Output 3: PIN/PDD for pilot projects

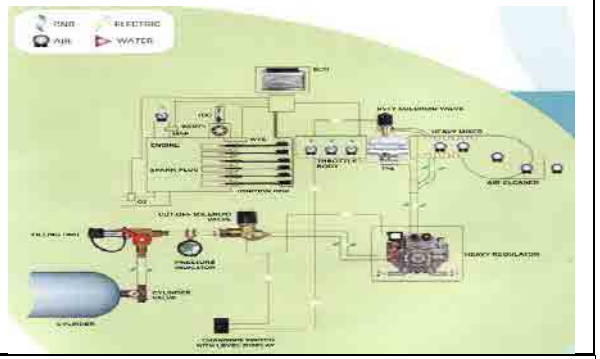
PROJECT IDEA NOTE

A. Project description, type, location and schedule

Name of Project: ***Installing NGV equipment for BMA vehicles***

Date submitted: ***14 September, 2010***

Technical summary of the project

Objective of the project	The project is to install conversion kits to convert the existing engine in the BMA vehicle from using diesel or gasoline fuel to natural gas, to reduce Carbon Dioxide emission that causes global warming problem and air pollutants including Carbon Monoxide emission and black smoke. The project can also lower the fuel cost since NGV is cheaper than diesel.
Project description and proposed activities	The Mechanical Workshops Division of Bangkok Metropolitan Administration (hereafter BMA) will install NGV gas equipment to 50 diesel cars and 53 gasoline vehicles in fiscal year 2011. Diesel Dual Fueled (DDF) kits for 200 diesel vehicles 47 gasoline vehicles had been installed and so far. Fuel switching from diesel fuel to natural gas can reduce greenhouse emission and air pollution due to black smoke from diesel combustion since natural gas is gaseous fuels that easily form a homogeneous mixture with air and leads to soot-free complete combustion.
Technology to be employed	Installation a fuel conversion kit to convert an existing diesel or gasoline fueled engine to a natural gas fueled engine will be implemented and tested. 50 units of diesel engine and 53 units of gasoline engine vehicles that belong to the BMA office will be targeted. The schematic diagram of the conversion kit is as below: 

Project developer	
Name of the project developer	Mechanical Workshop Division, BMA
Organizational category	a. Government b. Government agency ⓒ Municipality

	d. Private company e. Non Governmental Organization
Other function(s) of the project developer in the project	a. Sponsor ⓑ Operational Entity under the CDM c. Intermediary d. Technical advisor
Summary of the relevant experience of the project developer	BMA installed NGV gas equipment to 200 diesel cars and 47 gasoline vehicles so far fiscal. Project has already started but BMA has a plan to expand the project, applying to more vehicles, which may be applicable to CDM.
Address	Bangkok Metropolitan Administration Bangkok City Hall 2: Mitmaitree Road, Dindang Bangkok 10400, Thailand
Contact person	*Name of the Project Development Manager* Mr. Sunsurn Sitithanapornpun
Telephone / fax	086-593-6984
E-mail and web address, if any	http://www.bangkok.go.th/en/index.php
Project sponsors *(List and provide the following information for all project sponsors)*	
Name of the project sponsor	Financial authority of BMA
Organizational category	a. Government b. Government agency ⓒ Municipality d. Private company e. Non Governmental Organization
Address	Same as the above mentioned
Main business activities	The roles of the Bangkok Metropolitan Administration (BMA) are to formulate and implement policies regarding the management of Bangkok, which includes transport services, urban planning, waste management, housing, roads and highways, security services and the environment.
Type of the project	
Greenhouse gases targeted	CO_2
Type of activities	Abatement
Field of activities	c. Transport Fuel switch from diesel or gasoline to natural gas
a. Energy supply	
b. Energy demand	
c. Transport	
d. Waste management	
e. Land Use Change and Forestry	
Location of the project	
Country	Kingdom of Thailand
City	Bangkok
Brief description of the location of the project	The project aims to use less carbon intensive energy and reduce the use of diesel or gasoline fuel, by letting Bangkok office/department' cars switch to use natural gas which has less carbon dioxide emissions than using diesel or gasoline fuel.
Expected schedule	
Earliest project start date	Installation: 2010 Operation: 2010-2011
Estimate of time required before becoming operational after approval of the PIN	*Time required for financial commitments: xx months* *Time required for legal matters: xx months* *Time required for negotiations: xx months* *Time required for installation: xx months*

Expected first year of verified Emission Reduction or CER delivery	2012
Project lifetime	7 years
Current status or phase of the project	Opportunity study finished. And the proposal of the budget to support the DDF kit installation in fiscal year 2011 have submitted. The project proponent wishes to carry out the project as a CDM but has not started any documentation for CDM.

B. Expected environmental and social benefits

Estimate of Greenhouse Gases abated / CO_2 Sequestered (in metric tons of CO_2-equivalent)	GHG emission reductions are estimated as follows: - Number of target cars is 103 including 50 of diesel vehicles and 53 of gasoline vehicles - Diesel fuel consumption by 50 of diesel vehicles (liter/year): 148,030 - Gasoline fuel consumption by 53 of gasoline vehicles (liter/year): 105,570 - Net calorific value of the diesel fuel (MJ/liter): 36 - Net calorific value of the gasoline fuel (MJ/liter): 32 - CO_2 emission factor of diesel fuel (tCO_2/MJ): 0.0000741 - CO_2 emission factor of gasoline fuel (tCO_2/MJ): 0.0000693 - CO_2 emission factor of natural gas (tCO_2/MJ): 0.0000561 =(148,030*36)*(0.0000741-0.0000561)+(105,570*32)*(0.0000693-0.0000561) =140 tCO_2e/year
Specific global & local environmental benefits *(In total about ¼ page)*	
Local benefits	The project aims to reduce consumption of diesel/gasoline fuel which releases carbon dioxide and soot/smoke, substances that will cause pollution to local environment and human body.
Global benefits	Bangkok governor has a plan to address climate change (global warming problem) and to reduce emissions of carbon dioxide and carbon monoxide that will cause global warming problem.
Socio-economic benefits What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	Saving of the Bangkok's budget for purchase of diesel/gasoline fuel is expected to occur as a direct effect because natural gas is cheaper than diesel/gasoline fuel. Training/education opportunities associated with the introduction of new technologies and products of the NGV equipment such as DDF kits are expected to occur as an indirect effect.
Environmental strategy/ priorities of the Host Country	As the current increase in prices of fuel sources coupled with a high demand for energy has made it necessary for the country to seek out the use of green/clean energy sources and/or the improvement of energy efficiency in order to prevent an energy shortage that would have a negative impact on the country, CDM will therefore encourage the private sector in utilizing green/clean energy sources and/or improving energy efficiency for their activities, which includes energy efficiency project for changing the types of fuel consumption to procure electric/thermal energy.

C. Finance

Total project cost estimate	
Development costs	None (already developed technology)
Installation costs	Cost of DDF kit about 150,000 Thai Baht/unit Amount of Vehicle = 103 Vehicles Total Installation costs = 150,000 x 103 = 15,450,000
Other costs	Operation and Maintenance Cost = 1,000 Baht / Vehicle Amount of Vehicle = 103 Vehicles Total O&M costs = 1,000 x 103 = 103,000 Baht/year
Total project costs	Installation costs + Other costs = 15,553,000 Baht
Sources of finance to be sought or already identified	
Equity	
Long-term debt	
Short-term debt	
Not identified	Mechanical Workshop Division has asked Bangkok Metropolitan Administration the budget for installing the DDF kit to 50 diesel fuel vehicles. Mechanical Workshop Division can use 2009 budget for installing the DDF kit to 53 gasoline vehicles.

D. Baseline and Additionality

Baseline scenario Which emissions is the proposed CDM project displacing? What would the future look like without the proposed CDM project?	Baseline scenario The baseline scenario is continuous situation that the BMA office's vehicles utilize more carbon intensive fossil fuel, diesel or gasoline fuel, compared with natural gas for the energy use. Baseline emissions The baseline emissions are the energy use per unit of travel distance for the vehicle that would otherwise have been used times the average annual units of travel distance per vehicle times the number of vehicles affected times the emission coefficient for the fuel used by vehicle that would otherwise have been used.
For sequestration projects only: Existing vegetation and land use	
Approved methodology(ies) applied to the project activity	AMS-III.S: Introduction of low-emission vehicles/technologies to commercial vehicle fleets
Applicability check of the chosen methodology(ies)	According to AMS-III.S, applicable technology/measure for the project should be as follows: "1. Retrofitting of existing vehicles (e.g. switching from high greenhouse gas intensive to low greenhouse gas intensive fossil fuel) is also included in the methodology." - The retrofitted Natural Gas Vehicle (NGV) in the project activity utilizes Compressed Natural Gas (CNG) which is less carbon intensive fuel compared with diesel/gasoline fuel. "4. Project participants must demonstrate that: The project activity is unlikely to change the level of service provided on each route before the project activity;" - The type of vehicles covered by the project is BMA offices/departments' cars to serve for official travels by BMA officers whose annually average level of service stays just about flat. "6. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually." - Estimated emission reductions for the project are 564 tCO_2/year. Therefore the project is applicable to this methodology.

Demonstration of additionality of the proposed CDM project activity	Investment Barrier analysis Project proponent, the mechanical workshops division, has not got a budget yet because it needs all budgets from BMA. Project proponent must coordinate with all departments of BMA to secure the project investment and operational cost. Even though the project activity is not an economically attractive option for BMA at this stage, however the project will be implemented if BMA approves the budget that covers all of the expense including investment and operational cost according to BMA's action plan. Thus, there is no investment barrier for this project, and it means that this project does not have the additionality as a CDM project.
Demonstration of Prior consideration	The project proponent wishes to carry out the project as a CDM but has not started any documentation for CDM.

