# CLEAN DEVELOPMENT MECHANISM
# SIMPLIFIED PROJECT DESIGN DOCUMENT
# FOR SMALL SCALE PROJECT ACTIVITIES (SSC-PDD)
# INCOMEX HYDROELECTRIC PROJECT, BRASIL

## 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>. |

## A. General description of project activity

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

Incomex Hydroelectric Project,
version 10, 21th August 2006.

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

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

- Rio Branco, located at Alta Floresta D'Oeste in Rondônia state with 6.9MW installed capacity;
- Monte Belo, located at Alta Floresta d'Oeste in Saldanha river in Rondônia state with 4 MW installed capacity and;
- CABIXI II, located at Comodoro, in Lambari river in Mato Grosso state with 2.8 MW installed capacity.

The units are connected to two isolated electricity systems: Rondônia-Acre and Cone-Sul, both located in Rondônia State, north region of Brazil. They are located in very remote areas, and bring electricity to develop these areas socially and economically, which has always been an important and difficult issue to be solved by the Brazilian authorities. The solution for the electricity supply problem in these areas was to set up what is known as an isolated electricity system which uses predominantly 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.

This cleaner source of electricity will have an important impact upon environmental sustainability, by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. The project activity reduces emissions of greenhouse gas (GHG) by avoiding the use fossil fuel based thermal units.

Since it deals with Run of River hydropower plants, the project presents significantly less negative environmental impacts than large hydropower facilities (which is the business as usual scenario in Brazil), mainly because it has either no, or a very small, flooded area.

The participants of the project recognize that Incomex Hydroelectric Project 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 since it will decrease use of fossil energy based on diesel sources, the predominant type of fuel used on isolated systems, and replace it with alternative renewable hydro energy. Also, in the absence of this project, energy generation in Rondônia State would still not reach the entire population and diesel would be the first option in the region. Therefore, the project contributes to the better use of natural local resources. In addition, it 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 a whole team for operation, management and repair services;
- Contributes towards better revenue distribution since the use of a renewable fuel decreases dependence on fossil fuels; decreases the 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, hand labour and technical maintenance will be provided inside Brazil. The whole system including turbines and generators represents technology with high efficiency. 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;
- Contributes to regional integration and connection with other sectors – the project facilitates the increase in hydroelectricity as a generating source in the region and therefore may encourage other similar companies that want to replicate the experience of Incomex. Also, it creates an alternative market for this kind of energy generation, indirectly joining the Brazilian energy and environmental sectors.

## A.3 Project participants:

**Table 1: Incomex 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 Country) | Incomex – Indústria, Comércio e Importação Ltda.& Grupo Cassol Energia | No |
| United Kingdom | EcoSecurities | 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.:

Rio Branco, and Monte Belo – located in Rondônia State; connected to the isolated system Rondônia-Acre.
Cabixi II – located in Mato Grosso State. Although this plant is in a different State, it belongs to Cone-Sul isolated system, in Rondônia.

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

Rio Branco – in the municipality of Alta Floresta d'Oeste.
Monte Belo - the municipality of Alta Floresta d'Oeste.
Cabixi II – the municipality of Comodoro.

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

1. Small Hydro Rio Branco – located in the Branco river – 11$^o$54'35"S and 62$^o$10'49"N, in the State of Rondonia (RO), north region of Brazil.
2. Small Hydro Monte Belo - located in the Saldanha river - 11 $^o$57'08.2"S and 62 $^o$10'58.7"W, in the State of Rondonia (RO), north region of Brazil.
3. Small Hydro Cabixi II – located in the Lambari river – 13 $^o$01'20.0" S and 60 $^o$08'01.7"W, in the State of Mato Grosso (MT), mid-west region of Brazil.

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

Renewable electricity generation for a grid (run-of-river hydro power plants). Total installed capacity for 3 energy units is 13.7 MW. The Project conforms to the small projects Type 1.D since the nominal installed capacity of the Project is below the 15 MW threshold and the plants will sell their generated electricity to the grid. The category 1D is included on the Scope 1 (Energy industries - renewable/non-renewable sources) from the List of Sectoral Scopes adopted by the CDM-AP.

