CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
(Version 02 - in effect as of: 1 July 2004)

CONTENTS

A. General description of project activity

B. Application of a baseline methodology

C. Duration of the project activity / Crediting period

D. Application of a monitoring methodology and plan

E. Estimation of GHG emissions by sources

F. Environmental impacts

G. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

Title of the project activity: "Raudi Chemical Salts"

Version number of the document: 2

Date of the document: 17 April 2006

A.2. Description of the project activity:

The purpose of the project activity is to produce chemical salts, including sodium bicarbonate ($NaHCO_3$), ammonium bicarbonate (NH_4HCO_3) and calcium carbonate ($CaCO_3$), with residual renewable CO_2 that was previously released to the atmosphere derived from the fermentation of sugarcane juice from an ethanol distillery, instead of using the conventional processes that use non-renewable CO_2.

The project also includes the use of renewable electricity and steam in the production process, both produced from bagasse-based cogeneration system, avoiding the consumption of grid electricity and fossil fuels (this component is not the scope of this CDM-PDD, though).

This project activity is proposed by Raudi Indústria e Comércio Ltda., with participation of Coopcana – Cooperativa Agrícola Regional de Produtores de Cana Ltda. Raudi, a special purpose company dedicated to the manufacturing of inorganic chemicals, was responsible for the development, testing and commercial operation of this innovative technology. Coopcana is an agricultural cooperative that controls the ethanol distillery, which processed 1,524,983 tonnes of sugarcane and produced 114,000 m³ of ethanol in 2004.

Project activity contributes to Sustainable Development in fostering a new technology that promotes the reduction of fossil carbon dependency in the chemical industry by using renewable carbon sources, such as that produced in biomass processing facilities. Also, the consumption of steam and electricity produced with biomass contributes to fostering this practice, instead of grid electricity and fossil fuel use.

Brazil has a very vigorous sugarcane industry, spread all over the country, but specially in the South and Southeast regions. The sugarcane sector is well recognized because of its contribution to the production of renewable bioenergy. Ethanol, bagasse and electricity are the main bioenergy products. The type of project activity proposed by Raudi promotes the integration of other production plants to this sector, contributing to greenhouse gases emissions reductions and to the development of clean technologies that takes advantage of waste streams derived from biomass processing facilities, in a new concept of chemical processing complexes.

Raudi chemical salts plant, in São Carlos do Ivaí, PR, Brazil

Chemical salts produced by Raudi

A.3. Project participants:

Name of Party involved (*) ((host) indicates host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Raudi Indústria e Comércio Ltda. (private entity)	NO
	Ecoinvest Carbon (private entity)	

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

Note: When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil

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

Paraná

A.4.1.3. City/Town/Community etc:

São Carlos do Ivaí

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

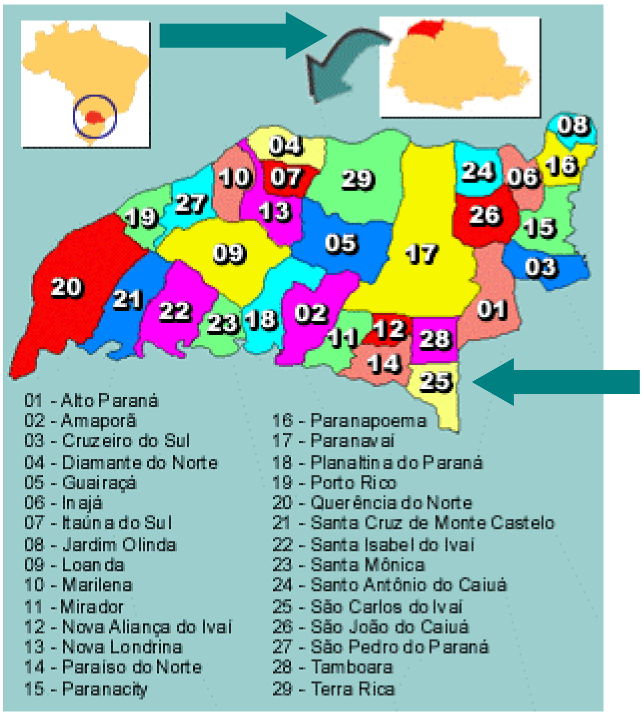
The project activity is located at:

Rodovia PR 559 – km 05

São Carlos do Ivaí – PR

ZIP CODE 87.770-000
Brazil

São Carlos do Ivaí is a small country-side city, with around 6,000 inhabitants that depends exclusively on the agricultural activity, mainly sugarcane and soy beans.



Location of São Carlos do Ivaí, PR, Brazil

A.4.2. Category(ies) of project activity:

Sectoral Scope 5 - Chemical Industries

A.4.3. Technology to be employed by the project activity:

Technology employed in the project activity is new, developed by Raudi. The CO_2 produced from the sugarcane fermentation at Coopcana is transported through a pipeline, from the ethanol distillery, to the chemical salts plant. In the chemical salts plant, the gas is filtered, cleaned and mixed with soda, inside a chemical reactor, to produce the chemical salts. Raudi patent pending technology is under requirement #PI0002730-8, July 13, 2000 INPI – Brazil.

Back-up of CO_2 is non-renewable, purchased from suppliers of industrial gases. This back-up is stored in tanks installed at the site and it is used whenever necessary. If it is used, adequate monitoring will exclude it from emissions reductions calculations. Currently, the plant operates only during the sugarcane harvest season.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The production of some inorganic compounds requires CO_2 as raw material. The gas is mixed with other raw material inside a chemical reactor producing the final product. This is the case, for instance, of sodium bicarbonate, ammonium bicarbonate and calcium carbonate.