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PROJECT IDEA NOTE

A. Project description, type, location and schedule

Name of Project: ***Natural gas for water distribution pumps***

Date submitted: ***Installation:November,2010***

Operation:2011

Technical summary of the project

Objective of the project	The project is to want reduce Carbon Dioxide emission have 2 measure, First repair and improve efficiency of water distribution pumps, Second install conversion to convert the existing engine in the BMA Generator from using diesel or gasoline fuel to natural gas, to reduce Carbon Dioxide emission that causes global warming problem and air pollutants including Carbon Monoxide emission and black smoke. The project can also lower the fuel cost since NG is cheaper than diesel.
Project description and proposed activities	The Mechanical Workshops Division of Bangkok Metropolitan Administration will install equipment and modify Generator to switching from diesel to NG year 2011 used to generated electricity 240-360 MW h. Repair 150 of existing water pumps can reduce greenhouse emission and air pollution due to black smoke from diesel combustion since natural gas is gaseous fuels that easily form a homogeneous mixture with air and leads to soot-free complete combustion
Technology to be employed	Installation of a natural gas combustion equipment to convert an existing diesel fuel generator to a natural gas generator will be implemented. XXX units of diesel generator that belong to the BMA's drainage pump stations will be targeted.
Project developer	
Name of the project developer	Mechanical Workshops Division Drainage and Sewage Department, BMA
Organizational category	a. Government b. Government agency (c) Municipality d. Private company e. Non Governmental Organization
Other function(s) of the project developer in the project	a. Sponsor b. Operational Entity under the CDM c. Intermediary (d) Technical advisor
Summary of the relevant experience of the project developer	Install NG equipment for Bangkok pump Generator to switching from diesel to NG
Address	Bangkok Metropolitan Administration Bangkok City Hall 2: Mitmaitree Road, Dindang Bangkok 10400, Thailand
Contact person	*Name of the Project Development Manager* Mr.Sunsurn Sitithanapompun Mechanical Engineering, BMA

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Telephone / fax	086-593-6984
E-mail and web address, if any	http://www.bangkok.go.th/en/index.php
Project sponsors *(List and provide the following information for all project sponsors)*	
Name of the project sponsor	Financial authority of BMA
Organizational category	a. Government b. Government agency (c) Municipality d. Private company e. Non Governmental Organization
Address	Same as the above mentioned
Main business activities	The roles of the Bangkok Metropolitan Administration (BMA) are to formulate and implement policies regarding the management of Bangkok, which includes generated electricity planning fuel, repair maintenance, management and the environment.
Type of the project	
Greenhouse gases targeted	CO_2
Type of activities	Abatement
Field of activities	Switching fossil fuel
a. Energy supply	
b. Energy demand	
c. Transport	
d. Waste management	
e. Land Use Change and Forestry	
Location of the project	
Country	Kingdom of Thailand
City	Bangkok
Brief description of the location of the project	The project aims to use less carbon intensive energy and reduce the use of diesel or gasoline fuel, by letting Bangkok office/department' drainage pump stations switch to use natural gas which has less carbon dioxide emissions than using diesel or gasoline fuel for generator.
Expected schedule	
Earliest project start date	Installation: 2010 Operation: 2011
Estimate of time required before becoming operational after approval of the PIN	*Time required for financial commitments: xx months* *Time required for legal matters: xx months* *Time required for negotiations: xx months* *Time required for construction: xx months*
Expected first year of verified Emission Reduction or CER delivery	2012
Project lifetime	10 year
Current status or phase of the project	Opportunity study finished. And the proposal of the budget to support the generated electricity switching from diesel to NG year 2011 has submitted. The project proponent wishes to carry out the project as a CDM but has not started any documentation for CDM.

B. Expected environmental and social benefits

Estimate of Greenhouse Gases abated / CO_2 Sequestered (in metric tons of CO_2-equivalent)	GHG emission reductions are estimated as follows: - Current diesel fuel consumption by 50 pumps (liter/year): 83,000 - Net calorific value of the diesel fuel (MJ/liter): 36 - CO_2 emission factor of diesel fuel (tCO_2/MJ): 0.0000741 - CO_2 emission factor of natural gas (tCO_2/MJ): 0.0000561 = 83,000 * 36 * (0.0000741 - 0.0000561) = 54 tCO_2e/year

	Annual: 54 tCO_2-equivalent/year
Specific global & local environmental benefits *(In total about ¼ page)*	
Local benefits	The project aims to reduce consumption of diesel/gasoline fuel which releases carbon dioxide and soot/smoke, substances that will cause pollution to local environment and human body.
Global benefits	Bangkok governor has a plan to address climate change (global warming problem) and to reduce emissions of carbon dioxide and carbon monoxide that will cause global warming problem.
Socio-economic benefits What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	Saving of the Bangkok's budget for purchase of diesel/gasoline fuel is expected to occur as a direct effect because natural gas is cheaper than diesel/gasoline fuel. Training/education opportunities associated with the introduction of new technologies and products are expected to occur as an indirect effect.
Environmental strategy/ priorities of the Host Country	As the current increase in prices of fuel sources coupled with a high demand for energy has made it necessary for the country to seek out the use of green/clean energy sources and/or the improvement of energy efficiency in order to prevent an energy shortage that would have a negative impact on the country, CDM will therefore encourage the private sector in utilizing green/clean energy sources and/or improving energy efficiency for their activities, which includes energy efficiency project for changing the types of fuel consumption to procure electric/thermal energy.

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C. Finance

Total project cost estimate	
Development costs	*in USD or Baht*
Installation costs	3,500,000 Baht To natural gas equipment instead of diesel fueled for 50 pumps, it cost 70,000 Baht per each, 3,500,000 Baht in total.
Other costs	*in USD or Baht*
Total project costs	3,500,000 Baht
Sources of finance to be sought or already identified	
Equity	*Name of the organizations and finance (in USD or Baht)*
Long-term debt	*Name of the organizations and finance (in USD or Baht)*
Short-term debt	*Name of the organizations and finance (in USD or Baht)*
Not identified	Asking Bangkok Metropolitan Administration for 3,500,000 Baht

D. Baseline and Additionality

Baseline scenario Which emissions is the proposed CDM project displacing? What would the future look like without the proposed CDM project?	Baseline scenario The baseline scenario is continuous situation that the BMA office's generator for electricity utilize more carbon intensive fossil fuel, diesel or gasoline fuel, compared with natural gas for the energy use. Baseline emissions The baseline emissions are the energy use per unit of MWh for the generator for electricity used times the average annual units of MWh per generator times the number of generator use fuel affected times the emission coefficient for the fuel used by generator use NG that would otherwise have been used.
For sequestration projects only: Existing vegetation and land use	
Approved methodology(ies) applied to the project activity	AMS-III.B: Switching fossil fuels
Applicability check of the chosen methodology(ies)	According to AMS-III.B, applicable technology/measure for the project should be as follows: "1. This methodology comprises fossil fuel switching in industrial, residential, commercial, institutional or electricity generation applications (e.g., fuel switch from fuel oil to natural gas in an existing captive electricity generation or replacement of a fuel oil boiler by a natural gas boiler)." - This project aims to retrofit existing diesel oil-fired electricity generators to natural gas-fired ones for the energy use of water pumping facilities. "2. Fuel switch may be in a single element process or may include several element processes within the facility. Multiple fossil fuels switching in an element process however is not covered under this methodology." - The project aims to switch single fossil fuel from diesel oil to natural gas. "3. This methodology is applicable for new facilities as well as for retrofit or replacement of existing installations." - The project aims to retrofit existing diesel generators. "4. Fuel switching may also result in energy efficiency improvements. If the project activity primarily aims at reducing emissions through fuel switching, it falls into this methodology. If fuel switching is part of a project activity focused primarily on energy efficiency, the project activity falls under a Type II methodology." - This project primarily aims at reducing emissions through fuel switching from diesel oil to natural gas. "8. This category is applicable to project activities where it is possible to directly measure and record the energy use/output (e.g., heat and electricity) and consumption (e.g., fossil fuel) within the project boundary." - The project proponents will be able to measure and record both amount of electricity generation and natural gas consumption by the retrofitted captive generators. "10. Regulations do not constrain the facility from using the energy sources cited in paragraph 1 before or after the fuel switch. Regulations do not require the use of low carbon energy source (e.g., natural gas or any other fuel) in the element processes." - Any laws/regulations do not constrain captive generators to use natural gas for energy use in the drainage pump stations in Bangkok. "12. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually." - Estimated emission reductions for the project are 54 tCO_2/year. Therefore the project is applicable to this methodology.
Demonstration of additionality of the proposed CDM project activity	Investment Barrier Project proponent, the mechanical workshops division, has not got a budget

	yet because it needs all budgets from BMA. Project proponent must coordinate with all departments of BMA to secure the project investment and operational cost. The project activity is not an economically attractive option for BMA if there is no CER benefit. But if the project is conducted as a CDM project, the economical feasibility of the project will be improved. In addition, BMA will also be able to gain pioneering effect of CER acquisition and honor as an environmentally friendly administrative body. These factors will enable this project to be undertaken.
Demonstration of Prior consideration	The project proponent wishes to carry out the project as a CDM but has not started any documentation for CDM.

