power plants) to supply electricity to Rondônia isolated System. The two hydro power plants have a total installed capacity of 3.9MW (below the eligibility threshold of 15 MW for small scale projects)

**Table 2 – Technical description**

| | Martinuv 1$^{st}$ phase | Martinuv 2$^{nd}$ phase | Espigão 1$^{st}$ phase | Espigão 2$^{nd}$ phase |
|---|---|---|---|---|
| Installed Capacity(MW) | 0,92 | 1,48 | 0,9 | 0,6 |
| Turbine | 1 Francis | 1 Francis | 1 Francis | 1 Francis |
| Efficiency | 92% | 92% | 92% | 92% |

By legal definition of the Brazilian Power Regulatory Agency ( ANEEL – *Agência Nacional de Energia Elétrica*), resolution no 652, issued on December 9$^{th}$, 2003, small hydro in Brazil must have installed capacity greater than 1MW but not more than 30MW and with reservoir area less than 3km$^2$. Also, run-of-river projects are defined as “the projects where the river’s dry season flow rate is the same or higher than the minimum required for the turbines” (Eletrobrás, 1999). Run-of-River schemes do not include significant water storage, and must therefore make complete use of the water flow. A typical run-of-river scheme involves a low-level diversion dam and is usually located on swift flowing streams. A low level diversion dam raises the water level of the river sufficiently to enable an intake structure to be located on the side of the river. The intake consists of a trash screen and a submerged opening with an intake gate. Water from the intake is normally taken through a pipe (called a penstock) downhill to a power station constructed downstream of the intake and at as low a level possible to gain the maximum head on the turbine.

Martinuv and Espigão small hydro units 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.

Both Martinuv and Espigão are run-of-river plants and have minimum diversion dams, which store water to generate electricity for short periods of time, Martinuv has no reservoir area and the Espigão's reservoir area is 0,37km². Both small hydros will be implemented in two phases adding two groups of turbine-generator of each small hydro.

**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 proposed project activity will displace energy from Brazilian isolated systems, a more carbon-intensive grid (predominantly thermal power fired by fossil fuels such as diesel) with a renewable source of energy. In the absence of the proposed project activity, electricity generation would have been produced by thermal-power currently operating in the grid. It is unlikely that small hydro projects would be developed in the Host Country in the absence of the Project Activity due to unfavourable market conditions and the existence of significant market barriers for such projects.

The estimate of total emission reductions from the electricity generation component is 104,045 tonnes of $CO_2$e over 7 years, considering the displacement for two hydro plants. For more details about each plant's CER generation, please see Section E.

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

| Years | Annual estimation of emission reductions in tonnes of CO2e |
|---|---|
| 2007 | 7,827 |
| 2008 | 12,187 |
| 2009 | 15,575 |
| 2010 | 17,114 |
| 2011 | 17,114 |
| 2012 | 17,114 |
| 2013 | 17,114 |
| Total estimated reductions (tonnes of CO2e) | 104,045 |
| Total number of Crediting years | 7 |
| **Annual average over the crediting period of estimated reductions** (tonnes of CO2e) | 14,863.6 |

**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:**

Incomex – Indústria, Comércio e Exportação Ltda is developing one more CDM project, named "Incomex Hydroelectric Project". According to Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, the proposed project activity is not a fragmentation of a larger project if the analysis presented in the Table below results in a negative result. The proposed project activity will be considered a debundled component of a larger if the project participants, project category, registration date and project boundary are the same for all projects. The following analysis of debundling, for the proposed project activity and the project developed by Incomex, concluded that proposed project activity in not a debundled component of a larger project. See the next table.

**Table 3 - Debundling Occurrence Analysis**

| Item \ Project | Martinuv Espigão hydroeletric project | Incomex hydroelectric project | Occurrence of Debundling |
|---|---|---|---|
| **Project Participants** | Mauricio Martinuv and Incomex | Incomex & Grupo Cassol Energia | No |
| **Project category** | Renewable electricity generation for a grid | Renewable electricity generation for a grid | Yes |
| **Registration** | To be registered | To be registered | Possible |
| **Boundary** | Vilhena and Espigão d'Oeste cities | Alta Floresta d'Oeste and Comodoro cities | No |
| **Result (the project will be a debundling of a larger project if the four items above occur): Not debundling** | | | |

In addition to the boundary analysis, all "Incomex hydroelectric project" plants are more than 1 km far from "Martinuv Espigão hydroelectric project" plants. The smallest distance is approximately 28 km, between plant Cabixi II and plant Martinuv, moreover these plants have different owners, Grupo Cassol and Mauricio Martinuv Company respectively.

