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

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SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Khon Kaen fuel ethanol project

A.2. Description of the project activity:

>>
The project is located in North Eastern Thailand and involves the production of anhydrous ethanol from sugar cane molasses. The bio-ethanol will be blended with gasoline and used in transportation. The proportion of bio-ethanol in the final blend is expected to be 10% by volume. The bio-ethanol will act as an oxygenate and extender.

The project has a capacity of 85,000 litres of anhydrous ethanol per day and is currently at the planning stage with turnkey contractors identified and financing being sought. The plant is expected to be commissioned in July 2005.

The project will contribute significantly to sustainable development not only through the production of a renewable fuel but also via a number of other mechanisms. It will reduce Thailand's dependence on imports of crude oil and thus have a positive effect on the trade balance and exchange rate. (In 2003 Thailand imported 45,025 million litres of crude oil.) There will also be a potential budgetary benefit to the Thai economy as it will reduce the potential liability inherent in the Oil Price Stabilisation Fund, which seeks to maintain a fixed price for petrol products in Thailand.

The plant will contribute to the development of the area in which it is located. The plant is located in Khon Kaen province in the North East of Thailand, an area that has not seen the same growth rates as central Thailand and the metropolitan areas. The location of the plant will therefore provide valuable direct employment to those in rural areas and provide a further indirect stimulus to economic activity in the area. It is expected that 60 new jobs will be created through the production of bio-ethanol. The bio-ethanol plant will also diversify the revenue stream of the sugar industry and indirectly will support farmers who grow sugar cane.

A.3. Project participants:

>>
Host party: Thailand. Ministry of Natural Resources and Environment
Annex 1 Party: Denmark. Royal Danish Ministry of Foreign Affairs
Project host company: Khon Kaen Alcohol Company Limited. Thai entity and expected to be authorised by the Thai DNA.
Project developer: Agrinergy Ltd (contact for CDM project activity). UK entity and expected to be authorised by the UK DNA.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>
Thailand

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

>>
Khon Kaen Province, 40140

A.4.1.3. City/Town/Community etc:

>>
Nampong

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

>>
43 Moo 10, Nampong-Kranuan Road
The plant is located at grid reference, 16°72'79.0"N, 102°84'58.8"E

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

>>
Transport

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

>>
There are two stages to the production of bio-ethanol, the fermentation of sugars to ethanol and then the further dehydration of ethanol to a quality suitable as a fuel substitute. The technology involved in the first stage of the process is readily available and well known. However the dehydration technology is more specialised involving the use of molecular sieves. In the case of the project activity the dehydration technology utilised will be EcoMol Molecular Sieve Technology, which will be installed under licence from Delta T Corporation, USA Praj.

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 reduction in anthropogenic emissions of GHGs will occur through the substitution of gasoline and MTBE with bio-ethanol, a renewable fuel. The total emission reductions arising from the project activity are estimated at 53,000 tonnes of CO_2e per annum.

There has been a drive in Thailand to employ more domestic natural resources and reduce dependence on imported oil. To this end, the government has embarked on a programme to foster the development of an anhydrous ethanol sector. There is currently a tax break for the blender of gasohol whereby the excise tax payable on the ethanol component of the marketed fuel is forgone and there is also an exemption of excise tax on all ex-refinery anhydrous ethanol. Ethanol blended with gasoline neither contributes to the Oil Fund nor the Energy Conservation Fund. It is estimated that the demand for ethanol in a 10%

gasohol blend will be over two million litres per day. To satisfy this demand the Thai government introduced a round of bids for licences in 2002 and again in 2004. In 2002 seven licences for the manufacture and production of anhydrous ethanol were given, the project under consideration receiving one of these licences. However actual commissioning of investments has been extremely slow due to the barriers facing investment in ethanol production facilities. To date only two of the licence holders have commissioned plants – one is a relatively small plant (operating at 25,000 litres per day), whilst the second investment was made by the largest hydrous ethanol producer in Thailand (and is therefore likely to be of a different scale and nature involving only the investment in dehydration).

In the absence of the project activity, the volume of ethanol would not be produced and therefore gasoline and MTBE would be combusted. That the project is not the baseline is demonstrated by the number of barriers facing the project activity - in the absence of the CDM the project would not be undertaken.