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PROJECT IDEA NOTE

A. Project description, type, location and schedule

Name of Project: **Biodiesel from cooking oil - for BMA's forklifts**

*Date submitted:*_____

Technical summary of the project

Objective of the project	1. To collect used cooking oil to produce biodiesel 2. To reduce the impact to people health from consumption of used cooking oil 3. To reduce the environment impact caused by used cooking oil 4. To be a learning sources and network of environment and energy of Bangkok
Project description and proposed activities	Bangkok is an organization consisting of several departments and each year a lot of diesel fuel about 85,000 liters/day is used by BMA. Production of biodiesel from used cooking oil is one alternative sources of renewable energy. It's also cut cycle of reused of used cooking oil in the cycle of people consumption that will affect to their health and the environment. When the used cooking oil has been left to the public sewer without removal correctly, fat will cause problem to clog drainage, barriers to drainage and smelly. Moreover, biodiesel from used cooking oil can reduce greenhouse gas emission and air pollution that may cause health risk such as dust, carbon monoxide, hydrocarbon and sulfur dioxide, etc. The Mechanical Workshops Division realized to those problems, so they have established a pilot product of biodiesel from used oil, and bring those biodiesels to test with forklift, and it is found that it can reduce black smoke down to 31%, and observe other situation there isn't an abnormal from the test of using biodiesel fuel with machinery and vehicles. There are results such as reduce pollution from exhaust and no effect to the engine in any way. So The Mechanical Workshops Division has conducted a pilot product of biodiesel to use with machines and vehicles of Bangkok. BMA will produce biodiesel from used cooking oil, the capacity of a size not exceeding 100 liters per day, then apply to car and pump of Bangkok without effect to the engine.

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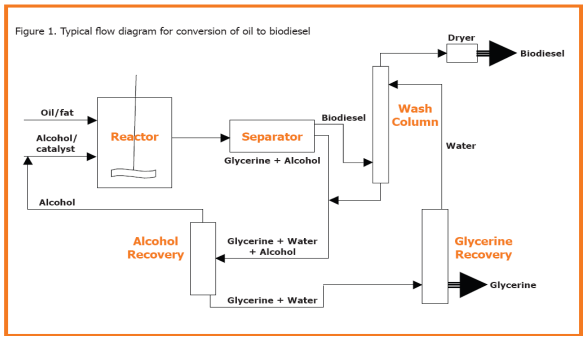
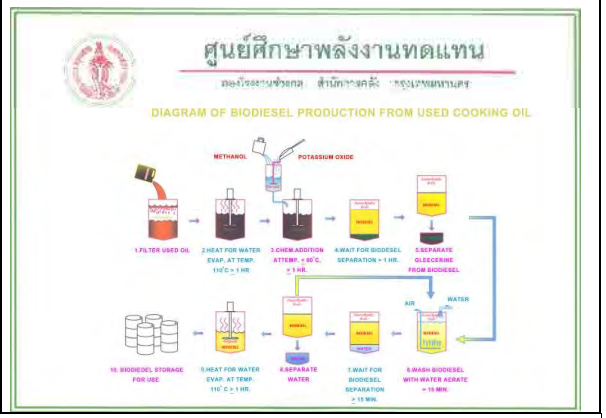
Technology to be employed	The project aims to install a biodiesel generation machine to utilize waste cooking oil-based biodiesel for existing diesel-fueled forklifts. Two forklifts will be supplied with biodiesel everyday in the project.  Figure 1. Typical flow diagram for conversion of oil to biodiesel Dryer Biodiesel Oil/fat Alcohol/ catalyst Reactor Separator Biodiesel Wash Column Water Glycerine + Alcohol Alcohol Alcohol Recovery Glycerine + Water + Alcohol Glycerine Recovery Glycerine Glycerine + Water  ศูนย์ศึกษาพลังงานทดแทน DIAGRAM OF BIODIESEL PRODUCTION FROM USED COOKING OIL
Project developer	
Name of the project developer	Mechanical Workshop Division Finance Department of BMA
Organizational category	a. Government b. Government agency c. Municipality d. Private company e. Non Governmental Organization
Other function(s) of the project developer in the project	a. Sponsor b. Operational Entity under the CDM c. Intermediary d. Technical advisor
Summary of the relevant experience of the project developer	BMA have established a pilot product of biodiesel from used

	oil, and bring those biodiesels to test with forklift, Mitsubishi brand, car license number 5ต-0178, found that it reduce black smoke down to 31%, and observe other situation there isn't an abnormal from the test of using biodiesel fuel with machinery and vehicles.
Address	173 Dinso Road, Bangkok 10200 Thailand
Contact person	Mr.Sunsurn Sitithanapornpun (Mechanical Engineering, BMA)
Telephone / fax	086-593-6984
E-mail and web address, if any	http://www.bangkok.go.th/en/index.php
Project sponsors *(List and provide the following information for all project sponsors)*	
Name of the project sponsor	Financial authority of BMA
Organizational category	a. Government b. Government agency c. Municipality d. Private company e. Non Governmental Organization
Address	173 Dinso Road, Bangkok 10200 Thailand 086-593-6984 http://www.bangkok.go.th/en/index.php
Main business activities	The roles of the Bangkok Metropolitan Administration (BMA) are to formulate and implement policies regarding the management of Bangkok, which includes transport services, urban planning, waste management, housing, roads and highways, security services and the environment.
Type of the project	
Greenhouse gases targeted	CO_2
Type of activities	Abatement: Emission reduction type small scale CDM
Field of activities	
a. Energy supply	Renewable energy
b. Energy demand	
c. Transport	
d. Waste management	
e. Land Use Change and Forestry	
Location of the project	
Country	Kingdom of Thailand
City	Bangkok
Brief description of the location of the project	The location of bio diesel plant is inside Mechanical Workshop Division.
Expected schedule	
Earliest project start date	November 2010
Estimate of time required before becoming operational after approval of the PIN	*Time required for financial commitments: xx months* *Time required for legal matters: xx months* *Time required for negotiations: xx months* *Time required for construction: xx months*

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Expected first year of verified Emission Reduction or CER delivery	2012
Project lifetime	Approximately 10 years
Current status or phase of the project	**Status** - The project has already started. BMA has a plan to expand its capacity in the future. (August 2010) **CDM status** - The project proponent wishes to carry out the project as a CDM but has not started any documentation on CDM.

B. Expected environmental and social benefits

Estimate of Greenhouse Gases abated / CO_2 Sequestered (in metric tons of CO_2-equivalent)	**Annual: 32 tCO_2-equivalent** GHG emission reductions are estimated as follows: - % of biodiesel mix: 50 - Amount of biodiesel produced (l./ year): 21,120 - Net calorific value of biodiesel (GJ/ ton): XXX - Transportation distance to carry waste oil to refinery (hr/ year): 2,100 - Net calorific value of biodiesel (MJ/kg): 27 - Density of the biodiesel fuel (kg/liter): 0.9 - CO_2 emission factor of diesel fuel (tCO_2/MJ): 0.0000741 = 32 tCO_2e/year
Specific global & local environmental benefits *(In total about ¼ page)*	
Local benefits	Reduce air pollution that may cause health risk such as dust, carbon monoxide, hydrocarbon and sulfur dioxide, etc.
Global benefits	Reduce greenhouse gas emission
Socio-economic benefits What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	- Using biodiesel can reduce oil imports from foreign. - Using biodiesel to help create markets for the purchase of fuel used to grow up.
Environmental strategy/ priorities of the Host Country	Government policy is to promote, support, research and development of all forms of alternative energy. As an alternative to the public. And reduce greenhouse gas emissions. Enabling all sectors respond to this policy. BMA is one of the other agencies that implement this project in Biodiesel from cooking oil - for BMA's forklifts.

C. Finance

Total project cost estimate	
Development costs	*in USD or Baht*
Installation costs	**200,000 Baht/unit** Installation cost of biodiesel equipment
Other costs **[operation cost]**	**504,000 Baht** Operation cost of biodiesel production process which does not include biodiesel apparatus installation cost are as follows: - Chemical reagent cost: 7 Baht / litter - Raw material (used cooking oil): 14 Baht/litter - Production capacity per day: 100 litter /day - Operation cost per year: 100 litter/day * 21 Baht/litter * 240 working day = 504,000 Baht/year
Total project costs	**704,000 Baht**
Sources of finance to be sought or already identified	
Equity	*Name of the organizations and finance (in USD or Baht)*
Long-term debt	*Name of the organizations and finance (in USD or Baht)*
Short-term debt	*Name of the organizations and finance (in USD or Baht)*
Not identified	Asking BMA for 704,000 Baht