Small Hydro run-of-river projects consist of the use of water, either from storage in small holding ponds or 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 defined as "the project where the river's dry season flow rate is the same or higher than the minimum required for the turbine" (Eletrobrás). According to the Brazilian Power Regulatory Agency ANEEL, to be considered a Small Hydro, the area of the reservoir must be less than 3 $Km^2$ and generation capacity must be less than 30 MW. In case of Monte Belo and Rio Branco plants, both units uses water directly from the river, without any dam or minimum flooded area. In case of Cabixi II, this unit presents a 0,2 $km^2$ of flooded area. None of those units generates more than 30 MW.

All 3 hydro units will use Brazilian turbines of the Francis model (Hydraulic reactor turbine in which the flow exits the turbine blades in a radial direction), produced by Hidráulicas S/A – HISA; that turbine is widely used among water turbines, and its performance can be calculated by comparing the output energy to the energy supplied (see tables below).

**Table 2: Monte Belo Plant main characteristics.**

| Monte Belo | |
|---|---|
| Installed Capacity | 4 MW |
| Turbine | 2 Francis |
| Efficiency | 92 % |

**Table 3: CABIXI II Plant main characteristics.**

| Cabixi II | |
|---|---|
| Power | 2,8 MW |
| Turbine | 1 Francis |
| Efficiency | 92% |

**Table 4: Rio Branco Plant main characteristics.**

| Rio Branco | |
|---|---|
| Power | 6,9 MW |
| Turbine | 3 Francis |
| Efficiency | 94 % |

**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 the Brazilian isolated system, a more carbon-intensive grid (predominantly thermal power fired by a fossil fuel 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 195.706 $tCO_2e$ over 7 years, considering the displacement for 3 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:**

A renewable crediting period is used, with 2 periods of 7 years for Cone Sul and Rondônia-Acre isolated systems together. To see data separated for each system, please see Tables 7 and 8 on Section E. Total life cycle of the project is 14 years.

**Table 5: Annual estimation of emission reductions over the chosen crediting period:**

| **Years** | **Annual estimation of emission reductions over the chosen crediting period** |
|---|---|
| Year 1 | 12.770 |
| Year 2 | 15.379 |
| Year 3 | 18.226 |
| Year 4 | 18.226 |
| Year 5 | 42.218 |
| Year 6 | 44.444 |
| Year 7 | 44.444 |
| **Total estimated reductions** (tonnes of $CO_2$) | 195.706 |
| **Total number of crediting years** | 7 |
| **Annual average over the crediting period of estimated reductions** (tonnes of $CO_2$) | 27.958 |

### A.4.4 Public funding of 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:

This small-scale renewable energy project is not part of a larger emission-reduction project given that this is a unique CDM project proposed by Incomex.

## B. Application of a baseline methodology

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

- Project Activity 1.D. - Renewable electricity generation for a grid

### 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 Incomex Hydroelectric project activity is applicable to small scale project type 1 (Renewable Energy), methodology 1.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. Incomex Hydroelectric project will use hydro as the source to generate electricity and will supply Rondônia isolated systems with renewable energy.

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

**Table 6: 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 |

The use of each reference will be better explained 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 Rondônia-Acre and Cone-Sul isolated systems, and non implementation of Monte Belo, Rio Branco and Cabixi II small hydroelectric units.

- 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**

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 thermo units fossil fuelled fired. CCC subrogation now says that renewable energy can also apply for that subside. 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 in an example in Germany.

Although the plants considered for Incomex Project are subscribed on 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 both isolated systems being considered by this project comes from diesel fuel units. From a total of 815 MW of installed capacity in the Rondônia-Acre isolated system, 735 MW comes from thermal units, whilst from a total of 47 MW of installed capacity in the Cone-Sul isolated system, 26 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 Cabixi II, Monte Belo and Rio Branco are subscribed under that clause.

  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 investments 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 on 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.

  At last, the implementation costs for those units in the North Region are considerably high. 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 7 below). This is due to difficulties better detailed on the prevailing practice barrier, related to logistics, transportation and etc. Based on the same author, even with the CCC Subrogation benefits, the average energy cost for this region is still high.

**Table 7: 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 subside 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 subside 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').