## SECTION B. Application of a baseline methodology:

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

The proposed project activity falls under Type/Category I.D. - Gird connected renewable electricity generation - I.D/Version 09, scope 1, 28 July 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) and is applicable to small scale project type 1 (Renewable Energy), methodology I.D. –renewable electricity generation for a grid.

The total installed capacity of the project activity is 3.9MW which is below the eligibility limit of 15 MW for small scale projects.

The baseline scenario is the continuation of the current situation of electricity supplied predominantly by thermal-power stations.

Martinuv and Espigão project comprises renewable energy generation units because it is a bundle of two small run-of-river hydro that will supply electricity to an electricity distribution system, supplied by at least one fossil fuel generating unit. Martinuv Espigão Hydroelectric project will supply electricity to Rondônia Isolated System.

According to the approved baseline methodology I.D/Version 09, scope 1, 28 July 2006, the following two options are offered for preparing the baseline scenario: (a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002; and (b) The weighted average emissions (in $kgCO_2/kWh$) of the current generation mix. Option (a) was selected.

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

**Table 4 - Key information and data used to determine the baseline scenario**

| Variable | Data Source |
|---|---|
| Operating Margin Emissions Factor ($EF\_OM_y$, in $tCO_2/MWh$) | ANEEL, Eletrobras SA and CERON |

| | |
|---|---|
| Build Margin Emissions Factor ($EF\_BM_y$, in $tCO_2$/MWh) | ANEEL, Eletrobras SA and CERON |
| Baseline Emissions factor ($EF_y$) | ANEEL, Eletrobras SA and CERON |
| Electricity generated by the project (EG, in MWh) | ANEEL, Eletrobras SA and CERON |
| Baseline Emissions (BE, in $tCO_2$) | ANEEL, Eletrobras SA and CERON |
| Project emissions (PE, in $tCO_2$) | ANEEL, Eletrobras SA and CERON |

**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 to why the proposed project is additional is offered under the following categories of barriers: (a) investment, (b) technological, (c) prevailing practice and (d) other barrier.

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.

For this analysis, the following 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 fossil fuel units on Rondônia-Acre isolated system.

- Scenario 2 - The construction of the new renewable energy plant – This scenario represents the use of a new renewable source, small hydro generation plant, considered neutral in terms of GHG 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**

According to the audit report elaborated from Brazilian Court of Audit (2004), the Brazilian Electricity System mainly consists in an interconnected system that includes South, Southeast, Middle-West, Northeast and part of the North Regions. The North Region is predominantly supplied by isolated systems, which are diesel fuelled. In 1993 in order to promote the development of the North Region, the Brazilian Government come up with a law - 8631/93 - that obliged all energy concessionaires to divide proportionally the fuel consumption costs done by the isolated systems. Therefore the electricity would be available in the North Region, with a reasonable price. This obligation is called CCC ("Conta Consumo de Combustíveis"), which means Fuel Consumption Account.

Besides CCC, the government also created the CCC Subrogation (law no. 9648/98). This policy was implemented because CCC only applies to electricity generation from thermal units fired by fossil fuels. The CCC subrogation now says that renewable energy can also apply for the subsidy. Therefore, the subrogation of CCC resources facilitates the replacement of fossil fuel consumption by other alternative and renewable sources, as for example, hydro energy (Tolmasquim, 2004).

CCC Subrogation represents an attractive alternative: according to ANEEL (National Electricity Agency), for the implementation of new generation unit the construction can be subsided from 50% to 75% and the internal rate of return for those investments can increase considerably. However, there are still two main obstacles involved in the CCC Subrogation that will be better described in the financial barriers items below, specifically considered in this project.