The project activity is the production of chemical salts with waste streams of renewable CO_2, derived from the fermentation of sugarcane juice at an ethanol distillery, instead of using the conventional processes that use non-renewable CO_2. The CO_2 stream from the ethanol distillery was previously released to the atmosphere, so that no diversio of CO_2 from other activities are present.

In the business as usual scenario, the CO_2 would be obtained, basically, from two different sources:

(1) Fossil CO_2, e.g., through thermochemical processing of hydrocarbons from fossil origin.
(2) Mineral CO_2, e.g., calcination of calcium carbonate ($CaCO_3$) from mineral origin.

In both cases, CO_2 is non-renewable because it is obtained from mineral or fossil reserves, meaning that its release to the atmosphere leads to CO_2 concentration increase. This is what happens during the final use of the product because of the thermal dissociation of its molecules. The amount of emissions depends on the composition of the chemical salt. Therefore, if a project activity substitutes the source of CO_2, switching from non-renewable CO_2 to renewable CO_2, emissions of non-renewable CO_2 during the use of the chemical salts are avoided.

Raudi technology is proprietary, the “first of its kind”, developed by the project proponent. For this reason, the mostlikely alternative in the absence of the project activity, in its area of influence, is the conventional technology that use mineral or fossil sources of CO_2 as raw material.

The incentives of the CDM are very important for Raudi to develop and implement the technology as the benefits from the reduction of greenhouse gases emissions were always used as an important added value of this technology.

There are no national and/or sectoral policies and circumstances that influence the decisions or impose obligations to the proposed project activity. The waste CO_2 stream from the ethanol distillery is not regulated by any local legislation. The production of chemical salts is not affected by any specific legislation, except the usual legislation applied to any industrial activity.

Therefore, no sectoral policies and circumstances would make the new manufacturing technology preferred, rather than the conventional one. The only national circumstance that foments the new technology is the participation of Brazil in the Kyoto Protocol, which allows the project to benefit from the greenhouse gases emissions reductions.

Detailed definition of alternatives to the project activity, additionality assessment and identification of the baseline scenario are conducted in Sections B.2 and B.3, please refer to those sections.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Table below accounts for the estimated amount of emissions reduction for the first crediting period of 7 years.

Estimated emission reductions for the first crediting period

Years	Annual estimation of emission reductions [tCO_2]
2005	1,401
2006	5,730
2007	15,338
2008	21,427
2009	25,355
2010	25,355
2011	25,355
Total estimated reductions (tonnes of CO_2eq)	119,960
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2eq)	17,137

A.4.5. Public funding of the project activity:

The project is being developed on equity basis. Raudi has implemented the project without any public funding or other source of debt.

SECTION B. Application of a baseline methodology

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

Approved baseline methodology AM0027 – “Substitution of CO_2 from fossil or mineral origin by CO_2 from renewable sources in the production of inorganic compounds”.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

AM0027 is applicable generally to industrial production/manufacturing processes of inorganic compounds where fossil or mineral sources of CO_2 are presently used as an input and where renewable sources of CO_2 are available as a substitute input in the project activity case. This is the case of Raudi project which is an industrial production processes of inorganic compounds, mainly sodium bicarbonate, ammonium bicarbonate and calcium carbonate. Fossil or mineral sources of CO_2 are presently used as an input in other similar plants producing the same chemicals and renewable sources of CO_2 are available as a substitute input in the project activity.

The methodology is applicable under the following conditions:

• The residual CO_2 from the processing of biomass was already produced but was not used before the project activity, so that no diversion of CO_2 from other applications is due to the project activity. Coopacana ethanol distillery operates since 1979, hence, before the implementation of Raudi project. CO_2 was produced before the project activity as a consequence of sugarcane juice fermentation for ethanol production and was not used for any other purpose. It was released to the atmosphere.

• The processing of biomass undergoes no substantial changes in the process with the project activity. In fact, the processing of sugarcane at the distillery did not undergo any substancial change to produce CO_2 used by the project activity.

• CO_2 from fossil or mineral sources that is used for the production of inorganic compounds prior to the project activity will not be emitted to the atmosphere with the project activity. In Brazil, the alternative scenario for the production of inorganic compounds uses non-residual CO_2, obtained from synthesis gases and other fossil hydrocarbons, dedicated to the production of these compounds. Therefore, with the implementation of the project activity and use of renewable CO_2, fossil sources of CO_2 would not need to be generated and released to the atmosphere.

• There are no substantial changes (e.g. product change) in the production process of inorganic compounds as a result of the project activity. No substantial changes that might result in differences in greenhouse gases emissions other than the raw material CO_2 are a result of the impoementation of the project activity.

• Production levels of the plant (tons of inorganic compound produced per year) may in general not increase with the project activity over historic maxima. In the case of Raudi project, the use of renewable CO_2 did not increase the production levels above the estimated levels of the plant.

• No additional significant energy quantities are required to prepare the renewable CO_2 from biomass processing for use in the production of inorganic compounds (related CO_2 emissions are below 1% of total emission reduction). In fact, the processing of sugarcane at the distillery did not undergo any substancial change to produce CO_2 used by the project activity. The levels of energy consumption did not change.

• All Carbon in the produced inorganic compounds stems from the CO_2 supplied during the production process. This is the case of Raudi.