The production and use of bio-ethanol in transportation will result in a reduction in GHG emissions, with the volume of emission reductions calculated on a lifecycle basis.

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

>>
Over the fixed crediting period of 10 years the project is expected to generate 530,000 tonnes of CO_2e.

A.4.5. Public funding of the project activity:

>>
The project has received no public funding.

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 suitable methodology for the proposed project activity has been approved, and therefore a new methodology is proposed. The proposed title of the new methodology is: **Production of sugar cane based bio-ethanol for transportation use**.

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

>>
The methodology is directly relevant to the project activity – the project activity is an investment in sugar cane based bio-ethanol fuel production facilities. In terms of the specific applicability criteria:

1. The relevant national bio-ethanol fuel market is production constrained, and therefore the factor prohibiting the use of bio-ethanol fuel is lack of supply.

As outlined in section A.4 the Thai government has provided incentives for the blending of bio-ethanol in gasoline, and issued seven ethanol production licences in 2002. However only two of these facilities have been commissioned, accounting for total capacity of 125,000 litres per day, and

the smaller of these plants we believe is not currently operating. In terms of the 75% rule outlined in the methodology, this is nowhere near being reached despite Thailand being the world's third largest sugar cane producing country. The following table shows the most recent data for consumption of fuels in Thailand. The table also shows the potential demand for bio-ethanol given the permitted 10% blending ratio for premium gasoline based on the historic figures outlined in the table (there is also the ability to blend bio-ethanol in regular gasoline but demand originating from this source has not been included).

Table 1: Sales of fuel, million litres

Type of fuel	2001	2002	2003	2004 (until June)
Gasoline	6,857.1	7,326.0	7,635.1	3,964.3
Regular	3,856.0	4,341.4	4,550.3	2,347.5
Premium	3,001.0	2,984.7	3,084.8	1,616.8
Potential bio-ethanol demand	300.1	298.5	308.5	161.7

Source: www.eppo.go.th/info/T31.html

2. There does not exist an effectively enforced mandate on the use of bio-ethanol in transportation in the relevant national market.

The Thai government has provided tax incentives for the blending of bio-ethanol, but no mandate on its use exists in Thailand.

3. It can be readily verified that the bio-ethanol will be used as a transportation fuel within the relevant national market.

The bio-ethanol produced by the facility will be sold to PTT, the largest retailer of gasoline in Thailand. It will be used by PTT for blending with gasoline for final sale as a transport fuel. This can be verified through sale and delivery receipts and also written confirmation from PTT that the bio-ethanol was blended and sold as a transport fuel.

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

>>

Having determined that the methodology is applicable, we must outline the baseline scenario. The project activity consists of the installation of a bio-ethanol fuel production facility and the subsequent production and sale of bio-ethanol for transportation. The methodology uses approach 48b to determine baseline emissions. Under this approach, the economically attractive course of action, taking into account barriers to investment is the "non-project" option - the investment and subsequent production and sale of bio-ethanol for transportation use does not occur. Under this baseline scenario, the existing conventional fuel mix will remain and this is therefore the fuel upon which baseline emissions will be calculated[1].

As outlined in the methodology, both project and baseline fuel emissions are calculated on a lifecycle basis. In terms of baseline emissions, PTT Research and Technology Institute have conducted tests on direct emissions from fuels. Under these tests an average gasoline emission coefficient of 2298.97

[1] Bio-ethanol may be used as an oxygenate as well as an extender, and in this case will displace MTBE. MTBE has higher lifecycle emissions than gasoline, and therefore the use of gasoline as the basis for baseline emissions is conservative.

gCO_2/l is derived[2], for Tank-to Wheel (TTW). Inherent in this calculation of emissions was a fuel efficiency figure that assumed 13.46 km/l, however the figure for fuel efficiency in the methodology is 12.26 km/l, a more conservative figure and therefore no amendment to the baseline methodology figure is required with respect to fuel efficiency. The overall PTT emissions figure is comparable to the TTW emissions data for gasoline of 2269.93 gCO_2e/l outlined in the methodology using the LBST data, highlighting the conservativeness of using the LBST as a data source[3]. The methodology states that if local data are more conservative they should be adopted, but in this case the data in the methodology is the most conservative and we therefore apply a baseline well to wheel (WTW) gasoline lifecycle GHG emission factor of 2689.11 gCO_2e/l (EFB_y) to the project activity.