According to "ANEEL CCC + CCC subrogation utilization guide" it should be created other legal devices to help changing the source of energy from fossil to renewable, in which the Kyoto Protocol is suggested as an alternative.

Although the plants considered for Martinuv Espigão Project are subscribed to the CCC Subrogation, this cannot be used as incentive in the baseline scenario. This is due to the fact that the CCC Subrogation is a National and/or sectoral policy that gives positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies, thus it is classified as type E-, according to annex 3 of EB meeting nº16. Policies type E- shall not be taken into account in developing a baseline scenario.

Even though, the project would face economical and prevailing practice barriers better detailed on items below.

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

- The continuation of current practices (Scenario 1) does not pose any financial/economical barrier to the project developer, and requires no further financing. The greater part of the energy supplied to the isolated system being considered by this project comes from diesel fuel units. From a total of 862 MW of installed capacity in the Rondônia-Acre system, 761 MW comes from thermal units.

- The construction of a renewable energy plant (Scenario 2) faces specific financial/economic barriers due to the fact that even receiving the subsidies from the CCC Subrogation, the project faces two important obstacles, quoted from the Brazilian Court of Audit (2004). As explained above, the CCC initiative subsidises the use of fossil fuel fired thermal units in the isolated system, while the CCC Subrogation subsidises renewable sources of energy, and Espigão and Martinuv are subscribed under that clause. Although, Espigão and Martinuv will receive subsidies from CCC Subrogation to support the equipment purchasing, this will only occur in the second phase because both plants are under 1MW in the first phase.

  One of the two main obstacles is: **lack of long-term financing available for medium investors**. (Quoted from the Brazilian Court of Audit, 2004, paragraph 115). Besides all the investment barriers that are normally involved in Brazilian financial activities, there is the uncertainty from resource suppliers due to the lack of guarantees in selling the energy. It is known that the North region concessionaires experience a precarious economical situation, which brings insecurity for the investors in energy sector.

  The other barrier is: **lack of interest from energy concessionaires**. The energy companies prefer not losing the guaranteed CCC subsidies to support generation investments based on renewable fuel sources. This is enforced by the fact that energy producers must have a pre-set selling contract with the buyer or an official document that assures that the energy produced will be sold in order to access the subsidy. The producer can only apply for the subsidy once the unit is fully operating and producing the same amount of energy as was agreed in the contract. Thus thermal units are preferable than hydro units.

  At last, the implementation costs for those units in the North Region are considerably higher than in other regions. Camargo, quoted in Tolmasquim (2004), verified that the implementation costs for hydros until 10 MW in isolated systems is considerably higher than in the other regions (see Table below). This is due to difficulties better detailed on the prevailing practice barrier, related to logistics, transportation etc. Based on the same author, even with the CCC Subrogation benefits, the average energy cost for this region is still high.

  Table 5 - **Small hydro units construction costs in different Brazilian regions – R$/kW.***

| | North/Isolated | Northeast | Middle-West | Southeast | South |
|---|---|---|---|---|---|
| **Small plants (1-10 MW)** | 4.000 | 3.500 | 3.500 | 2.800 | 2.800 |
| **Other plants (10-30 MW)** | 4.000 | 3.500 | 3.500 | 3.000 | 2.800 |

  *Elaborated based on Camargo, 2004.

  Furthermore, the subsidy for the construction is not fully paid when the subrogation is conceded. This is amortized every month for the maximum of 5 years and the amount paid is related with the energy produced. Consequently if the energy producer produces less energy than he assured in the contract, the subsidy would be paid proportionally to that value and the rest would be postponed to the following months.

In conclusion, although both renewable and non-renewable plants may receive a subsidy, it is easier, faster and cheaper for thermal plants to be put into operation and to receive the subsidy, and also there are few other complications involved in the operation of conventional thermal plants (better detailed under ‘prevailing practice’).

With respect to the **technical/technological** barriers:

- In the case of Scenario 1 (continuation of current practices), there are no technical/technological barriers as this simply represents a continuation of current electricity generation practices which have been shown to work, and does not involve implementation of any new technology or innovation.
- In the case of Scenario 2, there are no significant technical/technological barriers. All the technologies involved in this scenario are available in the market, and have been used effectively in the Host Country.