To evidence this, a financial analysis were developed comparing the two possible scenarios in this case: the construction of a thermal plant unit and the construction of a hydro plant unit. This analysis were elaborated based on data from ANEEL (National Energy Agency), Eletrobrás (responsible for Isolated Systems recorded data), IEA (International Energy Agency), Guascor Ltd (private company) and the project proponents. All those references are clearly demonstrated on the spreadsheet for CERs and financial analysis calculation (Incomex calculation (MD) crediting 2005 - v. 18.05.06). The results of the calculation clearly showed the VPL and IRR for both scenarios: for a thermal plant the VPL corresponds to R$ 5,3 million dollars in 21 years, while for a hydro plant, the same VPL is R$ 4,3 million. Also, the IRR for the thermal is 34% against an IRR of 32% for the hydro. It clearly demonstrates what was mentioned above: comparing the advantages of a thermal and a hydro plant, the thermal is still more attractive. However, the thermal plant does not present risks related to rain variations. Besides, the prevailing practices confirmed this results: in the North region, specifically in Rondônia, most plants uses fossil sources as fuels, while hydro were always the minority (comparing the Operational Plans for 2001 until 2005 – Please see **prevailing business practice** below).

| | | THERMAL PLANT | SMALL HYDRO |
|---|---|---|---|
| | Discount rate | 21 years | 21 years |
| Present Value at | 15% | R$ 5.256.615,78 | R$ 4.289.098,62 |
| TIR | | 34% | 32% |

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 the same report cited above (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 systems, both are 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 consists in the concessionaire responsible by generation and transmission activities inside Porto Velho System, the mainly electricity system in Rondônia. Originally, Porto Velho system comprises 1 hydro unit (UHE Samuel) and 8 thermal units (Rio Madeira, Termonorte I and Termonorte II) - Operational Plan from 2001. According to this plan, both 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 reservoirs. 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 just increased. According to Operational Plan (2003), forecasted hydro generation corresponded to 2,048 GWh, while thermal generation corresponded to 6,991 GWh. Besides, according to this same plan, thermal generation was previewed to increase by 9% and hydro generation to decrease by 5%. Still, in the Operational Plans for 2004 and 2005, comparison between thermal and hydro generations always indicates a clearly predominance of thermal generation. This can be better visualized on the tables below, directly from the Operational Plan for 2005 (the most actual plan). According to these Table 3.2-2, the amount of thermal generation units in Rondônia corresponds to 160 (148 + 20), while on Table 3.2-3, the amount of hydro generation units in Rondônia corresponds to 28 (5 + 23).

**Quadro 3.2-2**
**Número de Unidades Geradoras e Potência Instalada em 2005 – Parque Gerador Térmico**

| 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 |

Quadro 3.2-3
Número de Unidades Geradoras e Potência Instalada em 2005 – Parque Gerador Hidráulico

| 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 practices in terms of energy generation in Rondônia is predominantly thermal and consequently, trends 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 1 below summarises the results of the analysis regarding the barriers faced by each of the plausible scenarios. As the table indicates, Scenario 1 faces no barriers, whereas Scenario 2 faces financial/economic barriers and is against prevailing practice.

**Table 6: 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 represented by the continued use of electricity from the Rondônia-Acre and Cone-Sul isolated systems, based mainly on diesel consumption.
- The **Project Scenario** is represented by the construction of 3 new hydroelectric plants of 13.7 MW in total. The new plants 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 project activity:**

The system boundary for the baseline is defined as the electricity grid that previously provided electricity to the municipalities of Alta Floresta D'Oeste and Comodoro, which is 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. Specifically for Rio Branco and Monte Belo small hydroelectric plants, both are connected to State of Rondônia isolated system, which is under CERON's (Centrais Elétricas de Rondônia) responsibility, the local energy generator and distributor. Rio Branco unit is more isolated and therefore connected to the Cone-Sul Isolated System.

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 Project uses baseline Type 1.D, with option (b) of paragraph 29 of Appendix B, related to the generation of renewable energy where the project is not connected to the main electricity grid of the country and will therefore displace a single fossil-fuel generating source, i.e. diesel generators that are prevalent in offgrid situations.

Date of completion of baseline development is 30/11/2005.

The entity determining the baseline and participating in the project as its Carbon Advisor is EcoSecurities Ltd. Incomex and Grupo Cassol are both project participants, as operators and carbon credits originators, with contact details are listed in Annex 1 of this document.

## C. Duration of the project activity / Crediting period

### C.1 Duration of the project activity:

### C.1.1 Starting date of the project activity:

01 January 2001.

**C.1.2 Expected operational lifetime of the project activity:** 21y-00m

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

### C.2.1 <u>Renewable crediting period</u>

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

01 February 2001.

### 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

## 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.

### 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 metering the electricity generated by the renewable technology.

The methodology consists in using metering 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 any other activity.