Turning to project emissions, as outlined in the methodology, we take the net lifecycle GHG emission coefficient of 401.16 gCO_2e/l (EFP_y). We assume that 1 litre of bio-ethanol will replace 1 litre of gasoline, and therefore arrive at a net emissions reduction coefficient of 2287.95 gCO_2e per litre of bio-ethanol produced and sold for use as transportation fuel (NEF_y).

Turning to transport emissions, the contract with PTT has not as yet been finalised. There is some uncertainty as to whether the bio-ethanol would have to be delivered to Saraburi, near Bangkok, for blending or whether it would be possible to blend the bio-ethanol in Khon Kaen. Under the latter case it is unlikely that there will be a requirement to calculate transport emissions but a final decision on whether transport emissions should be incorporated into the calculation of emission reductions for the project activity will be taken at a later date.

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 outlined in the methodology, the determination of additionality follows the draft consolidated tools for demonstrating additionality outlined by the Methodologies Panel at its eleventh meeting.

Step 0. Preliminary screening of projects started after 1 January 2000 and prior to 31 December 2005.

The project activity was submitted to a CDM purchase tender in March 2004 whilst the plant is expected to be commissioned in July 2005. The formal submissions to the CDM purchase tender will be made available to the validator.

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

Sub-step 1a

Define alternatives to the project activity. The alternatives to the project activity can be restricted to:

- The proposed project not undertaken as a CDM project activity
- Continuation of the current situation (no project activity undertaken)

[2] http://www.pttplc.com/servlet/ipscustDesktop?pageid=10&page=product&right=product_fuel_gasohol_06.html
This is calculated from the average emissions of carbon dioxide and average fuel efficiency of the sample taken by PTT.

[3] The figures derived are also more conservative than the TTW IPCC figure for gasoline emissions of 3172.31gCO_2e/kg, which at a specific density of 0.75 kg/l gives an emissions factor of 2379 gCO_2e/l.

Sub-step 1b
Compliance with applicable laws and regulations. The above alternatives are both in compliance with applicable legal and regulatory requirements. Moreover, there is no foreseeable regulatory change that would make the above alternatives non-compliant.

Step 2. Investment Analysis.
Sub-step 2a
As the project activity generates revenues other than those related to the CDM and the proposed project and plausible baseline alternatives do not involve investments of comparable scale, Option III (benchmark analysis) is undertaken.

Sub-step 2b – Option III
The selected benchmark used is the IRR. Both equity and project IRRs are calculated. The benchmark hurdle that the project IRR must overcome is the weighted average cost of capital (WACC). This is a standard benchmark used in investment appraisal and reflects the costs of resources to the company. For a project to be worthwhile, its return must exceed the company's WACC. The WACC is derived from the cost of debt adjusted for tax relief on interest payments, the cost of equity and the shares of debt and equity in the total company market valuation. The benchmark hurdle for the equity IRR is the cost of equity.

Comparing the project IRR to the WACC is a standard capital decision making tool. A large diversified company will tend to decide on a specific ratio of equity to debt and thus the total cost of capital is the relevant hurdle rate. An increase in the amount of debt a company has will increase the return on equity required by investors in the company (due to increased company risk), leaving the WACC the same. Thus it is the firms total cost of capital that is the relevant hurdle, not the immediate source of funds used for an individual investment.

The cost of debt and relative share of debt and equity in the company's valuation are relatively easy to establish. In emerging markets, estimating the cost of equity can be difficult. The standard approach to this is the capital asset pricing model (CAPM), which estimates the premium over the risk free interest rate required by investors. Looking at Thai stock market returns and government bond yields for the period 1999-2003[4], and taking a conservative estimate of 0.7 for beta, gives a cost of equity of 30%. This figure however may be artificially high, reflecting recent stock market volatility. Two independent studies have therefore been used to estimate a cost of equity for Thailand. One study has restricted access, but will be supplied to the validator, whilst the second is publicly available[5] and gives a cost of equity for Thailand of 20.64%. To maintain conservatism, we have taken the lower cost of equity figure of 14.1%. This figure is felt by the management of KSL to be a lower bound reflection of the return expected by equity investors given the risks inherent in investing in Thailand.

