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:

>>
Rice based bio-ethanol project in Vietnam

A.2. Description of the project activity:

>>
Purpose of the project activity

The purpose of the project is to produce anhydrous ethanol from rice. The project plant will be built in an industrial zone of Long An province, in the Mekong Delta region of South Vietnam. The main agricultural product in the region is paddy rice and the project produces bio-ethanol from broken rice, which is a by-product of rice milling. The project plant has a capacity of 100,000 liters of anhydrous ethanol per day, and rice-husk power generation facility is installed within the project site to supply electricity to the plant. The produced ethanol is sold to petroleum companies. The bio-ethanol is blended with gasoline at a rate of 10 percent and used as a transportation fuel in Vietnam. The project promotes mitigation of greenhouse gas emissions through partially substituting gasoline with bio-ethanol, which is biomass derived fuel and GHG emissions from this kind of energy consumption are defined as "Carbon neutral".

Contribution of the project activity to sustainable development of Vietnam

Vietnam is a crude oil producing country, however it imports almost all refined petroleum products to feed the national energy consumption because it has only one small refinery at this point in time. Therefore, the change in international oil prices affects the national economy of Vietnam. Moreover, the annual average GDP growth rate of Vietnam has been nearly 8%; especially the industry and construction sector has grown by 10%, thus a further increase in demand for energy is expected. Because of the above situation, the emphasis is placed on the development of alternative energy within the country in terms of energy security and climate change in Vietnam, and the government has been formulating "Master Plan of bio-fuel in Vietnam".

Biomass derived ethanol manufactured in Vietnam is produced mainly from sugar cane molasses. However it is difficult to ensure the stable supply of molasses because of domestic structural reform of the sugar industry. Therefore, the Vietnamese government pursues the stable supply of ethanol to be required for introducing E10 (10% of ethanol) into the national market through research for the possibility of producing alcohol from starch and sugar contained crops, because the country has plentiful agricultural resources. In addition, biomass derived ethanol currently manufactured in Vietnam is not anhydrous ethanol because dehydration technology has not been developed and spread yet in Vietnam, thus fuel ethanol is still under research.

This project is to produce bio-ethanol from broken rice that is a by-product of rice milling, and therefore the project can create added value in rice by utilizing its by-product, then it will lead to the revitalization of rice market and the increased income of farmers. Moreover, it is expected that new employment opportunities will be created through the bio-ethanol production.

Other than that, the project contributes to sustainable development of Vietnam in many aspects and here lists all the aspects.

(1) reduce the dependence on the import of refined petroleum products

(2) reduce GHG emissions and air pollution
(3) provide the stable supply of fuel ethanol
(4) technology transfer
(5) create added value in rice
(6) create employment opportunities and help farmers to increase their income

A.3. Project participants:

>>

Name of Party involved	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
Vietnam (host)	State owned companies: Vietnam Japan Rice Alcohol Company (to be established), Vietnam Southern Food Corporation Governmental organization: Ministry of Natural Resource and Environment	Yes
Japan	Private company: Sojitz Corporation	Yes

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>
Socialist Republic of Vietnam

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

>>
Long An province

A.4.1.3. City/Town/Community etc:

>>
Thanh Hoa district

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

>>
The bio-ethanol plant will be located in Thuan Nghia Hoa Industrial Zone, which will be set up in Thanh Hoa district in Long An province. Long An province is at the north-east end of Mekong Delta region in south Vietnam, and it adjoins Ho Chi Minh City.

Thuan Nghia Hoa Industrial Zone will be directly connected with Ho Chi Minh City by National Highway No.2 (N2), which is under construction at present. Moreover, the industrial zone is planed along a cannel, therefore water transportation of raw material is available.

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

>>
Transport

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

>>
The project uses dehydration technology, and the technology will be transferred to the host country since the kind of technology is still under development in Vietnam. Two kinds of technology are described below.

Molecular Sieve
Most common forms of molecular sieves are produced commercially from "zeolites" (aluminum silicate materials) as a highly durable bead containing molecular pores that selectively adsorb water from ethanol and other materials, typically in the vapor phase
One or more beds selectively adsorb water while the remaining bed(s) concurrently regenerate to prepare for the next adsorption cycle. In vapor phase, this is referred to as Pressure Swing Adsorption (PSA) process.

Zeolite Membrane
The Zeolite Membrane is grown on the surface of a porous ceramic support tube after hydrothermal treatment of the tube dipped in the aluminosilicate gel, which was prepared by alumina (AI) source and silica (Si) source. For practical industrial use, the membrane tubes are bundled to form the module and are built into the various plants. The feed is introduced to the outer side of the membrane in the module. By maintaining required vacuum inside membrane, water is vaporized through the membrane.

The technical specifications will be finalized before the PDD is submitted.

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:

>>

In the proposed project activity, the reduction of anthropogenic emissions of greenhouse gases will occur through the substitution of gasoline with bio-ethanol, which is biomass derived fuel and GHG emissions from this kind of energy consumption are defined as "Carbon neutral" under IPCC guidelines.

The project plant has a capacity of 100,000 liters of anhydrous ethanol per day. The produced ethanol is blended with gasoline at a rate of 10 percent and used as a transportation fuel in within the country. The total emission reductions are estimated at 53,326 tCO_{2e} per year.

The above emission reductions do not occur in the absence of the proposed project activity, because any national and/or sectoral policies or regulations have not been implemented in Vietnam on the use of bio-

ethanol in the transport sector. The government has made a draft of "Target and content of the biological fuel development project to 2015"and it is stated that the government aims to start using E10 by 2020.

In the document, it is also stated that one of objectives in the period of 2006-2010 is to approach and to be master of the technology of biological fuel production from mass-living; it means the productivity improvement of the living-mass into fuel transformation process, the possession of the appropriate mixing technology, the improvement of the community awareness of the role and benefit of biological fuel. In other words, the technology of anhydrous bio-ethanol production is still under development, thus it is not expected that bio-ethanol is produced and used as transportation fuel in order to substitute gasoline in the absence of the proposed project.

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

>>

The crediting period chosen for the project activity is 21 years with 2 renewals at each 7 year interval. Estimated amount of emission reductions over the first crediting period is shown in the table below.

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 1	53,326
Year 2	53,326
Year 3	53,326
Year 4	53,326
Year 5	53,326
Year 6	53,326
Year 7	53,326
Total estimated reductions	373,282

A.4.5. Public funding of the project activity:

>>

No public funding is used in the project activity.

SECTION B. Application of a baseline methodology

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

>>

To date, no baseline methodology can be applied to the project activity has been approved by EB, therefore a new baseline methodology is proposed. The title of the new methodology is;

Baseline methodology for the production of rice based bio-ethanol for transportation

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

>>

Applicability conditions are given in the proposed baseline methodology. The project meets the each condition as explained below.

1. *The project produces bio-ethanol from broken rice.*

The project uses broken rice as a raw material and produces bio-ethanol. The project plant will be constructed next to a rice mill and a raw material of bio-ethanol is procured mainly from the adjacent mill. According to the report from Cuulong Delta Rice Research Institute, broken rice rate in the process of rice milling is 20.58% and it is estimated that about 3.8 million tonnes of broken rice has been produced at Mekong Delta region in the year 2004. Total annual amount of raw material required for the project activity is estimated at 66,000 tonnes, which is equivalent to only 1.74% of total broken rice produced at the region. Hence, there will be no problem using broken rice as a raw material over the crediting period.

2. *The anhydrous bio-ethanol produced by the project activity will be used as transportation fuel as a substitute for gasoline.*

The produced bio-ethanol will be directly sold to petroleum companies then blended with gasoline and sold at filling stations. Therefore, the ethanol will not be circulated in national market for other intended uses. Moreover, petroleum companies are required to submit a latter to the project participants to guarantee that the bio-ethanol they purchase is not exported to outside of Vietnam and it is used only in the transport sector.