B.2. Description of how the methodology is applied in the context of the project activity:

Identification of alternatives to the project activity

In Section B.3, project participants identified realistic and credible alternatives(s) to the project activity considering how CO_2 would be obtained in the absence of the CDM project activity and what would happen to the baseline and project sources of CO_2 in the absence of the project activity.

Assessment of project additionality

In Section B.3, project additionality is assessed and demonstrated with the "Tool for the demonstration and assessment of additionality – Version 2".

Selection of the most likely alternative scenario (baseline scenario)

In Section B.3, after the identification of alternatives to the project activity, project participants applied the "Tool for the demonstration and assessment of additionality – Version 2" to identify which one of the alternatives should be excluded from further consideration for baseline determination.

Calculation of baseline emissions

When the final use of the inorganic compound emits CO_2 to the atmosphere, resulting emissions are N moles of CO_2 for each mol of inorganic compound used. Hence, emission factor results the following:

$$EF_{CA} = 44 \cdot \frac{N}{M} \quad [tCO_2/t \text{ of inorganic compound}]$$

This is based on the assumption that all carbon in the inorganic compound stems from the CO_2 supplied during the production process (applicability condition).

The calculation of the baseline emissions (B) consists of three parts: GHG emissions during final consumption (BE), GHG sequestration during final consumption (BS) and possible emissions related to the activity, e.g. from the production of inorganic compounds (BI). It is calculated as follows:

$$B = BE - BS + BI \quad [tCO_2]$$

Emissions of non-renewable CO_2 are:

$$BE = EF_{CA} \cdot m_1 \cdot (1 - k_b) = 44 \cdot \frac{N}{M} \cdot m_1 \cdot (1 - k_b) \quad [tCO_2]$$

Sequestration in the baseline is:

$$BS = EF_{CA} \cdot m_2 \cdot k_b = 44 \cdot \frac{N}{M} \cdot m_2 \cdot k_b \quad [tCO_2]$$

Possible emissions related to the activity (*BI*) are not accounted for because:

- The processing of sugarcane at the distillery did not undergo any substancial change due to the implementation of the project activity. CO_2 was produced before the project activity and remained being produced in the same way.

- No additional significant energy quantities are required to prepare the renewable CO_2 from biomass processing for use in the production of inorganic compounds.

- There are no substantial changes in the production process of inorganic compounds as a result of the project activity that might result in differences in greenhouse gases emissions other than the raw material CO_2 are a result of the impoementation of the project activity

Definition of parameters and variables is provided at the end of the project emissions section below.

<u>Calculation of project emissions</u>

The calculation of project emissions (*P*) also consists of three parts: GHG emissions during final consumption (*PE*), GHG sequestration during final consumption (*PS*) and other possible emissions related to the activity, e.g. from the production of inorganic compounds (*PI*). It is calculated as follows:

$$P = PE - PS + PI \quad [tCO_2]$$

Emissions from the project activity are:

$$PE = EF_{CA} \cdot m_1 \cdot (1 - k_p) = 44 \cdot \frac{N}{M} \cdot m_1 \cdot (1 - k_p) \quad [tCO_2]$$

Sequestration in the project activity is

$$PS = EF_{CA} \cdot m_2 \cdot k_p = 44 \cdot \frac{N}{M} \cdot m_2 \cdot k_p \quad [tCO_2]$$

Possible emissions related to the activity (*PI*) are not accounted for because:

- The processing of sugarcane at the distillery did not undergo any substancial change due to the implementation of the project activity. CO_2 was produced before the project activity and remained being produced in the same way.

- No additional significant energy quantities are required to prepare the renewable CO_2 from biomass processing for use in the production of inorganic compounds.

- There are no substantial changes in the production process of inorganic compounds as a result of the project activity that might result in differences in greenhouse gases emissions other than the raw material CO_2 are a result of the implementation of the project activity

For both, baseline and project emissions, parameters are described below:

- 44 is the molecular weight of CO_2, [g/mol]. Fixed parameter.

- *N* is the carbon content of the inorganic compound, i.e., the number of carbon atoms in the inorganic compound molecule that would thermally dissociate in the final use of one molecule of the compound. *N* is a fixed parameter that needs to be determined for each inorganic compound, [non dimensional].

- *M* is the molecular weight of the inorganic compound, a fixed parameter that depends on the inorganic compound involved. It is calculated straightforwardly by summing the atomic weights of the compound constituents, in [g].

- *m* is the total amount of the inorganic compound produced, in [tonnes]. This parameter is monitored during the crediting period.

- m_1 is the amount of the inorganic compound that releases CO_2 in the final use, in [tonnes]. This parameter does not need to be monitored independently because emissions reductions are calculated directly from *m* explained above ($m = m_1 + m_2$).

- m_2 is the amount of the inorganic compound that does not release CO_2 in the final use, in [tonnes]. This parameter does not need to be monitored independently because emissions reductions are calculated directly from *m* explained above ($m = m_1 + m_2$).

- k_b and k_p are non-dimensional correction factors for renewable CO_2 in the baseline and project activity and are calculated as follows:

$$k_b = \frac{m_{br}}{m_{br} + m_{bnr}} \quad and \quad k_p = \frac{m_{pr}}{m_{pr} + m_{pnr}} \quad \text{[non-dimensional]}$$

- m_{br} is the total amount of renewable CO_2 used in the baseline scenario, [tonnes].

- m_{bnr} is the total amount of non-renewable CO_2 used in the baseline scenario, [tonnes].

- m_{pr} is the total amount of renewable CO_2 used by the project, [tonnes].

- m_{pnr} is the total amount of non-renewable CO_2 used by the project, [tonnes].

