CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

>>

- The title of the project activity

Programme on avoidance of methane production by on-site cassava pulp utilization in Thailand

- The current version number of the document

Version 1

- The date when the document was completed.

Feb, 2009

A.2. Description of the small-scale programme of activities (PoA):

>> The following information shall be included here:

1. *General operating and implementing framework of PoA*
2. *Policy/measure or stated goal of the PoA*
3. *Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.*

1. General operating and implementing framework of PoA

The purpose of the PoA is to avoid methane emissions that would have been released into the atmosphere from anaerobic decay of cassava pulp at stockpiles within the yard of starch factories. Cassava pulp is a by-product of starch production processes and it will be utilized as a raw material to produce ethanol in each CPA of the PoA.

The PoA coordinating/managing entity is Thai Tapioca Starch Association (TTSA). TTSA has roles of operating and managing the PoA as a whole, taking charge of necessary communication with the Board and DOE, management of each CPA, quality assurance and quality check of monitored data, and calculation of emission reductions. At present, CPA implementers are starch company A, B and C affiliated with TTSA.

Crude ethanol (moisture content 50 to 75%) produced by each CPA will be transported to automobile ethanol plants, which were already licensed to produce ethanol by the government, and will be refined more than 99.5% to supply as automobile fuel. Cassava pulp is a by-product (waste) of starch plants, therefore it is possible to produce ethanol without competing with foods.

2. Policy/measure or stated goal of the PoA

The PoA will contribute to climate change mitigations through reducing methane emissions at starch factories, and also contribute to sustainable development of Thailand in following viewpoints:

i) Stable management of starch plants, stabilization of income of cassava farmers

To utilize cassava pulp as a valuable resource, which is a by-product (waste) of cassava starch plants, it will lead to stable management of starch plants. Currently, more than 95 % of income sources of a cassava starch plant is profit of starch sales, and the revenue from cassava pulp is very small even if it can be sold. The price of cassava is determined by the relations between harvest amount, amount of tip productions and international cereal prices. On the other hand, the price of starch is determined by market prices of other competing products such as sugar. Since the prices of both raw material and the final product has been changed significantly, the income of starch plants fluctuates and the purchase price of cassava by starch plant owner also fluctuates significantly. Therefore, the income of cassava farmers is far from stable.

ii) Production of automobile ethanol from a raw material that do not compete with foods

In the case if supply of molasses will be insufficient, an alternative raw material is cassava to produce ethanol. However, some experts have pointed out that this will be a problem because the use of cassava to produce ethanol will compete with food purpose. The PoA proposes to produce automobile ethanol from cassava pulp. Cassava pulp is a by-product (waste) of starch plants, therefore it is possible to produce ethanol without competing with foods.
The harvest season of sugar cane, from which molasses is produced, is from November to April, and the operating period of sugar plants is also the same period. The rest of the period, from May to October, ethanol is produced from molasses that is stocked in sugar plants. However, if supply and demand loses its balance or export of molasses increases, it leads to lack of molasses before sugar plants start its operation. On the other hand, in the case of cassava, cassava yield decreases during the rain season, from September to October, because cassava farmers tend to stop harvesting. However, there is no such period in a year that 70 starch factories in Thailand stop their operation all together, therefore cassava pulp as a raw material of ethanol can be supplied constantly throughout the year.
Thai government has been implementing the automobile ethanol promotion programme with the aims of reduction of fossil fuel consumption, improvement of energy self-sufficiency and development of new market on agricultural field. The proposed PoA is in line with the promotion program and these aims.

iii) Policy to coexist with existing ethanol factories

There are a lot of licensed automobile ethanol production factories in Thailand, and there are some concern that new production facilities with the PoA will have potential to lead to increase competition. However, the product of the PoA is crude ethanol from cassava pulp, and it will be refined in existing automobile ethanol production factories, therefore the PoA can coexist with existing ethanol factories.

iv) Creation of employment of skillful engineers

Ethanol production from cassava pulp has many processes that need expertise such as saccharification and fermentation process (biotechnology) or distillation process (chemical engineering). Proposed PoA can create employment of skillful engineers in Thailand.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

TTSA is not enforced or mandated by laws or ordinances or national programs to implement the PoA. Without the PoA, TTSA has no economic capacity to manage the program because all operating costs related to functioning coordinator will be covered by revenues from PoA in term of CER. Therefore, the proposed PoA is a voluntary action by TTSA.

A.3. Coordinating/managing entity and participants of SSC-POA:

>> The following information shall be included here:

1. *Coordinating or managing entity of the PoA as the entity which communicates with the Board*
2. *Project participants being registered in relation to the PoA. Project participants may or may not be involved in one of the CPAs related to the PoA.*

1. Coordinating or managing entity of the PoA as the entity which communicates with the Board

Thai Tapioca Starch Association (TTSA) is the coordinating/managing entity of the PoA.

2. Project participants being registered in relation to the PoA. Project participants may or may not be involved in one of the CPAs related to the PoA.

Project Participants are TTSA and starch companies Sanguan Wongse Industries Co., Ltd. Other starch companies and Mayekawa Mfg, Co., Ltd. will also be a project participants.

A.4. Technical description of the small-scale programme of activities:

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In each CPA of the PoA, methane that would have been released into the atmosphere from anaerobic decay of cassava pulp at stockpiles will be avoided through utilizing cassava pulp as a raw material to produce ethanol.

