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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Production of bio-diesel fuel from soybean oil in Brazil

A.2. Description of the project activity:

>>
＜Outline and Objective of the Project＞

The project activity is to produce bio-diesel fuel (hereafter referred to as BDF) from soybean oil in the southern part of the state of Minas Gerais, Brazil. And this renewable energy BDF will substitute for a part of petro-diesel fuel that has been used in transportation sector so far. The purpose of the project is to reduce the greenhouse gas (GHG) emissions generated through combustion of the petro-diesel fuel.

Brazil's annual output of soybean is 50 million tons, which is the second largest in the world.
Making the best use of abundant soybean supplies, Sumitomo Corporation and Petrobras (Petróleo Brasileiro S.A.), largest oil company in Brazil are planning to construct a BDF production plant with the annual capacity of 100 thousand tons (300 tons per day). Soybean oil extracted from soybean will be used as a raw material of BDF. That is the reason why the plant will be built near the large warehouse of soybean in the suburb of Uberlandia City, the southern part of Minas Gerais and an agricultural area in the south about 250 km of Brasilia, the capital city of Brazil.
The plant will begin to operate at the middle of 2008. As the production method of BDF, alkali catalyst method which is technically established will be adopted.

The soybean oil extraction plant will begin operation at about the end of 2006, before the project starts. At this stage the produced soybean oil is scheduled to be exported to Japan. Once the project starts, the soybean oil of an annual output of 100,000 tons will be transported through piping directly to BDF production plant what Sumitomo and Petrobras jointly manage.

Petrobras will buy the whole quantity of BDF produced at the BDF production plant. BDF will be transported to its refinery by tank lorry. It will be mixed with B2 diesel fuel (B5 after 2013) and then sold at its gas stations in São Paulo City (about 600 km from the BDF plant).

Using BDF produced by the project as an alternate of petro-diesel fuel for transportation in Brazil, is expected to reduce the amount of petro-diesel fuel consumption. In consequence the amount of CO_2 emissions will be reduced.

＜Consistency with the national policy of Brazil＞

Brazilian government values the use of BDF as a renewable energy source. On January 14, 2005, the law 11097 was promulgated authorizing the introduction of BDF in the Brazilian energy matrix. The law permits that, for the next three years, the addition of 2% of BDF to the petro-diesel fuel. This percent value will become mandatory after 1st of January 2008. Furthermore, this mixture rate will increase to 5% in 2013.

To achieve the goal of the policy, the government has already introduced a variety of support measures as follows.
First of all, the Brazilian Development Bank (BNDES, Banco Nacional de Desenvolvimento Econômico e Social), which is a federal public company that is associated to the Ministry of Development, Industry and Foreign Trade, approved "Financial Support Program for Biodiesel Investments" on the 3rd of December.
It is the financing system applied to investments in all phases of BDF production including warehousing and logistics.

In addition, the government has introduced the tax reduction to the raw material production farmers of BDF, because the support to the BDF production also has the meaning as the promotion of agriculture, local economy, and employment. The tax reduction rates are different depending on the raw material, the production area, and the producer of BDF. In the case family farmers in the northeast region and semi-arid region produce the seeds of castor bean and palmae, the tax related to Pis/Pasep is exempted.

Thus, Brazil is promoting the production of BDF as a national policy, and the project conforms to the promotion policy of the renewable energy introduction.

＜Contribution to Sustainable Development of Brazil＞

In approving the CDM projects, Brazil's Designated National Authority (DNA) evaluates the project candidates based on the following eight guidelines and sets the priority among them.

① Contribution to climate change mitigation
② Contribution to sustainability of regional environment
③ Contribution to employment creation
④ Influence on income distribution
⑤ Contribution to sustainability of balance of payments
⑥ Contribution to sustainable economic growth
⑦ Cost-effectiveness
⑧ Contribution to technical independence

The project will bring about not only reducing the GHG emissions but also the following effects which contribute to the sustainable growth that Brazil's DNA attaches importance to.

・Besides CO_2, reducing SOx (sulfur oxide) emissions by the use of petro-diesel fuel will lead to the mitigation of urban air pollution from automobile emissions.
・A new production facility will necessitate new workers, such as facility operators, maintenance operators, and administrative staffs. These workers will be recruited within the local labour market. It means employment will be created thanks to the new facility.
・The amount of the import of light oil will decrease by using the domestic energy source, and it will contribute to the energy security.
・BDF production technology by alkali catalyst method has been used in Brazil only by foreign companies so far. Taking it into consideration, the penetration of this technology will lead to technical independence by domestic enterprises.

A.3. Project participants:

>>
The participants of the project are as follows.

Participants (Host country)	Outline of participants	hope for to be considered as the project participant?
Interministrial Commission on Global Climate Change (Brazil)	Government institution Host country's DNA	No
Petrobras (Petróleo Brasileiro S.A.) (Brazil)	Private oil company (Investment in BDF producing company and sales of BDF)	Yes
Sumitomo Corporation Sumitomo Corp. do Brasil S.A. (Japan)	Private enterprise (Procurement of BDF raw material such as soybean oil and methanol etc. and investment in BDF producing company)	Yes
Nippon Mining Research & Technology Co., Ltd. (Japan)	Private enterprise (Think tank)	Yes

A4. 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.:

>>
Minas Gerais

A.4.1.3. City/Town/Community etc:

>>
Uberlandia City

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

>>
Soybean oil extraction plant and BDF production plant are scheduled to be located in Uberlandia City, which is in the southern part of Minas Gerais. The city is in an agricultural area in the south about 250 km of Brasilia, the capital city of Brazil and in the north about 600 km of São Paulo City. The area where the BDF production plant is to be constructed is near the large warehouse of soybean in the suburb of Uberlandia City. There are no the private house around the project site.
BDF will be supplied to the gas stations about 600 km from the BDF production plant in São Paulo City.

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

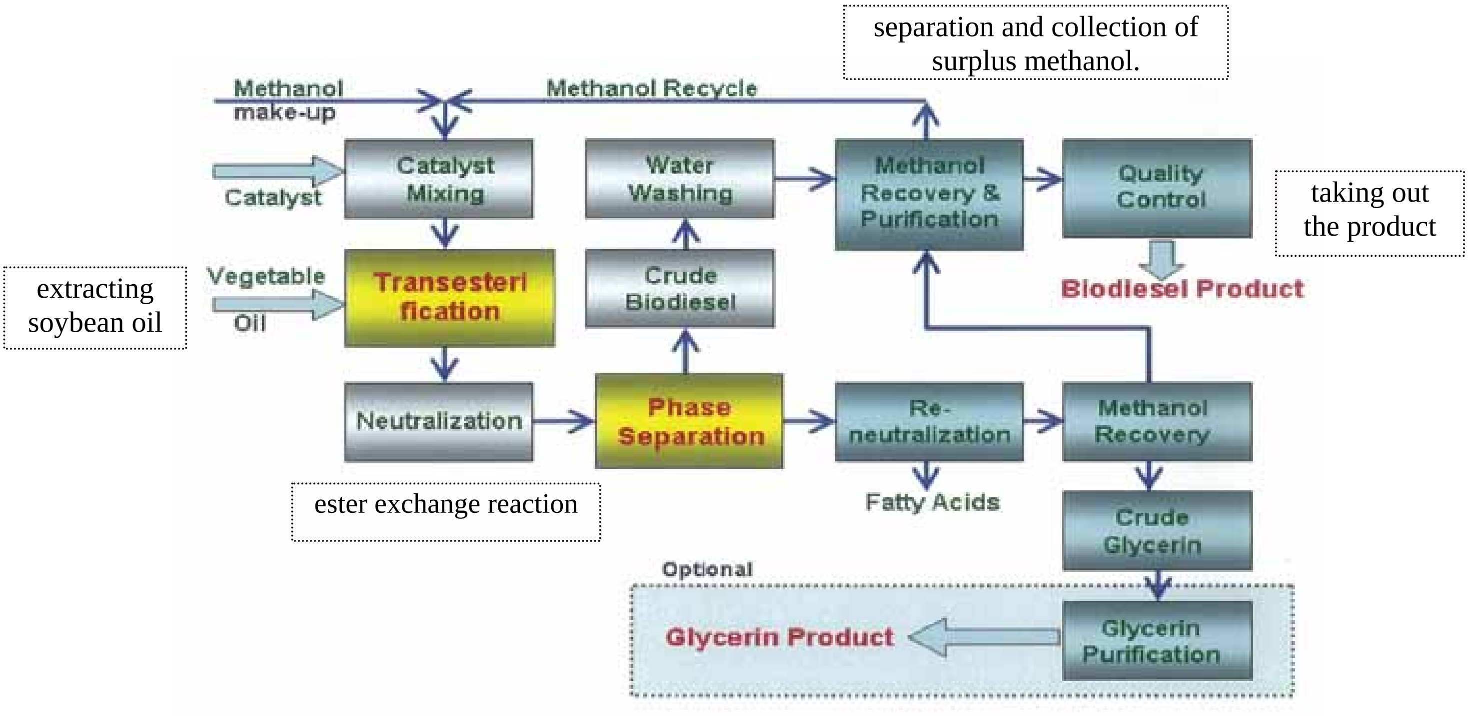
>>
Type III Other Project Activities,
－III.C. Emission Reductions by Low-Greenhouse Gas Emitting Vehicles in the categorization