<u>Emissions Reductions</u>

The applicability criteria require that neither the processing of biomass (generating waste renewable CO_2) nor the production process (for inorganic compounds) undergo substantial changes with the project activity. With this, it may be assumed that potential GHG emissions from the biomass processing and the production process remain the same in the baseline (*BI*) and in the project activity (*PI*). In this case:

$$BI = PI$$

Total emissions reductions which covers direct emissions of GHG and sequestration can be written as:

$$ER = B - P = (BE - PE) + (PS - BS) + (BI - PI) = 44 \cdot \frac{N}{M} \cdot (m_1 + m_2) \cdot (k_p - k_b) \quad [tCO_2]$$

Therefore,

$$ER = 44 \cdot \frac{N}{M} \cdot m \cdot (k_p - k_b) \quad [tCO_2]$$

Where,

$$k_b = \frac{m_{br}}{m_{br} + m_{bnr}} \quad and \quad k_p = \frac{m_{pr}}{m_{pr} + m_{pnr}} \quad [\text{non-dimensional}]$$

Leakage

The main potential source of leakage for this project activity is the possible increase in emissions due to diversion of CO_2 from other users as a result of the project activity. As the residual CO_2 from the processing of biomass was already produced but was not used before the project activity, it was released to the atmosphere, leakage is zero.

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 CDM project activity:

The additionality of the project activity is demonstrated and assessed using the ‘‘Tool for the demonstration and assessment of additionality - Version 2’’.

Step 3 of the Tool is used to identify the most plausible scenario among all realistic and credible alternatives(s) to the project activity, i.e. the baseline scenario.

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

Project participants wish to have the crediting period starting prior to the registration of the project activity. Therefore, in accordance with the ‘‘Tool for the demonstration and assessment of additionality'' and the "Decision -/CMP.1 - Further guidance relating to the clean development mechanism" it is provided below:

(1) Evidence that the project activity started in the period between 1 January 2000 and 18 November 2004. Design and construction started in July, 2002 and plant started operation in August 2004, thus, after January 1st 2000 and before November 18th 2004.

(2) Evidence that the project activity has either submitted a new methodology or have requested validation by a designated operational entity by 31 December 2005. Project activity has submitted a new methodology proposal in early 2005 in Round 10 under number NM0115.

(3) Evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. Project proponent has seriously considered the incentives of the CDM since the beginning of technology development and project implementation. It can be demonstrated by the contract of CO_2, steam and electricty, between Raudi and Coopcana, signed in 2001. The contract considered the revenues from the carbon credits, showing that project proponents considered the CDM impacts since the beginning of project development. Evidence is available with project proponents at the project site.

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

Project participants considered the following alternative scenarios to the project activity, representing how CO_2 would be obtained in the absence of the CDM project activity and what would happen to the CO_2 in the absence of the project activity:

C1: The proposed project activity (use of renewable source of CO_2) not undertaken as a CDM project activity.

C2: The proposed project activity, implemented at a later point in time and not undertaken as a CDM project activity.

C3: The use of CO_2 from a particular existing or new plant, on-site or off-site, using other renewable CO_2 sources, such as other biomass sources.

C4: The use of CO_2 from a particular existing or new plant, on-site or off-site, using non-renewable sources of CO_2, such as CO_2 derived from thermochemical processing of fossil hydrocarbons, CO_2 derived from mineral products, etc. If not used as input for the production of inorganic compounds, the CO_2 would not be produced, and would not be emitted in the atmosphere.

C5: The use of CO_2 in a particular existing or new plant, on-site or off-site, using non-renewable residual CO_2 sources, such as residual CO_2 from other industrial process that uses fossil or mineral as raw materials, as in the cement industry. If not used as input for the production of inorganic compounds, the CO_2 would accrue anyway and would be emitted in the atmosphere.

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

All the alternatives are in compliance with all applicable legal and regulatory requirements. There are no sectoral policies and circumstances that can be taken into account by the project activity and that would affect the six scenarios identified or make the new manufacturing technology (Scenario C1) preferred, rather than the conventional one. The only national circumstance that foments the new technology is the participation of Brazil in the Kyoto Protocol, which allows the project to benefit from the greenhouse gases emissions reductions.

Step 2. Investment analysis

Investment analysis is not undertaken.

Step 3. Barrier analysis

The following barriers are identified :

(1) Development of a new technology, the "first of its kind", in an uncertain economic scenario, in a country with little incentive for technology development and with capital restrictions. Raudi had to develop substantial research effort to enable the new technology. Two aspects need to be highlighted: (i) adaptations in the conventional process needed to be implemented and (ii) more stringent quality assurance and quality control procedures needed to be developed and implemented.

(2) Construction of the plant on equity basis, without any public or private funding. The risk perception involved in the development of the technology and construction of the plant was high, incurring in very unfavorable interest rates and funding conditions for the project activity.

(3) Capital markets are very attractive in Brazil, especially considering the high interest rates in the country, what makes the investment in the capital markets much more attractive than funding production, specially considering the risks in a "first of its kind" technology. Real interest rates have been extraordinarily high since the Real plan stabilized inflation in 1994. As a consequence of the long period of inflation, the Brazilian currency experienced a strong devaluation, effectively precluding commercial banks from providing any long-term debt financing. The lack of a long-term debt market has had a severely negative direct impact on the financing of projects in Brazil.

(4) Risks associated with the operation of a new technology based plant. The new technology was not proved before the construction and operation of the plant. Uncertainties about performance of the installation, production costs and quality of the final product needed to be solved from the beginning.