### D.3 Data to be monitored:

**Table 6: 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 | Gross Electricity generated by the project | MWh | M | Continuous | 100% | Electronic and paper | During the whole crediting period + 2 years | |
| D.3.2 | | Electricity consumed by the project (new plant) | | | | | | | |

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

Quality control and quality assurance procedures will guarantee the quality of data collected. The electricity instruments will undergo maintenance subject to appropriate industry standards. The plant operation and training procedures in place will ensure the integrity of the data collected, according to previous environmental internal procedures, for all plants. All electricity measuring instruments are calibrated by the distribution concessionaire CERON, which signs a long term PPA with the plants. In case of any doubt concerning measurements, INMETRO (Instituto Nacional de Metrologia, Normalização e Qualidade Industrial) – national institute responsible for standards – to calibrate the instruments.

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

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

The team responsible for plant operation and maintenance consists in: Mr. Reditário Cassol, Mr. Iran Alves de Brito and Mr. José Aldino Lopes. Concerning the measuring, calibration, and data recording, CENTRAIS ELÉTRICAS DE RONDÔNIA S/A - CERON / ELETROBRÁS is the responsible company for this.

Leakage is not being considered for this project activity.

**D.6. Name of person/entity determining the monitoring methodology:**
EcoSecurities Ltd is the entity determining the monitoring plan and participating in the project as the Carbon Advisor.

## E. Calculation of GHG emission reductions 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 GHG's 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 29.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 $\omega_{OM}$ and $\omega_{BM}$ are by default 0.5.

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

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

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.

For this project, EcoSecurities calculated two distinct combined margins, according to Rondônia-Acre and Cone-Sul isolated grid data. Specifically, for Rondônia-Acre isolated system, the combined margin is 0.862 $tCO_2$/Mwh and for Cone-Sul isolated system it is 0.415 $tCO_2$/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 (acessed on http://www.eletrobras.gov.br/EM_Atuacao_SistIsolados/default.asp) - ELETROBRAS;
3. Data from GTON Brazilian Monthly Operational reports-2004 (acessed on http://www.eletrobras.gov.br/EM_Atuacao_SistIsolados/default.asp) - ELETROBRAS;
4. Personal comunication with CERON (electricity company responsible for distribution inside Rondônia state) for 2004 data;
5. Aneel BIG-Information Generation Base.

. All those sources are indicated in the spreadsheets of the emission reductions calculations and financial calculation for this project.

**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 formula 1 above. The expected annual emission reduction from the total grid-electricity displacement component is detailed on Tables 7, and 8 below.

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

**Tables 7 and 8: Electricity generation emission reductions for hydroelectric units.**

**Summary Table 1D component Rondonia Acre**

| Electricity generation emission reductions | Per year |
|---|---|
| Operating Margin Emissions Factor ($EF\_OM_y$, in $tCO_2/MWh$) | 0.881 |
| Build Margin Emissions Factor ($EF\_BM_y$, in $tCO_2/MWh$) | 0.843 |
| Baseline Emissions factor ($EF_y$) | 0.862 |
| Electricity generated by the project (EG, in MWh) | 56,905 |
| Estimation of baseline reductions (tonnes of CO2e) | 39,949 |
| Project emissions (PE, in $tCO_2$) | 0 |
| **Emission reductions from electricity generation ($tCO_2/yr$)** | 40,174 |

**Cabixi II:**

**Summary Table 1D component Cone Sul**

| Electricity generation emission reductions | Per year |
|---|---|
| Operating Margin Emissions Factor ($EF\_OM_y$, in $tCO_2/MWh$) | 0.829 |
| Build Margin Emissions Factor ($EF\_BM_y$, in | 0.000 |

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

| | |
|---|---|
| $tCO_2$/MWh) | |
| Baseline Emissions factor ($EF_y$) | 0.415 |
| Electricity generated by the project (EG, in MWh) | 10,302 |
| Estimation of baseline reductions (tonnes of CO2e) | 4,270 |
| Project emissions (PE, in $tCO_2$) | 0 |
| **Emission reductions from electricity generation ($tCO_2$/yr)** | 4,270 |