D. Baseline and Additionality

Baseline scenario Which emissions is the proposed CDM project displacing? What would the future look like without the proposed CDM project?	<u>Baseline scenario</u> The baseline scenario is a situation that diesel engines in BMA's forklifts utilize more carbon intensive diesel fuel compared with biodiesel oil for the energy use. <u>Baseline emissions</u> Baseline emissions are calculated based on the amount of displaced petrodiesel determined as follows. $BE_y = BD_y * NCV_{BD,y} * EF_{CO2,PD,y}$ Where: BE_y: Baseline emissions during the year y (tCO_2) BD_y: Quantity of biodiesel eligible for crediting in year y (tonnes) $NCV_{BD,y}$: Net calorific value of biodiesel produced for the year y (GJ/tonnes) $EF_{CO2,PD,y}$: Carbon dioxide emissions factor for petrodiesel (tCO_2/GJ)
For sequestration projects only: Existing vegetation and land use	
Approved methodology(ies) applied to the project activity	**AMS-III.AK:** Biodiesel Production and Use for Transport Application.
Applicability check of the chosen methodology(ies)	According to AMS-III.AK, applicable technology/measure for the project should be as follows: "1. This methodology comprises project activities for cultivation of oilseeds and sourcing of waste oil/fat to be used in production of biodiesel for use in transportation applications." - Sourcing of used/waste cooking oil from local community will be realized in the project. "2. This methodology is only applicable if the final biodiesel blending proportion is a maximum of 20% by volume (B20). This is to ensure that technical performance characteristic of the blended biodiesel do not differ from those of petrodiesel." - The BMA Mechanical Workshops Division use biodiesel mixed with diesel in the ratio of B100.Therefore, this methodology is not applicable to this project. "3. Only biodiesel consumed in excess of mandatory regulations is eligible for the purpose of the project activity." - There is no mandatory regulation to use biodiesel oil in a captive fleet of vehicles/transportation applications in Bangkok. "4. This methodology is applicable under the following conditions: (a) In the baseline situation the vehicles/transportation applications use diesel;" - The project aims for introduction of waste cooking oil-based biodiesel into the BMA's forklift machines which currently run on diesel oil. "5. Measures are limited to those that result in emission reductions of less than or equal to 60 $ktCO_2$ equivalent annually." - Estimated emission reductions for the project are 32 tCO_2e/year. AMS-III.AK is the most suitable methodology for this project, however, in order to apply this methodology to this project, blending proportion of this project shall change to B20 from B100.
Demonstration of additionality of the proposed CDM project activity	<u>Investment Barrier</u> Project proponent, the mechanical workshops division, has not got a budget yet because it needs all budgets from BMA. Project proponent must coordinate with all departments of BMA to secure the project investment and operational cost. The project will be implemented if BMA approves the budget that covers all of the expense including investment and operational cost according to BMA's action plan. Thus, there is no investment barrier for this project.
Demonstration of Prior consideration	The project proponent wishes to carry out the project as a CDM but has not started any documentation for CDM.

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PROJECT IDEA NOTE

A. Project description, type, location and schedule

Name of Project: Urban Mass Transit Project
Date submitted: 7 February, 2010

Technical summary of the project

Objective of the project	• To improve the efficiency of transportation used by lower GHG emissions measures. • To reduce the travel time and increase safety and reliability by modal shift. • To replace the transit of people from personal vehicles into public transportation
Project description and proposed activities	• The purpose of the project activity named "MRT urban mass transit project" is the establishment and operation of an urban railway system, namely the Purple Line, which is an efficient, rapid, safe, convenient, comfortable and effective mass transit system (MRTS) ensuring high ridership levels in Bangkok and Nonthaburi. • This project is consisted of two sections. The section1 is to establish and operate the MRTS between from Bang Yai to Bang Sue. The section2 is to establish and operate the MRTS from Ban Sue to Rat Burana. • Only the section1 is focused in this PIN. • The route length of the section1 is 23 km. with elevated structure for all the route, incorporating 16 stations. The project starts from Bang Yai to Bang Sue. • The ridership forecast: according to the F/S report is as follows; 2012 - 195,505 passengers 2022 – 288,292 passengers 2032 – 403,588 passengers 2042 – 503,057 passengers • The number of the above-mentioned passengers will shift from a personal vehicle to MRTS. • The project has begun from 2007, and the operation of MRTS will begin from August, 2014.

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	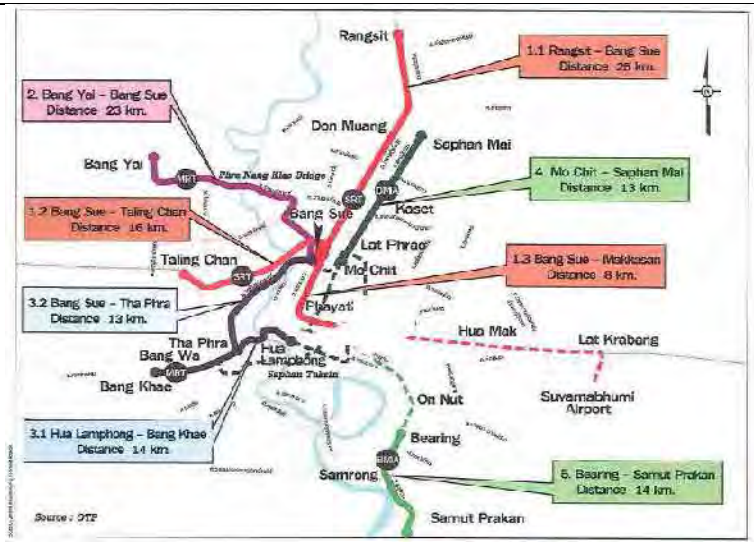
Technology to be employed	Technology to be employed by project activities are: • Heavy Rail Transit System, "Rolling stock", will be used. • Rolling stock is three-car trains which can serve a total number of passengers between 700-1000 passengers, and the capacity of up to 50,000 passenger/ hr/ direction. Track Standard gauge is 1.435 m and the maximum speed is 80 km/hr. They can be used for 30 years, and with overhaul inspections, the designed life time of them could be expanded up to 15 years. • Electrification is third rail paralleled to the track for distributing electricity to the train (The power supply system is fed in by two MEA sub-station). Supervisory Control and Data Acquisition System (SCADA) is to control the power supply to the systems from a remote place. In worst case, the uninterruptible power supply (UPS-System) services essential loads. • Signaling system and communication system are Train Management System (TMS), Centralized Traffic Control (CTC), Automatic Train Protection (ATP) and Automatic Fare Collection System (AFC). • The life time of the infrastructure is designed for 100 years.

Project developer	
Name of the project developer	Mass Rapid Transit Authority (MRTA)
Organizational category	a. Government (b.) Government agency c. Municipality d. Private company/ Private Entity e. Non Governmental Organization

Other function(s) of the project developer in the project	a. Sponsor b. Operational Entity under the CDM c. Intermediary d. Technical advisor
Summary of the relevant experience of the project developer	1. MRTA constructed The Metropolitan Rapid Transit Chaloem Ratchamongkhon Line (Blue Line Project) and have given concession to Bangkok Metro Public (BMCL) for operating on 2000, 1th August. 2. MRTA had submitted PDD and other documents of MRT Blue Line extension project to TGO for LOA consideration, on 20th December 2010. 3. Purple Line Project (Bang Yai-Bang Sue section) is upon the submission of the letter of intent to TGO, Thailand.
Address	175 Rama XI Road, Huai Khwang, Bangkok 10320, Thailand
Contact person	Mr. Theeraphan Tachasirinugune
Telephone/ fax	Tel: +662 612 2444 # 632
E-mail and web address, if any	Email: theeraphan_t@mrta.co.th
Project sponsors *(List and provide the following information for all project sponsors)*	
Name of the project sponsor	Government of Thailand
Organizational category	a. Government b. Government agency c. Municipality d. Private company e. Non Governmental Organization
Address	*Address, PO Box, City, Country* *Web address, if any* Government of Thailand
Main business activities	*Not more than 5 lines* The Royal Decree Establishing the MRTA B.E. 2535 (1992) was announced in the Royal Gazette on 20 August, 1992. Currently MRTA is authorized to operate MRTS within Bangkok area and other provinces and to run business related to the MRTS enterprise and other business for the benefit of MRTA and the passengers.
Name of the project sponsor	Government of Thailand and Japan International Cooperation Agency (JICA)
Organizational category	a. Government b. Government agency c. Municipality d. Private company e. Non Governmental Organization
Address	*Address, PO Box, City, Country* *Web address, if any* 1-6th floor, Nibancho Center Building 5-25, Niban-cho, Chiyoda-ku, Tokyo 102-8012, Japan http://www.jica.go.jp/english/

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Main business activities	*Not more than 5 lines* JICA/JBIC signed a Japanese ODA loan agreement totaling up to 62,442 million yen with the MRTA to finance the Mass Transit System Project in Bangkok (Purple Line). This is the first Japanese ODA loan in six years for a new project in Thailand (the last offered was in 2002) as of March 31, 2008.
Type of the project	
Greenhouse gases targeted	*CO_2 / CH_4 / N_2O / HFCs / PCFs / SF_6* *(mention what is applicable)* CO_2
Type of activities	*Abatement / CO2 Sequestration* Abatement
Field of activities	*(choose applicable field(s) from below)* c. Transport, modal shift to metro/subway system
a. Energy supply	*Renewable energy, including biomass / biogas / cogeneration / improving energy efficiency by replacing existing equipment / minimization of transport and distribution / fuel switch (e.g., switch coal to biomass)* *(mention what is applicable)*
b. Energy demand	*Replacement of existing "household equipment" / improvement of energy efficiency of existing production equipment* *(mention what is applicable)*
c. Transport	*More efficient engines for transport / modal shift / fuel switch (e.g. public transport buses fuelled by natural gas)* *(mention what is applicable)*
d. Waste management	*Capture of landfill methane emissions / utilization of municipal waste and wastewater emissions* *(mention what is applicable)*
e. Land Use Change and Forestry	*Afforestation/ reforestation/ forest management/ wetlands management/ watershed management/ improved agriculture / land degradation prevention* *(mention what is applicable)*
Location of the project	
Country	Kingdom of Thailand
City	Bangkok Metropolitan Area, Thailand, including Nonthaburi Province.
Brief description of the location of the project	*No more than 3 - 5 lines* The alignment passes through notables places as follows: Bang Yai, Rattana Tibet road, Phra Nang Klao bridge, Tiwanon road, Nontha Buri intersection, Wong Sawang intersection and Tao Poon.
Expected schedule	
Earliest project start date	*Year in which the plant will be operational* Operation (start of service); August, 2014
Estimate of time required before becoming operational after	*Time required for financial commitments: xx months* *Time required for legal matters: xx months* *Time required for negotiations: xx months* *Time required for construction: approx.56 months (Dec,2009-Aug,2014)*

approval of the PIN	Land acquisition: Jan. 2007 to Oct. 2010 Selection of project consultants: Jan. 2008 to Feb. 2010 Selection of project contractors: Apr. 2008 to Mar. 2010 Start of Construction: Dec. 2009
Expected first year of verified Emission Reduction or CER delivery	2015
Project lifetime	*Number of years* Expected operational life time of the project activity is 30 years. (The primary structure of the rolling stock body can be used 30 years of operational period. After inspection and overhaul, rolling stocks could be used up to 15 years.)
Current status or phase of the project	*Identification and pre-selection phase / opportunity study finished / pre-feasibility study finished / feasibility study finished / negotiations phase / contracting phase / etc.* *(choose what is applicable and indicate the available documentation [e.g., the feasibility study])* 1) F/S completed 2) Under constructed of civil work 3) Funded by JICA loan 4) CDM application was considered in Oct. 2007 prior to the starting date. 5) Letter of intent is submitted to TGO on 14, November 2008.