Sub-step 2c
Taking a cost of equity of 14.1%, a cost of debt of 5.5% which is the current 18 year government bond yield in Thailand, an equity/debt valuation split of 0.58:0.42 and a corporate income tax rate of 30%, we arrive at a WACC of 9.8%. The project IRR before CDM revenue is 4.6%, well below the WACC, and

[4] Government bond data are available at: http://www.thaibdc.or.th/yieldcurve/YieldTTM.aspx

[5] The Cost of Equity in Emerging Markets: A Downside Risk Approach. JAVIER ESTRADA, IESE business school, Barcelona.

the equity IRR before CDM is 9.6%, demonstrating that the project is not financially attractive and is not part of the baseline scenario. The key assumptions underlying this analysis will be outlined in the final completed PDD.

Sub-step 2d
Sensitivity analysis mainly revolves around the price of the substrate for the production of bio-ethanol (the price of the substrate accounts for 70% of the final price of the product). In terms of sensitivity analysis we have adjusted the price of the substrate and the price of ethanol in the following table to yield a set of project IRRs. Whilst this does show a potential set of outcomes one would expect the price of bio-ethanol and the price of the substrate to tend to move in line maintaining the current level of margin.

Table 1: Price of substrate and impact on project IRR

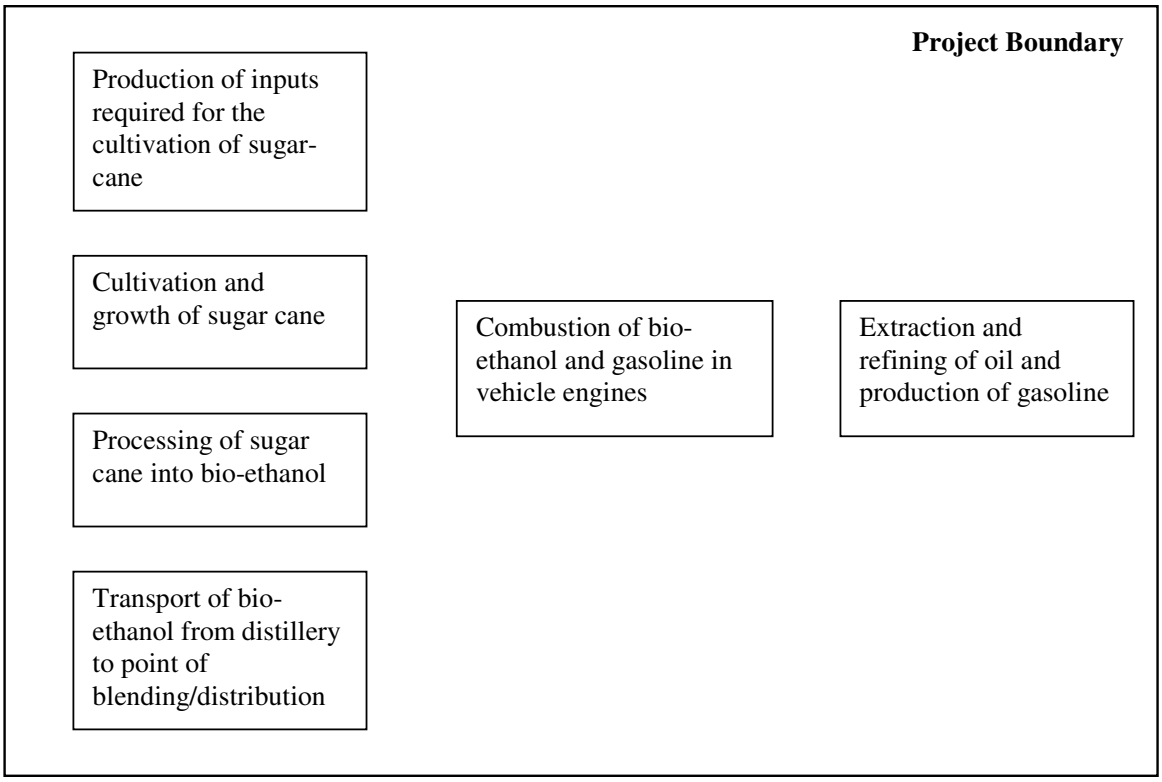
IRR		Price of ethanol, Baht/l				
		11.5	12.0	12.5	13.0	13.5
Price of substrate, Baht/mt	1500	5.31%	8.52%	11.53%	14.39%	17.13%
	1600	2.17%	5.60%	8.80%	11.80%	14.65%
	1700	-1.27%	2.49%	5.91%	9.08%	12.06%
	1800	-5.14%	-0.91%	2.82%	6.21%	9.36%
	1900	-9.70%	-4.73%	-0.56%	3.14%	6.50%