in the categorization of small scale CDM projects.
（However, this categorization does not mean that the project is categorized as small scale CDM.）

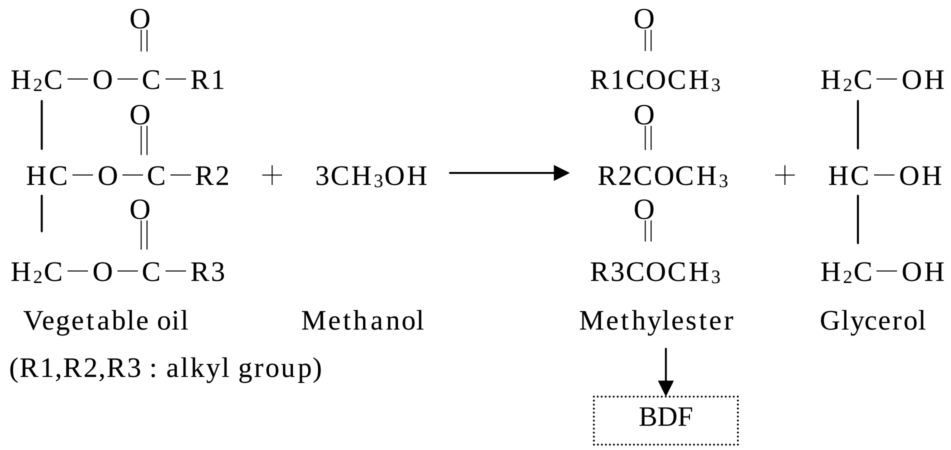
The project is a sort of fuel-switching project from fossil fuel to biomass-based fuel in the transportation sector.

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

>>
The alkali catalyst method is applied as BDF production technology in the project.
The process of BDF shown in the figure below. After pre-processing the feedstock (extracting the soybean oil), it consists of such parts as ester exchange reaction, taking out the product, and the separation and collection of surplus methanol.



The figure below shows the ester exchange reaction.



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 main reason of the GHG emission reductions through the project is as follows.

The market circulation of BDF produced through the project will substitute for the petro-diesel fuel used till then. Because of that, the CO_2 emissions in the case of BDF circulation will decrease as compared with the case of the baseline scenario in which BDF doesn't circulate.
Actual emission reductions will be achieved when the petro-diesel fuel of many unspecific vehicles will be substituted by BDF.
Therefore, the emission reductions are calculated from the amount of BDF supplied to the market, that is, the amount of substitution for the petro-diesel fuel.

On the other hand, the additionality of the project is mainly shown by barrier / investment analysis of the BDF production plant. The barrier / investment analysis includes not only BDF but also other by-products having market value (glycerin).

As for the identification of the baseline scenario in B.2., we assess for three stages of material flow, that is, ①production process of biomass raw material, ②BDF production plant, ③BDF consumption.

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

>>
Average amount of annual emission reductions during the project period is expected 270,000 tons. However, the amount of the reduction at the first year will be half the above-mentioned average because the plant will begin to operate in the 3rd quarter.

The amount of the emission reductions through the crediting period is shown in the table below

YEAR	Emission Reduction
2008	135,000t
2009	270,000t
2010	270,000t
2011	270,000t
2012	270,000t
2013	270,000t
2014	270,000t
2015	270,000t
2016	270,000t
2017	270,000t
Total	2,565,000t

A.4.5. Public funding of the project activity:

>>
The public fund is not scheduled to be turned on to the project.

SECTION B. Application of a baseline methodology

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

>>
Generalized baseline methodology for transportation Bio-Fuel production project with Life-Cycle-Assessment (AM00xx)

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

>>
Here we check if the project satisfies the applicability conditions specified in the methodology as follows:

Conditions at the “biomass supply” stage are:

（a）The methodology is applicable to cases in which the project participants
（１） ask farmers to plant biomass for purchase
（２） import biomass from abroad
（３） obtain biomass waste oil, and/or
（４） obtain biomass from other channels.

As Soybean oil is obtained from the existing oil extraction plant, the project corresponds to case (3).

(b)The plantation site, if this is the source of biomass, utilizes only organic fertilizers (possibly recycled from the BDF production plant).

The project does not have the process of plantation of biomass. Therefore, it is unnecessary to think about fertilizers.

(c) The use of the fossil fuel, which the BDF is going to replace, is not banned legally or substantially in the host country, or there is no mandatory regulations to use the same type of BDF(which is not the type E-policy) in the host country.

Petro-diesel fuel can be used in Brazil without any restriction.
On the other hand, mandatory regulations (targeting fuel sellers) to blend 2% of BDF with petro-diesel fuel will be introduced in 2008 (refer to A.2). However, as clarified in CDM EB 16th decisions, it is not necessary to take into account national and/or sectoral policies or regulations that have been implemented after the adoption by the COP of the CDM M&P(11, November 2001) like this regulation in developing a baseline scenario.

(d)In case some mandatory or virtually mandatory regulations(targeting fuel sellers) to expand the use of the BDF or other compatible biomass-based fuels by setting some quantified threshold have been/will be introduced as non-type E－policy, the compatible biomass-based fuel has a larger share than the threshold level and/or competitive in the associated fuel market.

Although several policies to promote BDF production are introduced in Brazil, real production of BDF just gets under way and BDF does not have a large share in the fuel market. The proportion of BDF production capacity at this moment is less than 1%(150,000kl) of the petro-diesel fuel production capacity.

(e)The penetration rate of some biomass based fuels, which can be alternative to the BDF produced by the project, and whose biomass-ratio is above the produced BDF, is less than [70]% in the host country if conditions (b) and (c) are met,

Production of BDF just gets under way in Brazil.

（f）The BDF produced by the project is consumed for vehicle or in-house uses, or used for some other specific purposes as an alternative to a fossil based fuel, and is not exported to/used in Annex I countries,

In order to satisfy the condition (f), the project participants will make a contract with Petrobras which prohibits him to use BDF for some other specific purposes or export to Annex I countries.

In addition, the project participants will also monitor that the sold BDF is surely blended with the fossil transportation fuel and is not exported to Annex I countries, by annually providing related evidences obtained from the fuel suppliers, after the project starts.

(g)The fossil fuel to be replaced by the BDF, has excess supply capacity in the host country, therefore the project does not create new/hidden demand of the fossil fuel, *i.e*., the BDF is to replace fossil fuel fully under the competitive environment,

Though Brazil depends its demand of petro-diesel fuel on import from abroad, there is no limitation in the amount of import and/or demand. Therefore, the demand of petro-diesel fuel is not constrained, nor expected to be constrained in the foreseeable future.

As a conclusion from above, the project satisfies the applicability conditions of the methodology.

B.2. Description of how the methodology is applied in the context of the project activity:
>>
As explained in the section of the applicability condition in the “Generalized baseline methodology for transportation bio-fuel production project with Life-Cycle-Assessment” the project lifecycle related to GHG emission reductions is categorized into the following three stages:

Stage 1 ：Biomass [soybean]supply
Stage 2：BDF production[from soybean oil], and
Stage 3：BDF consumption

In order to identify the baseline scenario, the alternative scenario options are to be listed up for each stage under the no CER revenue condition.