Cassava pulp contains 70 to 80 % of moisture right after discharged from the starch production process, and 50 to 60 % of the dry weight is starch component, therefore cassava pulp can decay easily. Currently, cassava pulp is piled in the yard of starch factories, and in the dry season, after sun drying, cassava pulp is sold as a raw material for animal feed to cassava pellet factories. However, in the rain season, cassava pulp can not be dried well by the poor sunshine and it is left to decay in the stockpile and greenhouse gases such as methane have been released. The rain season ends and soon after the start of dry season, piled cassava pulp can be dried under sufficient insolation and is sold as a raw material for animal feed.

In each CPA, cassava pulp will be removed from the stockpile before it will decay, and utilized as a raw material to produce ethanol at the on-site ethanol plant within the starch factory, therefore methane release can be avoided.

Figure 1 shows the flowchart of producing crude ethanol from cassava pulp. To produce crude ethanol, cassava pulp will be gone through each processes such as drying, pretreatment, liquefy/saccalification, fermentation and distillation. With the conventional technologies, it is difficult to pre-treat cassava pulp to utilize as a raw material to produce ethanol, however it can be possible and realized with the technology developed in Japan.

The ethanol produced by the on-site plant is refined up to 50% concentration, and after that it will be transported to automobile ethanol plants, which were already licensed to produce ethanol by the government, and will be refined more than 99.5% to supply as automobile fuel.

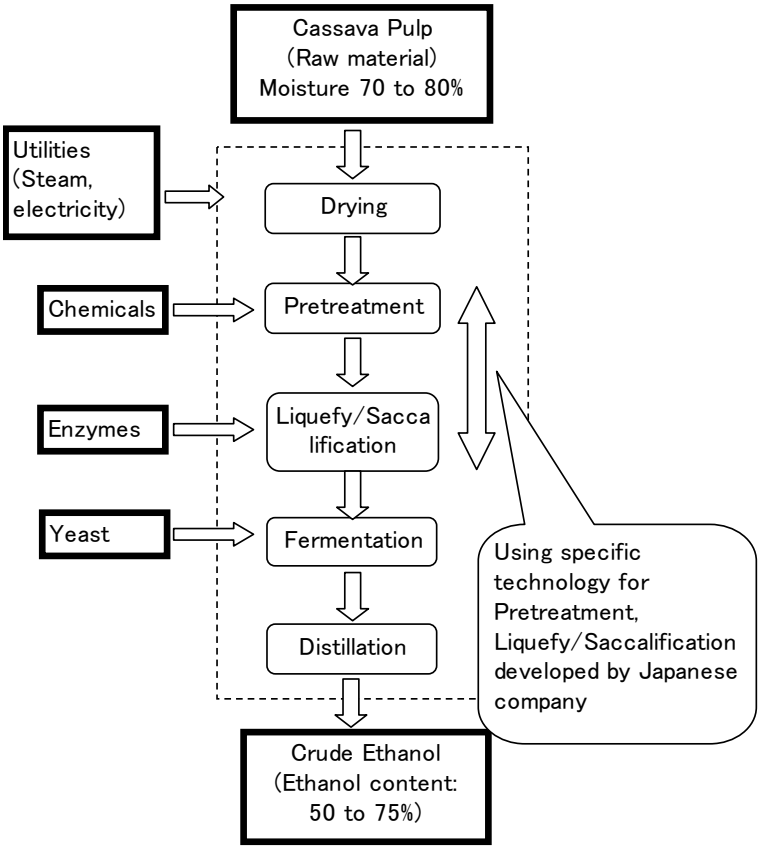

Figure 1 The flowchart of producing crude ethanol from cassava pulp

A.4.1. Location of the programme of activities:

>>

A.4.1.1. Host Party(ies):

>>

Kingdom of Thailand

A.4.1.2. Physical/ Geographical boundary:

>> Definition of the boundary for the PoA in terms of a geographical area (e.g., municipality, region within a country, country or several countries) within which all small-scale CDM programme activities (SSC-CPAs) included in the PoA will be implemented, taking into consideration the requirement that all applicable national and/or sectoral policies and regulations of each host country within that chosen boundary;

The PoA will cover all the starch factories in Thailand, therefore, every starch factory can participate to the PoA. Figure 2 shows the prefectures where starch factories are located (Red underline). Especially, there are a lot of starch factories in the area A to D.

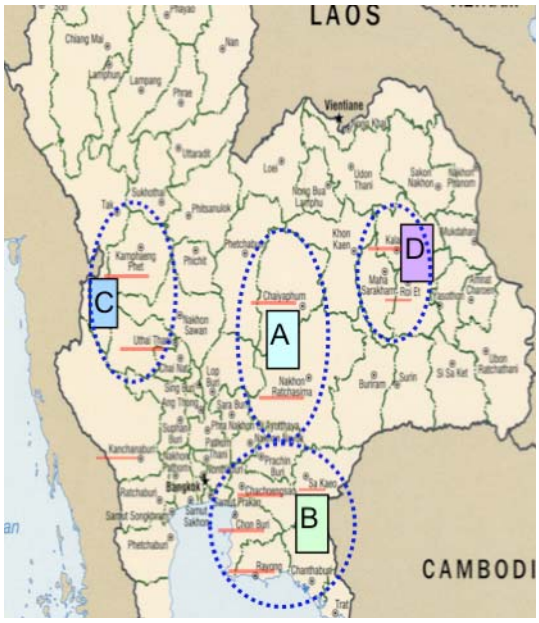

Figure 2 Locations of the PoA
(Red under lines show the prefectures where starch factories are located)

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

>>

A CPA under the PoA consists of:

1) Avoidance of methane emissions that would have been released into the atmosphere from anaerobic decay of cassava pulp at stockpiles within the yard of starch factories.