(5) The supply of CO_2, steam and electricity depends on a single third party. Therefore, the conditions of supplying needed to be very well agreed so that problems do not affect the operation of the plant.

The barriers affect the alternatives as showed in the following table:

How barriers affect the alternatives

	C1: Project activity not undertaken as CDM	**C2: Project activity at later point, not as CDM**	**C3: Use of other source of renewable CO_2**	**C4: Use of non-renewable dedicated CO_2**	**C5: Use of non-renewable residual CO_2**
Barrier 1: development of a new technology	Strongly prevents	Strongly prevents	Strongly prevents	Does not prevent	Prevents
Barrier 2: construction of the plant on equity basis	Strongly prevents	Strongly prevents	Strongly prevents	Does not prevent	Prevents
Barrier 3: attractivenes of capital markets	Strongly prevents	Strongly prevents	Strongly prevents	Does not prevent	Prevents
Barrier 4: risks associated with operations	Strongly prevents	Strongly prevents	Strongly prevents	Does not prevent	Prevents
Barrier 5: dependence on one external supplier	Strongly prevents	Strongly prevents	Strongly prevents	Does not prevent	Prevents
Result of the analysis	Project alternative is strongly prevented by identified barriers, more than the other alternatives	Project alternative implemented at a later point is strongly prevented by identified barriers, more than the other alternatives	Scenarios C3 is disregarded in the analysis because it is does not represent a realistic alternative. There is no other alternative for the obtention of residual renewable CO_2 in a reliable and safe manner different from the option used in the project activity	Scenario C4 is not prevented by identified barriers and remains as baseline candidate	Barriers prevent scenario C5 but less than scenarios C1, C2 and C3

The barrier analysis shows that:

(i) Scenario C1 is strongly prevented by identified barriers and for this reason is an unlikely scenario. Therefore, the project scenario remains as a possible additional scenario and Step 4 and 5 are undertaken in order to demonstrate additionality.

(ii) The barriers does not prevent scenario C4. Then, it is chosen as the baseline scenario.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

The only other activity, similar to the proposed project activity, is the conventional fabrication of chemical salts in plants installed next to petrochemical industry. These plants take advantage of the availability of CO_2 and fuels in these places.

Sub-step 4b. Discuss any similar options that are occurring:

No similar options are occurring. Project proponent developed the technology and no other company has a similar one.

Step 5. Impact of CDM registration

Since the beginning of technology development and plant construction, CDM incentives have been considered. The approval and registration of the project activity as a CDM activity, and the benefits and incentives derived from the project activity, will alleviate the identified barriers and thus enable the project activity to be undertaken for the following reasons:

- The environmental aspect of chemical industries ingeneral is important because of the public perception of its positive and negative impacts. The registration of this project activity in the CDM will add positive value to Raudi corporate image, resulting in intangible benefits in favour of project activity.

- The registration of the project in the CDM will also result in financial benefits from the revenue obtained by selling CERs, what can help to reduce project costs.

As Step 5 is satisfied, the proposed CDM project activity (scenario C1) is additional.

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

Table below illustrates in detail which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

	Source	Gas		Explanation
Baseline	Processing of fossil or mineral hydrocarbons	CO_2	Excluded	Excluded for simplification. This is conservative.
		CH_4	Excluded	
		N_2O	Excluded	
	Production of inorganic compounds	CO_2	Included but cancelled out	Due to applicability criteria, the process of production of inorganic compounds is not changed with the implementation of the project activity and potential baseline and project emissions are the same
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Final use	CO_2	Included	CO_2 is either emitted to the atmosphere or stored.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
Project activity	Uptake of CO_2 by biomass growth	CO_2	Included but cancelled out	CO_2 uptake in biomass growth is covered by the fact that renewable CO_2 is treated climate-netral
	Processing of biomass, producing residual CO_2	CO_2	Included but cancelled out	May be an important emission source. However, due to applicability criteria, the biomass processing is not changed with the implementation of the project activity and baseline and project emissions are the same.
		CH_4	Excluded	Excluded because it is not significant.
		N_2O	Excluded	Excluded because it is not significant.
	Production of inorganic compounds	CO_2	Included but cancelled out	Due to applicability criteria, the process of production of inorganic compounds is not changed with the implementation of the project activity and potential baseline and project emissions are the same
		CH_4	Excluded	Excluded because it is not significant.
		N_2O	Excluded	Excluded because it is not significant.
	Final use	CO_2	Included	CO_2 is either emitted to the atmosphere or stored
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

Date of baseline completion: 4/jan/2006.

Ecoinvest Carbon
Rua Padre João Manoel, 222, conj. 36 – São Paulo – SP
Zip Code 01411-000
Brazil

Phone: +55 +11 3063-9068
Fax: +55 +11 3063-9069

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

11/07/2002

C.1.2. Expected operational lifetime of the project activity:

30 years 0 months

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

C.2.1. Renewable crediting period

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

01/04/2005

C.2.1.2. Length of the first crediting period:

7 years, 0 months.

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 project activity:

Approved monitoring methodology AM0027 – “Substitution of CO_2 from fossil or mineral origin by CO_2 from renewable sources in the production of inorganic compounds”.

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

The same conditions for the baseline methodology apply. Please, refer to Section B.1.1.