In the followings, we will think about what will possibly happen when the project does not realize as alternative scenario options.
Then narrows the possibility and identify the baseline scenario using applicability conditions of the methodology.

Stage１：Biomass [soybean] supply
There is not plantation process in the project, the alternative scenario options at this stage are:

Option 1-1 : Continuation of current practice (BaU case);
Option 1-2 : Obtain soybean oil as feedstock of BDF (project case);
Option 1-3 : Construction of some other facilities which emit GHGs

Option 1-3, which increases baseline emissions, can be neglected by selecting the conservative estimation. As the result, Option 1-1 and 1-2 are left.

Stage 2 : BDF production[from soybean oil]
The alternative scenario options at this stage are:

Option 2-1 : Continuation of current practice (BaU case);
Option 2-2 : Installing a BDF production facility (project case);
Option 2-3 : Installing a BDF production facility, whose production scale is larger or smaller than the project

Conditions to be satisfied at the "BDF production" stage are:
(c)The project is the optimal solution in its scale in the project participants' decision making considering several barriers with economical consideration, if a BDF production plant (by using the same biomass) is invested; and

(d)The project participants do not have any plan to implement other biomass based fuel production projects with different type of production process nearby or at the same place.

We are to confirm the above conditions by following procedures.

For condition (c), several aspects are considered for this project, such as
(1) financial constraint for project participants for lower limit,
(2) technological constraint for lower and upper limits, and
(3) available contracted farm field for biomass plantation.

With regard to the project, it is unnecessary to consider (2) because the BDF production technology employed by the project is a proven technology. As the project does not have the process of plantation of biomass, it is also clear that we do not need to consider (3) .
Therefore, the first constraint is the key determinant among them.

For condition (d), as soybean oil is to be obtained from an existing soybean extraction plant in the project, it will not happen that project participants produce another biomass-based fuel with a different production process from the project.
Even if project participants could not obtain soybean oil from that existing soybean extraction facility, there are no choices using biomass feedstock other than soybean oil because Minas Gerais is the largest soybean-producing area in Brazil.

Under the current situation of the host country, Option 2-3 is excluded.
As a result, the remaining option is to continue the current practice (BaU case) or the project case.

＜Confirmation of the additionality Condition＞
we will confirm whether the project would not be implemented in the baseline scenatio as follows.

The method of confirming the additionality is the barrier analysis and/or the economical analysis with calculations of the indicators used for investment decision-making of the BDF production project.

Step3: Barrier analysis and/or Step 2: Investment analysis of the "Tool for the demonstration and assessment of additionality" can be applied.
If the barrier analysis is insufficient for demonstrating that the project would not be implemented as the baseline scenario, investment analysis is needed.

Step 3
Sub-step 3a. Identify barriers that would prevent implementation of type of the proposed project

As Brazil promotes the BDF production as a national policy, there are no institutional or technological barriers which prevent implementation of the project.

In case of the project, the largest barrier is the cost, because the economical incentives to invest in such a project may not necessarily be sufficient.
Calculation is provided in the following.

Strep 2
Calculation of Internal Rate of Return (IRR)

The IRR for10 years of crediting period is calculated as 8.2%(without CER) or 12.6%(with CER 5US$/t CO_2), being below the profitable level (15%). If the credit price is 8US$/t CO_2 , the IRR becomes 15%. (Outline of calculation, parameters are shown in Annex 3）

As a result, it can be concluded that the project is not an economically attractive course of action. Therefore, the investment analysis shows that it is difficult to implement the project as a baseline scenario.

Step 4
Common Practice Check
In case that the market penetration of the same type of the BDF is more than [10%] in the host country, the project participants shall demonstrate that the project would face the prohibitive barriers without the CER revenue with appropriate evidences.

However, production of BDF just gets under way in Brazil. Therefore, it is unnecessary to explain about common practice barrier because the market penetration of the same type of the BDF is less than 10%. (The details of BDF production plant installation in Brazil are provided in Annex 3.)

This additionality check excludes the project scenario from the baseline scenario candidates. The remaining option is the continuation of current practice (BaU case).

<u>Stage 3：BDF consumption</u>
The alternative scenario options at this stage are:

Option 3-1: Continuation of current situation (BaU case: no fossil fuels are replaced by the project);

Option 3-2: Complete replacement of the associated fossil fuel by the BDF sold by the project (project case);
Option 3-3: Incomplete replacement of the associated fossil fuel by the BDF sold by the project due to partial replacement by substituting other bio-fuels;
Option 3-4: Incomplete replacement of the associated fossil fuel by the BDF sold by the project due to incomplete consumption;
Option 3-5: Partial replacement of the associated fossil fuel by the BDF sold by the project due to export to some Annex I countries; and
Option 3-6: Replacement of other types of bio-fuels, instead of the fossil fuel, by the BDF sold by the project;

The applicability conditions (c)－(g) ensures that the BDF displaces the fossil-based fuel.
In addition, it is obvious that only the Option 3-1 remains as the baseline scenario from the result of the review at stage 2 (because the project case or other Bio-fuel production is not chosen as the baseline scenario).

Result of the identification of the baseline scenario

From the above logical development, it is possible to conclude that the baseline scenario is to continue current practice if all of the applicability conditions and other conditions shown above are met at all stages.

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:

>>
As shown in B.2., the baseline scenario is to continue the current practice.
Therefore, the vehicles utilizing BDF in the project scenario use petro-diesel in the baseline scenario.

As the baseline emissions are estimated to be more than the project emissions (shown in Section E), it can be said that the project is additional.

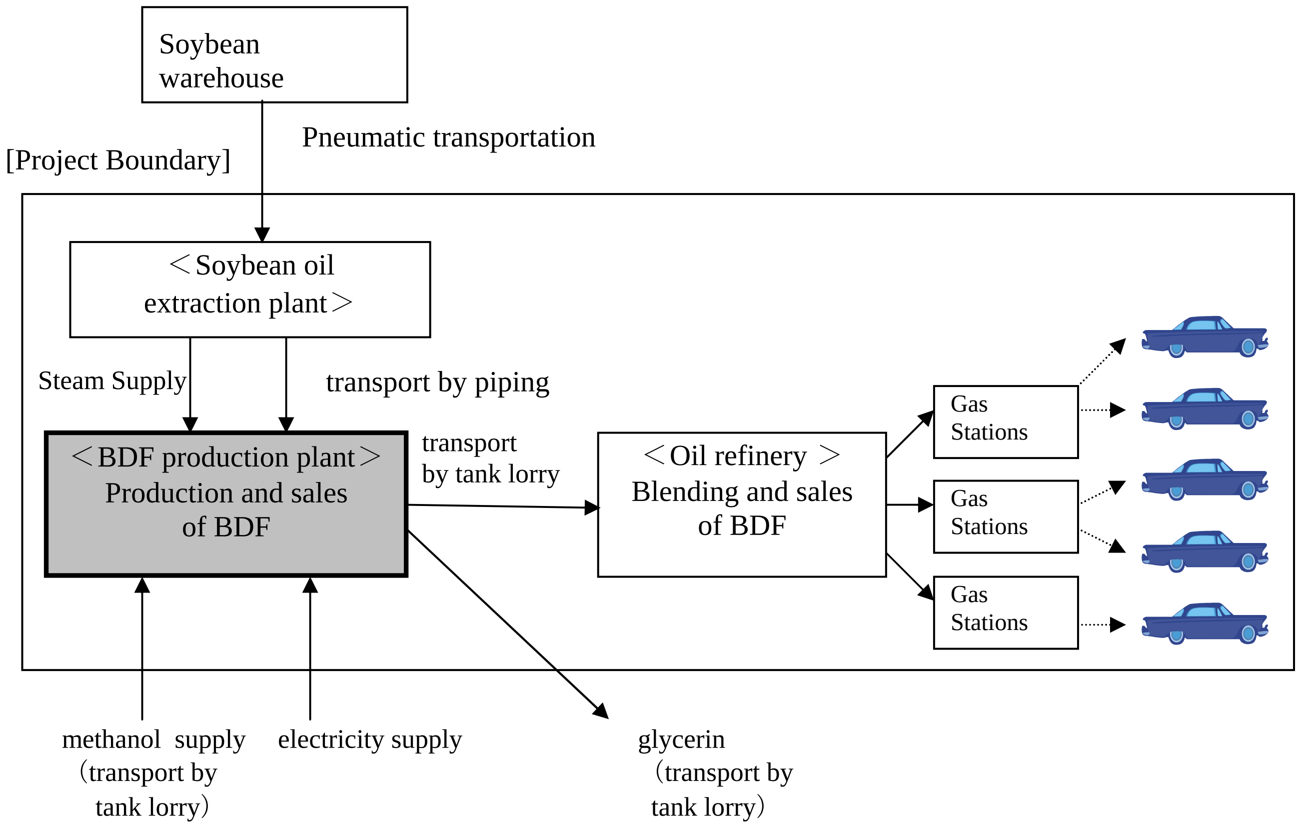
B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

>>
As mentioned in the methodology, the principal GHG reductions through the project are realized at many vehicles which utilize the BDF.