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B. Expected environmental and social benefits

Estimate of Greenhouse Gases abated / CO_2 Sequestered (in metric tons of CO_2-equivalent)

Annual: 9,732 – 23,559 *tCO_2-equivalent*

Expected GHG emission reductions of the section1 for Purple Line (23 km), Bang Sue-Bang Yai section, is estimated as follows:

Emission reduction: 26,925.01 – 17,193 = 9,732.02 tCO_2e/yr(in 1st year:2014)

1.Baseline: Purple line(Bang Sue - Bang Yai)

	$EF_{PKM,i}$ (gCO_2/PKM)	P_y (passengers/day)	BSP_i (%)	BTD_{Pi} (km)	$BE_{y,i}$ (of the first year) (tCO_2e /yr)
Bus	25.47	110,971.07	53.40	7.30	7,531.03
Private car	99.48	49,666.83	23.90	7.30	13,164.91
Taxi	227.27	8,520.25	4.10	7.30	5,159.53
Motor cycle	35.77	11,221.79	5.40	7.30	1,069.54
					26,925.01

Note: EF_{PKM}, BSP_i, BTD_{Pi} is referred to Blue Line extension.
P_y is referred to Purple line feasibly study report

2.Project: Purple line(Bang Sue - Bang Yai)

Passenger in 2014 (Operational year)	207,811	passengers
Electricity consumed	0.39	kwh/passenger
The grid emission factor	0.5812	tCO_2/Mwh Grid emission factor
CO_2 for Electricity Consumption	17,193	tCO_2/y

Note: Kwh/passenger is referred to Blue Line extension.
Passenger in 2014 is referred to ridership forecast in case of without transfer fee in F/S report

3.Emission reduction 9,732.02 tCO_2e/y

4. Estimations of emission reductions of the Project following ACM 0016 methodology

Years	Passengers	Baseline Emission	Project Emission	Estimations of emission reductions (tCO2e)
2014	207,811	26,925.01	17,193.00	9,732.02
2019	238,573	30,910.69	19,738.06	11,172.63
2024	311,351	40,340.16	25,759.26	14,580.91
2029	368,999	47,809.32	30,528.70	17,280.63
2034	423,482	54,868.41	35,036.28	19,832.12
2039	473,217	61,312.32	39,151.05	22,161.27
2042	503,057	65,178.53	41,619.83	23,558.71

Specific global & local environmental benefits *(In total about ¼ page)*	
Local benefits	• Reduction of air pollutant emission, such as PM, NOx, CO, hence this project contributes to alleviate air pollution and harmful health effects for Bangkok and Nonthaburi people. • Reduce noise pollution.
Global benefits	• Reduction of GHG emissions, therefore this project contributes to mitigate the climate change.
Socio-economic benefits What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	*(In total about ¼ page)* *• Direct effects (e.g. employment creation, capital required, foreign exchange effects)* *• Indirect effects (e.g. training/education opportunities associated with the introduction of new technologies and products, or effects on other industries)* • Increase the employment creation. • Reduction of traffic congestion that helps people to save time and improve economic performance of Bangkok and Nonthaburi province. • Introduction a new technology to transportation sector. • Reduction of the traffic accidents resulting in injury or death
Environmental strategy/ priorities of the Host Country	*A brief description of the relationship of the consistency of the project with environmental strategy and priorities of the Host Country* Some policies have to consisted between proposed project activity and environmental strategy and priorities of Thailand as follows: a) OTP master plan 2008-2013, aimed to promote and support the environmental sustainable development, safety and energy saving which the potential way to mitigate the air pollution and GHG mitigation. b) 8th National Social and Economic Development Plan lays out the development priority to efficiency of mass transit system by preparation of a network extending to the community surrounding Bangkok so that people can travel conveniently and reducing the use of private cars in traveling. *c)* Mass transit system has been urgent policies to be implemented of Thai government since 2001. Also, the policy statement of the government of Mr. Abhisit Vejjajiv has given high priories to develop a complete mass electric train system network in Bangkok and surrounding areas as well as in suburban areas to link to mass electric train system network and other mass transport systems in a fast, efficient and convenient way at appropriate prices as well as expand development of mass transport system to major cities in the region. Enhance to reduce GHG emission in transportation sector and country emission level significantly with emphasizing to serve the passenger demands more efficiently.

C. Finance

Total project cost estimate	
Development costs	*10,595MBaht* *(Land Acquisition=9,209MBaht, Project consultant(Civil work and Track work) =1,565.4 MBaht)*
Installation costs	*49,298 MBaht* *(Civil Works=36,055 MBaht, M&E Works =13,243 MBaht)*
Other costs	*in USD or Baht*
Total project costs	*60,072.4 MBaht*
Sources of finance to be sought or already identified	
Equity	*Government 40% (by supporting fund without interest is called Public-Private Partnership or PPP)*
Long-term debt	*JBIC loan 60% (interest rate is 3.75% for civil works and 4.05% for M&E and rolling stock)*
Short-term debt	-
Not identified	-

D. Baseline and Additionality

Baseline scenario Which emissions is the proposed CDM project displacing? What would the future look like without the proposed CDM project?	*(About ¼ - ½ page)* Baseline scenario The continuous use of the current transportation system, such as private passenger car, taxis, motorcycle and bus, is the most simple and convenient measures for the people. And with the economy developing, the number of vehicles will be increasing in near future without any political countermeasures. However, considering a development of urban rail transportation system requires huge investment, the continuous use of the current transportation system has precedence of all other options. Therefore, the continuation of the current transport system is clearly defined as the baseline scenario. Baseline emissions Essentially the baseline emissions are calculated based on the surveyed data such as number of passengers, mode used, the trip distance per mode and the emission factor per mode as follows: $BE_{p,y} = \sum_i BTD_{p,i,y} \cdot EF_{PKM,i,y}$ Where: $BE_{p,y}$: Baseline emissions per surveyed passenger p in the year y (g CO_2) $EF_{PKM,i,y}$: Emission factor per passenger-kilometer of mode i in the year y (g CO_2/PKM) $BTD_{p,i,y}$: Baseline trip distance per surveyed passenger p using mode i in the year y (PKM) p: Surveyed passenger (each individual) i: Relevant vehicle category y: Year of the crediting period

For sequestration projects only: Existing vegetation and land use	-
Approved methodology(ies) applied to the project activity	*Number and title of the methodology(ies)* ACM0016 (baseline methodology for mass rapid transit projects).
Applicability check of the chosen methodology(ies)	*(In total about ¼ page)* According to ACM0016, applicable technology/measure for the project should be as follows: a) The project constructs a new rail-based infrastructure or segregated bus lanes, In the case of rail systems the project needs to provide new infrastructure(new rail lines) (Project conditions) The project constructs new rail-based mass transit systems. It will replace partially operations on existing bus routes. b) The methodology is not applicable for operational improvements (e.g. new or larger buses0 of an already existing and operating bus lane or rail-based MRTS (Project conditions) The project is the extension of the existing rail infrastructure and not operational improvements of already existing and operating rail-based system c) The methodology is not applicable for operational for bus lanes replacing an existing rail-based system i.e. the existing urban or suburban rail infrastructure must remain fully (in its full length) operational (Project conditions) The project is a new rail-based mass transit system. d) The methodology is applicable for passenger transport only (Project conditions) The Purple line extension is a passenger transport system. e) Any fuels including (liquefied) gaseous fuels or biofuel blends, as well as electricity can be used in the baseline or project case. (Project conditions) The project uses electricity. The major baseline transport fuels are diesel, gasoline, LPG, and natural gas. f) the methodology is not applicable for the implementation of air and water-based transport systems (Project conditions) The project systems is rail based and not air or water based.

	g) The project system partially replaces a traditional public transport system in a given city. The methodology cannot be used in areas where currently no public transport is available. (Project conditions) The Purple line replaces partially traditional bus and passenger car trips. Public transports such as bus are currently available in the project area. h) The methodology is applicable for urban or sub-urban trips. It is not applicable for inter-urban transport. (Project conditions) The Purple line is urban and sub-urban transport and not inter-urban transport. i) This methodology is only applicable if the application of the procedure to identify the baseline scenario results in that a continuation of the current public transport system is the most plausible baseline scenario. (Project conditions) The identified baseline is a continuation of the current public transport system.
Demonstration of additionality of the proposed CDM project activity	*(About ¼ - ½ page)* The proposed CDM project activity is demonstrated additionality as follows: <u>Investment barrier</u> MRT project requires much investment cost, especially for the infrastructure, so that the host country has difficulty to implement it with own budget. And the Financial internal rate of return (FIRR) is - 1.47% (referred to MRTA information). Therefore, host country applies funds for the infrastructure from investor like JICA. For this reason, MRT project clearly faces the investment barrier for the constructional cost. <u>Common practice barrier</u> The proposed project activity is regarded as common practice if MRTA have already been implemented in 50% of the cities with more than 1 million habitants in the host country without using the CDM. According to the statistics of the department of Provincial Administration, Thailand has 19 cities which have more than 1 million populations. Among these cities, only four (4) cities have rail system or bus lane. Therefore, MRTS is only implemented in 5.3% of the above cities. Therefore, this project is not common practice in Thailand. For those reasons, the proposed project is not financially feasible without the revenue of CERs and not common practice in Thailand, thus is additional.