3. *The anhydrous bio-ethanol will be blended with gasoline at a maximum level of 20%.*

The anhydrous bio-ethanol produced by the project is blended with gasoline at a rate of 10 % and used as a transportation fuel in Vietnam.

4. *There are not effective policies or regulations in the host country on the use of bio-ethanol in the transport sector that have been implemented before the adoption of the CDM M&P.*

There are not effective policies or regulations in Vietnam on the use of bio-ethanol in the transport sector. The government has done research to prepare for a standard system and an appropriate technical regulation to promote the E10 using and development, however it still needs time to get ready.

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

>>
To identify the baseline scenario, the alternative scenario options are listed up, and then they are to be examined one by one and winnowed down to the most likely one.

The following three alternative scenarios are given in the proposed baseline methodology.

1) Substituting gasoline with bio-ethanol, not produced by a CDM project activity
2) Other alternative fuels are used as a substitute for gasoline
3) The continuation of a current activity – the use of gasoline

Step 1. Analyze the use of bio-ethanol blended gasoline as a baseline fuel.
As mentioned in Section B.1.1, there are not effective policies or regulations in Vietnam on the use of bio-ethanol in the transport sector up to now.

The most important factor that affects consumers to make a choice of transportation fuel is a price. Therefore one of the significant requirements for the spread of bio-ethanol blended gasoline is that the price of gasohol is lower than that of gasoline. The production cost of bio-ethanol is still expensive therefore, with an infusion of subsidies or CER revenues into bio-ethanol production, gasohol can have an advantage in price competition. In other words, similar bio-fuel production projects would not be promoted without CDM scheme.

In addition, dehydration technology in Vietnam has not been developed to produce enough anhydrous ethanol for E10 use, thus it would not be expected that bio-ethanol is used in Vietnam as a baseline fuel.

Step 2. Analyze the use of other alternative fuels as a baseline fuel.
In order to prevent the harm of lead to human health and environment, especially urban environment do to lead gasoline pollution, Prime Minister decided to use lead-free gasoline from July 2001, and it is now prohibited to use lead gasoline in Vietnam. MTBE (Methyl tertiary butyl ether), had been used as an octane enhancer instead of lead compound to enhance octane ratings and improve fuel combustion, however MTBE is thought to be carcinogenic and it is required to develop other octane enhancers. Against this background, bio-ethanol attracts a lot of attention because ethanol raises the octane of gasoline and reduces engine knock without affecting the efficiency of the catalytic converter.

Under the circumstance, the Ministry of Industry has been formulating “Master Plan of bio-fuel in Vietnam” to promote the use of bio fuel and they have done research on both bio-ethanol and bio diesel to make a development plan. Vietnam has plentiful agricultural resources thus there are a lot of raw materials of bio-ethanol such as paddy, sugar cane and other starch and sugar contained crops. On the other hand, cultivation of oil crops (such as oil palm or soybean), which are raw materials of bio diesel, is not flourishing. Therefore, the development of bio-ethanol will be put before that of bio diesel in Vietnam.

In regard to natural gases such as CNG, LNG or LPG, there are not any governmental programs that promote the use of natural gases as transportation fuels, it would not be expected that petroleum companies or motorists start promoting natural gases of their own will.

Therefore the alternative scenario that other alternative fuels are not used as a substitute for gasoline is not the baseline scenario.

According to the methodology, the continuation of a current activity, which is the use of gasoline, is identified as the baseline scenario for the project activity.

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:

>>

Following the proposed baseline methodology, "Tool for the demonstration and assessment of additionality" is applied.

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

This step is not required of the project activity because it will start in December 2008.

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

Sub-step 1a. Define alternatives to the project activity:

The project activity has two alternatives described below.

- Substituting gasoline with bio-ethanol, not produced by a CDM project activity
- The continuation of a current activity – the use of gasoline

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

All alternatives defined above are in compliance with all applicable laws and regulations in Vietnam.

Step 2. Investment analysis

The project proponent skips this step and proceeds to Step 3.

Step 3. Barrier analysis

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

The following barriers are identified for the project activity.

Technical barrier

Ethanol-blended fuels can hold water but once the fuel is saturated with water, excess water will separate and cause two distinct layers of product. The top layer will be mostly gasoline while the bottom layer is a mix of ethanol and water that will not burn. For the use as a transportation fuel, producers must use dehydration methods after fermentation and distillation processes to purify the ethanol.

Biomass derived ethanol currently manufactured in Vietnam is not anhydrous ethanol, therefore it cannot be used as bio-fuel. Dehydration technology is still under research and is not in the practical stage. The Vietnamese government has made a plan of researching and deploying the technology of ethanol 99.5% production. The estimated result is quoted below:

Period of 2006 – 2010: to be master of the technology of molecular sifting to produce ethanol 99.5%, to set up an ethanol 99.5% factory with capacity of 3 million liters/year. To produce initially and experimentally the molecular sieve in our country.

Period of 2011 – 2015: to be master of the technology of molecular sieve production aimed at satisfying the demand of big production. To enlarge the ethanol 99.5% factories aimed at satisfying the demand of E10 mixing.

The project includes technology transfer of dehydration technology, which is still under development in Vietnam. Therefore, technological barrier exists to implement type of the proposed project activity.

Investment barrier
The project IRR of the project computed excluding CER revenues is 15%. Vietnam issued its first overseas government bond in October 2005 and the fixed rate of interest for 10-year bonds is 7.125% per year, which represents country risk of the country. The project IRR is higher that the rate of interest, however 15 percent-IRR is not attractive to investors taking project risk into consideration. For the reason, it is difficult to convince investors to invest in the project, and therefore investment barrier exists

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

The identified barriers are for the implementation of the bio-ethanol production project and both of them do not prevent the implementation of the alternative scenario - the continuation of gasoline use.

Step 4. Common practice analysis
Vietnam has only one bio-fuel project planned within the country. The one is the production and the use of bio diesel and it is still under research. Thus, this is the first bio-ethanol project and there are not any other activities similar to the proposed project activity.

Step 5. Impact of CDM registration
The project can get CER revenue when the project is registered as a CDM project. The revenues heighten the IRR of the project activity and it can reduce the investment barrier.

As described through Step 0 to Step 5, it is demonstrated that the project activity is additional.

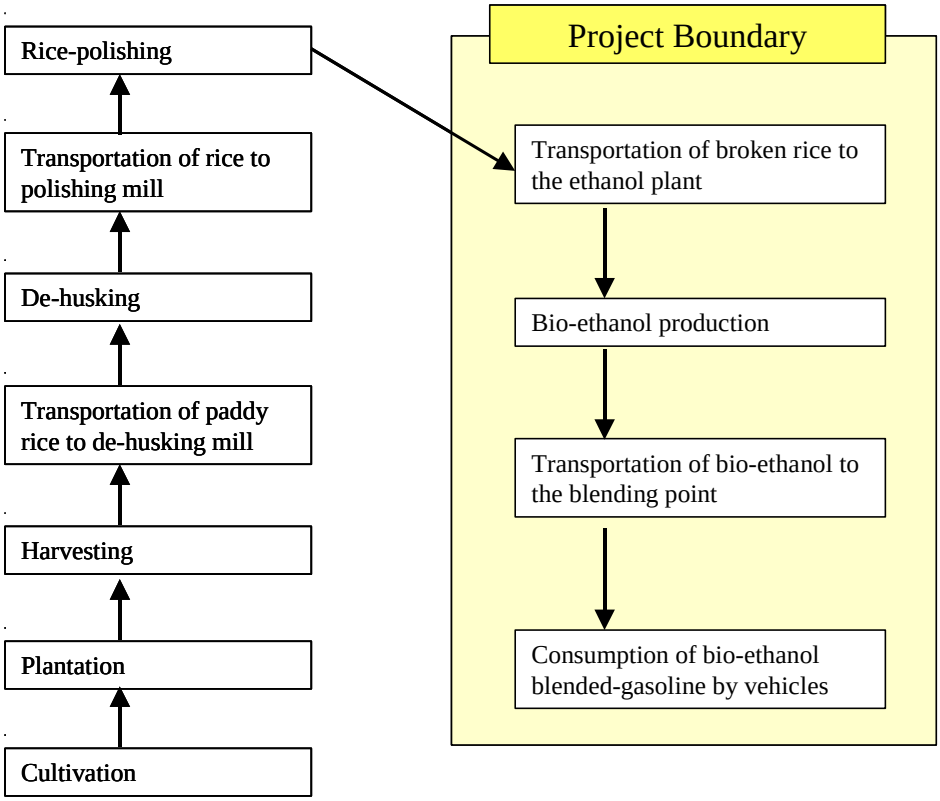
B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

>>

The project produces bio-ethanol from broken rice. The produced ethanol is sold to petroleum companies, and then it is blended with gasoline at a rate of 10 percent and used as a transportation fuel in Vietnam. Therefore, the project boundary includes;

- Transportation of broken rice
- Bio-ethanol production
- Transportation of bio-ethanol
- Consumption of bio-ethanol

The project boundary of the project is shown in the figure below.