This case is similar to the grid-connected renewable energy project-type. Therefore, the project boundary is chosen as

- Soybean oil extraction plant
- transportation to the project site (BDF production plant)
- the project site (BDF production plant)
- transportation to the oil refinery （in São Paulo City）
- the oil refinery
- transportation to the fuel supply facility (Gas station)
- the fuel supply facility
- all vehicles which utilizes the BDF produced by the project

referring to the case of ACM0002, which includes all the power plants connected to the grid to be in the boundary.



Each emission sources in and outside the boundary are listed in the below chart.
Following the result of the uncertainty analysis (refer to Annex 3 "Baseline Information") , some of the emissions can be neglected.

	In the Boundary	Outside of the Boundary

Baseline Scenario (BLS)	Significant (monitored)	• Each vehicle using the BDF in the PJS（CO_2 from fossil fuel use substituted by BDF）	• Exploitation, Refinement, Transportation of fossil fuels substituted by the BDF[oil field/port/refinery/gas station]（CO_2,CH_4）
	Negligible or Common (not monitored)（※）	• Fuel supply facility（CO_2 : common） • Each vehicle using the BDF in the PJS（N_2O from petro-diesel fuel use）	n.a.
Project Scenario (PJS)	Significant (monitored)	• BDF production plant (CO_2 from fossil fuel consumption for steam supply) • Each vehicle using the BDF in the PJS (CO_2 from non-bio C content (originated in methanol) in the BDF) • Transportation of BDF（CO_2）	
	Negligible or Common (not monitored)（※）	• Each vehicle using the BDF in the PJS（CO_2 from petro-diesel fuel contained in the BDF; common to BLS, N_2O: negligible） • Fuel supply facility（CO_2:common）	• Power Plants linked to the grid (CO_2 from electricity used for acceptance of soybean oil and production of BDF in the BDF production plant) • Transportation of methanol from outside the boundary（CO_2） • Co-products (glycerin) outside the boundary [transportation]（CO_2）

（※） The uncertainty analysis to identify negligible emission sources are provided in Section E and Annex3.

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:

>>

The information needed for identification of the baseline scenario is:

- Information related to the BDF production plant: the investment analysis for excluding the possibility to implement this project even without the CER revenue is provided in Annex 3.

The information needed for development of the baseline emissions formula is:

- Data/information regarding emission factors is provided in Annex 3
- Uncertainty analysis to identify negligible emission sources is provided in Annex 3

Completion date of the baseline study: 10/03/2006

The baseline is determined by:

Mr. Koichi Kato
Nippon Mining Research & Technology Co.,Ltd.

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:

>>

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

>>
13 years as of 2006（The first 2 years are the period for the feasibility study and construction of the plant）

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:

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
July 2008

C.2.2.2. Length:

>>
10years

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

>>

Generalized monitoring methodology for transportation Bio-Fuel production project with Life-Cycle-Assessment (NM129→AM00xx)

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

>>

The baseline methodology applied to the project is "Generalized baseline methodology for transportation bio-fuel production project with Life-Cycle-Assessment (NM129→AM00xx)" which is expected to be approved by CDM EB in the near future. Therefore, the baseline methodology shall be used in conjunction with the monitoring methodology（NM129→AM00xx）.

Since the project fulfils the applicability conditions of the baseline methodology (See secion B.1.1.), this monitoring methodology is also applicable to the project.

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
P1. $FF^{BFP}_{oil,y}$	Heavy oil consumption for steam supply to the BDF production plant	flow meter	kl	m	daily	100%	electronic	
P2. $COEF^{FF}_{oil}$	LCA CO_2 emission factor of the heavy oil	Fuel supplier, statistics	t CO_2/kl	c	Once in the beginning of the crediting period	100%	electronic	
P3. $BF^{mass}y$	BDF sold or utilized in a certain year	Weight meter	t	m	daily	100%	electronic	Check against BF^{fvol}_y and BDFsales record.
P4. $COEF^{FS}$	CO_2 emission factor of the non-bio feedstock (Methanol) contained in the BDF	-	tCO_2/ t-BDF	c	Once at the time of drafting PDD	100%	electronic	Theoretical calculation
P5. $PE^{Transp1}_y$	Transportation-related CO_2	-	tCO_2/yr	c	monthly	100%	electronic	From BDF production facility to Sao Paulo : one way 600km, Round trip

	emissions from the BDF production plant to fuel supply facility							1,200km Transport by trucks of loading 15t in weight. Calculated by multiplying P6 and P7
P6. $ML^{Transp1}_{,y}$	Transportation distance from the BDF production plant to the fuel supply facility	Forwarder's receipts or odometer records	km	m	monthly （measure at a time of transportation ）	100%	electronic	
P7. $COEF^{TR}_{mode\ 1}$	CO_2 emission coefficient for transportation of the BDF(by diesel truck)	Statistical data	$kgCO_2/km$	c	Once at the time of drafting PDD	100%	electronic	IPCC Guidelines is used.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

The project emissions PE_y within the project boundary in a certain year y are given by the following formula.

$$PE_y = FF^{BFP}_{oil,\,y} \times COEF^{FF}_{oil} + BF^{mass}_{y} \times COEF^{FS} + PE^{Transp1}_{y}$$

$FF^{BFP}_{oil,\,y}$ ：Heavy oil consumption for steam supply to the BDF production plant [kl/yr]
$COEF^{FF}_{oil}$ ：LCA CO_2 emission factor of the heavy oil [tCO_2/kl]
BF^{mass}_{y} ：BDF sold or utilized in a certain year [t-BDF/yr]
$COEF^{FS}$ ：CO_2 emission factor of the non-bio feedstock (methanol) contained in BDF [tCO_2/t-BDF]
$PE^{Transp1}$ y ：Transportation-related CO_2 emissions from the BDF production plant to the fuel supply facility [tCO_2/yr]

$$PE^{Transp1}_{y} = ML^{Transp1}_{,y} \times COEF^{Transp1}$$

$ML^{Transp1}_{,y}$ ：Transportation distance from the BDF production plant to the fuel supply facility [km]
$COEF^{Transp1}$ ：CO_2 emission coefficient for transportation of the BDF(by diesel truck) [$kgCO_2$/km]

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
B1. BF_y	BDF sold or utilized in a certain year	-	GJ/yr	m	daily	100%	electronic	B2×B3×B4
B2. BF^{vol}_y	BF_y volume	volumeter	m^3/yr	m	daily	100%	electronic	Check against $BF^{mass}y$ and fuel sales record.
B3. $Density_y$	BDF density	densimeter	ton/m^3	m	monthly	sampling	electronic	In the early state of project implementation, more frequent sampling should be done in order to assess fluctuation.
B4. HV_y	BDF calorific value	-	GJ/ton	m	monthly	sampling	electronic	Chemical component analysis or combustion test is applied in the beginning. Later, $Density_y$ is used to approximate this value. In the early state of project implementation, more frequent sampling should be done in order to assess fluctuation.
B5. $COEF^{FF}$	LCACO_2 equivalent emission factor or the petro-diesel fuel , which the BDF substitutes	BDF purchaser, statistical data, scientific literature	tCO_2/GJ	c	Once in the beginning of the crediting period	100%	electronic	