Demonstration of Prior consideration	*Submission date of the form F-CDM-Prior Consideration to the UNFCCC secretariat and Thailand DNA* • MRTA Board had discussed with ONEP about how to develop the new lines of MRT project, such as Purple line and Blues line extension, as a CDM project using the assistance from OTP on 28th June 2007. • MRTA Board had discussed with OTP about Baseline Methodology development for Transportation project as a CDM project on 3rd July 2007. • MRTA has required OTP to include emission reduction methodology for MRT project in their study report. Therefore, MRTA can use the study result for developing CDM project and getting benefit from Carbon Finance on 2nd August, 2007. • MRTA submitted the Letter of Intent (LoI) to TGO on 15 June, 2008 for all new lines project and on 15 January, 2010 for Purple line.

PROJECT IDEA NOTE

A. Project description, type, location and schedule

Name of Project: Namphon Dairy Farm Bio-Gas Development Project

*Date submitted:*_____

Technical summary of the project

Objective of the project	This project has been developed to solve problem on animal manure handling from more than 5,000 dairy cows farm which is now growing. By building a Cover lagoon manure digester, with their internal gas –liquid circulation, complete mixed, in order to help more digester effect. And aiming to utilize their Bio-gas for internal power generator through a Bio-gas generator, expecting for a maximum of 2 MW.
Project description and proposed activities	Project description Namphon Farm Limited partnership, a company 100% own by Thai, having a dairy cow farm business located their dairy farms at 16 Moo 2 Salangpun Wangmuang district Saraburee province. Namphon Farm LP having more than 5,000 dairy cows on a single area. All cows are life in the new style barn, close system. Namphon farm have been developing their Bio gas project in 2 phases, the first phase was carried out 3 years ago, when the farm having 2,000 head of dairy cows. Namphon Farm requested technical support from BTC- Biogas Technologies Chiangmai, that owned a channel digester technology suitable for animal manure digester. And Namphon farm got the financial support form NEPO as well (@20% of the total investment) and the low interest rate project development loan from NSTDA. At the moment, the farm is having their own 200 KVA gas generator and most of their electric are internal consuming which can help farm get saving of approximately 6 – 700,000 baht per year. However, Now the farm has been growing up, having more dairy cows more than 5,000 and more problems on manure handling. Namphon Farm needs to develop another 20,000 m3 digester and 20,000 m3 of waste water treatment pond in order to treat their manure waste from dairy business.

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	proposed activities Now the farm are willing to install another Bio-gas digester using their sister company technology, Advance Environmental Engineering, whose had given a design and build for a Cover lagoon manure digester, with their internal gas –liquid circulation, complete mixed, in order to help more digester effect. With their newly extra Bio-Gas digester, more Bio-gas will be produced, and expecting for a good Bio-Gas Generator will be acquired, for 2 units of 250 KVA, the first to serve their internal demand. Once the management is ready, the farm will challenge for VSPP of 1 MW sale project. The farm has decided to make proceed in the project without any support organization, however, in order to sell the electric power, the farm need to have a Very Small Power Producer (VSPP) contract with PWA or EGAT. And the farm needs to introduce a sub-station for electric part, but the cost is so expensive that the farm has not be able to proceed this project. In order to make proceed in this project, the farm decided to apply this project as a CDM project.
Technology to be employed	✓ A cover lagoon digester with internal gas circulation for complete mixed, by Advance Environmental engineering Co.,Ltd. ✓ Bio-Gas Generator
Project developer	
Name of the project developer	Namphon Farm limited Partnership
Organizational category	a. Government b. Government agency c. Municipality d. Private company e. Non Governmental Organization
Other function(s) of the project developer in the project	a. Sponsor b. Operational Entity under the CDM c. Intermediary d. Technical advisor
Summary of the relevant experience of the project developer	*Describe in less than 5 lines* This farm has an experience to install the bio digester on 1st phase.
Address	*Address, PO Box, City, Country* 16 moo 2, Tambon Salange pun, amphur Wangmuang, Saraburee Province, Thailand.
Contact person	*Name of the Project Development Manager* M.L. Prakrit Sukswadi
Telephone / fax	Tel: 081-642-47-64
E-mail and web address, if	Email: prakrit_ss@yahoo.com

any	
Project sponsors *(List and provide the following information for all project sponsors)*	
Name of the project sponsor	National Energy Policy Office (NEPO) @20% of the total investment
Organizational category	a. Government b. Government agency c. Municipality d. Private company e. Non Governmental Organization
Address	*Address, PO Box, City, Country* *Web address, if any* 121/1-2 Phetchaburi Road, Ratchathewi, Bangkok 10400, Thailand http://www.eppo.go.th/index-E.html
Main business activities	The Energy Policy and Planning Office (EPPO) is a pivotal agency in the management and administration of national energy policies and planning, adhering to the principles and giving due consideration to the economic, social and environmental development with transparent operation, emphasizing stakeholders' participation and networking, and is a learning organization that is recognized at both national and international levels.
Type of the project	
Greenhouse gases targeted	*CO_2 / CH_4 / N_2O / HFCs / PCFs / SF_6* *(mention what is applicable)* CH_4
Type of activities	*Abatement / CO2 Sequestration* Abatement
Field of activities	*(choose applicable field(s) from below)*
a. Energy supply	*Renewable energy, including biomass / biogas / cogeneration / improving energy efficiency by replacing existing equipment / minimization of transport and distribution / fuel switch (e.g., switch coal to biomass)* *(mention what is applicable)*
b. Energy demand	*Replacement of existing "household equipment" / improvement of energy efficiency of existing production equipment* *(mention what is applicable)*
c. Transport	*More efficient engines for transport / modal shift / fuel switch (e.g. public transport buses fuelled by natural gas)* *(mention what is applicable)*
d. Waste management	*Capture of landfill methane emissions / utilization of municipal waste and wastewater emissions (mention what is applicable)*

	Capture of methane emissions from animal manure to utilize bio gas generator.
e. Land Use Change and Forestry	*Afforestation/ reforestation/ forest management/ wetlands management/ watershed management/ improved agriculture / land degradation prevention* *(mention what is applicable)*
Location of the project	
Country	Thailand
City	16 moo 2, Tambon Salange pun, amphur Wangmuang, Saraburee Province
Brief description of the location of the project	Arid, red soil, not good environment, far from villagers, no impact with other people. 200 rais
Expected schedule	
Earliest project start date	*Year in which the plant will be operational* The project is now in 2nd phase which will start in 2011. - Construction and installation: Approx. April 2011 - Operation: Approx. end of year 2011
Estimate of time required before becoming operational after approval of the PIN	*Time required for financial commitments: 6 months* *Time required for legal matters: 4 months* *Time required for negotiations: 3 months* *Time required for construction: 6 months*
Expected first year of verified Emission Reduction or CER delivery	*Year* 2012
Project lifetime	*Number of years* Life of farm, or 15 years or more, (a period on financial support is 7 years)
Current status or phase of the project	The project is now in 2nd phase. Although, the 2nd phase has been started, because of the short of investment money, the 2nd phase has been stopped from 2009.

B. Expected environmental and social benefits

Estimate of Greenhouse Gases abated / CO_2 Sequestered (in metric tons of CO_2-equivalent)	Annual: 19,258 tCO_2-equivalent/year GHG emission reductions from avoidance of methane emissions are estimated based on parametric values of the Namfon Cow Farm from sampling as follows: • Number of dairy cows 5,000 (cows) • Amount of manure 1,250 (m^3/day) • Potential biogas production 3,750 (m^3/day) or 1,368,750 (m^3/year) • Methane gas density 0.00067 (tCH_4/m^3) • GWP of methane gas 21 (tCO_2/tCH_4) • COD of wastewater 17,000 (mg/l) • TKN of wastewater 200 (mg/l) • Total Solid of wastewater 15,000 (mg/l)

	• pH value of wastewater 7.2 = 1,368,750 (m^3/year) * 0.00067 (tCH_4/m^3) * 21 (tCO_2/tCH_4) = 19,258 (tCO_2e/year)
Specific global & local environmental benefits *(In total about ¼ page)*	
Local benefits	**Waste management** - Reduce air and water pollution from animal manure.
Global benefits	- Reduce GHG emissions by capture of methane from animal manure. - Reduce use of fossil fuels and natural resources.
Socio-economic benefits What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	*(In total about ¼ page)* *• Direct effects (e.g. employment creation, capital required, foreign exchange effects)* *• Indirect effects (e.g. training/education opportunities associated with the introduction of new technologies and products, or effects on other industries)* **Cost saving** - Replacing gridded-electricity by using electricity from bio gas generator. - Income creation from fertilizer. **Other benefits** - Employment creation - Technology transfer from government to local
Environmental strategy/ priorities of the Host Country	*A brief description of the relationship of the consistency of the project with environmental strategy and priorities of the Host Country* *(Not more than ¼ page)* Thailand has some environmental and energy strategy to prevent the environmental pollution and energy shortage that would be negative impact for the country. This project will have good effect for the global environment and local environment, as well as the energy development in the region. The strategy or the policy that are related to this project as follows; - National Climate Change Strategy 2007-2012 - Thai Energy Development Plan B.E. 2542-2544 - Thailand Energy Strategy and Policy - Renewable Energy Strategy

C. Finance

Total project cost estimate	
Development costs	
Installation costs	Approximate 120 million Baht
Other costs	Approximate 2 million Baht/year for O/M cost
Total project costs	Approximate 120 million Baht of total project costs;

Sources of finance to be sought or already identified	
Equity	*Name of the organizations and finance (in USD or Baht)*
Long-term debt	*Name of the organizations and finance (in USD or Baht)*
Short-term debt	*Name of the organizations and finance (in USD or Baht)*
Not identified	*Name of the organizations and finance (in USD or Baht)* The owner has no financial support on the 2nd phase. No financial institutes being applied for financial supporting yet.