Step 4. Common practice.
As mentioned above, only two bio-ethanol facilities have been commissioned to date in Thailand with a total capacity of 125,000 litres/day. The larger of these facilities, representing 100,000 litres/day, is operated by the largest hydrous ethanol manufacturer in Thailand and therefore the investment has been limited to dehydration technology.

Step 5. Impact of CDM registration.
CDM registration and the resulting revenue from CER sales helps the project to overcome the investment barrier outlined above. The impact of CER revenue improves the project IRR by 5% and increases the equity IRR by 11% (both of which are significant impacts in their own right) and moreover, the inclusion of CDM revenue lifts the project IRR above the WACC. The financial risks outlined in the sensitivity analysis are also significant but through the inclusion of CER revenue there is an important buffer added in case of rises in substrate prices or falls in bio-ethanol prices.

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

>>
The methodology used follows a lifecycle approach, and therefore the project boundary encapsulates all emissions related to the production and combustion of both bio-ethanol and gasoline. The boundary seeks to incorporate emissions from carbon dioxide through the combustion of gasoline and also nitrous oxide and methane in the production and cultivation of sugar cane. Whilst methane emissions may be slightly lower for bio-ethanol in comparison to gasoline when combusted in engines this difference is small and for the sake of conservatism we have not included these in the overall calculation of emission reductions.



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:

>>
August 2004
Ben Atkinson/Robert Taylor, Agrinergy Ltd, as listed in Annex I.

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:

>>
July 2005

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

>>
20 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:

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/07/2005

C.2.2.2. Length:

>>
10 years

SECTION D. Application of a monitoring methodology and plan

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

>>
A new methodology has been proposed for the project activity. The title of the methodology is **Baseline methodology for the production of sugar cane based bio-ethanol for transportation use.**

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

>>
Without an appropriate existing methodology a new methodology has been proposed. The monitoring methodology is directly related to the baseline methodology used for the project activity.

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 EFP_y	*Carbon emission factor*	*Macedo et al study*	*tCO_2e/l*	*Constant*	*Annual*	*100%*	*Electronic*	*This data represents the project emissions constant in the baseline methodology. It will be monitored annually as a check against new studies on project emissions.*

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

>>

Project and baseline emissions are estimated from the same formula as project emissions and baseline emissions both depend on the volume of bio-ethanol produced.

$$CER_y = BFP_y . NEF_y \qquad \text{(E.1.1.)}$$

Where:

CERy = Emission reductions, tCO_2e
BFP_y = Bio-fuel production and sale for use in transportation, l
NEF_y = Net emissions reduction coefficient, tCO_2e/l

Where:

$$NEF_y = EFB_y - EFP_{y\,y} \qquad \text{(E.1.2.)}$$

Where:

NEF_y = Net emissions reduction coefficient, tCO_2e/l

EFB_y = Baseline lifecycle emissions coefficient, tCO_2e/l
EFP_y = Project lifecycle emissions coefficient, tCO_2e/l

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
2 BFP_y	*Volume quantity*	*Factory records Purchaser records*	*l*	*M*	*Annual*	*100%*	*Electronic*	*The verifier must obtain confirmation from the buyer that the fuel has been used in transportation*
3 EFB_y	*Carbon emission factor*	*LBST study*	*tCO_2e/l*	*Constant*	*Annual*	*100%*	*Electronic*	*The data represents the baseline emissions constant in the baseline methodology. It will be monitored annually as a check against new studies on baseline emissions.*

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

>>
See section D.2.1.2

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

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

>>
As highlighted in the baseline methodology the use of a life-cycle approach will not result in leakage.