B6. $BF_{[produced]}{}^{VOL}{}_{y}$	BDF production	Volumeter	m^3	c	daily	100％	electronic	This value is not directly used in the calculation of the baseline emissions, while it is used to check the appropriateness of the “sold amount” of the BDF（B2）. If some inconsistencies are found, the project participants shall investigate its origin and correct the data as appropriate.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

The baseline emission BE_y within the boundary in a certain year y is given by the following formula.

$$BE_y = BF_y \times COEF^{FF} \times (1+\delta)$$

BF_y : BDF sold or utilized in a certain year [GJ/yr]

$= BF^{vol}{}_y \times Density_y \times HV_y$

$BF^{vol}{}_y$: BF_y volume [m^3/yr]

$Density_y$: BDF density [ton/m^3]

HV_y : BDF calorific value [GJ/ton]

$COEF^{FF}$: LCACO_2 equivalent emission factor of petro-diesel fuel which BDF substitutes [tCO_2/GJ]

δ : Correction factor of the difference in the average mileage among fuels per GJ

$= [L_{biofuel}/L_{fossil}] - 1$

L_{fossil} : the average mileage of petro-diesel fuel which will be substituted by BDF [m/MJ]

$L_{biofuel}$: the average mileage of BDF [m/MJ] δ : Scientific literature says that the difference in the average mileage between BDF and petro-diesel fuel is in the range of fluctuation and considers δ as zero.

This can also be guessed because those two fuels have the similar length of carbon chain in terms of chemical construction.

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

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

>>

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 *(Please use numbers to ease cross-referencing to table 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
L1. *EL_y*	Electricity used for acceptance of soybean oil and production of BDF in the BDF production plant	Wattmeter	Mwh	m	monthly	100%	electronic	Check against the power purchase receipt.
L2. *$COEF^{EL}_y$*	CO_2 emission factor of the used electricity	Statistical data	tCO_2/MWh	c /e	yearly	100%	electronic	Based on the approved methodology ACM0002, Simple OM method will be applied. In case of Brazil, more than 50%of the grid electricity is dominated by hydropower. Therefore, Simple Ajusted OM is appropriate to apply. In order to justify the usage of OM, the project participants shall obtain the signed letter of the person who is in charge of the power development plan of the power company that the power development plan is never affected by the existence of the project.
L3. *$Loss_y$*	Transmission loss of the grid	Statistical data	No dimension	c /e	yearly	100%	electronic	Statistical data is applied for the latest year.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>
Leakage L_y , as the net emission change in a certain year y, is given by the following formula.

$$L_y = EL_y \times COEF^{EL}_y / (1 - Loss_y)$$

EL_y : Electricity used for acceptance of soybean oil and production of BDF in the BDF production plant[MWh/yr]
$COEF^{EL}_y$: CO_2 emission factor of the used electricity [tCO_2/MWh]
$Loss_y$: Transmission loss of the grid [－]

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_2 equ.)

>>
Emission reductions ER_y is given by the following formula.

$$ER_y = BE_y - PE_y - L_y$$

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 necessaty.
P1,P4, P6, B2, L1	Low	Data will be checked against the sales/purchase receipts/records. Especially for B2, the produced amount(B6) is monitored and consistency is checked. If some inconsistency is found, the project participants shall investigate the reasons and provide suitable explanation to the verifier with appropriate corrections.
Measurable parameters at the BDF production plant	Low	Management system of the data is settled.

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

>>

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

>>

Mr. Koichi Kato
Nippon Mining Research & Technology Co.,Ltd.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

The project emissions PE_y within the project boundary in a certain year y are given by the following formula.

$$PE_y = FF^{BFP}_{oil,\,y} \times COEF^{FF}_{oil} + BF^{mass}_{y} \times COEF^{FS} + PE^{Transp1}_{y}$$

$FF^{BFP}_{oil,\,y}$: Heavy oil consumption for steam supply to BDF production plant [kl/yr]
$COEF^{FF}_{oil}$: LCA CO_2 emission factor of heavy oil [tCO_2/kl]
BF^{mass}_{y} : BDF sold or utilized in a certain year [t-BDF/yr]
$COEF^{FS}$: CO_2 emission factor of the non-bio feedstock (methanol) contained in BDF [tCO_2/t-BDF]
$PE^{Transp1}$ y : Transportation-related CO_2 emissions from the BDF production plant to the fuel supply facility [tCO_2/yr]
$ML^{Transp1}_{,y}$: Transportation distance from the BDF production plant to the fuel supply facility [km]
$COEF^{Transp1}$: CO_2 emission coefficient for BDF transportation (by diesel truck) [$kgCO_2$/km]

Heavy oil consumption for steam supply to BDF production plant

The steam used as heat source in the BDF production plant will be supplied directly by piping from the boiler of the soybean oil extraction plant.
Heavy oil consumed as fuel of the boiler is estimated to be 2,900[kl/yr].
The calculation of CO_2 emissions by consumption of heavy oil using IPCC default value for $COEF^{FF}_{oil}$ is as follows;

$$FF^{BFP}_{heavy\ oil,\,y} \times COEF^{FF}_{heavy\ oil}$$
$$= 2{,}900[kl/yr] \times 3.1[tCO_2/kl]$$
$$= 8{,}890[tCO_2/yr]$$

Methanol contained in BDF

BDF is generated with the chemical reaction of the soybean oil and methanol. Therefore, among CO_2 emissions by BDF combustion, emissions originated with soybean oil can be considered to be the same amount as that absorbed during the growth of the soybean according to the IPCC guidelines. It means that CO_2 emissions originated with soybean oil is zero.
On the other hand, it is necessary to calculated CO_2 emissions originated with C contained in methanol because methanol is chemical synthesis product.
However, C contained in glycerin which is by-product of the chemical reaction is originated with soybean and C in methanol contained in BDF is the same amount with C in glycerin originated with soybean. Relatively, C in methanol can be considered to be converted into glycerin.

Therefore, $COEF^{FS}$ is assumed to be zero and CO_2 emissions from methanol ($BF^{mass}_{y} \times COEF^{FS}$) are also estimated as zero.

Transportation of BDF
BDF(100,000[t/yr]) produced in the BDF production plant in Uberlándia, Minas Gerais is planned to be sold at fuel supply facility after blending with petro-diesel fuel at the oil refinery operated by Petrobras. Transportation-related CO_2 emissions from the BDF production plant to the fuel supply facility in São Paulo which is 600km away from the BDF plant $PE^{Tarnsp1}_y$ is calculated as follows.

Laden weight of trucks : 15t
$ML^{Transp1}_{,y}$（Transportation distance from the BDF production plant to fuel supply facility [km]） will be measured ex post at the time of transportation. However, in order to estimate CO_2 emissions, we assume the distance from Uberlándia to São Paulo (round trip 1,200km) as the transportation distance.

$COEF^{Transp1}$ （CO_2 emission coefficient for transportation by diesel truck） is 0.77kgCO_2 /km according to IPCC guidelines.

$$PE^{Tarnsp1}_y = 100{,}000[t/yr] ／ 15[t] \times 1{,}200[km] \times 0.77[kgCO_2/km]$$
$$= 6{,}160[tCO_2/yr]$$

Project Emissions
From the above ex ante estimation, the project emissions in case of producing 100,000[t/yr] of BDF is as follows.

$$PE_y = 8{,}890[tCO_2/yr] + 0 + 6{,}160[tCO_2/yr]$$
$$= 15{,}150[tCO_2/yr]$$

E.2. Estimated leakage:
>>
Leakage L_y , as the net emission change in a certain year y, is given by the following formula.

$$L_y = EL_y \times COEF^{EL}_y ／ (1 - Loss_y)$$

EL_y : Electricity used for acceptance of soybean oil and production of BDF in the BDF production plant[MWh/yr]
$COEF^{EL}_y$: CO_2 emission factor of the used electricity [tCO_2/MWh]
$Loss_y$: Transmission loss of the grid [－]

Here we estimate leakage in case of producing 100,000[t/yr] of BDF.