The project manufactures bio-ethanol from broken rice, which is a by-product produced in the process of rice milling. Under such conditions, rice is cultivated for food and it is not cultivated as energy crop, thus rice cultivation is not under the control of the project participants. Hence the emissions related to rice cultivation and all the process of rice milling are excluded from the project boundary.

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: 17/02/2006

Akiko Nishinomiya
Sojitz Research Institute, Ltd.
nishinomiya.akiko@sea.sojitz.com

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:

>>
December 2008

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

>>
25 years

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:

>>
01/12/2008

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Application of a monitoring methodology and plan

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

>>

To date, no baseline methodology can be applied to the project activity has been approved by EB, therefore a new baseline methodology is proposed. The title of the new methodology is;

Monitoring methodology for the production of rice based bio-ethanol for transportation

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

>>

The applicability conditions of the proposed monitoring methodology are identified to those of the baseline methodology. Therefore, the explanation that the project meets the each condition is given in 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
1 TF^{RMT}	Transportation fuel consumption for raw material transportation	*Transportation service company*	liter/y	*m*	*Monthly*	*100%*	*Electronic*	*Checked against the purchase receipt*
2 CV^{TF}	Calorific value of transportation fuel	*Bio-ethanol plant data, national or IPCC data*	MJ/liter	*m, c*	*Annually*	*100%*	*Electronic*	
3 $COEF^{RMT}$	CO_2 Emission Factor for road/non-road mobile sources used for raw material transportation	*National or IPCC data*	tCO_2/MJ	*c*	*Annually*	*100%*	*Electronic*	
4 $CP_{i,y}$	Captive power generated from fuel type *i* per year	*Bio-ethanol plant*	kWh	*m*	*Continuously*	*100%*	*Electronic*	*Measured with an ammeter*
5 $COEF^{CP}_{i}$	Captive power generation emission factor of fuel type *i*	*National or IPCC data*	tCO_2/kWh	*c*	*Annually*	*100%*	*Electronic*	*Calculated statistical data according to a type of a captive biomass power generating unit*

The proposed monitoring methodology instructs project participants to monitor other parameters such as grid electricity and fossil fuel that provide energy to the bio-ethanol plant. However a rice-husk power generating unit is installed in the project site to cover all the energy at the plant, thus the project does not use any fossil fuel or grid electricity. Therefore it is not required to monitor those parameters.

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 following formula is used to estimate the project activity emissions <PE_y> in a certain year <*y*>.

$$PE_y = PE^{RMT}_y + PE^{BFP}_y$$

where:

- PE^{RMT}_y = Emissions from raw material transportation to the bio-ethanol plant [tCO_2e/y]
- PE^{BFP}_y = Emissions from bio fuel production [tCO_2e/y]

Emissions from raw material transportation to the bio-ethanol plant

$$PE^{RMT}_y = TF^{RMT}_y * CV^{TF} * COEF^{RMT}$$

where:

- TF^{RMT}_y = Transportation fuel consumption for raw material transportation [liter/y]
- CV^{TF} =Calorific value of transportation fuel [MJ/liter]
- $COEF^{RMT}$ = CO_2 Emission Factor for road/non-road mobile sources used for raw material transportation [tCO_2/MJ]

Emissions from bio fuel production

$$PE^{BFP}_y = CP_{i,y} * COEF^{CP}_i$$

where:

- $CP_{i,y}$ = Captive power generated from fuel type *i* per year [kWh]

· $COEF^{CP}_{i}$ = Captive power generation emission factor of fuel type *i* [tCO_2/kWh]

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 B.7)*	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
6 BF^{vol}_{y}	Volume of bio fuel consumption in the transport sector	*Petroleum company*	KL/y	*m*	*Monthly*	*100%*	*Electronic*	*Checked against the purchase receipt from the project plant*
7 CV^{BF}	Calorific value of bio-ethanol	*Bio-ethanol plant data, national or IPCC data*	TJ/KL	*m, c*	*Annually*	*100%*	*Electronic*	
8 CEF	Carbon Emission Factor of gasoline	*National or IPCC data*	tC/TJ	*c*	*Annually*	*100%*	*Electronic*	
9 FCO	Faction of Carbon Oxidized	*IPCC data*	-	*c*	*Annually*	*100%*	*Electronic*	

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 following formula is used to estimate the baseline emissions <BE_y> in a certain year <*y*>.

$$BE_y = BF^{therm}_y * COEF$$
$$= (BF^{vol}_y * CV^{BF}) * (CEF * 44/12 * FCO)$$

where:

- BE_y = Emissions from gasoline consumption by vehicles [tCO_2e/y]
- BF^{therm}_y = Thermal content of bio fuel consumption in the transport sector [TJ/y]
- COEF = CO_2 Emission Factor of gasoline [tCO_2/TJ]
- BF^{vol}_y = Volume of bio fuel consumption in the transport sector [KL/y]
- CV^{BF} =Calorific value of bio-ethanol [TJ/KL]
- CEF = Carbon Emission Factor of gasoline [tC/TJ]
- FCO = Faction of Carbon Oxidized

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 B.7)*	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
10 $LE^{N2O}_{i,y}$	Leakage N_2O emissions penalty from fertilizer use in planted area of the agricultural crop type *i*	*Statistics and national or IPCC data*	tCO_2e/y	*c*	*Annually*	*100%*	*Electronic*	*Calculated by using the statistical data of agricultural production. National or IPCC data is applied to GHG calculation.*
11 $LE^{CO2}_{i,y}$	Leakage CO_2 emissions penalty from fossil fuel use in planted area of the agricultural crop type *i*	*Statistics and national or IPCC data*	tCO_2e/y	*c*	*Annually*	*100%*	*Electronic*	*Calculated by using the statistical data of agricultural production. National or IPCC data is applied to GHG calculation.*

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

>>

Leakage $<L_y>$ in a certain year $<y>$ is given by the following formula.

$$L_y = \sum_i LE^{N2O}_{i,y} + \sum_i LE^{CO2}_{i,y}$$

where:

- $LE^{N2O}_{i,y}$ = Leakage N_2O emissions penalty from fertilizer use in planted area of the agricultural crop type *i* [tCO_2e/y]
- $LE^{CO2}_{i,y}$ = Leakage CO_2 emissions penalty from fossil fuel use in planted area of the agricultural crop type *i* [tCO_2e/y]

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 $<ER_y>$ are calculated as:

$$ER_y = BE_y - (PE_y + L_y)$$

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 necessary.
2,3,5,7,8,9	*low*	*Based on reliable national or IPCC data*
4	*low*	*Measurable at the plant. The data must be measured following the procedure given by ISO9001 in order to improve the accuracy.*
1,6	*low*	*Check against the sales/purchase receipts*
10,11	*middle*	*Out of project participants' control*

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

>>
Management system on monitoring based on ISO9000 is to be established to maintain the credibility of the measured value.