2) Cassava pulp is a by-product of starch production processes and it will be utilized as a raw material to produce crude ethanol (moisture content 50 to 75%) in each CPA.

A.4.2.1. Technology or measures to be employed by the SSC-CPA:

>>

Elaborated in A.4.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

>> Here only a description of criteria for enrolling the CPA shall be described, the criteria for demonstrating additionality of CPA shall be described in section E.5

The CPA under the PoA shall meet the following criteria:

1) The CPA implementer is a member company of TTSA.

2) To avoid methane emissions that would have been released into the atmosphere from anaerobic decay of cassava pulp at stockpiles within the yard of starch factories.

3) Methane emissions was measured from the stockpiles by on-site measurement.

4) Cassava pulp is a by-product of starch production processes and it will be utilized as a raw material to produce ethanol within the starch factory.

5) Crude ethanol (moisture content 50 to 75%) produced by each CPA will be transported to automobile ethanol plants, which were already licensed to produce ethanol by the government, and will be refined more than 99.5% to supply as automobile fuel.

6) The emission reductions of a CPA may not exceed 60,000 tCO_2e per year.

7) The CPA is not registered as a CDM project or as a CPA under another PoA.

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

>> The following shall be demonstrated here:

(i) The proposed PoA is a voluntary coordinated action;
(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;
(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;
(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

The information presented here shall constitute the demonstration of additionality of the PoA as a whole.

(i) The proposed PoA is a voluntary coordinated action;

The PoA is not enforced or mandated by laws or ordinances or national programs, but is a voluntary coordinated action by TTSA aiming to contribute to climate change mitigation and to realize recycling-oriented society in starch factories in Thailand.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

Each CPA under the PoA can not be realized without the CER revenue, and the PoA will also be operated and managed utilizing these revenue. It would not be implemented in the absence of the PoA.

(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;

Not applicable.

(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

Not applicable.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

>> Description of the operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA, including:

(i) A record keeping system for each CPA under the PoA.
(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA,
(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.
(iv) *The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;*

Operational and management structure of the PoA is shown in the following figure.

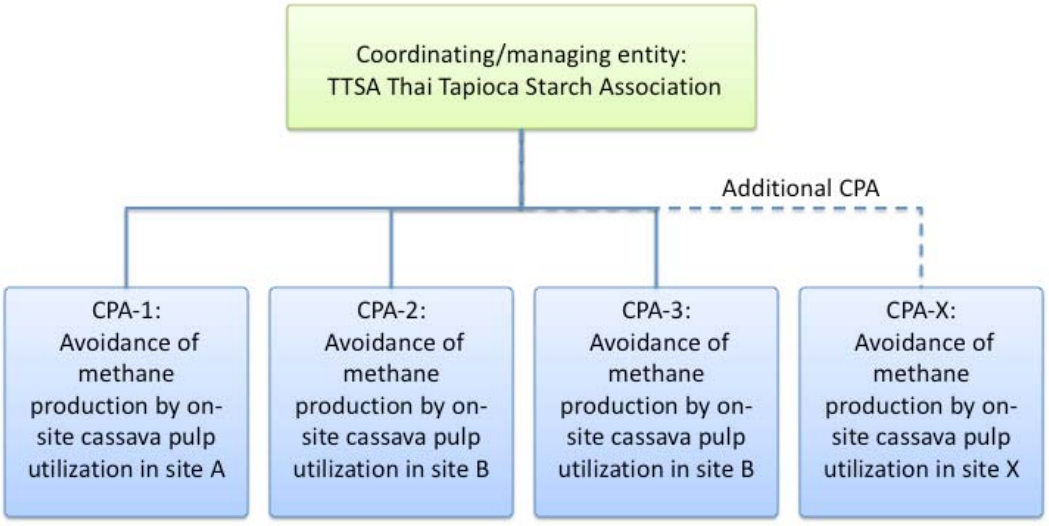

Figure Operational and management structure of the PoA

(i) A record keeping system for each CPA under the PoA.

A well-designed record keeping system will be operated to ensure timely completion of all activities against the agreed schedule and in line with the project objectives. The record keeping system consists of the data base format that will be maintained, including but not limited to the

name and geographical location, production capacity of the CPA, all necessary data for monitoring, and corresponding responsibilities of project components with related regulations and measures ensuring of CPA implementation under the PoA. The database must be completed by CPA implementers and be submitted to TTSA periodically, and TTSA verifies and certifies the reported data.

(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA.

On the formulation and inclusion of new CPA, it will be verified to avoid double accounting that the CPA is not registered either as CDM project activity or as a CPA of another PoA via asking the project implementer, Thai DNA and checking UNFCC website.