D. Baseline and Additionality

Baseline scenario Which emissions is the proposed CDM project displacing? What would the future look like without the proposed CDM project?	The animal manure will be transferred to the retention pond nearby and emit CH4 to the atmosphere in the absence of the project activity because there are any regulatory and operational barriers. And, in addition, the electricity would have to be generated by other means such as fossil-fueled power generation on the grid. Therefore, the continuation of the current situation/manner is clearly defined as the baseline scenario.
For sequestration projects only: Existing vegetation and land use	*• What is the current land cover and land use? Is the tree cover more or less than 30 %?* *N/A*
Approved methodology (ies) applied to the project activity	*Number and title of the methodology(ies)* AMS-III.D: Methane recovery in animal manure management systems AMS-I.D: Grid connected renewable electricity generation
Applicability check of the chosen methodology(ies)	*(In total about ¼ page)* According to AMS-III.D, applicable technology/measure for the project should be as follows: 1. This methodology covers project activities involving the replacement or modification of existing anaerobic manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane. This methodology is only applicable under the following conditions: (a) The livestock population in the farm is managed under confined conditions; The farm is in confined conditions. (b) Manure or the streams obtained after treatment are not discharged into natural water resources (e.g., river or estuaries), otherwise AMS-III.H shall be applied; Manure or streams obtained after treatment are not

	discharged into natural water resources. (c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C; The usual temperature is 30°C. (d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than 1 month, and in case of anaerobic lagoons in the baseline, their depths are at least 1 m; The retention time is more than 1 month and the depths are more than 1 m. (e) No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario. At the moment, there is no methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario. 2. The project activity shall satisfy the following conditions: (a) The final sludge must be handled aerobically. In case of soil application of the final sludge the proper conditions and procedures (not resulting in methane emissions) must be ensured; The project aims to recycle the treated sludge in the digestion tank or to use it as soil application in the agriculture land. The aerobic condition of soil application will be ensured by project proponent. (b) Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared; The biogas that are produced by the digester flow into the generator directly. (c) The storage time of the manure after removal from the animal barns, including transportation, should not exceed 5 days before being fed into the anaerobic digester. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not apply. The storage time of the manure is less than 5 days.

	Consideration of the information of the project, the proposed methodology is applicable for this project.
Demonstration of additionality of the proposed CDM project activity	Investment Barrier The project activity can only be started with the financial support from the local bank. It is normal practice in Thailand that the bank will support the project with the payback period of 5 years or less, especially in the agro-industrial sector. Therefore, in order to obtain the bank loan support for the project activity, the income from the CER credit is crucial. It is essential to overcome the investment barrier. The project activity is not an economically attractive option for the farm if there is no CER benefit. But if the project is conducted as a CDM project, the economical feasibility of the project will be improved. In addition, the farm will also be able to gain pioneering effect of CER acquisition and honor as an environmentally friendly private company. These factors will enable this project to be undertaken.
Demonstration of Prior consideration	*Submission date of the form F-CDM-Prior Consideration to the UNFCCC secretariat and Thailand DNA* The project proponent has not applied any forms for CDM consideration yet.

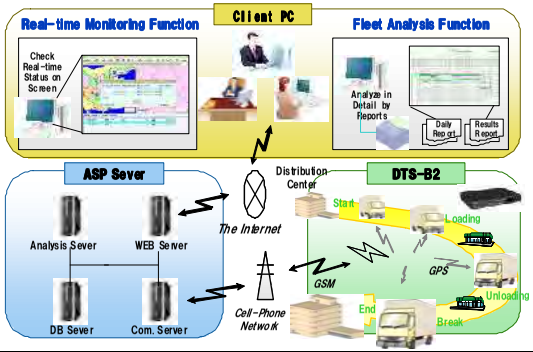
PROJECT IDEA NOTE

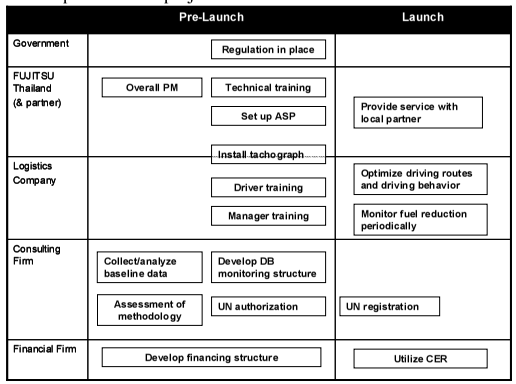
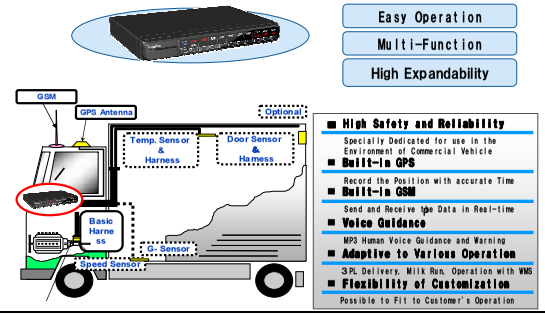
A. Project description, type, location and schedule

Name of Project: ***Smart Logistics- Reducing fuel usage of commercial vehicles in Thailand***

Date submitted: ***24 January, 2011***

Technical summary of the project

Objective of the project	The purpose of the project is to introduce advanced driving behavior monitoring equipment into commercial vehicles in logistic industry sector in Thailand, which also enables to reduce the fuel usage by optimizing the travel route of commercial vehicles.
Project description and proposed activities	The project introduces digital tachograph systems for road freight transport operating on a number of identified traceable routes in Thailand. Fujitsu, a supplier of the equipment, is planning to install the system to 107 commercial vehicles of a logistic company. The digital tachograph system enables the logistic company to manage its vehicle fleet and optimize usage of gasoline or diesel fuel. The system also enables to optimize travel route and reduces the number of vehicles operated by analyzing detailed delivery status and real time monitoring/ tracking of vehicle fleet status. It also enables to optimize driving behavior of each vehicle driver by warning the drivers to improve driving behavior using voice alerts when the vehicle is in operation, and also the system monitors and analyzes each driver's driving behavior on a daily basis and provides instructions for the drivers based on the "Safety Report." Fleet analysis and real time monitoring using GPS (Global Positioning System) enables optimized routing and optimized driving behavior which will reduce energy (fossil fuels) consumption, thus leading to GHG emission reduction. 

	Fujitsu provides the technology and technical support to the users, and service will be provided by local partners in Thailand (Mobile innovation CO., Ltd) – thus realizing knowledge transfer to the local business. The role of related parties in the project is shown below. 
Technology to be employed	Two major technologies are introduced, which are "Digital tachograph" and "Voice alert system". Description of the system is outlined in the chart below. The Digital tachograph product has already been commercialized in Thailand launched back in 2006. 
Project developer	
Name of the project developer	Fujitsu Systems Business (Thailand) Ltd.
Organizational category	a. Government b. Government agency c. Municipality (d) Private company e. Non Governmental Organization
Other function(s) of the project developer in the project	a. Sponsor b. Operational Entity under the CDM c. Intermediary (d) Technical advisor (e) Others (equipment supplier)
Summary of the relevant experience of the project developer	Fujitsu had conducted several case studies for logistic companies in Japan such as a large convenience store chain (Seven-Eleven Japan), bus

	transportation company and oil company. In 2005 Fujitsu had launched its first pilot project for manufacturing company (automobile parts distribution) in Thailand. Fujitsu has promoted proposed system for local companies and has introduced in about 2,500 cars.
Address	Exchange Tower, 22-23 Floor, 388 Sukhumvit Road, Klongtoey, Bangkok 10110
Contact person	Mr. Masaki Kajiyama Ms. Aurawan Rattanavinyoo
Telephone / fax	Phone: + 66 (0) 2302 1500, (0)2302-1658 Fax: + 66 (0) 2302 1555
E-mail and web address, if any	Uramat Waisupee [uramat@th.fujitsu.com]
Project sponsors	
Name of the project sponsor	
Organizational category	a. Government b. Government agency c. Municipality d. Private company e. Non Governmental Organization
Address	
Main business activities	
Type of the project	
Greenhouse gases targeted	CO_2
Type of activities	Abatement
Field of activities	c. Transport (Introduction of low-emission technologies to commercial vehicle fleets)
Location of the project	
Country	Thailand
City	TBA
Brief description of the location of the project	
Expected schedule	
Earliest project start date	Installation : 2011 Operation : 2012-
Estimate of time required before becoming operational after approval of the PIN	Need at least 9 months before the launch of operation. This pre-launch (or operation) works include item such as -Collection/analysis of baseline data -Development of database monitoring structure -Assessment of methodology planned -Development of financing structure -Export of components (digital tacograph) -Knowledge transfer/ training (installation & operation) -Installation of components (digital tacograph) -Preparation of Application Service Provider (ASP) service provision
Expected first year of verified Emission Reduction or CER delivery	N/A
Project lifetime	3-5 years to realize environmental benefits set at the beginning, and roughly another 5-7 years maintaining the optimization.
Current status or phase of the project	The project is still at a planning and design stage. Fujitsu is planning to introduce the system to 107 commercial vehicles of a logistic company in 2011 (Just target). Before start of the project, pre-F/S may be needed in this company.