D.2.1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	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)	Comment
Not applicable	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2eq)

Not applicable.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Not applicable	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2eq)

Not applicable.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. *N*	Carbon content of the inorganic compound, i.e., the number of carbon atoms in the inorganic compound molecule that would thermally dissociate in the final use of the compound.	Technical literature, such as, chemical engineers handbooks.	Non dimensional	C	Once, at the validation	100%	Electronic and paper	This is a fixed parameter that needs to be demonstrated through the chemical dissociation equation in the final use of each compound produced.
2. *M*	Molecular weight of the inorganic compound.	Technical literature, such as, chemical engineers handbooks.	g/mol	C	Once, at the validation	100%	Electronic and paper	This is a fixed parameter calculated from the summation of the atomic weights of the compound constituents.

3. *m*	Total amount of chemical produced.	Company books, sales documents	tonnes	M	Monthly	100%	Electronic and paper	This variable is monitored directly in the site. It is the total amount of production. For instance, the sales receipts that contain the quantity sold may be used for monitoring.
4. *mpnr*	Total amount of non-renewable CO2 used in the process.	Local measurements through field instruments	tonnes	M	Monthly	100%	Electronic and paper	The amount of non-renewable CO2 eventually used in the project needs to be monitored directly in the project site. The means of monitoring depends on each specific project. For instance, if CO2 is purchased from external suppliers, then, this variable can be monitored from the amount of CO2 purchased. The purchase receipts may be used for this purpose.
5. *mpr*	Total amount of renewable CO2 used in the process.	Local measurements through field instruments	tonnes	C	Monthly	100%	Electronic and paper	This variable is calculated from *m* and *mpnr*. The calculation depends on the chemical produced and the stoichiometric equation that represents its production. With the stoichiometric equation, and the monitored variables *m* and *mpnr* , the calculation is performed as a conventional stoichiometric calculation.

6. *mbnr*	Total amount of nonrenewable CO2 used in the process before the start of the project activity.	Project site records	tonnes	M	Monthly, over three years before the start of the project activity	100%	Electronic and paper	The amount of non-renewable CO2 eventually used in the baseline needs to be monitored. The means of monitoring depends on each specific project. In the case that no renewable CO2 has been used in the baseline scenario, *mbnr* is zero.
7. *mbr*	Total amount of renewable CO2 used in the process before the start of the project activity.	Project site records	tonnes	C	Monthly, over three years before the start of the project activity	100%	Electronic and paper	This variable is calculated from *m* and *mbnr*. The calculation depends on the chemical produced and the stoichiometric equation that represents its production. With the stoichiometric equation, and the monitored variables *m* and *mbnr* , the calculation is performed as a conventional stoichiometric calculation. In case that no renewable CO2 has been used in the baseline scenario, *mbr* is zero.

8. Product	Type of inorganic compound produced	Plant operator	Description os chemical substance produced and stoichiometric chemical	M	Annually after start of project activity	100%	Electronic and paper	The type of inorganic compound produced is monitored to assure that the product does not change and that the methodology remains applicable.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not applicable. Please, refer to Section B.2.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number	Data variable	Source of data	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)	Comment
Not applicable	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2eq)

Not applicable. Please refer to Section B.2.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2eq)

As explained in Section B.2, total emissions reductions from the project activity are:

$$ER = 44 \cdot \frac{N}{M} \cdot m \cdot (k_p - k_b) \quad [tCO_2]$$

$$k_b = \frac{m_{br}}{m_{br} + m_{bnr}} \quad and \quad k_p = \frac{m_{pr}}{m_{pr} + m_{pnr}} \quad \text{[non-dimensional]}$$

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 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.
1, 2	Low	Check consistency with literature.
3	Low	Any direct measurements with mass or volume meters at the plant site should be cross-checked with an annual energy balance that is based on purchased quantities and stock changes.
8	Low	Type of inorganic compound well known to producers.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

Project operator and manager is Raudi Indústria e Comércio Ltda..

At the moment, the plant is being certified under ISO 9000. Calibration, internal audits, operations procedures are being developed together with this process. The forecast is to have all the procedures ready and operational in the second half of 2006.

The process, including all the variables that need to be monitored, is controlled and monitored from the plant control room, where all the information is available electronically and with historic back up.

All data necessary for the monitoring of the project activity is normally monitored as part of plants operations. Therefore, there are several existing reports from which the information will be obtained, depending on the area involved. Production data is obtained from the electronic control system that automatically monitors and control plant operations. The data is kept electronically in the system, with back-up available. Monthly reports are produced from these data.

The calculation of emissions reductions is made through a Microsoft Excel spreadsheet, which contains formulae in accordance with the methodology. The data obtained from the consolidated reports shall be introduced in the spreadsheet and emissions reductions will be calculated automatically.

All monitored data related with the project activity will be stored until two years after the end of the crediting period.

The project activity contributes to sustainable development by:

- Fostering a new technology that promotes the reduction of fossil carbon dependency in the chemical industry by using renewable carbon sources, such as that produced in biomass processing facilities.

- The consumption of steam and electricity produced with biomass contributes to fostering this practice, instead of grid electricity and fossil fuel use.

- Due to the clearness of the process it was not necessary to enrol an Environmental Impact Assessment. All the permits the plants requires to operate have been obtained which is strong evidence that the process does not have any significant negatives impacts. Also, the environmental agency did not make any exigencies concerning the environmental impacts.

- The installation of the plant had significant impacts on creating local jobs. The maintenance of the current situation will increase people income, what would not happen in the absence of the project activity. Besides, for the plant properly operate it is necessary to count on the presence of Engineers that can assure the safe of the procedures as well as the improvement of the qualification.