(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

On the formulation and inclusion of new CPA, it will be verified that the CPA is not a de-bundled component of another CPA or CDM project activity via asking the project implementer, Thai DNA and checking UNFCC website.

(iv) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;

TTSA promises the information and data sharing between all project participants in order to ensure timely and smoothly implementation of CPAs. The provisions speculated in the agreements, between participants, such as mutual inform policy, information sharing policy and burden sharing policy ensure operation of any CPA under the awareness and understanding of participants.

A.4.4.2. Monitoring plan:

>> The following information shall be provided here:

(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.

(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

In the PoA, monitoring will be done for each CPA. The monitoring plan is provided as follows.

1) Monitoring framework

The monitoring will be managed by TTSA. TTSA operates and manages the PoA as a whole, and takes charge of necessary communication with the Board and DOE, management of each CPA, quality assurance and quality check of monitored data, calculation of emission reductions.

CPA implementer is each starch company. CPA implementer will operate and manage the CPA, and measure necessary data for the monitoring of the CPA and report to TTSA based on the operation and monitoring manual prepared by TTSA.

2) The role of TTSA and the CPA implementers

The following table shows the role of TTSA and CPA implementers.

Table

	CPA implementers (Each starch company)	The program coordinator (TTSA)
Monitoring management	-	- Operation and management of the PoA and supervision of each CPA - Develop the operation and monitoring manual for CPAs. - Develop and establish data collection and reporting system for parameters monitored in every CPAs.
Data collection and reporting	- Implement data collection of the CPA - Report data to TTSA - Check data quality	- Check data quality and collection procedures of each CPAs regularly - Prepare monthly and annual report
Data storage and management	- Enter collected data to a computer. - Implement data management of CPA. - Store and maintain records.	- Develop database format of CPA. - Check the reported data from each CPAs. - Calculate emission reductions based on the data reported by each CPA implementer. - Implement data management of PoA. - Store and maintain records.
Quality check and quality assurance	- Undertake regular maintenance of the facility - Receive necessary training for proper operation of the facility and quality assurance of monitoring data	- Request regular maintenance of the facility to each CPA implementer. - Implement training for CPA implementers to operate the facility, and quality assurance and quality control of monitoring data

3) Monitored data

The data should be monitored are described in section E.7.1.

A.4.5. Public funding of the programme of activities (PoA):

>>

No public funding is utilized in the PoA.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

>>

To be fixed.

B.2. Length of the programme of activities (PoA):

>>

28 years

SECTION C. Environmental Analysis

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C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at SSC-CPA level ☑

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

Not applicable. The analysis is done at CPA level.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA):

>>

In each CPA of the PoA, ethanol plant will be constructed within the existing starch plant, and it is not a Greenfield project. Therefore, an environmental impact assessment is not required.
However, preparations of IEE (Initial Environmental Evaluation) and SDC (Sustainable Development Criteria) is required by Thailand DNA. (These will be attached to this document before submitting to the validation process.)

SECTION D. Stakeholders' comments

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D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at SSC-CPA level ☑

Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

There are distances between target starch factories, therefore stakeholder's meetings will be done at CPA level.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>

Not applicable.

D.3. Summary of the comments received:

>>

Not applicable.

D.4. Report on how due account was taken of any comments received:

>>

Not applicable.

SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical SSC-CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form used to define and include a SSC-CPA in this PoA (PoA specific CDM-SSC-CPA-DD).

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

>>

The following approved SSC baseline and monitoring methodology is applied to a SSC-CPA in the PoA:

AMS III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasifcation or mechanical/thermal treatment / The latest version

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

>>

The choice of the methodology is appropriate and it is applicable, since each CPA satisfies the following conditioned provided in the methodology as the table below.

Applicability conditions (Paragraph 1 to 15 of the methodology)	Each CPA
1. This project category comprises measures that avoid the production of methane from biomass or other organic matter that: (a) Would have otherwise been left to decay under clearly anaerobic conditions throughout the crediting period in a solid waste disposal site without methane recovery, or (b) Is already deposited in a waste disposal site without methane recovery.	The purpose of the PoA is to avoid methane emissions that would have been released into the atmosphere from anaerobic decay of cassava pulp at stockpiles within the yard of starch factories. Cassava pulp is a by-product of starch production processes and it will be utilized as a raw material to produce ethanol in each CPA of the PoA.
2. Due to the project activity, decay of the wastes of type referred to in paragraph 1(a) and/or 1(b) above is prevented through one of the following measures: (a) Controlled combustion. (b) Gasification to produce syngas/producer gas. (c) Mechanical/thermal treatment to produce refuse-derived fuel (RDF) or stabilized biomass (SB). An example of a mechanical/thermal treatment process is the pelletization of wood particles.	Cassava pulp will be utilized as a raw material to produce ethanol in each CPA of the PoA.
3. The produced RDF/SB shall be used for combustion either on site or off-site.	Not applicable.
4. In the case of stockpiles of wastes baseline emission calculations as described in the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" shall be adjusted. Stockpiles can be characterized as waste disposal sites that consist of wastes of a homogenous nature with similar origin (e.g. rice husk, empty fruit bunches of oil palm, sawmill waste, etc.). Paragraph 22 provides specific instructions for the calculation of baseline emissions where the baseline is stockpiling of the waste.	Currently and in the baseline, cassava pulp is piled in the yard, therefore the baseline emission is calculated based on the instructions specified in paragraph 22.
5. Measures are limited to those that result in emission reductions of less than or equal to 60 $ktCO_2$ equivalent annually.	Annual emission reductions are less than 60 $ktCO_2$, therefore it is less than the criteria.
6. Where in the baseline usually there is a reduction in the amount of waste through regular open burning or removal for other applications, the use of the "tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" shall be adjusted to take account of this burning or removal in order to estimate correctly the baseline emission.	Not applicable. There is no open burning or any other removal processes utilized in the baseline scenario.
7. The project activity does not recover or combust methane unlike AMS III.G. Nevertheless, the location and characteristics of the disposal site in the baseline condition shall be known, in such a way as to allow the	The project activity does not recover or combust methane.