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.)

>>
As the methodology undertakes a lifecycle analysis of emissions leakage is not a considered in the baseline methodology nor the monitoring methodology.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	*Low*	*This will be checked against new studies as and when they become available.*
2	*Low*	*This data will be taken from records which form the basis of revenue streams for the factory and may therefore be checked against*
3	*Low*	*This will be checked against new studies as and when they become available.*

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

>>
There will be put in place a system to monitor the emission reductions arising from the project on a monthly basis through the collection of data on the sales of bio-ethanol to blenders. This information will be held at the head-office in Bangkok and will form the basis of monthly reporting so that the resultant emission reduction position may be continuously adjusted.

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

>>
Theera Sanguandeekul, KSL Group
Robert Taylor, Agrinergy Ltd

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>
Estimated emission reductions due to the project activity are calculated using the following formula:

$$CER_y = BFP_y . NEF_y - TE_y \quad \text{(E.1.1.)}$$

Where:

CERy = Emission reductions, tCO_2e
BFP_y = Bio-fuel production and sale for use in transportation, l
NEF_y = Net emissions reduction coefficient, tCO_2e/l
TE_y = Additional emissions from the transportation of bio-ethanol to the blend/distribution location, tCO_2e

Where:

$$NEF_y = EFB_y - EFP_{y\,y} \quad \text{(E.1.2.)}$$

Where:

NEF_y = Net emissions reduction coefficient, tCO_2e/l
EFB_y = Baseline lifecycle emissions coefficient, tCO_2e/l
EFP_y = Project lifecycle emissions coefficient, tCO_2e/l

As determined in the baseline methodology NEF_y is equal to 2287.95 gCO2e/l (2689.11-401.16). As we have excluded transport emissions, given our present uncertainty surrounding their applicability, equation E.1.1. simplifies to:

$$CER_y = BFP_y . 0.00228795 \quad \text{(E.1.3.)}$$

Assuming that the project activity produces 22,950,000 litres of bio-ethanol per year, total emission reductions will be 52,508 tonnes CO_2e.

E.2. Estimated leakage:

>>
Zero

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

>>
52,508 tonnes CO_2e

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

>>
Zero

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

>>
52,508 tonnes CO_2e

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

>>

	Bio-ethanol production for use in transportation (kl)							
	15000	17000	19000	21000	22950	25000	27000	29000
CERs	34319	38895	43471	48047	52508	57199	61775	66351

SECTION F. Environmental impacts

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

>>

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:

>>

SECTION G. Stakeholders' comments

>>

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:	Khon Kaen Alcohol Company Ltd
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Represented by:	
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State/Region:	
Postfix/ZIP:	10400
Country:	Thailand
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E-Mail:	
URL:	www.monre.go.th
Represented by:	
Title:	Dr
Salutation:	
Last Name:	Krairapanond
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State/Region:	
Postfix/ZIP:	DK - 1448
Country:	Denmark
Telephone:	+45 33 92 00 00
FAX:	+45 33 92 04 93
E-Mail:	asi@um.dk
URL:	www.um.dk
Represented by:	
Title:	
Salutation:	
Last Name:	Mukdasathien
Middle Name:	
First Name:	Nippon
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project activity has received no public funding