Electricity used for acceptance of soybean oil and production of BDF in the BDF production plant
The electricity used for acceptance of soybean oil is estimated 18[MWh/yr], and electricity used for production of BDF is estimated 4,970[MWh/yr]. Therefore, the total electricity consumption EL_y will be 4,988[MWh/yr].
Since this amount is not so large to affect the grid, Operating Margin method is applied in accordance with the methodology.

$COEF^{EL}_y$ (CO_2 emission factor of the electricity) is calculated using “Average OM method” referred in ACM0002(See Annex3 for details）. The result of calculating is 0.160 [tCO_2/MWh].

Therefore, in case of producing 100,000[t/yr] of BDF , CO_2 emissions from electricity used for acceptance of soybean oil and production of BDF in the BDF production plant are estimated as follows. Transmission loss is assumed 5%.

$$L_y = EL_y \times COEF^{EL}{}_y ／(1－Loss_y)$$
$$=4{,}988[MWh/yr] \times 0.160\ [tCO_2/MWh]\ ／(1－0.05)$$
$$=840[tCO_2/yr]$$

Since this amount is smaller than 1% of baseline emissions, this emission source can be considered to be negligible.

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

>>

As leakage is negligible, the total project emissions are as follows.

$$PE_y = 15{,}150[tCO_2/yr]$$

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

>>

The baseline emissions BE_y within the boundary in a certain year y is given by the following formula.

$$BE_y ＝ BF_y \times COEF^{FF} \times (1+ \delta)$$

BF_y : BDF sold or utilized in a certain year [GJ/yr]
$＝BF^{vol}{}_y \times Density_y \times HV_y$

$BF^{vol}{}_y$: BF_y volume [m^3/yr]
$Density_y$: BDF density [ton/m^3]
HV_y : BDF calorific value [GJ/ton]

$COEF^{FF}$: LCACO_2 equivalent emission factor for the petro-diesel which BDF substitutes [tCO_2/GJ]

δ : Correction factor of the difference in the average mileage among fuels per GJ
$＝[L_{biofuel}/L_{fossil}]－1$

L_{fossil} : the average mileage of petro-diesel which will be substituted by BDF [m/MJ]
$L_{biofuel}$: the average mileage of BDF [m/MJ]

BF_y : The amount of BDF production is assumed to be 100,000[t/yr]. Low calorific value of BDF is 9,730[kcal/kg-BDF].

$$BF_y ＝ 100{,}000[t/yr] \times 10^3[kg/t] \times 9{,}730[kcal/kg\text{-}BDF]$$
$$＝973.0 \times 10^9[kcal/yr]$$

$COEF^{FF}$ (Life-cycle GHG emission factor of the fossil fuel) :

Strictly speaking, the LCA effect is originated outside the boundary. However, it is easier to include such effect in calculating $COEF^{FF}$.

As Brazil is an oil-producing country, even if we consider conservatively, there are no increase in LCA CO_2 emission factor of the fossil fuel in Brazil. According to the IPCC guidelines default value, emission factor of the fossil fuel without LCA effect and $COEF^{FF}$ are as bellows.

$$\text{IPCC default value} = 20.2[tC/TJ] \times 43.33[TJ/10^3 ton] \times 44/12[tCO_2/tC]$$
$$= 3.21[tCO_2/t\text{-diesel}]$$

$$COEF^{FF} = 3.21[tCO_2/t\text{-diesel}] \div 10{,}950[kcal/t\text{-diesel}] \times 1.0$$
$$= 2.93 \times 10^{-4}[kgCO_2/kcal]$$

δ : Scientific literature says that the difference in the average mileage between BDF and petro-diesel is in the range of fluctuation and considers δ as zero.

This can also be guessed because those two fuels have the similar length of carbon chain in terms of chemical construction.

Therefore, the baseline emissions in case of producing 100,000[t/yr] of BDF is estimated as follows.

$$BE_y = 973.0 \times 10^9[kcal/yr] \times 2.93 \times 10^{-4}[kgCO_2/kcal] \times 1$$
$$= \mathbf{2.85 \times 10^5\ [tCO_2/yr]}$$

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

>>

Emission reductions ER_y in case of producing 100,000[t/yr] of BDF is given by the following formula.

$$ER_y = BE_y - PE_y - L_y$$
$$= 2.85 \times 10^5\ [tCO_2/yr] - 15{,}150[tCO_2/yr] - 0[tCO_2/yr]$$
$$= \mathbf{2.70 \times 10^5\ [tCO_2/yr]}$$

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

>>

Estimated amount of emission reductions during the crediting period is shown below:

Year	BDF [t/yr]	$FF^{BFP}_{oil,y}$ [kl/yr]	EL_y [MWh/yr]	BE_y [tCO_2eq/yr]	PE_y [tCO_2eq/yr]	L_y [tCO_2eq/yr]	ER_y [tCO_2eq/yr]
2008	50,000	1,450	2,494	142,500	7,575	—	135,000
2009	100,000	2,900	4,988	285,000	15,150	—	270,000

2010	100,000	2,900	4,988	285,000	15,150	—	270,000
2011	100,000	2,900	4,988	285,000	15,150	—	270,000
2012	100,000	2,900	4,988	285,000	15,150	—	270,000
2013	100,000	2,900	4,988	285,000	15,150	—	270,000
2014	100,000	2,900	4,988	285,000	15,150	—	270,000
2015	100,000	2,900	4,988	285,000	15,150	—	270,000
2016	100,000	2,900	4,988	285,000	15,150	—	270,000
2017	100,000	2,900	4,988	285,000	15,150	—	270,000
Total	950,000	27,550	47,386	2,707,500	143,925	—	2,565,000
Average	95,000	2,755	4,739	270,750	14,393	—	256,500

SECTION F. Environmental impacts

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

>>
The government (municipality) approval for construction and the operation of the BDF production plant is scheduled to be acquired. In that case, environmental impact assessment will be implemented if necessary.

It is hard to assumed that the project results in a serious environmental impact because the soybean oil extraction plant is not newly established but existing, and private houses doesn't exist around newly constructed BDF production plant.

On the other hand, it can be expected the reduction of SOx emissions besides the reduction of CO_2 emissions thanks to the BDF substituting for petro-diesel fuel in the project. It results in the improvement of the air pollution.

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 serious environmental impact is expected to be caused by the project.

SECTION G. Stakeholders' comments

>>
The stakeholders' opinion for the project is scheduled to be taken to through hearing in the future.

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

>>

G.2. Summary of the comments received:

>>

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

>>

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Nippon Mining Research & Technology Co., Ltd.
Street/P.O.Box:	3－17－35
Building:	
City:	Niizo Minami, Toda city
State/Region:	Saitama Prefecture
Postfix/ZIP:	335－8502
Country:	Japan
Telephone:	81－48－430－2511
FAX:	81－48－430－3811
E-Mail:	
URL:	http://www.shinnikko-tr.co.jp/
Represented by:	
Title:	Executive Director of Consulting, Doctor of Engineering
Salutation:	
Last Name:	Kato
Middle Name:	
First Name:	Koichi
Department:	Overseas project department
Mobile:	
Direct FAX:	81－48－430－3811
Direct tel:	81－48－430－2810
Personal E-Mail:	kato@shinniko-tr.co.jp

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The public fund is not scheduled to be turned on to the project.

Annex 3

BASELINE INFORMATION

I. Items to be considered when baseline scenario is identified

Outline of investment analysis and IRR calculation of the project

The precondition to do the investment analysis is shown as follows.

(1) The initial investment is US$25 million including the acquisition of land ($0.1 million US : 10,000m^2), BDF production plant, and the incidental facilities. The initial costs consider drastic rise of the raw material cost in recent times, which makes the costs of constructing the facility 20-30% higher than one year ago.

(2) The full amount of the initial investments is covered by funds on hand.

(3) Assuming the capacity utilization rate is 50% at the first year, 50,000t/yr of BDF production is expected. As of the second year, 100,000t/yr of production is expected with the 100% of capacity utilization rate.

(4) The cost for BDF production of 100,000t/yr is $65.33 million US.
The table below shows the breakdown.