estimation of its methane emissions.	
8. If the project activity involves combustion, gasification or mechanical/thermal treatment of partially decayed waste mined (i.e. removed) from a solid waste disposal site in addition to freshly generated waste the project participants shall demonstrate that there is adequate capacity of the combustion, gasification or mechanical/thermal treatment facility to treat the newly generated wastes in addition to the partially decayed wastes removed from the disposal site. Alternately justifications for combusting, gasifying or mechanically/thermally treating the partially decayed wastes instead of the newly generated wastes shall be provided.	Not applicable. The project do not involve partially decayed waste mined (i.e. removed) from a solid waste disposal site.
9. If the combustion facility, the produced syngas, producer gas or RDF/SB is used for heat and electricity generation within the project boundary, that component of the project activity shall use a corresponding methodology under type I project activities.	Not applicable. The produced ethanol is used for motor vehicles.
10. In case of RDF/SB production, project proponents shall provide evidence that no GHG emissions occur, other than biogenic CO2, due to chemical reactions during the thermal treatment process for example limiting the temperature of thermal treatment to prevent the occurrence of pyrolysis and/or the stack gas analysis.	Not applicable.
11. In case of gasification, the process shall ensure that all the syngas produced, which may contain non-CO2 GHG, will be combusted and not released unburned to the atmosphere. Measures to avoid physical leakage of the syngas between the gasification and combustion sites shall also be adopted.	Not applicable. The project do not utilize gasification process.
12. In case of RDF/SB processing, the produced RDF/SB should not be stored in such a manner as resulting in high moisture and low aeration favouring anaerobic decay. Project participants shall provide documentation showing that further handling and storage of the produced RDF/SB does not result in anaerobic conditions and do not lead to further absorption of moisture.	Not applicable.
13. In case of RDF/SB processing, local regulations do not constrain the establishment of RDF/SB production plants/thermal treatment plants nor the use of RDF/SB as fuel or raw material.	Not applicable.
14. During the mechanical/thermal treatment to produce RDF/SB no chemical or other additives shall be used.	Not applicable.
15. In case residual waste from controlled combustion, gasification or mechanical/thermal is stored under anaerobic conditions and/or delivered to a landfill	Not applicable.

emissions from the residual waste shall to be taken into account using the first order decay model (FOD) described in AMS III.G.	

E.3. Description of the sources and gases included in the SSC-CPA boundary

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The boundary of a CPA includes:

(a) Where cassava pulp would have been disposed and methane emissions occur in absence of the CPA
(b) Ethanol production plant where cassava pulp is utilized as a raw material
(c) The itineraries between (a) and (b), where the transportation of cassava pulp occurs

In the table below, all sources of the baseline and the project activity are listed.

Table Emission sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline emissions	Uncontrolled release of methane from anaerobic ~~decay of cassava pulp~~	CO_2	No	Not significant. Excluded for simplification and conservativeness
		CH_4	Yes	Major emission source
		N_2O	No	Not significant. Excluded for simplification and conservativeness
	Emissions from trucks for transport cassava pulp from the starch factory to the disposal site	CO_2	Yes	Counted in "project emissions" as "Incremental transportation" compared with project emissions
		CH_4	No	Not significant. Excluded for simplification and conservativeness
		N_2O	No	Not significant. Excluded for simplification and conservativeness
Project emissions	Emissions from electricity consumption at the ethanol production plant	CO_2	Yes	Major emission source
		CH_4	No	Not significant. Excluded for simplification.
		N_2O	No	Not significant. Excluded for simplification.
	Emissions from fossil fuel ~~consumption at the ethanol~~ production plant	CO_2	Yes	Major emission source
		CH_4	No	Not significant. Excluded for simplification.
		N_2O	No	Not significant. Excluded for simplification.
	Emissions from incremental ~~transportation of cassava~~ pulp and ethanol	CO_2	Yes	Major emission source
		CH_4	No	Not significant. Excluded for simplification.
		N_2O	No	Not significant. Excluded for simplification.

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

>>

Currently, cassava pulp, a by-product of starch production process, is piled in the yard of starch factories, and is left to decay in the stockpile and greenhouse gases such as methane have been released.

Effective utilizations of cassava pulp have been considered, however there is no promising and economically feasible option. For example, it can be supposed to sell all cassava pulp as a raw material for animal feed, however it is difficult to dry it well in the poor sunshine in the rain season, therefore this is not realistic option. As long as starch production continues throughout a year, huge amount of cassava pulp is produced and it is piled in the yard without roof. Currently, there is no law or regulation to stop pilling cassava pulp, and if some law or regulation will be established, starch factories have no other choice to stop producing cassava starch in rain seasons. Moreover, continuation of the above current situation requires minimal investment and operational costs.