| Year | Emission factor Rondônia - Acre = | | | | | 0,862 | Emission Factor Cone Sul = | | 0,414 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rio Branco | | | Monte Belo | | | Cabixi II | | | Total $tCO_2$ | Accumulated $tCO_2$ |
| | MW | MWH | $tCO_2$ | MW | KWh | $tCO_2$ | MW | KWh | $tCO_2$ | $tCO_2$ | $tCO_2$ |
| Year 1 | - | - | - | 4 | 16.188 | 12.770 | - | - | - | 12.770 | 12.770 |
| Year 2 | - | - | - | 4 | 16.188 | 13.955 | 2,80 | 10.302 | 1.423 | 15.379 | 28.149 |
| Year 3 | - | - | - | 4 | 16.188 | 13.955 | 2,80 | 10.302 | 4.270 | 18.226 | 46.374 |
| Year 4 | - | - | - | 4 | 16.188 | 13.955 | 2,80 | 10.302 | 4.270 | 18.226 | 64.600 |
| Year 5 | 6,90 | 30.415 | 23.992 | 4 | 16.188 | 13.955 | 2,80 | 10.302 | 4.270 | 42.218 | 106.817 |
| Year 6 | 6,90 | 30.415 | 26.219 | 4 | 16.188 | 13.955 | 2,80 | 10.302 | 4.270 | 44.444 | 151.262 |
| Year 7 | 6,90 | 30.415 | 26.219 | 4 | 16.188 | 13.955 | 2,80 | 10.302 | 4.270 | 44.444 | 195.706 |

## F. Environmental impacts

**F.1 If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:** *(if applicable, please provide a short summary and attach documentation)*

**Documentation:**

All 3 hydro plants have received official permits from local official authorities to start activities. All received operational licenses from the official authority in the State of Rondônia (MB and RB) and Mato Grosso, respectively. For each hydroelectric unit, project proponents developed an Environmental Control Plan, which evaluates the environmental aspects of the projects. The Plan was developed by AgroFlorestal Donanoni, and assessed potential impacts relating to land degradation; influence on hydrological quality; dips instability, and erosion risks.

**Impacts mitigation**

According to the Environmental Control Plan, all the impacts cited above were mitigated. The company carried out specific analysis to test water quality after using the turbines; they also started recovering the degraded land area. In the case of Monte Belo and Cabixi, engineer Antonio Carlos Vieira was responsible for developing the "Recovering degraded land plan". Concerning erosion risks, all areas that present this risk will be frequently checked and monitored.

## 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 Alta Floresta D'Oeste and Comodoro;
- 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. All project developers addressed questions raised by stakeholders during this period.

Due to an official request from the Brazilian DNA, all the invitation letters were sent again for the public above on the 11th May 2006. During 30 days, the PDD was available for comments at www.ecosecurities.com, so the comments period will be closed on the 11th June 2006.

### G.2 Summary of the comments received:

The project received one comment from the District Attorney of Rondônia on the 05th June 2006, about Rio Branco hydro unit. The District Attorney has submitted comments regarding:

I – The environmental assessment process carried out for the project. Environmental impacts due to the installation of hydro units at Rio Branco river were not evaluated in sufficient detail and therefore the assessment may not have identified possible impacts on close communities related to local water supply;

II – The reservoir management of the hydro units causes impacts on the water supply for indigenous people;

III – There were not sufficient environmental studies regarding the local fauna and flora and related impacts on them.

IV - Greenhouse gas emissions release from the hydro reservoirs.

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

Project proponents presented to the stakeholders the following clarifications regarding the comments above:

Regarding topics I and III:

Rio Branco unit had received an Operational License (number 0001548/NUCOF/SEDAM) from SEDAM (Environment agency from the State of Rondônia) based on the Environmental Control Plan. Project proponents must develop 3-monthly environmental reports to monitor environmental conditions of the Rio Branco unit. Besides this, the unit also received an Authorization from ANEEL, the National Energy Agency (Resolution Number 139, 12th April 2001) that permits installation of the Rio Branco unit at Rio Branco river;

Regarding topic II:
Regarding the water supply comment above, this problem is not directly caused by the Rio Branco hydro unit installation. This is due to the sand accumulation in several tributaries of Rio Branco that is provoked by the deforestation of bordering river vegetation in the upstream section of this river. Consequently, Rio Branco water volume figures decreased, starting the process of desertification that becomes worse during the dry season in the Amazon, which lasts 6 months in a year. During this period several tributaries dry up.

Regarding topic IV:
This is run-of-river hydro unit and therefore there is no water reservoir. Consequently, GHG emissions due to hydro activities are insignificant.

**Annex 1**

**CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY**

**Credit originator and project operator – Incomex:**

| | |
|---|---|
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| | |
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| Represented by: | |
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**Credit buyer and project advisor:**

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**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

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

## Attachment 1

## REFERENCES

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