The cost for producing 100,000t/yr of BDF
(Unit : $ million US/yr)

Feedstock (soybean oil, methanol, etc.)	59.08
Utility (electricity, steam, etc.)	1.46
Labor	0.43
Maintenance	1.25
Administration	3.11
Total	65.33

(5) BDF sales price

It is scheduled to contract a long-term selling agreement with Petrobras for BDF.
The sales price is based on the market price of petro-diesel fuel. Since Petrobras is obliged to buy the whole quantity of BDF, it is given price incentive.

Standard pricing method : $P_{BDF}=(P_{diesel}/1.0925)\times 0.80/2.20$

P_{BDF} : BDF sales price [US$／l]

P_{diesel} : petro-diesel fuel market price [R$／l]

$P_{diesel}/1.0925$: The tax (PIS/COFINS : 9.25％) is excluded from P_{diesel}.

0.80 : 10% margin of Petrobras and 10% incentive for Petrobras because of the long term contract in P_{diesel}

2.20 : US$1＝R$2.20

Calculated from a present rate

P_{diesel}＝R$1.80／l

P_{BDF} =(1.80／1.0925)×0.80／2.20

＝0.599 [US$／l]

＝0.680 [US$／kg] (BDF density : 0.88 [kg／l])

(6) Purchase price of soybean oil

The soybean oil price synchronizes with the price of soybean. The soybean price fluctuates greatly depending on the harvest situation. Since the direct impact of market volatility would be undesirable from the perspective of business continuity, the purchase price of soybean oil is decided according to the following rule.

Basic rule : The price in which the 10% margin is added to average price based on FOB Port of Paranagua for the past three years is assumed to be a soybean oil purchase price of the next year.

According to this rule, the soybean oil purchase price in 2008 when BDF production plant begins to operate will be calculated based on the soybean oil price from 2005 to 2007. At the current stage it is estimated by using the price from 2003 to 2005.
The table below shows the average price of the soybean oil in the port of Paranagua from 2003 to 2005.
The port of Paranagua, which is located in the south of São Paulo is the largest port of embarkation in Brazil for the soybean and soybean oil etc.

Soybean oil price movement (FOB Port of Paranagua)

(Unit : US$/t)

	2003	2004	2005
January	495.92	594.31	471.65
February	491.31	637.57	444.45
March	488.24	622.19	491.45
April	488.31	608.80	481.78
May	495.85	558.95	464.73
June	503.40	491.29	458.75
July	492.88	506.93	454.96
August	457.98	506.96	449.37
September	501.34	495.27	453.45
October	582.44	477.84	453.81
November	587.55	473.86	
December	597.08	481.90	
Highest	597.08	637.57	491.45
Lowest	457.98	473.86	444.45
Average	515.19	537.99	462.44
Average of 3 years			507.72

(Source : “SAFRAS & Mercado”)

Average from 2003 to 2005 = (515.19+537.99+462.44)／3＝507.72US$／t
＝0.508 US$／kg

Soybean oil purchase price is calculated by using this price of the soybean oil.

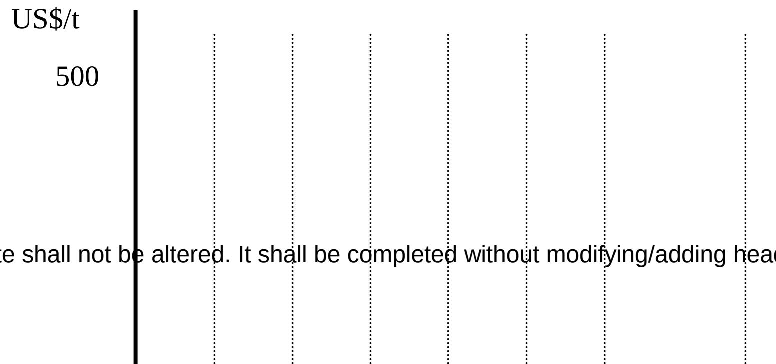
Soybean oil purchase price ＝0.508×1.10
＝0.559[US$／kg]
＝0.492[US$／l] (Soybean oil density : 0.88 [kg／l])

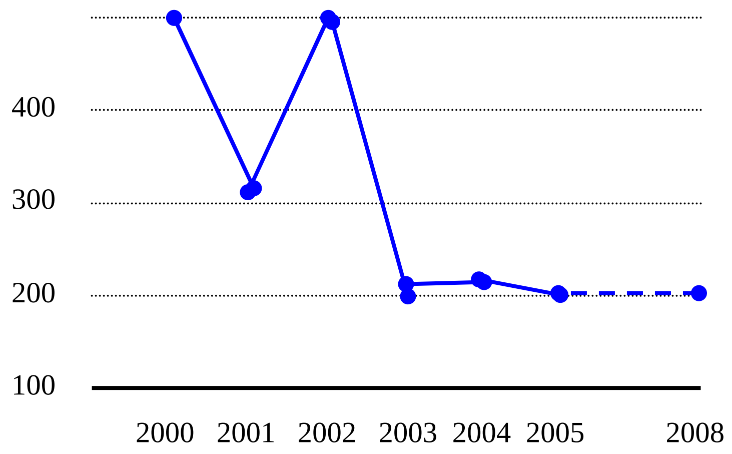
(7) Glycerin sales price

The figure below shows the actual price movement of raw glycerin and 2008 forecast in Oleoline glycerin market report.

The price of the glycerin has fallen along with the increase of BDF production. However, it is estimated to maintain the current price level for the long term in the report because in the ongoing BDF projects, the glycerin tends to be consumed in these plants whose combustion value is paid attention.

Therefore, as the glycerin sales price in this evaluation 0.200 US$/kg (200 US$/t) is adopted.





80% raw glycerol price movement (Rotterdam)

Source : “Oleoline glycerin market report No 69”
Note : December price from 2000 to 2004, June price in 2005, median exchange rate of each month, and the forecast price in 2008 are applied.

(8) Corporate tax rate is 34%.

(9) The 10 year fixed instalment method is used and the residual value is assumed to be 0 to calculate depreciation.

(10) The exchange rate is 1 US $ ＝2.2R$(Brazil real)
The result of calculating IRR during 10 years of the crediting period from the above-mentioned precondition is shown in the table below (the case with CER revenue and the case without CER revenue). In this calculation, CER credit price is assumed to be 5US$ / ton of CO_2.

Project IRR in the case with CER revenue

(Unit : $ Million US)

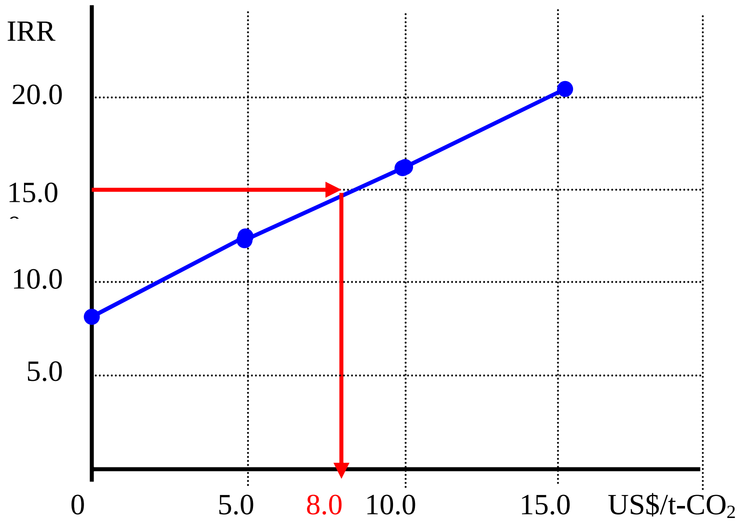
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
After-tax cash flow	1.92	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05
Cumulative after-tax cash flow	1.92	5.98	10.03	14.08	18.14	22.19	26.24	30.30	34.35	38.40
After-tax IRR										8.2

Project IRR in the case without CER revenue

(Unit : $ Million US)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
After-tax cash flow	2.37	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94
Cumulative after-tax cash flow	2.37	7.31	12.26	17.20	22.15	27.09	32.04	36.98	41.93	46.87
After-tax IRR										12.6

Without CER revenue, IRR of the project is 8.2% which is so low that profit of business can't be expected. If US$5 / ton of CO_2 is added as credit revenue, IRR will go up to 12.6%. But it won't reach IRR 15% that is the profit level.
As shown in the next figure, the CER credit price where IRR reaches 15% is US$8.0 / ton of CO_2.