With respect to the analysis of **prevailing business practice**:

- The continuation of current practices (Scenario 1) presents no particular obstacles. This is by definition prevailing practice in the region.

- In the case of Scenario 2, there are barriers that would have to be overcome. According to Brazilian Court of Audit, 2004, until the end of 2004, only 12 plants were approved for CCC Subrogation and only 6 are operating. The lack of interest from the local concessionaires in subscribing for this program is mainly due to financial reasons. However, many other specific reasons related to the prevailing practices can be appointed.

Concerning the Rondônia isolated system, predominantly thermal (according to official Operational Plans from 2001 until 2005). The isolated systems considered by the documents cited above were authorized by the Energy National Agency (ANEEL).

Below, a brief explanation of the electricity generation operational activities in Rondônia:

Isolated Systems in Rondônia:

ELETRONORTE is the concessionaire responsible for generation and transmission activities inside Porto Velho System, the main electricity system in Rondônia .Originally, the Porto Velho system comprised 1 hydro unit (UHE Samuel) and 8 thermal units (Rio Branco I, TEU Colorado, TEU Vilhena, Rio Branco II, Rio Acre, Rio Madeira, Termonorte I and Termonorte II) (Operational Plan from 2001). According to this plan, all thermal units were part of the “Thermoelectric Priority Program”, which focused on increasing the electricity supply for this state. The main reason to this initiative was due to water level instability of Samuel’s hydro reservoir. Besides Eletronorte, CERON is the concessionaire responsible for distribution and transmission activities for the interior of Rondônia. According to the same Plan, in 2001, there were 41 isolated systems in Rondônia, from which 39 were fuelled by diesel oil.

From 2001 until 2005, thermal generation inside the isolated system has only increased. According to Operational Plan (2003), forecasted hydro generation corresponded to 2,048 GWh, while thermal generation corresponded to 6,991 GWh. Furthermore, according to this same plan, thermal generation was projected to increase by 9% and hydro generation to decrease by 5%. Still, in the Operational Plans for 2004 and 2005, a comparison between thermal and hydro generations always indicates a clear predominance of thermal generation. This can be better visualized on the tables below, taken directly from the Operational Plan for 2005 (the most representative plan). According to Table 6, the number of thermal generation units in Rondônia corresponds to 160 (148 + 12), while on Table 7, the number of hydro generation units in Rondônia corresponds to 28 (5 + 23).

**Table 6 – Number of units and installed power in 2005 - Thermal units**

| Estado | Concessionária | Nº de Unidades | | Potência Nominal ( kW ) | |
|---|---|---|---|---|---|
| | | 2004 | 2005 | 2004 | 2005 |
| ACRE | ELETRONORTE | 24 | 24 | 94.400 | 94.407 |
| | ELETROACRE | 66 | 66 | 35.484 | 32.572 |
| AMAPÁ | ELETRONORTE | 7 | 30 | 122.800 | 145.800 |
| | CEA | 17 | 15 | 23.320 | 18.045 |
| AMAZONAS | MANAUS ENERGIA | 66 | 116 | 822.700 | 900.200 |
| | CEAM | 368 | 426 | 211.021 | 325.363 |
| PARÁ | CELPA | 180 | 155 | 97.992 | 95.614 |
| | JARI CELULOSE | 11 | 11 | 70.570 | 69.865 |
| RONDÔNIA | ELETRONORTE | 12 | 12 | 549.900 | 549.900 |
| | CERON | 154 | 148 | 90.333 | 101.060 |
| RORAIMA | BOA VISTA ENERGIA | 3 | 3 | 62.000 | 62.000 |
| | CER | 97 | 114 | 25.430 | 23.670 |
| BAHIA | COELBA | 5 | 5 | 1.578 | 1.578 |
| MARANHÃO | CEMAR | 3 | 3 | 872 | 872 |
| MATO GROSSO | CEMAT | 208 | 206 | 109.092 | 105.039 |
| MATO G. DO SUL | ENERSUL | 3 | 3 | 4.500 | 4.500 |
| PERNAMBUCO | CELPE | 10 | 3 | 4.934 | 2.730 |
| TOTAL PARQUE TÉRMICO | | 1234 | 1340 | 2.326.926 | 2.533.215 |