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

>>
Akiko Nishinomiya
Sojitz Research Institute, Ltd.
nishinomiya.akiko@sea.sojitz.com

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

The following formula is used to estimate the project activity emissions <PE_y> in a certain year <*y*>.

$$PE_y = PE^{RMT}{}_y + PE^{BFP}{}_y$$

where:

- $PE^{RMT}{}_y$ = Emissions from raw material transportation to the bio-ethanol plant [tCO_2e/y]
- $PE^{BFP}{}_y$ = Emissions from bio fuel production [tCO_2e/y]

Emissions from raw material transportation to the bio-ethanol plant

$$PE^{RMT}{}_y = TF^{RMT}{}_y * CV^{TF} * COEF^{RMT}$$
$$= 40{,}480[liter/y] * 35.53\ [MJ/liter] * 73 * 10^{-6}\ [tCO_2/MJ]$$
$$= 105\ [tCO_2e/y]$$

where:

- $TF^{RMT}{}_y$ = Transportation fuel consumption for raw material transportation
  = 44,000[t] / 200[t] * 100[km] * 2 * 0.92[l/km]
  = 40,480[liter/y]
  - · Total annual amount of raw material transported to the plant ：44,000 tonne
  - · Ship's burden ：200 tonne
  - · Average distance of conveyance (one way) ：100 km
  - · Barge mileage ：0.92 l/km
- CV^{TF} =Calorific value of transportation fuel
  $= 43.33*10^{-3}$[TJ/ton] * $0.82*10^{-3}$ [ton/liter]
  $= 35.53*10^{-6}$ [TJ/liter]
  = 35.53 [MJ/liter]
  - · Thermal content of diesel oil ：43.33TJ/10^3t （1996 IPCC Guidelines）
  - · Density of diesel oil ：0.82ton/KL（Chronological Scientific Tables 2006）
- $COEF^{RMT}$ = CO_2 Emission Factor for road/non-road mobile sources used for raw material transportation
  $= 73* 10^{-6}$ [tCO_2/MJ]
  - · CO_2 Emission Factor for diesel engines ：73 g/MJ （1996 IPCC Guidelines）

Emissions from bio fuel production

$$PE^{BFP}{}_y = CP_y * COEF^{CP}$$
$$= 1{,}000\ [kWh] * 0$$
$$= 0$$

where:

- CP_y = Captive rice husk power generation per year [kWh]
  = 1,000 [kWh]
- $COEF^{CP}$ = Rice husk power generation emission factor [tCO_2/kWh]
  = 0 [tCO_2/kWh]

Total project emissions are calculated as;

$$PE_y = PE^{RMT}_y + PE^{BFP}_y$$
$$= 105 + 0$$
$$= 105 \ [tCO_2e/y]$$

E.2. Estimated leakage:

>>

Leakage <L_y> in a certain year <y> is given by the following formula.

$$L_y = \sum_i LE^{N2O}_{i,y} + \sum_i LE^{CO2}_{i,y}$$
$$= 0$$

where:

- $LE^{N2O}_{i,y}$ = Leakage N_2O emissions penalty from fertilizer use in planted area of the agricultural crop type *i* [tCO_2e/y]
- $LE^{CO2}_{i,y}$ = Leakage CO_2 emissions penalty from fossil fuel use in planted area of the agricultural crop type *i* [tCO_2e/y]

The boundary for the project does not include rice cultivation in order to procure the raw material of bio-ethanol, thus there is a possibility of the diversion of broken rice from other uses to the project activity. In that case, other agricultural crops may replace broken rice.

However, as stated in Section B.1.1, total amount of raw material required for the project activity is estimated at 66,000 tonnes per year, and that is equivalent to only 1.74% of total broken rice produced at Mekong Delta region in the year 2004. Hence, this project activity will not affect the cultivation of other agricultural crops. Therefore, leakage is considered as zero.

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

>>

The annual project activity emissions, hereinafter called < PE^{total}_y >, are the sum of PE_y and L_y.

$$PE^{total}_y = PE_y + L_y$$
$$= 105 + 0$$
$$= 105 \ [tCO_2e/y]$$

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

>>

The following formula is used to estimate the baseline emissions <BE_y> in a certain year <y>.

$$BE_y = BF^{therm}_y * COEF$$
$$= (BF^{vol}_y * CV^{BF}) * (CEF * 44/12 * FCO)$$
$$= 33{,}000{,}000[liter/y] * 23.6*10^{-6}[TJ/liter] * 18.9[tC/TJ] * 44/12 * 0.99$$
$$= 53{,}431 \quad [tCO_2e/y]$$

where:

- BE_y = Emissions from gasoline consumption by vehicles [tCO_2e/y]
- BF^{therm}_y = Thermal content of bio fuel consumption in the transport sector [TJ/y]
- COEF = CO_2 Emission Factor of gasoline [tCO_2/TJ]
- BF^{vol}_y = Volume of bio fuel consumption in the transport sector
  = 100[KL/D] * 330[d/y]
  = 33,000 [KL/y]
  - Daily capacity of bio ethanol production : 100KL/D
  - Annual operating days : 330 days
- CV^{BF} =Calorific value of bio-ethanol
  = $1.3765*10^{-6}$[TJ/mol] * 1000/46[mol/kg] * 789[kg/KL]
  = $23.6*10^{-3}$ [TJ/KL]
  - Thermal content of ethanol：1,376.5KJ/mol (Chronological Scientific Tables 2006)
  - Mass density of ethanol ：0.789ton/KL (Chronological Scientific Tables 2006)
- CEF = Carbon Emission Factor of gasoline
  = 18.9 [tC/TJ] （1996 IPCC Guidelines）
- FCO = Faction of Carbon Oxidized
  = 0.99 (1996 IPCC Guidelines)

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

>>

Emission reductions <ER_y> are calculated as:

$$ER_y = BE_y - (PE_y + L_y)$$
$$= BE_y - PE^{total}_y$$
$$= 53{,}431 - 105$$
$$= 53{,}326 \ [tCO_2e/y]$$

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

>>

Years	Estimation of project emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
Year 1	53,431	0	105	53,326
Year 2	53,431	0	105	53,326
Year 3	53,431	0	105	53,326
Year 4	53,431	0	105	53,326
Year 5	53,431	0	105	53,326
Year 6	53,431	0	105	53,326
Year 7	53,431	0	105	53,326
Total estimated reductions	374,017	0	735	373,282

SECTION F. Environmental impacts

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

>>

In Vietnam, prior to the implementation of a new development or investment project, the entity implementing such project is basically obligated to perform an environmental impact assessment procedure. However the project plant will be built in an industrial zone and it is not needed to perform an EIA procedure, because EIA will be done when the industrial zone is developed.

The project plant will be designed following all the environmental regulations and standards in Vietnam.

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 considered.

SECTION G. Stakeholders' comments

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

>>

Comments were received through the meetings with stakeholders. The following stakeholders were identified for the project activity.

- Ministry of Natural Resource and Environment – DNA of Vietnam
- Department of Industry of Long An province
- Petroleum companies (PetroVietnam and Petrolimex)

G.2. Summary of the comments received:

>>

Comments received from stakeholders have been supportive. The project is welcomed because it is the first bio-ethanol project in Vietnam. Also, the local government of Long An province expects the project to revitalize local communities.

In regard to the local residents, People's Committee of Long An province has explained to local residents about the construction of the industrial zone and local residents welcome the construction of the industrial zone. The People's Committee will assist and support to obtain a suitable policy to minimize affection to local citizen in case any negative impact for instance resettlement occurs.

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

>>

No negative comments have been received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Viet Nam Southern Food Corporation
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	Socialist Republic of Vietnam
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Sojitz Corporation
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	Japan
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is used in the project activity.