- Raudi invests in the development of new projects and products with some partners like IPT – *Instituto dePesquisas Tecnológicas* – which provide the continuation of the research using the biomass to improve the quality of the process and develop new technologies using the renewable sources in an efficient manner.

- The technology implemented by the Raudi project is an innovating one and considering the potential of the region in producing biomass, is applicable to other industries that could be settled in the same region and so help to increase the indicators of sustainable listed above.

Considering the point listed above, the indicators that can measure the sustainability of the Raudi project are the following.

- Amount of CO_2 derived from fossil sources used over the period.

- Amount of steam and electricity from bagasse used over the period.

- Achieving all the necessary permits over the period.

- Amount of employees in the plant for both qualification levels.

The only possible source of unintended emissions is the back-up CO2 tanks. In the case any emergency causes unintended emissions the amount of CO2 that spilled from the tanks will be accounted in the project emissions. This variable is measured as part of the monitoring plan.

The quantity of raw material and final product can be cross-checked with measured parameters of the system and mass balances. It is possible to perform a mass balance of each product and production route so that inconsistencies are verified and data can be corrected.

D.5 Name of person/entity determining the monitoring methodology:

Ecoinvest Carbon. Refer to Section B.5.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

Not applicable. Emissions reductions are calculated directly from project activity parameters. Please refer to Section E.5.

E.2. Estimated leakage:

The main potential source of leakage for this project activity is the possible increase in emissions due to diversion of CO_2 from other users as a result of the project activity. As the residual CO_2 from the processing of biomass was already produced but was not used before the project activity, leakage is zero.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Not applicable. Emissions reductions are calculated directly from project activity parameters. Please refer to Section E.5.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

Not applicable. Emissions reductions are calculated directly from project activity parameters. Please refer to Section E.5.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

Raudi plant has the capacity of producing different products, for instance: sodium bicarbonate ($NaHCO_3$), ammonium bicarbonate (NH_4HCO_3) and calcium carbonate ($CaCO_3$). There are different possibilities for the production of each one of these products. For estimation purposes, four production routes will be considered in this PDD:

(1) Amonium bicarbonate via ammonia: $NH_3 + H_2O + CO_2 \rightarrow NH_4HCO_3$

(2) Sodium bicarbonate via caustic soda: $NaOH + CO_2 \rightarrow NaHCO_3$

(3) Sodium bicarbonate via soda ash: $Na_2CO_3 + CO_2 + H_2O \rightarrow 2\ NaHCO_3$

(4) Calcium carbonate via lime: $CaO + CO_2 \rightarrow CaCO_3$

It must be noted, however, that other routes are possible and may appear in the operation of the plant.

Nowadays, the plant operates only during the sugarcane harvest season.

Determination of N and M

Parameters *N* and *M*.

	$NaHCO_3$	NH_4HCO_3	$CaCO_3$
N	$NaHCO_3 \rightarrow Na^+ + OH^- + CO_2$ $N = 1$	$NH_4HCO_3 \rightarrow NH_4^+ + OH^- + CO_2$ $N = 1$	$CaCO_3 \rightarrow Ca^{++} + O^{--} + CO_2$ $N = 1$
M	$M = 23 + 1 + 12 + 3x16 = 84$ g/mol	$M = 14 + 5x1 + 12 + 3x16 = 79$ g/mol	$M = 40 + 3x16 + 12 = 128$ g/mol

Determination of m_{br} and m_{bnr}

In Brazil, the alternative scenario for the production of these chemical salts is the use of non-residual CO_2, obtained from synthesis gases and other fossil hydrocarbons, dedicated to the production of these compounds. Then, all the CO_2 used in the baseline is non-renewable:

$$m_{br} = 0$$

For this reason k_b becomes:

$$k_b = \frac{m_{br}}{m_{br} + m_{bnr}} = 0$$

Determination of m_{pr} and m_{pnr}

In the case of Raudi project:

(1) NH_4HCO_3 is completely produced with renewable CO_2. Then m_{pnr}=0:

$$k_p = \frac{m_{pr}}{m_{pr} + m_{pnr}} = \frac{m_{pr}}{m_{pr}} = 1$$

(2) In the case of $NaHCO_3$ via NaOH, non-renewable CO_2 is not used in the process. Therefore, m_{pnr}=0:

$$k_p = \frac{m_{pr}}{m_{pr} + m_{pnr}} = \frac{m_{pr}}{m_{pr}} = 1$$

(3) In the case of $NaHCO_3$ via Na_2CO_3, the CO_2 in Na_2CO_3 molecule is normally originated from the calcination of $CaCO_3$, a mineral non-renewable source of CO_2. Then non-renewable CO_2 is used together with renewable CO_2.

$Na_2CO_3 + CO_2 + H_2O \rightarrow 2\ NaHCO_3$
m_{pnr} = 44 tonnes and m_{pr} = 44 tonnes

Then,

$$k_p = \frac{m_{pr}}{m_{pr} + m_{pnr}} = \frac{44}{44+44} = 0.5$$

(4) $CaCO_3$ is completely produced with renewable CO_2. Then m_{pnr}=0:

$$k_p = \frac{m_{pr}}{m_{pr} + m_{pnr}} = \frac{m_{pr}}{m_{pr}} = 1$$

Determination of m

During the crediting period, the forecasted production of each product is:

Forecasted production during the first crediting period

	m, NH_4HCO_3 [tonnes]	*m*, $NaHCO_3$ via NaOH [tonnes]	*m*, $NaHCO_3$ via Na_2CO_3 [tonnes]	*m*, $CaCO_3$ [tonnes]
2005	400	1,500	1,500	0
2006	2,000	5,000	5,000	2,000
2007	2,500	9,000	9,000	20,000
2008	2,500	15,000	15,000	24,000
2009	2,500	20,000	20,000	24,000
2010	2,500	20,000	20,000	24,000
2011	2,500	20,000	20,000	24,000

Emissions Reductions

From data above, emissions reductions are calculated as:

(1) NH_4HCO_3:

$$ER = 44 \cdot \frac{N}{M} \cdot m \cdot (k_p - k_b) = 44 \cdot \frac{1}{79} \cdot m \cdot (1-0) = 0.5569 \cdot m$$

(2) For $NaHCO_3$ via NaOH:

$$ER = 44 \cdot \frac{N}{M} \cdot m \cdot (k_p - k_b) = 44 \cdot \frac{1}{84} \cdot m \cdot (1-0) = 0.5238 \cdot m$$

(3) $NaHCO_3$ via Na_2CO_3:

$$ER = 44 \cdot \frac{N}{M} \cdot m \cdot (k_p - k_b) = 44 \cdot \frac{1}{84} \cdot m \cdot (0.5 - 0) = 0.2619 \cdot m$$

(4) $CaCO_3$ via CaO:

$$ER = 44 \cdot \frac{N}{M} \cdot m \cdot (k_p - k_b) = 44 \cdot \frac{1}{128} \cdot m \cdot (1 - 0) = 0.3437 \cdot m$$

Estimated emissions reductions during the first crediting period

	ER for NH_4HCO_3 [tCO_2]	*ER* for $NaHCO_3$ via NaOH [tCO_2]	ER for $NaHCO_3$ via Na_2CO_3 [tCO_2]	ER for $CaCO_3$ via CaO [tCO_2]	Total *ER* [tCO_2]
2005	223	786	393	0	1,401
2006	1,114	2,619	1,310	687	5,730
2007	1,392	4,714	2,357	6,874	15,338
2008	1,392	7,857	3,929	8,249	21,427
2009	1,392	10,476	5,238	8,249	25,355
2010	1,392	10,476	5,238	8,249	25,355
2011	1,392	10,476	5,238	8,249	25,355

E.6. Table providing values obtained when applying formulae above:

Year	**Estimation of project activity emissions [tCO_2]**	**Estimation of baseline emissions [tCO_2]**	**Estimation of leakage emissions [tCO_2]**	**Estimation of emissions reductions [tCO_2]**
2005	*Not applicable*	*Not applicable*	0	1,401
2006	*Not applicable*	*Not applicable*	0	5,730
2007	*Not applicable*	*Not applicable*	0	15,338
2008	*Not applicable*	*Not applicable*	0	21,427
2009	*Not applicable*	*Not applicable*	0	25,355
2010	*Not applicable*	*Not applicable*	0	25,355
2011	*Not applicable*	*Not applicable*	0	25,355
Total	***Not applicable***	***Not applicable***	**0**	**119,960**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The project activity has been implemented in accordance with all the applicable environmental legislation in the Municipal, State and Federal levels.

The monitoring of environmental impacts is made according to the requirements of State and Federal environmental agencies. When requested by the environmental agencies, monitoring is provided. The verification of project atmospheric emissions, wastewater generation and solid residues final disposal was approved by the environmental agency as of the issuance of the license. Emergency plans and safety programs were developed and implemented, in accordance with Raudi current practices and environmental legislation.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

No significant environmental impacts are due to the project activity.

SECTION G. Stakeholders' comments

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

The Brazilian Designated National Authority for the CDM requires the compulsory invitation of selected stakeholders to comment the PDD sent to validation in order to provide the letter of approval. Raudi and Ecoinvest invited the local stakeholders for comments last March.
The organizations and entities invited for comments on the projects were:

- São Carlos do Ivaí City Hall
- São Carlos do Ivaí City Council
- IAP – State of Paraná Environmental Agency
- Environmental Department of São Carlos do Ivaí
- Paraná State Public Attorney
- AMUNPAR – *Associação dos Municípios do Noroeste do Paraná* - Local ONG
- FBOMS (Representative of Brazilian Environmental ONGs)

Copies of the invitation letters and receipts (AR – *Avisos de Recebimento*) are available with project proponents.

G.2. Summary of the comments received:

So far, a letter from FBOMS was received, suggesting the use of Gold Standard or similar tools.

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

The project participants consider that requests made by the Brazilian Government are sufficient to be used as sustainable indicators which are attended by this CDM project activity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Raudi Indústria e Comércio Ltda.
Street/P.O.Box:	Rodovia PR 559, km 05
Building:	
City:	São Carlos do Ivaí São
State/Region:	Paraná
Postfix/ZIP:	87.770-000
Country:	Brazil
Telephone:	+55 44 438-8300 / +55 11 3089-9800
FAX:	+55 44 438-8301
E-Mail:	raf@raudi.com.br
URL:	
Represented by:	Mr. Ricardo Audi Filho
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Ecoinvest
Street/P.O.Box:	Rua Padre João Manoel, 222 – Cj. 36
Building:	
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	01411-000
Country:	Brazil
Telephone:	+55 +11 3063-9068
FAX:	
E-Mail:	esparta@ecoinvestcarbon.com
URL:	
Represented by:	Mr. Ricardo Esparta
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not Applicable.

Annex 3

BASELINE INFORMATION

This section is intentionally left blank (see section B and E for baseline information).

Annex 4

MONITORING PLAN

This section is intentionally left blank (see section D for monitoring information).

- - - - -