**Table 7 – Number of units and installed power in 2005 – Hydro units**

| Estado | Concessionária | Nº de Unidades | | Potência Nominal ( kW ) | |
|---|---|---|---|---|---|
| | | UHE | PCH | UHE | PCH |
| AMAZONAS | MANAUS ENERGIA | 5 | - | 250.000 | - |
| RONDÔNIA | ELETRONORTE | 5 | - | 216.000 | - |
| | CERON | - | 23 | - | 57.404 |
| RORAIMA | CER | - | 2 | - | 5.000 |
| AMAPÁ | ELETRONORTE | 3 | - | 75.000 [1] | - |
| MATO GROSSO | CEMAT | - | 25 | | 32.975 |
| TOTAL PARQUE HIDRÁULICO | | 13 | 50 | 541.000 | 95.379 |

Nota: [1] Prevista repotenciação da 2ª unidade geradora da UHE Coaracy Nunes para maio de 2005.

Therefore, based on these data, it is clearly demonstrated that the prevailing practice in terms of energy generation in Rondônia is predominantly thermal and consequently, the trend in that region is the construction of units using fossil fuels, instead of hydro units.

With respect to the analysis of **other barriers**:

- Both scenarios present no other barriers.

Table below summarises the results of the analysis regarding the barriers faced by each of the plausible scenarios. Scenario 1 faces no barriers, whereas Scenario 2 faces financial/economic barriers and is against prevailing practice.

**Table 8 - Summary of barriers Analysis**

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

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 isolated system). Therefore, the project scenario is not the same as the baseline scenario, and these are defined as follows:

- The **Baseline Scenario** is the continued use of electricity from the Rondônia-Acre Isolated System, based mainly on diesel consumption.
- **The Project Scenario** is the construction of 2 new hydroelectric plants of 3.9 MW in total. The new plants will displace grid electricity from a more carbon-intensive source, resulting in significant GHG emission reductions. The Project Scenario is 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 boundary for the baseline is defined as the electricity grid that previously provided electricity to the municipalities of Vilhena and Espigão D'Oeste, which are isolated from the national grid, and will include all the direct emissions related to the electricity produced by these generators that will be displaced by the Project.

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:**

The baseline study was concluded on 01/06/2006. The entity determining the baseline as the Carbon Advisor is EcoSecurities Brasil Ltda. For further details contact:

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**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:**

01/06/2006.

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

30y-00m

**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:**

01/01/2007.

**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:

The Martinuv Espigão Small Scale Renewable Energy Project is being submitted as a small-scale project for Type I – Renewable energy projects I.D. renewable electricity generation for a grid, version 9, 28 July 2006

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

The methodology was selected as suggested by the Simplified Monitoring Methodologies for small-scale CDM projects for Type I.D. because it is a hydro project with a total installed capacity (3.9 MW) under 15 MW.

The monitoring of this type of projects consists of metering the electricity generated by the renewable technology.

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

## D.3 Data to be monitored:

In order to monitor the electricity generated by the renewable technology, the data collected will be a reading from the electricity meter as well as the energy sale receipt of each small hydro, because this document will show the amount of energy supplied to the grid. The table above show more details of the monitoring.

**Table 9 – Data to be collected in order to monitor emissions from the project activity, and how this data will be archived**

| 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 |
|---|---|---|---|---|---|---|---|---|---|
| D.3.1 | Energy | Electricity generation of the project delivered to grid | MWh | M | Continuous | 100% | Electronic and paper | During the whole crediting period + 2 years | To be obtained from one meter which will be read off by the project developer as well as the grid operator. |
| D.3.2 | *CO2 Emission Factor* | *CO2 Emission Factor of the grid* | tCO2/ MWh | C | At the start of the crediting period | 1000 % | Electronic | During the whole crediting period + 2 years | 3 years data vintage is used, therefore this is fixed ex-ante |
| D.3.3 | *OM Emission Factor* | *CO2 operating margin Emission Factor of the grid* | tCO2/ MWh | C | At the start of the crediting period | 100 % | Electronic | During the whole crediting period + 2 years | 3 years data vintage is used, therefore this is fixed ex-ante |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D.3.4 | *BM Emission Factor* | *CO2 build margin Emission Factor of the grid* | tCO2/ MWh | C | At the start of the crediting period | 100 % | Electronic | During the whole crediting period + 2 years | 3 years data vintage is used, therefore this is fixed ex-ante |