Annex 3

BASELINE INFORMATION

Data	Definition	Value	Source of data
BF^{vol}_{y}	Volume of bio fuel consumption in the transport sector	33000 KL/y	Calculated
	Daily capacity of bio ethanol production	100 KL/D	Project participants
	Annual operating days	330 days	Project participants
CV^{BF}	Calorific value of bio-ethanol	$23.6*10^{-3}$ TJ/KL	Calculated
	Thermal content of ethanol	1,376.5KJ/mol	Chronological Scientific Tables 2006
	Mass density of ethanol	0.789ton/KL	Chronological Scientific Tables 2006
CEF	Carbon Emission Factor of gasoline	18.9 tC/TJ	1996 IPCC Guidelines
FCO	Faction of Carbon Oxidized	0.99	1996 IPCC Guidelines

BF^{vol}_{y} = 100[KL/D] * 330[d/y] = 33,000 [KL/y]

CV^{BF} = $1.3765*10^{-6}$[TJ/mol] * 1000/46[mol/kg] * 789[kg/KL] = $23.6*10^{-3}$ [TJ/KL]

Annex 4

MONITORING PLAN

- - - - -

添付資料 2　新ベースライン方法論（NMB）

CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW METHODOLOGY: BASELINE (CDM-NMB)
Version 02 - in effect as of: 15 July 2005

CONTENTS
PROPOSED NEW METHODOLOGY: BASELINE (CDM-NMB)

SECTION A. Methodology title and summary description

Methodology title:

>>
Baseline methodology for the production of rice based bio-ethanol for transportation
Version: 1
Date: 26/12/2005

Summary description:

>>
The baseline methodology mainly consists of following five steps.

(1) Applicability conditions
(2) Project boundary
(3) Baseline scenario
(4) Additionality
(5) Calculation of emissions

Applicability conditions
The first step is to check the applicability conditions for the baseline methodology. Those conditions are specified to exclude the possibility to displace other GHG emission reduction activities.

Project boundary
In this section the project boundary is determined. Only activities under the control of the project participants shall be encompassed in the boundary. This methodology specifies to exclude rice cultivation from the project boundary because the raw material for the project activity is a by-product and rice cultivation is not under the control of the project participants. Since the emissions related to rice cultivation and all the process of rice milling are excluded from the project boundary, Life-Cycle-Assessment (LCA) is not applied to the proposed methodology for the GHG emission calculation.

Baseline scenario
To determine the basely scenario, step-wise procedures are used in the section. All reasonable baseline scenarios are listed up, and then they are examined one by one. They are to be winnowed down to the most likely one and the outcome is identified as the baseline scenario.

Additionality
"Tool for the demonstration and assessment of additionality" provided by EB is applied to demonstrate that the GHG emission reduction would not have occurred in the absence of the proposed project activity.

Calculation of emissions
Mathematical formulas to calculated GHG emission reductions are given in this section. Since the methodology does not use LCA, the total project emissions and total baseline emissions are the sum of emissions of each activity within the boundary.

If this methodology is a based on a previous submission, please state the previous reference number (NMXXXX/AMXXXX) here:

>>

SECTION B. Applicability/ project activity

Methodology procedure:

>>

The methodology applies to the following category: Transport

The methodology is applicable to project activities that produce bio-ethanol for use in transportation. The following conditions apply to the proposed methodology.

1. The project produces bio-ethanol from broken rice.
2. The anhydrous bio-ethanol produced by the project activity will be used as transportation fuel as a substitute for gasoline.
3. The anhydrous bio-ethanol will be blended with gasoline at a maximum level of 20%.
4. There are not effective policies or regulations in the host country on the use of bio-ethanol in the transport sector that have been implemented before the adoption of the CDM M&P.

Explanation/justification:

>>

The first applicability condition relates to the raw material of bio-ethanol. The proposed methodology can be applied to a project that produces bio-ethanol from broken rice, which is a by-product of rice milling. Utilization of broken rice is not a major use of paddy but a use of a by-product, therefore rice cultivation and rice milling are not reasonably attributable to the project activity and emissions from those activities are not to be included in the project emissions.

This applicability condition is the most important because Life-Cycle-Assessment (LCA) is not applied to the methodology on the basis of this prerequisite.

The second applicability condition relates to consumption of bio-ethanol produced by the project activity. In order to ensure the accurate verification, the use of bio-ethanol produced should be limited to transport fuel.

The third applicability condition relates to bio-ethanol blend ratio. In this methodology, the maximum level of bio-ethanol blend ratio is set at 20 percent, because gasoline blends that contain up to 20 percent ethanol require no engine modification. In order to avoid additional GHG emissions from engine modification, the bio-ethanol blend ratio is set below this level.

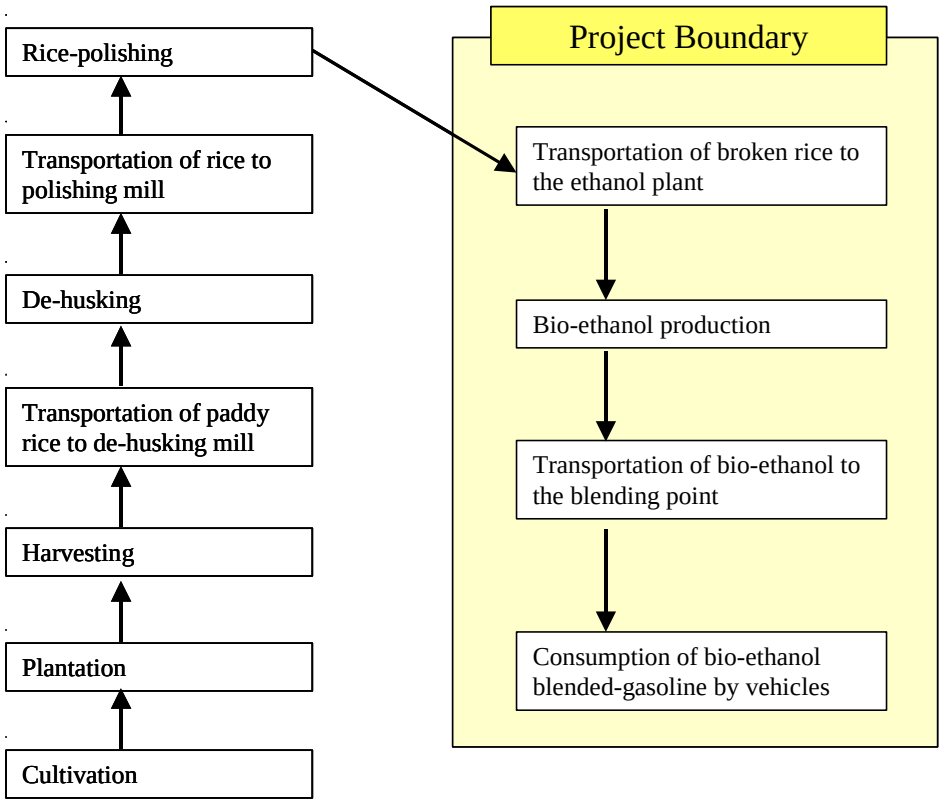
The fourth applicability condition relates to a mandate. According to the EB16 Report Annex 3, national and/or sectoral policies or regulations that give positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs) are categorized as “Type E-”. And “Type E-” policies or regulations that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) may not be taken into account in developing a baseline scenario. If “Type E-” policies or regulations were implemented before the adoption of the CDM M&P in the host country, the baseline scenario will be a hypothetical situation with the national and/or sectoral policies or regulations that give positive comparative advantages to less emissions-intensive technologies and this methodology is not applicable.

SECTION C. Project Boundary

Methodology procedure:

>>

The project boundary for the project activity is shown in the following figure.



Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Mining and transportation of crude oil	CO_2	No	Outside of the boundary
		CH_4	No	Outside of the boundary
		N_2O	No	Outside of the boundary
	Refining of crude oil	CO_2	No	Outside of the boundary
		CH_4	No	Outside of the boundary
		N_2O	No	Outside of the boundary
	Transportation of gasoline	CO_2	Yes	
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Consumption of gasoline	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
Project Activity	Rice	CO_2	No	Outside of the boundary

	cultivation	CH_4	No	Outside of the boundary
		N_2O	No	Outside of the boundary
	Transportation and milling of paddy rice	CO_2	No	Outside of the boundary
		CH_4	No	Outside of the boundary
		N_2O	No	Outside of the boundary
	Transportation of broken rice	CO_2	Yes	
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Bio-ethanol production	CO_2	Yes	
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Transportation of bio-ethanol	CO_2	Yes	
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Consumption of bio-ethanol	CO_2	No	Excluded for simplification
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

Explanation/justification:

>>

The project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases under the control of the project participants. As determined in Section B, bio-ethanol is made from broken rice, which is a by-product of rice milling. Under such conditions, rice is cultivated for food not as energy crop, thus rice cultivation is not under the control of the project participants, and the emissions related to rice cultivation and all the process of rice milling are excluded from the project boundary.

D. Baseline Scenario

Methodology procedure:

>>

Project proponents must examine the following potential baseline scenarios.

1) Substituting gasoline with bio-ethanol, not produced by a CDM project activity
2) Other alternative fuels are used as a substitute for gasoline
3) The continuation of a current activity – the use of gasoline

Those scenarios are to be evaluated according to instructions below.

Step 1. Analyze the use of bio-ethanol blended gasoline as a baseline fuel.

If any policies or regulations that oblige transportation fuel users to use bio-ethanol have been introduced in host country before the adoption of the CDM M&P, bio-ethanol is regarded as a baseline fuel.

Moreover, investment analysis of the "Tool for the demonstration and assessment of additionality" is applicable. If the bio-ethanol production project is economically or financially attractive even without the revenue from the sale of CERs and the price of gasohol blended with the bio-ethanol produced by the project activity is lower than the price of gasoline, bio-ethanol can be the a baseline fuel.

If Step 1 is satisfied, the project scenario is identified as the baseline scenario and this methodology is not applied. Otherwise, project proponents proceed to Step 2.

Step 2. Analyze the use of other alternative fuels as a baseline fuel.
In case it is demonstrated that the use of bio-ethanol is not a baseline scenario, the project proponents proceed to the next step. The second step is to demonstrate whether gasoline is more likely substituted with other alternative fuels (such as CNG, LPG or LNG) than substituted with bio-ethanol. This is also demonstrated by policies or regulations, Investment analysis or Barrier analysis.

If Step 2 is satisfied, the use of other alternative fuels as a substitute for gasoline is identified as the baseline scenario and this methodology is not applied. Otherwise, the baseline fuel is gasoline and the baseline scenario is the continuation of gasoline use and this methodology can apply to the proposed project activity.

Explanation/justification:

>>
In order to determine the baseline scenario, project proponents must consider the current situation and future prospect regarding transportation fuel consumption. All reasonable baseline scenarios are to be listed, then, the potential baseline scenarios are evaluated one by one and they are to be winnowed down to the most likely one. The outcome is identified as the baseline scenario.

SECTION E. Additionality

Methodology procedure:

>>
"Tool for the demonstration and assessment of additionality" provided by EB (EB 16 Report, Annex 1) is incorporated in this methodology to demonstrate and assess whether the project activity is additional. This is a step-wise approach and it includes;

Step 0. Preliminary screening based on the starting date of the project activity
Step 1. Identification of alternatives to the project activity consistent with current laws and regulations
Step 2. Investment analysis
Step 3. Barrier analysis
Step 4. Common practice analysis
Step 5. Impact of CDM registration

Here the project activity is an anhydrous bio-ethanol production, however the project boundary includes bio-ethanol consumption blended in gasoline for transportation fuel. Therefore analysis of bio-ethanol consumption as well as analysis of its production should be taken into account.

Explanation/justification:

>>
Fundamentally, a CDM project activity is additional where a project scenario is different from the baseline scenario and it has been demonstrated in Section D. However, this methodology recommends

applying “Tool for the demonstration and assessment of additionality” agreed by EB, which can be used to assess the additionality of a wide range of project types.

SECTION F. Baseline emissions

Methodology procedure:

>>

Baseline emissions include anthropogenic emissions by GHG sources of following activities.

- Gasoline consumption by vehicles in the transport sector
- Gasoline transportation to filling stations

However, GHG emissions from gasoline transportation depend on the distance to retail points and the fossil fuel type. Besides, GHG from bio-ethanol transportation is emitted in the project scenario as well. Thus, this calculation is not necessary since the difference of GHG emissions between them is negligible small.

Therefore, the following formula is used to estimate the baseline emissions <BE_y> in a certain year <*y*>.

$$BE_y = BF^{therm}_y * COEF$$
$$= (BF^{vol}_y * CV^{BF}) * (CEF * 44/12 * FCO) \quad (1)$$

where:

- BE_y = Emissions from gasoline consumption by vehicles [tCO_2e/y]
- BF^{therm}_y = Thermal content of bio fuel consumption in the transport sector [TJ/y]
- COEF = CO_2 Emission Factor of gasoline [tCO_2/TJ]
- BF^{vol}_y = Volume of bio fuel consumption in the transport sector [KLy]
- CV^{BF} =Calorific value of bio-ethanol [TJ/KL]
- CEF = Carbon Emission Factor of gasoline [tC/TJ]
- FCO = Faction of Carbon Oxidized

Explanation/justification:

>>

On the project scenario, the raw material of ethanol is limited to broken rice, which is rice-processing by-product and cultivation of paddy is independent from the project activity. Hence, Life-Cycle-Assessment (LCA) is not applied to this methodology.

The total amount of GHG emissions from each activity within the boundary is the baseline emissions. Emission sources included in the boundary is listed up in Section C. Here, the sum of emissions from gasoline consumption by vehicles and emissions from gasoline transportation is the baseline emissions.

To calculate baseline emissions, one of the most important factors is gasoline consumption. Since the baseline scenario is hypothetic and cannot be observed, it is required to estimate gasoline consumption from bio-ethanol consumption. Gasoline is substitute by ethanol with the same thermal content, not with the same quantity or the same weight, thus the thermal content, which is calculated on bio-ethanol consumption as a substitute for gasoline is directly used as the thermal content of gasoline.

SETION G. Project activity emissions

Methodology procedure:

>>

Project activity emissions include anthropogenic emissions by GHG sources of following activities.

- Raw material transportation to the bio-ethanol plant
- Bio fuel production
- Bio-ethanol transportation to filling stations

As stated in Section F, it is possible to offset GHG emissions from gasoline transportation with GHG emissions from bio fuel transportation. Therefore, project proponents may omit those transportation GHG emissions from the calculation.

Therefore, the following formula is used to estimate the project activity emissions $<PE_y>$ in a certain year $<y>$.

$$PE_y = PE^{RMT}_y + PE^{BFP}_y \quad (2)$$

where:

- PE^{RMT}_y = Emissions from raw material transportation to the bio-ethanol plant [tCO_2e/y]
- PE^{BFP}_y = Emissions from bio fuel production [tCO_2e/y]

Emissions from raw material transportation to the bio-ethanol plant

$$PE^{RMT}_y = TF^{RMT}_y * CV^{TF} * COEF^{RMT} \quad (3)$$

where:

- TF^{RMT}_y = Transportation fuel consumption for raw material transportation [liter/y]
- CV^{TF} =Calorific value of transportation fuel [MJ/liter]
- $COEF^{RMT}$ = CO_2 Emission Factor for road/non-road mobile sources used for raw material transportation [tCO_2/MJ]

Emissions from bio fuel production

$$PE^{BFP}_y = \sum FF_{i,y} * COEF^{FF}_i + GE_y * COEF^{GE} + CP_{i,y} * COEF^{CP}_i \quad (4)$$

where:

- $FF_{i,y}$ = Annual quantity of the fossil fuel type *i* combusted to provide non-electrical energy to the bio-ethanol production [tonne/y]
- $COEF^{FF}_i$ = CO_2 Emission Factor for the fossil fuel type *i* [tCO_2/tonne]
- GE_y = Grid electricity imported per year [kWh]
- $COEF^{GE}$ = Combined margin grid emission factor [tCO_2/kWh]
- $CP_{i,y}$ = Captive power generated from fuel type *i* per year [kWh]
- $COEF^{CP}_i$ = Captive power generation emission factor of fuel type *i* [tCO_2/kWh]

Explanation/justification:

>>

Project activity emissions mean estimated anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary. In this methodology, the project boundary as well as the project activity included was determined in Section C, and emission sources within the boundary is Ttransportation of broken rice, Bio-ethanol production, Transportation of bio-ethanol and Consumption of bio-ethanol.