Therefore, the baseline scenario of a CPA is:

"The situation where in the absence of the project activity, cassava pulp is left to decay within the project boundary and methane is emitted to the atmosphere in an uncontrolled manner."

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

>> Here the PPs shall demonstrate, using the procedure provided in the baseline and monitoring methodology applied, additionality of a typical CPA.

According to Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

- Investment barrier:
- Technological barrier:
- Barrier due to prevailing practice:
- Other barriers

For the CPAs of the PoA, investment barrier and technological barrier are chosen to demonstrate the additionality. A typical demonstration of additionality can be described as follows. The detail assessment should be done at CPA level.

- Investment barrier:

Large investment is necessary for the construction of the ethanol plant, and the profitability of ethanol production project utilizing cassava pulp is much worse than existing ethanol plants, mainly because the production capacity of cassava pulp ethanol plant is very small, only around 30 kl/day, compared with existing ethanol plant whose capacity is around 150 kl/day. On the other hand, continuation of the current practice requires no investment and less operational costs because cassava pulp has been just piled in the yard.
Therefore, in terms of investment, it is difficult to realize the CPA without CDM.

- Technological barrier:

In Thailand, currently, there is no project that produce ethanol from cassava pulp. There is some project in China that utilize cassava pulp as auxiliary raw material for cassava chip ethanol production plant,

however there is no plant which use cassava pulp as a main raw material. Cassava pulp contains more fiber than cassava chips or roots, therefore advanced technologies are needed.
Therefore, in terms of technology, it is difficult to realize the CPA without CDM.
In Japan, there are plants that already start commercial operation of ethanol production utilizing cassava pulp as main raw material. Therefore, it is possible for Japanese project participants to transfer the technology to each CPA.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

>> Here the PPs shall provide the key criteria for assessing additionality of a CPA when proposed to be included in the registered PoA. The criteria shall be based on additionality assessment undertaken in E.5.1 above. The project participants shall justify the choice of criteria based on analysis in above section.
It shall be demonstrated how these criteria would be applied to assess the additionality of a typical CPA at the time of inclusion.

NOTE: Information provided here shall be incorporated into the PoA specific CDM-SSC-CPA-DD that shall be included in documentation submitted by project participants at registration of PoA.

Barrier	Criteria
Investment barrier	Project case is less financially attractive than the baseline case.
Technological barrier	One of the following advanced technologies should be introduced - Advanced pre-treatment technology to remove cassava fiber before fermentation process - Other innovative technologies

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

>>

Methodological choices selected for a typical SSC-CPA are as follows.

In monitoring, paragraph 9 is selected.

9. In the case of replacement, modification and retrofit measures the monitoring shall consist of:
(a) Documenting the specifications of the equipment replaced;
(b) Metering the energy use of the industrial or mining and mineral production facility, processes or the equipment affected by the project activity;
(c) Calculating the energy savings using the metered energy obtained from subparagraph (b).

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

>>

I. Baseline emissions

The Baseline emissions of a CPA are CH_4 emissions from decay of degradable organic carbon in cassava pulp in disposal site:

$$BE_y = BE_{CH4,SS,y} - MD_{reg,y} * GWP_{CH4} \quad \text{(Equation 1)}$$

BE_y : Baseline emissions in the year "y" (tCO_2e)
$BE_{CH4,SS,y}$: Baseline emissions from the decay of cassava pulp
$MD_{reg,y}$: Methane that would be destroyed or removed in the year "y" for safety or to comply with regulations
GWP_{CH4} : GWP for methane

There is presently no regulation or policy in place in Thailand to recover methane from landfill. Therefore;

$$MD_{reg,y} = 0 \quad \text{(Equation 2)}$$

Therefore the baseline emissions are calculated as follows:

$$BE_y = BE_{CH4,SS,y} \quad \text{(Equation 3)}$$

$BE_{CH4,SS,y}$ is the yearly methane generation potential calculated using "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)"

$$BE_{CH4,SS,y} = \varphi*(1-f)*GWP_{CH4}*(1-OX)*16/12*F*DOC_f*MCF*\Sigma W_x*DOC*e^{-k(y-x)}*(1-e^{-k}) \quad \text{(Equation 4)}$$

Where:
$BE_{CH4,SS,y}$: Baseline emissions from the decay of cassava pulp (tCO_2e)
φ : Model correction factor to account for model uncertainties (= 0.9: Default value in the applied methodology)
f : Fraction of methane captured at the disposal site and flared, combusted or used in another manner (= 0: Default value in the applied methodology)
GWP_{CH4} : Global Warming Potential (GWP) of methane, valid for the relevant commitment period (21)
OX : Oxidation factor (= 0: Default value in the applied methodology)
F : Fraction of methane in the disposal site gas (volume fraction) (= 0.5: Default value in the applied methodology)
DOC_f : Fraction of degradable organic carbon (DOC) that can decompose (= 0.5: Default value in the applied methodology)
MCF : Methane correction factor (= 0.28: Default value for stockpile)
W_x : Amount of cassava pulp prevented from disposal in the disposal site in the month x, dry basis (tons)
DOC : Fraction of degradable organic carbon (by weight, dry basis) in cassava pulp (= 0.44: Default value for stockpile (Pulp, paper and cardboard (other than sludge) (Dry)) in the applied methodology)

k : Decay rate for cassava pulp (= 0.06: Default value for stockpile (Pulp, paper and cardboard (other than sludge), Boreal and Temperate, Dry)) in the applied methodology)
x : Month during a year: x runs from the first month of a year (x = 1) to the month y for which avoided emissions are calculated (x = y)
y : Month for which methane emissions are calculated

See section B.6.3 and B.7 for values selected for the above parameters.