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

Quality control and quality assurance procedures will guarantee the quality of data collected. The electricity instruments will undergo maintenance subject to industry standards. All electricity measuring instruments are calibrated by the distribution concessionaire CERON, which signs a long term PPA with the plants.

All assurance procedures are executed according to fire brigade rules, a condition for obtaining Hydro Units Installation Approval Certification, and also according to Labor Ministry Rules certification. Besides, all procedures are being supervised by the National Electricity Energy Agency (ANEEL); the fire brigade, and the Labor Ministry.

**Table 10 – Data monitoring information**

| **Data (Indicate table and ID number eg 3.1 -3.2 )** | **Uncertainty level of data (High, Medium, Low)** | **Explain QA/QC procedures planned for these data, or why such procedures are not necessary** |
|---|---|---|
| D.3.1 | Low | Data collected by the project developer will be cross checked with the electricity sales receipts obtained from the grid operator. |
| D.3.2 | Low | Fixed ex-ante, therefore data does not to be monitored during the crediting period |
| D.3.3 | Low | Fixed ex-ante, therefore data does not to be monitored during the crediting period |
| D.3.4 | Low | Fixed ex-ante, therefore data does not to be monitored during the crediting period |

**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:**

Data will be read off the meter and energy sales receipts will be collected of each small hydro by Martinuv and Espigão plants, this information will be transferred to EcoSecurities monthly in order to monitor emission reductions. Leakage is not being considered for this project activity.

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

The monitoring plan was concluded on 23/05/2006. The entity determining the monitoring plan as the Carbon Advisor is EcoSecurities Brasil Ltda. For further detail on contact:

Leandro Noel and Rodrigo Braga
Rua Lauro Müller, 116, room 4303
Rio de Janeiro- RJ
Brazil 22290-160

| | |
|---|---|
| Telephone. | 55 (21) 2275 9570 |
| Email | rodrigo.braga@ecosecurities.com or leandro.noel@ecosecurities.com |
| Website | www.ecosecurities.com |

## 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 $CO_2$e) 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 option (a) of the approved baseline methodology I.D/Version 09, scope1, 28 July 2006, which uses the average of the approximate operating margin and the build margin.

**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.

$$BE_y = EG_y * EF_y \quad (1)$$

**The baseline emissions factor (**$EF_y$) is a weighted average of the $EF\_OM_y$ and $EF\_BM_y$:

$$EF_y = (\omega_{OM} * EF\_OM_y) + (\omega_{BM} * EF\_BM_y) \quad (2)$$

where:

$EF\_OM_y$ is the operating margin carbon emissions factor
$EF\_BM_y$ is the build margin carbon emissions factor
and the weights $\omega_{OM}$ and $\omega_{BM}$ are by default 0.5.

**The Operating Margin emission factor** ($EF\_OM_y$) is calculated using the following equation:

$$EF\_OM_y\,(tCO_2/MWh) = \frac{\sum_{i,j} F_{i,j,y} * COEF_{i,j}}{\sum_j GEN_{j.y}]} \quad (3)$$

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 simple OM method was used since the system is predominantly thermal.

**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:

$$EF\_BM_y\,(tCO_2/MWh) = \frac{[\sum_{i,m} F_{i,m,y} * COEF_{i,m}]}{[\sum_m GEN_{m.y}]} \quad (4)$$

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

For this project, EcoSecurities calculated a unique combined margin, according to Rondônia isolated system data. Specifically, for this isolated system, the combined margin is 0.8435 $tCO_2$/Mwh. Data and assumptions for combined margin calculations for isolated systems were based on 5 data sources:

1. Data obtained from project developer (Incomex);

2. Data from GTON[1] Brazilian Annual Operational Plan-2004 - ELETROBRAS;
3. Data from GTON Brazilian Monthly Operational reports-2004 - ELETROBRAS;
4. Personal communication with CERON (Electricity Company responsible for distribution inside Rondônia state) for 2004 data;
5. ANEEL BIG-Information Generation Base.