For transportation of broken rice and bio fuel produced, emissions are from mobile combustion and are calculated based on the transportation distance and CO_2 Emission Factor. In order to determine CO_2 Emission Factor, the type of transportation fuel and the type of vehicle need to be monitored. Each transportation fuel has different carbon content, and in addition, emission factor varies with types of vehicles.

For bio-ethanol production, emissions are the sum of emissions from each kind of energy consumption, electricity consumption and non-electrical energy consumption in this methodology. It seems quite likely that a captive biomass-power generating unit is set up as an annex to the bio-ethanol plant. Emissions from electricity consumption need to be calculated separately divided into grid electricity and captive power generation.

For consumption of bio-ethanol by vehicles are deemed as zero because bio-ethanol is biomass derived fuel and CO_2 emissions from this kind of energy consumption are defined as “Carbon neutral” under IPCC guidelines.

SECTION H. Leakage

Methodology procedure:

>>

The main potential source of leakage for the type of project activity covered by the methodology is a change of anthropogenic emissions due to the diversion of broken rice from other uses to the project plant as a result of the project activity. The diversion of broken rice can be replaced with other agricultural crops. If the CDM project activity causes some increase of planted area of other crops, a change of anthropogenic emissions accompanied by it/those cultivation is to be considered.

Leakage $<L_y>$ in a certain year $<y>$ is given by the following formula.

$$L_y = \sum_i LE^{N2O}_{i,y} + \sum_i LE^{CO2}_{i,y} \qquad (5)$$

where:

- $LE^{N2O}_{i,y}$ = Leakage N_2O emissions penalty from fertilizer use in planted area of the agricultural crop type i [tCO_2e/y]
- $LE^{CO2}_{i,y}$ = Leakage CO_2 emissions penalty from fossil fuel use in planted area of the agricultural crop type i [tCO_2e/y]

Explanation/justification:

>>
The project activity covered by the methodology does not include rice cultivation in order to procure the raw material of bio-ethanol. Therefore, there is a possibility of the diversion of broken rice from other uses to the project plant.

Broken rice is not used as biomass energy directly for heat and/or electricity generation or other energy purposes, but it is used for non-energy purposes or indirectly energy purposes as a raw material of biomass energy. In every case, it is not replaced by fossil fuels but by other agricultural crops. Therefore the diversion of broke rice should be monitored, and when any leakage is found, leakage penalty according with alternative crop cultivation should be calculated.

For agricultural crop cultivation, 2 GHG emission sources are primarily expected. One is "Direct emissions of N_2O from fertilizer use in cultivation" and the other is "Emissions from fossil fuel combustion in the process of cultivation (i.e. farm vehicle)". Sum of emissions from each source is considered as leakage.

SECTION I. Emission reductions

Methodology procedure:

>>
Emission reductions $<ER_y>$ are calculated as:

$$ER_y = BE_y - (PE_y + L_y) \quad (6)$$

The notations are defined in Section F, G and H.

Explanation/justification:

>>

SECTION J. Changes required for methodology implementation in 2nd and 3rd crediting periods (if relevant / optional)

Methodology procedure:

>>
No change is required for methodology implementation in 2nd and 3rd crediting periods.

Explanation/justification:

>>

SECTION K. Selected baseline approach from paragraph 48 of the CDM modalities and procedures

Choose One (delete others):

☒ Existing actual or historical emissions, as applicable;
☐ Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
☐ The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.

Explanation/justification of choice:

>>
In Section D of this proposed methodology, the baseline scenario was determined as the continuation of a current activity, therefore the first approach is appropriate.

SECTION I. Other Information

Explanation/justification:

>>
Potential strengths of the methodology:
This proposed methodology is a very simple method to calculate GHG emissions. It is stated in Section B that the raw material of bio-ethanol is limited to broken rice and this applicability condition enable project proponents to omit rice cultivation from the project boundary. GHG emission calculation using LCA requires a lot of complicated formalities. This methodology can lighten the burden on project proponents.

Potential weakness of the methodology:
In order to keep the validity of the methodology, adaptation of this methodology is confined to projects that use only broken rice for raw material of bio-ethanol.

-.-.-.-

添付資料 3　新モニタリング方法論（NMM）

CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW METHODOLOGY: MONITORING (CDM-NMM)
Version 01 - in effect as of: 1 July 2004

CONTENTS

SECTION A. Identification of methodology

A.1. Title of the proposed methodology:

>>

Monitoring methodology for the production of rice based bio-ethanol for transportation
Version: 1
Date: 26/12/2005

A.2. List of category(ies) of project activity to which the methodology may apply:

>>

Transport

A.3. Conditions under which the methodology is applicable to CDM project activities:

>>

The proposed monitoring methodology is to be used in conjunction with the proposed baseline methodology; Baseline methodology for the production of rice based bio-ethanol for transportation. The project activity covered by the proposed monitoring methodology needs to satisfy the following applicability conditions.

1. The project produces bio-ethanol from broken rice.
2. The anhydrous bio-ethanol produced by the project activity will be used as transportation fuel as a substitute for gasoline.
3. The anhydrous bio-ethanol will be blended with gasoline at a maximum level of 20%.
4. There are not effective policies or regulations in the host country on the use of bio-ethanol in the transport sector that have been implemented before the adoption of the CDM M&P.

A.4. What are the potential strengths and weaknesses of this proposed new methodology?

>>

Its applicability is directly related to the baseline methodology and it shares the strength and weakness of the baseline methodology. The sphere of monitoring is practically measurable but this methodology has a very limited applicability on a type of raw material of bio-ethanol.

SECTION B. Proposed new monitoring methodology

B.1. Brief description of the new methodology:

>>

To calculate GHG emissions from the project activity covered by the monitoring methodology, parameters required calculating GHG emissions from energy consumption in the process of bio-ethanol production and fossil fuel combustion during raw material transportation and bio-ethanol transportation are monitored. If the project proponents install a captive biomass-power generating unit in the project site and use both captive electricity and grid electricity for bio-ethanol production, the consumption of each kind of electricity must be monitored individually because of the different emission factors.

According to the baseline methodology proposed with this monitoring methodology, the baseline scenario of the project covered by the methodology is the continuation of gasoline use. Thus, the key emission source of baseline emissions is gasoline combustion by vehicles in the transport sector in the host country. The baseline scenario is hypothetic in this case and it is impossible to monitor baseline emissions directly, therefore the amount of gasoline substituted with bio-ethanol needs to be estimated by the amount of bio-ethanol used as a substitute and heat conversion coefficient of ethanol (local or IPCC data). In addition, GHG emissions from bio-ethanol transportation need to be included to calculate baseline emissions and parameters for the calculation must be monitored.

The main potential leakage of the project activity is a change of anthropogenic emissions due to the diversion of broken rice from other uses to the project plant. Project proponents must monitor whether the diversion of broken rice is replaced with other agricultural crops.

The monitoring methodology proposes to monitor parameters to estimate GHG emission reductions for the project activity and the baseline. Following processes must be included.