2. BDF production plants installation in Brazil

There were 15 BDF production plants with 156,000kl/yr production capacity in Brazil at the end of 2005. Among them, however, 8 plants were approved by ANP (Agencia National do Petroleo, Gas National e Biocombustiveis) and only 4 plants had been operated, whose production amount is less than 1% compared with the total production capacity. From that situation, it can be concluded that these BDF production plants are in the stage of trial operation than in the stage of commercial operation.

By the end of 2006, reinforcement of the 15 plants and installation of the new 11 plants will have been completed. The total production capacity of 26 plants are estimated to be 816,000kl/yr, which will be able to supply enough BDF to produce B2 diesel oil from 2008.

Since the price of steel material rises rapidly in these days, it is expected to results in the remarkable rise of the prices of BDF production plants and incidental equipment. Therefore, it is not certain whether construction of BDF plants is performed as scheduled shown in the table below.

The production amount of BDF plants with ANP approval (in 2005)

(Unit：kl)

	Month / producers	3	4	5	6	7	8	9	10	11	12	2005
1	Soyminas	7.8	0	5.3	0	2.6	28.1	0	0			43.8
2	Agropalma	―	13.1	14.0	21.6	0	25.9	0	20.2			94.8
3	Brasil Biodiesel	―	―	―	―	0	0	0	0			0
4	Brasil Biodiesel(filial)	―	―	0	0	1.5	2.0	2.0	0			5.5
5	Biolix	―	―	6.4	1.2	3.1	1.1	0	13.7			25.5
6	Renobras	―	―	―	―	―	―	―	―			0
7	Fertibom	―	―	―	―	―	―	―	―			0
8	Nutec	―	―	―	―	―	―	―	―			0
	Total	7.8	13.1	25.7	22.8	7.2	57.1	2.0	33.9			169.6

（Source：ANP“Revisao 29 09/12/2005”）

BDF production plants in Brazil at the end of 2005

	producer	location	state	Production capacity (1,000kl/yr)		operation situation	Main feedstock
				’05.12	’06.12		
1	Soyminas	Cassia	MG	12	12	Operating	soybean, sunflower, turnip
2	Agropalma	Belem	PA	8	8	Operating	palm
3	Brasil Biodiesel	Floriano	PI	27	38	Operating	castor
4	Brasil Biodiesel	Teresina	PI	0.6	0.6	Operating	castor
5	Biolix	Rolandia	PR	6	6	Preparing	soybean, sunflower
6	Renobras	Dom Aquino	MT	6	6	Preparing	soybean, sunflower
7	Fertibom	Catanduva	SP	6	6	Preparing	multi - oils
8	Nutec	Fortaleza	CE	0.5	0.5	Preparing	castor
9	Bionatural	Formosa	GO	1.3	13.5	Operating	—
10	Petrocap	Charqueadas	SP	36	150	Preparing	soybean, vegitable oil residues
11	Ecomat	Cuiaba	MT	8	17	Preparing	soybean, tallow
12	Petrobras	Guamare	RN	0.6	1.2	Preparing	castor
13	Granol(Ceralit)	Campinas	SP	35	35	Preparing	soybean, sunflower
14	Fusermann	Barbacena	MG	6	6	Preparing	soybean, sunflower
15	Agrodiesel	Iguatama	MG	3	3	Preparing	soybean, sunflower
16	Biodiesel Sul	Icara	SC	—	0.9	Under construction	Oil residues (food)
17	Petrobras	Quixada	CE	—	40	Planning	soybean, castor, jatropha
18	Petrobras	Candeias	BA	—	40	Planning	soybean, castor, jatropha
19	Petrobras	Montes Claros	MG	—	40	Planning	soybean, castor, jatropha
20	BSBIO	Passo Fundo	RS	—	100	Planning	soybean
21	Biominas	Itauna	MG	—	12	Planning	—
22	Bertin	Lins	SP	—	110	Planning	tallow
23	Bioeste (Ponte di Ferro)	Estrela do Oeste	SP	—	40	Planning	tallow
24	Biotec	Campina Grande	PB	—	50	Planning	castor, cotton, tallow
25	Granol	Anapolis	GO	—	40	Planning	—
26	Barralcool	Barra dos Bugres	MT	—	57	Planning	soybean, sunflower, peanut
	Total			153	816		

Notes: MG : Minal Gerais, PA : Para, PI : Piaui , PR : Parana , MT : Mato Grosso Do Sul, SP : São Paulo, CE : Ceara, GO : Goias, RN : Rio Grande Do Norte SC : Santa Catarina, BA : Bahia, PB : Paraiba

II. Items to be considered for calculation of baseline emissions

１． CO_2 emission factor of electricity grid

As for CO_2 emission factor of electricity grid $COEF^{EL}_y$, which is used to calculate electricity consumption for the acceptance of feedstock of BDF and production of BDF in the BDF production plant, “Average OM method” of ACM0002 is adopted. The CO_2 emission factor of electricity grid is 0.160 from the result of calculation shown in the table below.

Calculation of CO_2 emission factor of electricity grid in 2003 energy source

Source of energy	Power generation		$F_{ij,y}$	$EF_{CO2,i}$	NCV_i	$OXID_i$	CO_2 exhaust	exhaust coefficient
	(GWh/yr)	(%)	(kt/yr)	(tCO_2/TJ)	(TJ/kt)	(%)	($MtCO_2$/yr)	(kCO_2/kWh)
Hydro	263,300	73.3						
Natural gas	21,200	5.9	4,420	56.1	52.3	99.5	12.90	0.608
Heavy Oil＊	53,200	14.8	13,820	77.4	42.0	99.0	44.48	0.836
Nuclear	7,900	2.2						
Renewable energy	13,600	3.8						
Total	359,200	100.0						0.160

Heavy Oil＊ : Total of oil derivative products (21,400GWh/yr) and imported energy (31,800GWh/yr)

２． Uncertainty analysis

In case of calculating larger GHG emission sources, the error margin greatly influences the amount of GHG emission reductions. It results in the uncertainty.

The comparison of the emissions in each scenario is as follows.

Baseline emissions amount	285,000[tCO_2/yr]
Project emissions amount	15,150[tCO_2/yr]
Leakage	—[tCO_2/yr]

The largest emission source is the CO_2 emission from petro-diesel fuel consumption substituted for by BDF. Among the necessary factors to calculate the CO_2 emission, the amount of BDF sales can be actually measured. Therefore, it can be said that the error margin is 1% or less. Concerning the other error margins such as emission coefficient of petro-diesel fuel $COEF^{FF}$ and the combustor efficiency δ, they aren't so large and they are estimated at 1% or less, too.

Emission sources which is smaller than 1% (2,850[tCO_2/yr]) of baseline emission can be thought as the range of error and be taken as negligible.

In the project there are two other emission sources which are small as follows.

(1) Transportation of methanol

Methanol as the feedstock is transported from São Paulo City to the BDF production plant in Uberlandia City of Minas Gerais. CO_2 emissions by the transportation of the methanol $PE^{Tarnsp2}_y$ is as follows when calculated on the bases of identical conditions for the transportation of BDF.

$PE^{Tarnsp2}_y$=10,900[t/yr]／15[t]×1,200[km]×0.77[kgCO_2/km]
=671[tCO_2/yr]

This amount can be thought to be negligible because it is smaller than 2,850[tCO_2/yr].

(2) Transportation of glycerin

Glycerin as a by-product is transported to São Paulo City as well as BDF. The CO_2 emission by the transportation of the glycerin $PE^{Tarnsp3}_y$ is as follows when calculating on the similar condition to the transportation of BDF.

$PE^{Tarnsp3}_y$=10,500[t/yr]／15[t]×1,200[km]×0.77[kgCO_2/km]
=647[tCO_2/yr]

This amount can also be thought to be negligible because it is smaller than 2,850[tCO_2/yr].

Annex 4

MONITORING PLAN

Detailed monitoring plan is scheduled to be fixed in the future.