**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 from the grid-electricity displacement are calculated using formula (1) above. The total amount of reductions is detailed on Table 12 below.

[1] Grupo Técnico Operacional da Região Norte (Technical Group from Brazilian North Region).

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

**Table 11- Baseline emission factor calculated for the gird**

| | **Martinuv** | **Espigão** |
|---|---|---|
| Starting generation: | 2006 | 2007 |
| location: | Rondônia | Rondônia |
| Gird: | Rondônia-Acre Isolated System | Rondônia-AcreIsolated System |
| Operating Margin Emissions Factor (EF_OMy, in tCO2/MWh) | 0.8766 | 0.8766 |
| Build Margin Emissions Factor (EF_BMy, in tCO2/MWh) | 0.8105 | 0.8105 |
| Baseline Emissions factor (EFy) ton CO2/MWh | 0.8435 | 0.8435 |

**Table 12 - Total amount of Emission Reductions**

| **Years** | **Estimation of project activity emission reductions (tonnes of $CO_2$e)** | **Estimation of baseline reductions (tonnes of $CO_2$e)** | **Estimation of leakage (tonnes of $CO_2$e)** | **Estimation of emission reductions (tonnes of $CO_2$e)** |
|---|---|---|---|---|
| 2007 | 0 | 7827 | 0 | 7827 |
| 2008 | 0 | 12187 | 0 | 12187 |
| 2009 | 0 | 15575 | 0 | 15575 |
| 2010 | 0 | 17114 | 0 | 17114 |
| 2011 | 0 | 17114 | 0 | 17114 |
| 2012 | 0 | 17114 | 0 | 17114 |
| 2013 | 0 | 17114 | 0 | 17114 |
| Total | 0 | 104045 | 0 | 104045 |

## SECTION F.: Environmental impacts:

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

The Martinuv and Espigão small Hydropower projects generate no emissions of greenhouse gases and no emissions of toxic waste, and have limited, controlled and reversible effects on the environment because the projects are run of river and use water directly from the river, with a small storage area designed only to allow the water intake to operate. The projects have easy integration in the landscape and compatibility with the protection of water, fauna and flora.

As for the regulatory permits, both Martinuv and Espigão have the authorization issued by ANEEL (ANEEL Resolution nº 251, issued on 27/jun/2005) to operate as an independent power producer, which gives the plants the right to operate.

As for environmental permits, the project has the necessary environmental licenses. The licenses were issued by the state environmental agency, NUCOF/SEDAM, LI number 0002255 issued on 20/07/2006 for Martinuv and for Espigão a Previous Licence Protocol was issued on 13/10/2004 by the environmental agency NUCOF, all documents related to operational and environmental licensing are public and can be obtained at the state environmental agency.

**Table 13 -Environmental impacts**

| IMPACT | PREVENTION |
|---|---|
| Slope instability and erosion | Slope conservation by planting vegetation, covering by grass and native forest species, during construction. |
| Water and soil pollution, Sedimentation of water courses | Fully preventable, following good practice. Small excavations should not carry any suspension material to the river. Among the measures to be taken in transporting excavation material are irrigation to avoid formation of dust, and covering truck's to avoid loss of the transported material. Removal vegetal coverage and superficial soil layer, with high content of organic matter, will be carried out to avoid the holding pond's eutrofication. The area of the low-level diversion dam will be restricted to the construction of a 3m high threshold, with the construction lasting a 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. Temporarily 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 is no utilization of 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 and reforestation. |
| Loss of habitat in dried up channels. | River habitat around falls and rapids often unproductive, no mitigation required (or compensation water release) since the project is a run of river facility. |

## 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 project 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 Vilhena ;
- Public ministry;
- Chamber of Deputy of Vilhena;
- City Hall of Espigão D'Oeste;
- SEDAM Porto Velho;
- Brazilian Fórum of NGOs
- Environmental Agency of Espigão d'Oeste
- Environmental Agency of Vilhena
- Chamber of Deputy of Espigão D'Oeste.