Annex 3

BASELINE INFORMATION

Type	Source	Reference
Gasoline sales data for Thailand	EPPO	www.eppo.go.th/info/T31.html
Thailand specific vehicle TTW GHG emissions	PTT	http://www.pttplc.com/servlet/ipscustDesktop?pageid=10&page=product&right=product_fuel_gasohol_06.html
Baseline (gasoline) lifecycle emissions coefficient	LBST Report. Data taken from pages 42, 80, 86, 91	GM well-to-wheel analysis of energy use and greenhouse emissions of advanced fuel/vehicle systems – a European study. (http://www.lbst.de/gm-wtw/)
Project (sugar cane based bio-ethanol) lifecycle emissions coefficient	Macedo *et al*	Assessment of greenhouse gas emissions in the production and use of fuel ethanol in Brazil. Macedo *et al*. Government of the State of São Paulo, 2004. (http://www.unica.com.br/i_pages/files/pdf_ingles.pdf)
CO_2 emission factor transportation vehicle fuel	IPCC	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual
Haulage distance to blend/distribution location	Proprietary data	
Fuel efficiency of haulage vehicles	Manufacturers' data	Will be taken from vehicle model used for transportation.
Ethanol substrate pricing	Published and proprietary data	Internal company records and external published data will be corroborated.
Historical stock market returns in Thailand	Published data	Bangkok stock exchange
Historical Thai Government bond yields	Bank of Thailand	http://www.thaibdc.or.th/yieldcurve/YieldTTM.aspx
Cost of equity in Thailand	Published studies	The Cost of Equity in Emerging Markets: A Downside Risk Approach. JAVIER ESTRADA, IESE business school, Barcelona, and confidential study.

Annex 4

MONITORING PLAN

The monitoring plan for the proposed CDM project comprises the following elements, which should be completed with the associated spreadsheet tool. The processes detailed below show how data from the Khon Kaen fuel ethanol project should be recorded and analysed to provide a calculation of the Certified Emissions Reductions (CERs) from the project activity.

The monitoring plan has two aims, to ensure the environmental integrity of the project activity and to ensure the data monitoring requirements are as closely aligned with the current practice of the project operator. These aims are complementary, the use of data collected for financial accounts (such as amount of bio-ethanol sold) will be of high quality as external checks will already be required. The ability to use financially reliable data will contribute to the environmental integrity through data accuracy and also help reduce the project's costs to the operator.

As highlighted in the section E of the PDD the quantity of ERs is given by the product of the sales of bio-ethanol and the net emission reduction coefficient. We have arrived at a net emission reduction coefficient of 0.00228791 tCO2e/l and therefore the monitoring will focus solely on the quantity of bio-ethanol produced and sold for transportation use. The monitoring plan therefore seeks to record the sales of ethanol on a monthly basis thus providing a monthly estimate of likely emission reductions generated in any one year. This data will be collected and maintained until two years after the end of the final crediting period.

Monitoring will consist of checking the quantities recorded against receipts for bio-ethanol sales. There will also be the requirement for the positive confirmation from each buyer of the bio-ethanol that it has been used as a transport fuel. In line with the monitoring methodology published studies that may result in changes to the lifecycle emissions will be monitored throughout the life of the crediting period and reported to the verifier.

The responsibilities for the monitoring have been separated. A manager will be given responsibility for the completion of the monthly monitoring and an operator will be appropriately trained in completing it. At the end of each year the spreadsheet should be finalised and signed off and dated by the operator and manager responsible for the monitoring plan. However the completion of the spreadsheet tool should be done as part of routine monitoring. This will not be too onerous as the data will be readily available from the production data and also the sales logs of the bio-ethanol plant. Monitoring of the potential lifecycle studies will also be on-going but a report will be produced at the end of each year which will detail studies and their likely impact on emission reduction estimates.

In line with the monitoring plan the project operator should therefore make available the spreadsheet tool and all relevant data including, but not limited to, the following to the verifying DOE:

- Monthly sales of bio-ethanol
- Confirmation from each purchaser that the bio-ethanol has been used for transport
- Details of lifecycle emission studies undertaken in the previous year.

The following is an annual sheet from the spreadsheet tool that will be used as part of the monitoring plan.

MONITORING PLAN - KHON KAEN FUEL ETHANOL PROJECT

Lifecycle emissions of bio-ethanol	0.00040116
Lifecycle emissions of gasoline	0.00268911
Net lifecycle emissions, tCO2e/l	0.00228795

Monthly sales data, litres

Month	Bio-ethanol sales	Non-qualifying	Qualifying volume
Jul-04			0
Aug-04			0
Sep-04			0
Oct-04			0
Nov-04			0
Dec-04			0
Jan-05			0
Feb-05			0
Mar-05			0
Apr-05			0
May-05			0
Jun-05			0
			0

Emission reductions	0

Approved:

Manager Date

Approved:

Operator Date

Input data in yellow cells, blue cells update automatically

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