II. Project emissions

Project emissions are calculated by following equation.

$$PE_y = PE_{y,comb} + PE_{y,transp} + PE_{y,power} \quad \text{(Equation 5)}$$

Where:
PE_y : Project activity direct emissions in the year y (tCO_2e)
$PE_{y,comb}$: Emissions through combustion of non-biomass carbon of ethanol in the year y (tCO_2e)
$PE_{transp,y}$: Emissions from incremental transportation in the year y (tCO_2e/year)
$PE_{power,y}$: Emissions from electricity and diesel consumption in the year y (tCO_2e/year)

$$PE_{power,y} = PE_{FF,y} + PE_{Elec,y} \quad \text{(Equation 6)}$$

Where:
$PE_{FF,y}$: Emissions from fossil fuel consumption for ethanol production plant (tCO_2e/year)
$PE_{elec,y}$: Emissions from electricity consumption for ethanol production plant (tCO_2e/year)

The above project emissions will be calculated as follows:

(a) Emissions through combustion of non-biomass carbon of ethanol

Emissions through combustion of non-biomass carbon of ethanol is calculated as follows:

$$PE_{y,comb} = Q_{y,non\text{-}biomass} * 44/12 + Q_{y,fuel} * EF_{y,fuel} \quad \text{(Equation 7)}$$

$Q_{y,non\text{-}biomass}$: Non-biomass carbon of ethanol consumed in the year y (tonnes of carbon)
$Q_{y,fuel}$: Quantity of auxiliary fossil fuel used in the year y (tonnes)
$EF_{y,fuel}$: CO_2 emission factor for the combustion of the auxiliary fossil fuel (tCO_2/ton)

Ethanol produced in the project do not contain any non-biomass carbon, and no auxiliary fossil fuel will be used when ethanol will be combusted.

$$PE_{y,comb} = 0$$

(b) Emissions from incremental transportation:

CO_2 emissions from incremental transportation by the project activity are calculated as follows;

$$PE_{y,transp} = (Q_y/CT_y) * DAF_w * EF_{CO2} + (Q_{y,ash}/CT_{y,ash}) * DAF_{ash} * EF_{CO2} + (Q_{y,RDF/SB}/CT_{y,RDF/SB}) * DAF_{RDF/SB} * EF_{CO2} \quad \text{(Equation 8)}$$

Where:

Q_y	: Quantity of cassava pulp utilized in the year "y" (= W_x tonnes)
CT_y	: Average truck capacity for cassava pulp transportation (tonnes/truck)
DAF_w	: Average incremental distance for cassava pulp transportation (km/truck)
EF_{CO2}	: CO_2 emission factor from diesel fuel due to transportation (tCO_2/km)
$Q_{y,ash}$	: Quantity of residues from ethanol production in the year "y" (tonnes)
$CT_{y,ash}$	: Average truck capacity for residues transportation (tonnes/truck)
DAF_{ash}	: Average distance for residues transportation (km/truck)
$Q_{y,RDF/SB}$	: Quantity of ethanol produced in the year "y" (tonnes)
$CT_{y,RDF/SB}$	: Average truck capacity for ethanol transportation (tonnes/truck)
$DAF_{RDF/SB}$	: Aggregate average distance for ethanol transportation to the storage in the production site as well as to the end user sites (km/truck)

(c) Emissions from fossil fuel consumption for ethanol production plant

CO_2 emissions from fossil fuel consumption for ethanol production plant are calculated as follows;

$$PE_{FF,y} = \Sigma (FC_y * EF_{CO2,i}) \quad \text{(Equation 9)}$$

$PE_{FF,y}$	: Emissions from fossil fuel consumption at the ethanol production plant (tCO_2e/year)
FC_y	: Annual consumption of fossil fuel i at the ethanol production plant
$EF_{CO2,i}$	: CO_2 emission factor of fossil fuel i

(d) Emissions from electricity consumption for ethanol production plant

CO_2 emissions from electricity consumption for ethanol production plant are calculated as follows;

$$PE_{elec,y} = EC_y * EF_{grid} \quad \text{(Equation 10)}$$

$PE_{elec,y}$	: Emissions from electricity consumption at the ethanol production plant (tCO_2e/year)
EC_y	: Annual consumption of grid electricity at the ethanol production facility in year y (MWh/year)
EF_{grid}	: Grid emission factor (0.523tCO_2/MWh)

III. Leakage

According to the methodology, the following two leakages should be taken into account.