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.

### 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

### Credit originator and project operator – Incomex:

| | |
|---|---|
| Organization: | Incomex – Indústria, Comércio e Exportação Ltda. |
| Street/P.O.Box: | Rodovia BR 364, km 511 |
| Building: | - |
| City: | Pimenta Bueno |
| State/Region: | Rondônia |
| Postcode/ZIP: | |
| Country: | Brasil |
| Telephone: | |
| FAX: | |
| E-Mail: | |
| URL: | |
| Represented by: | |
| Title: | Superintendent |
| Salutation: | Mr. |
| Last Name: | Gomes |
| Middle Name: | - |
| First Name: | Antônio |
| Department: | Generation Supervision |
| Mobile: | 69 8403 6277 |
| Direct FAX: | |
| Direct tel: | 69 3481 3241 |
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### Mauricio Martinuv:

| | |
|---|---|
| Organization: | Mauricio Martinuv |
| Street/P.O.Box: | lote 85 sector 12 linha 145 bairro Gleba Corumbiara |
| Building: | - |
| City: | Vilhena |
| State/Region: | Rondônia |
| Postcode/ZIP: | |
| Country: | Brasil |
| Telephone: | +55 69 3322-6549 |
| FAX: | |
| E-Mail: | pchmartinuv@terra.com.br |
| URL: | |
| Represented by: | |
| Title: | Director |
| Salutation: | Mr. |
| Last Name: | Martinuv |
| Middle Name: | - |
| First Name: | Mauricio |
| Department: | - |
| Phone/fax: | |

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

**Credit buyer and project advisor:**

| | |
|---|---|
| Organization: | EcoSecurities Ltd, UK. |
| Street/P.O.Box: | 21, Beaumont Street |
| Building: | - |
| City: | Oxford |
| State/Region: | - |
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| Represented by: | |
| Title: | Director |
| Salutation: | Dr. |
| Last Name: | Moura Costa |
| Middle Name: | |
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| | |
| Title: | Consultants |
| Name: | Leandro Noel and Rodrigo Braga |
| Personal E-mail: | leandro.noel@ecosecurities.com, Rodrigo.braga@ecosecurities.com |

**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

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

# Attachment 1

## Baseline Information

| Hours/year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8760 | Espigão | | | Martinuv | | | Total tCO2 | Accumulated tCO2 |
| Year | KW | KWh | tCO2 | KW | KWh | tCO2 | tCO2 | tCO2 |
| 2007 | 0.000 | 0 | 0 | 0.92 | 4757 | 7827 | 7827 | 7827 |
| 2008 | 0.900 | 4652 | 1635 | 2.40 | 12509 | 10552 | 12187 | 20014 |
| 2009 | 1.500 | 7779 | 5023 | 2.40 | 12509 | 10552 | 15575 | 35589 |
| 2010 | 1.500 | 7779 | 6562 | 2.40 | 12509 | 10552 | 17114 | 52703 |
| 2011 | 1.500 | 7779 | 6562 | 2.40 | 12509 | 10552 | 17114 | 69817 |
| 2012 | 1.500 | 7779 | 6562 | 2.40 | 12509 | 10552 | 17114 | 86931 |
| 2013 | 1.500 | 7779 | 6562 | 2.40 | 12509 | 10552 | 17114 | 104045 |

## Attachment 2

## REFERENCES

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Tribunal de Contas da União - TCU; Agência Nacional de Energia Elétrica - ANEEL e Centrais Elétricas Brasileiras S.A – Eletrobrás, 2004. Auditoria Operacional . Conta de Consumo de Combustíveis Fósseis dos sistemas isolados – CCC-isol.

Tolmasquim, M. T., 2004. Alternativas energéticas sustentáveis no Brasil. Rio de Janeiro: Relume Dumará: COPPE: CENERGIA.

Internet sources:

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Aneel BIG-Information Generation Base

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