Project Emissions

- ✓ Raw material transportation to the bio-ethanol plant
- ✓ Bio-ethanol production
- ✓ Bio-ethanol transportation

Baseline Emissions

- ✓ Gasoline consumption by vehicles
- ✓ Gasoline transportation

Leakage

- ✓ Cultivation of agricultural crop that replace broken rice

B.2. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario:

>>

B.2.1. Data to be collected or used 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 B.7)*	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
1 TF^{RMT}	Transportation fuel consumption for raw material transportation	*Transportation service company*	liter/y	*m*	*Monthly*	*100%*	*Electronic*	*Checked against the purchase receipt*
2 CV^{TF}	Calorific value of transportation fuel	*Bio-ethanol plant data, national or IPCC data*	MJ/liter	*m, c*	*Annually*	*100%*	*Electronic*	
3 $COEF^{RMT}$	CO_2 Emission Factor for road/non-road mobile sources used for raw material transportation	*National or IPCC data*	tCO_2/MJ	*c*	*Annually*	*100%*	*Electronic*	
4 $FF_{i,y}$	Annual quantity of the fossil fuel type *i* combusted at the bio-ethanol plant	*Bio-ethanol plant*	tonne/y	*m*	*Monthly*	*100%*	*Electronic*	*Checked against the purchase receipt*
5 $COEF^{FF}{}_{i}$	CO_2 Emission Factor for the fossil fuel type *i*	*National or IPCC data*	tCO_2/tonne	*c*	*Annually*	*100%*	*Electronic*	

6 GE_y	Grid electricity imported per year	*Power company*	kWh	*m*	*Monthly*	*100%*	*Electronic*	*Checked against the power purchase receipt*
7 $COEF^{GE}$	Combined margin grid emission factor	*Power company*	tCO_2/kWh	*c*	*Annually*	*100%*	*Electronic*	
8 $CP_{i,y}$	Captive power generated from fuel type *i* per year	*Bio-ethanol plant*	kWh	*m*	*Continuously*	*100%*	*Electronic*	*Measured with an ammeter*
9 $COEF^{CP}_i$	Captive power generation emission factor of fuel type *i*	*National or IPCC data*	tCO_2/kWh	*c*	*Annually*	*100%*	*Electronic*	*Calculated statistical data according to a type of a captive biomass-power generating unit*

B.2.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

The following formula is used to estimate the project activity emissions <PE_y> in a certain year <*y*>.

$$PE_y = PE^{RMT}_y + PE^{BFP}_y$$

where:

- PE^{RMT}_y = Emissions from raw material transportation to the bio-ethanol plant [tCO_2e/y]
- PE^{BFP}_y = Emissions from bio fuel production [tCO_2e/y]

Emissions from raw material transportation to the bio-ethanol plant

$$PE^{RMT}_y = TF^{RMT}_y * CV^{TF} * COEF^{RMT}$$

where:

- TF^{RMT}_y = Transportation fuel consumption for raw material transportation [liter/y]

- CV^{TF} =Calorific value of transportation fuel [MJ/liter]
- $COEF^{RMT}$ = CO_2 Emission Factor for road/non-road mobile sources used for raw material transportation [tCO_2/MJ]

Emissions from bio fuel production

$$PE^{BFP}_y = \sum FF_{i,y} * COEF^{FF}_i + GE_y * COEF^{GE} + CP_{i,y} * COEF^{CP}_i$$

where:

- $FF_{i,y}$ = Annual quantity of the fossil fuel type *i* combusted to provide non-electrical energy to the bio-ethanol production [tonne/y]
- $COEF^{FF}_i$ = CO_2 Emission Factor for the fossil fuel type *i* [tCO_2/tonne]
- GE_y = Grid electricity imported per year [kWh]
- $COEF^{GE}$ = Combined margin grid emission factor [tCO_2/kWh]
- $CP_{i,y}$ = Captive power generated from fuel type *i* per year [kWh]
- $COEF^{CP}_i$ = Captive power generation emission factor of fuel type *i* [tCO_2/kWh]

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:

ID number *(Please use numbers to ease cross-referencing to table B.7)*	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
10 BF^{vol}_y	Volume of bio fuel consumption in the transport sector	*Petroleum company*	KL/y	*m*	*Monthly*	*100%*	*Electronic*	*Checked against the purchase receipt from the project plant*
11 CV^{BF}	Calorific value of bio-ethanol	*Bio-ethanol plant data, national or IPCC data*	TJ/KL	*m, c*	*Annually*	*100%*	*Electronic*	

12 CEF	Carbon Emission Factor of gasoline	*National or IPCC data*	tC/TJ	*c*	*Annually*	*100%*	*Electronic*	
13 FCO	Faction of Carbon Oxidized	*IPCC data*	-	*c*	*Annually*	*100%*	*Electronic*	

B.2.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

The following formula is used to estimate the baseline emissions <BE_y> in a certain year <*y*>.

$$BE_y = BF^{therm}_{\ y} * COEF$$
$$= (BF^{vol}_{\ y} * CV^{BF}) * (CEF * 44/12 * FCO)$$

where:

- BE_y = Emissions from gasoline consumption by vehicles [tCO_2e/y]
- $BF^{therm}_{\ y}$ = Thermal content of bio fuel consumption in the transport sector [TJ/y]
- COEF = CO_2 Emission Factor of gasoline [tCO_2/TJ]
- $BF^{vol}_{\ y}$ = Volume of bio fuel consumption in the transport sector [KL/y]
- CV^{BF} =Calorific value of bio-ethanol [TJ/KL]
- CEF = Carbon Emission Factor of gasoline [tC/TJ]
- FCO = Faction of Carbon Oxidized

B.3. Option 2: Direct monitoring of emission reductions from the project activity:

>>

B.3.1. Data to be collected or used 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 B.7)*	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

B.3.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

B.4. Treatment of leakage in the monitoring plan:

>>

B.4.1. 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 B.7)*	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
14 $LE^{N2O}_{i,y}$	Leakage N_2O emissions penalty from fertilizer use in planted area of the agricultural crop type *i*	*Statistics and national or IPCC data*	tCO_2e/y	*c*	*Annually*	*100%*	*Electronic*	*Calculated by using the statistical data of agricultural production. National or IPCC data is applied to GHG calculation.*
15 $LE^{CO2}_{i,y}$	Leakage CO_2 emissions penalty from fossil fuel use in planted area of	*Statistics and national or IPCC data*	tCO_2e/y	*c*	*Annually*	*100%*	*Electronic*	*Calculated by using the statistical data of agricultural production. National or IPCC data is applied to GHG calculation.*

	the agricultural crop type *i*							

B.4.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

Leakage $<L_y>$ in a certain year $<y>$ is given by the following formula.

$$L_y = \sum_i LE^{N2O}_{i,y} + \sum_i LE^{CO2}_{i,y}$$

where:

- $LE^{N2O}_{i,y}$ = Leakage N_2O emissions penalty from fertilizer use in planted area of the agricultural crop type *i* [tCO_2e/y]
- $LE^{CO2}_{i,y}$ = Leakage CO_2 emissions penalty from fossil fuel use in planted area of the agricultural crop type *i* [tCO_2e/y]

B.5. 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 $<ER_y>$ are calculated as:

$$ER_y = BE_y - (PE_y + L_y)$$

B.6. Assumptions used in elaborating the new methodology:

>>

No specific assumption

B.7. Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items 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.
2,3,5,7,9,11,12,13	*low*	*Based on reliable national or IPCC data*
8	*low*	*Measurable at the plant. The data must be measured following the procedure given by ISO9001 in order to improve the accuracy.*
1,4,6,10	*low*	*Check against the sales/purchase receipts*
14,15	*middle*	*Out of project participants' control*

B.8. Has the methodology been applied successfully elsewhere and, if so, in which circumstances?

>>

No

- - - - -