- *If the controlled combustion, gasification or mechanical/thermal treatment technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects at the site of the other activity are to be considered.*
- *In case of RDF/SB production, project proponents shall demonstrate that the produced RDF/SB is not subject to anaerobic conditions before its combustion end-use resulting in methane emissions. If the produced RDF/SB is not used in captive facilities but sold to consumers outside the project boundary*

as a fuel, a default 5% of the baseline emissions shall be deducted as leakage to account for these potential methane emissions, unless project proponents can prove otherwise (e.g. by demonstrating that potential risks of methane emissions from RDF/SB are avoided through measures such as appropriate packaging, by showing that monitored moisture content of the RDF/SB is under 12% or by the use of standards that ensure that characteristics of the RDF/SB during the entire lifecycle of the product is not conducive for methane production).

The ethanol production plant is new and not transferred from or to another project activity. Methane will not be produced from ethanol.
Therefore leakage is not necessary to be considered.

IV. Emission reduction

Emission reduction is calculated as follows;

$$ER_y = BE_y - (PE_y + Leakage_y) \quad \text{(Equation 12)}$$

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Data / Parameter:	φ
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)"
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)".
Any comment:	-

Data / Parameter:	**OX**
Data unit:	-
Description:	Oxidation factor
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)"
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The disposal site of the baseline scenario is not "a managed solid waste disposal sites". Therefore, default value of "Other type of solid waste disposal site" was selected from "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)".
Any comment:	-

Data / Parameter:	**F**

Data unit:	-
Description:	Fraction of methane in the disposal site gas (volume fraction)
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)"
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)".
Any comment:	-

Data / Parameter:	**DOC_f**
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)"
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)".
Any comment:	-

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data used:	AMS III.E. version 15.1
Value applied:	0.28
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value for stockpiles.
Any comment:	-

Data / Parameter:	**DOC**
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight, dry basis) in cassava pulp (Dry basis)
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)"
Value of data	0.44
Justification of the choice of data or	Default value of "Pulp, paper and cardboard (other than sludge)" as per "Tool to determine methane emissions avoided from disposal of waste at a solid waste

description of measurement methods and procedures actually applied :	disposal site (The latest version)".
Any comment:	-

Data / Parameter:	**k**
Data unit:	-
Description:	Decay rate for cassava pulp
Source of data used:	AMS III.E. version 15.1
Value applied:	0.06
Justification of the choice of data or description of measurement methods and procedures actually applied :	The k value for the relevant waste type must be the lower value from the range provided for the Boreal and Temperate Climate Zone as listed in Table 3.3 in Chapter 3, volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Any comment:	-

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each SSC-CPA:

Data / Parameter:	W_x
Data unit:	tons/year
Description:	Total amount of cassava pulp prevented from piling in month x (tons) (Dry basis)
Source of data to be used:	Measurements by project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Provided in each CPA-DD
Description of measurement methods and procedures to be applied:	Provided in each CPA-DD
QA/QC procedures to be applied:	Provided in each CPA-DD
Any comment:	Monitored monthly.

Data / Parameter:	FC_y
Data unit:	liter/year
Description:	Annual consumption of fossil fuel i at the ethanol production plant
Source of data to be used:	Records of fuel purchase invoices
Value of data applied for the purpose of	Provided in each CPA-DD

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Provided in each CPA-DD
QA/QC procedures to be applied:	Verify the conformity of data with the fuel purchase invoices and equipments fuel consumption
Any comment:	Each delivery of fuel is recorded

Data / Parameter:	EC_y
Data unit:	MWh/year
Description:	Annual consumption of grid electricity at the ethanol production facility in year y
Source of data to be used:	Records of grid electricity purchase invoices
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Provided in each CPA-DD
Description of measurement methods and procedures to be applied:	Provided in each CPA-DD
QA/QC procedures to be applied:	Verify the conformity of data with the fuel purchase invoices and equipments electricity consumption
Any comment:	

Data / Parameter:	f
Data unit:	-
Description:	Fraction of methane captured at the disposal site and flared, combusted or used in another manner
Source of data to be used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (The latest version)"
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Written information from the operator of the solid waste disposal site and/or site visits at the solid waste disposal site
QA/QC procedures to be applied:	-
Any comment:	Monitored annually.

E.7.2. Description of the monitoring plan for a SSC-CPA:

>>

In the PoA, monitoring will be done for each CPA. The monitoring plan is provided as follows.

1) Monitoring framework

CPA implementer will operate and manage the CPA, and measure necessary data for the monitoring of the CPA and report to TTSA based on the operation and monitoring manual prepared by TTSA.

2) The role of CPA implementers

Table

	CPA implementers (Each starch company)
Data collection and reporting	- Implement data collection of the CPA - Report data to TTSA - Check data quality
Data storage and management	- Enter collected data to a computer. - Implement data management of CPA. - Store and maintain records.
Quality check and quality assurance	- Undertake regular maintenance of the facility - Receive necessary training for proper operation of the facility and quality assurance of monitoring data

3) Monitored data

The data should be monitored are described in section E.7.1.

E.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

Date of completion of the application of the methodology: 1/2/2009

Dr. Naoki Matsuo and Mr. Yasuki Shirakawa, Climate Experts, Ltd.

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Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The PoA do not utilize any public funding.

Annex 3

BASELINE INFORMATION

See E.6.3 and each CPA-DD.

Annex 4

MONITORING INFORMATION

See A.4.4.2 and E.7.2 for details about monitoring plan.