A3-21

B. Expected environmental and social benefits

Estimate of Greenhouse Gases abated / CO_2 Sequestered (in metric tons of CO_2-equivalent)	Annual: 101 tCO_2-equivalent **Data from case study of the bus transportation company in Japan** - Reduction of consumed fuel (diesel): 3,162.3L/ month* - Net calorific value of the diesel fuel (MJ/ liter): 36 - CO2 emission factor of diesel fuel (tCO2/MJ): 0.0000741 *Under confirmation of car number
Specific global & local environmental benefits	
Local benefits	Environmental benefit is to control local air pollution by reducing dust emitted from combustion of fossil fuels from commercial vehicles in baseline. Also the activity contributes to the efficient use of fossil fuels, which are limited resources, and thus contributes to the energy security of Thailand.
Global benefits	Global benefit is to reduce GHG by reducing fuel consumption.
Socio-economic benefits What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	Economic benefits are - to optimize the use of fuel, thus reducing the total fuel consumption and fuel cost for the user - to transfer environmentally sound technology from Japan to Thailand Social benefit is to enhance traffic safety by improving driving behavior (e.g. driving at constant speed)
Environmental strategy/ priorities of the Host Country	As the current increase in prices of fossil fuels coupled with a high demand for energy in Thailand, it is necessary for the country to seek out the use of green/ clean energy sources and the improvement of energy efficiency in order to secure the country's energy security. In addition, to reduce GHG emission, it is important to increase the use of alternative energy and improve energy efficiency. CDM will therefore encourage the private sector in improving energy efficiency for their activities. The above is supported by "Thailand's energy policy" and "Alternative energy development plan".

C. Finance

Total project cost estimate	
Development costs	
Installation costs	IT system High model*:26,000 *Baht/ car* Standard model:21,000 *Baht/ car* *In High model, driver can set the system by himself with button handling.
Other costs	System maintenance 580 *Baht/ month/ car*
Total project costs	10,229, 200 *Baht* / 10 Years Note; Installation of High model to 107 cars. Operational cost on the logistic company's side (e.g. behavioral training to the drivers, driving route analysis and designing) are not included.
Sources of finance to be sought or already identified	
Equity	*n/a*
Long-term debt	*n/a*
Short-term debt	*n/a*
Not identified	*Financial source will be identified by the user of the technology*

D. Baseline and Additionality

Baseline scenario Which emissions is the proposed CDM project displacing? What would the future look like without the proposed CDM project?	At present, practices of many local drivers in road freight transport are inefficient. For example, it is a common practice for local drivers to use the regular roads instead of taking highways. This leads to more frequent accelerations and braking, and results in higher fuel consumption which emit more CO2 and other air pollutants. This CDM project activity is to introduce a digital tachograph system which enables the logistic company to manage its vehicle fleet and optimize resource usage such as fuel consumption by optimizing delivery routes and reducing number of vehicles and optimizing driving behavior of each vehicle drivers.
For sequestration projects only: Existing vegetation and land use	*n/a*
Approved methodology(ies) applied to the project activity	There is no approved methodology exists that can be applied to the project activity. For related project using same Fujitsu system, new methodology SSC-NM061 titled "Transportation Energy Efficiency Activities installing digital tachograph systems to commercial freight transport fleets" has been submitted, which is still under evaluation by the small-scale working group of the CDM Executive Board.
Applicability check of the chosen methodology(ies)	Closest, but currently not applicable, approved methodology is AMS III.S; "Introduction of low-emission vehicles/ technologies to commercial vehicle fleets," which is applicable to project activities introducing low-greenhouse gas emitting vehicles for freight transport, operating on a number of routes with comparable conditions. AMS III.S requests that project participants shall identify the vehicles that are in use on that each fixed route **before and after** project implementation. The project activity is to introduce the digital tachograph system for existing commercial trucks in order to reduce fuel consumption by optimizing route and drive behavior. So if the routes that are taken by the same vehicle are changed after project implementation, AMS III.S can not be applied to the proposed project. However, SSC-NM061 was submitted to SSC WG and t is under discussion. Upon approval of the said new methodology, the proposed project will be applied for registration as a CDM project activity.
Demonstration of additionality of the proposed CDM project activity	The proposed project may face an investment barrier. Although the cash flow may be changed depending on the characteristics of a client/ user, it is considered that the revenue related to the reduction of fuel consumption is not significantly large compared with the initial investment and installation cost. Therefore, depending on the target payback period or expected rate of return of the potential user, the project may have significant investment barrier. In this case, revenue from CER sales will be a crucial revenue source to increase profitability of the project.
Demonstration of Prior consideration	The proposed project activity has not started yet. Prior consideration letter will be prepared and submitted to TGO and UNFCCC when the user is identified.

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CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM ACTIVITY DESIGN DOCUMENT FORM (CDM-SSC-CPA-DD)
Version 01

CONTENTS

Annexes

NOTE:

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

(ii) The coordinating/managing entity shall prepare a CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)[1,2] that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

[1] The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

[2] At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case).

SMALL-SCALE CDM PROGRAMME ACTIVITY DESIGN DOCUMENT FORM
(CDM-SSC-CPA-DD) - Version 01 (09 Jan 2011)

NAME /TITLE OF THE PoA: Biogas generation from food waste in Bangkok___

SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

>>
Biogas generation from food waste programme CPA 01
Date: DD/MM/YYYY

A.2. Description of the small-scale CPA:

>>
This CPA is being proposed under the Biogas generation from food waste in Bangkok PoA. The CPA will be implemented as per the same implementation framework as described in the Biogas generation from food waste in Bangkok PoA-DD.

Biogas generation from food waste programme CPA 01 is the school managed by BMA. The school feeds their students for their lunch, and about 20 kg food waste would be generated per day. The food waste has collected by BMA and disposed to sanitary landfill site, as a result of that, methane is emitted to the atmosphere.

The project aims to install biodigester at this CPA so that organic waste (mostly food waste) from school feeding will be used as material input to generate biogas. And then generated biogas will be used for cooking fuel at schools instead of LPG, leading not only to avoidance of methane emissions from anaerobic decay, but to reduction of fossil fuel LPG consumption for cooking stoves, thus contributing to reduction of GHG emissions.

The Bangkok Metropolitan Administration (BMA) would be the Coordinating/ Managing Entity (C/ME)[3] of the PoA. BMA is responsible for this CPA. The BMA will support and supervise the school in setting up biodigesters, providing the technical know-how, and monitoring the implementation and operation of the each bio-digestors with DEDE technical consulting in equipment specification, installation, and the training for system operator.

The CPA 01 is positive supporting the related climate change mitigation policies in Thailand such as; the Renewable Energy Development Plan for B.E.2551-2565 (2008-2022)[2], Thailand Climate Change Strategy (2007-2011), and Bangkok Metropolitan Administration Action Plan on Global Warming Mitigation 2007 – 2012. Those also aimed to increase efficiency in Solid Waste Management for eliminated GHG emission especially methane release during the decomposition process of organic waste.

Moreover, the CPA 01 is a voluntary action by participating schools confirmed their voluntary participation by signing the cooperation agreement with C/ME. Furthermore, Thailand legislation and regulation have not enforce any organization to adopt onsite waste management technology or the use of alternative energy as mandatory practice.

[3] The C/ME shall be a project participant authorized by all participating host country DNAs involved and identified in the modalities of communication as the entity which communicates with the Executive Board, including on matters relating to the distribution of CERs.

[2] Announced by Department of Alternative Energy Development and Efficiency (DEDE) on 7June 2007

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.

A.3. Entity/individual responsible for the small-scale CPA:

>>

BMA is responsible for the CPA as C/ME under the PoA and communicates with the Board.

Table 1 – Table of the parties involved in the SSC- PoA

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Thailand (host)	Bangkok Metropolitan Administration (BMA)	No
	Funder???	

A.4. Technical description of the small-scale CPA:

A.4.1. Identification of the small-scale CPA:

>>

BMA identified the organization to be included in the small-scale CPA as follow identifying procedure;

Stage 1: Programme information and organization eligibility criteria questionnaire were sent to the potential organization by BMA.

Stage 2: The potential organization completed the questionnaire and sent back to BMA in charge to verify the organization information and eligibility criteria consistency. The result of verification would inform the potential organization. If the organization eligibility consisted with the criteria, the project participating application form is attached.

Step 3: The feasibility study and project preparation practice for the participating organization conducted by BMA to ensure that the organization ready and applicable to join the PoA.

Step 4: The organization and BMA agree to participate in the PoA by signing the Letter of Intent (LoI) and the cooperation agreement.

A.4.1.1. Host Party:

>>

Thailand

A.4.1.2. Geographic reference or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

>>Geographic reference or other means of identification[4], Name/contact details of the entity/individual responsible for the CPA, e.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

[4] E.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

>>

The location of participating organization of the CPA 01 is described in Table A 4.1.2 and Fig A 4.1.2.

Table A 4.1.2 Location of the CPA 01

No.	Organization	City	North coordinate	East coordinate
	(to be assigned)			

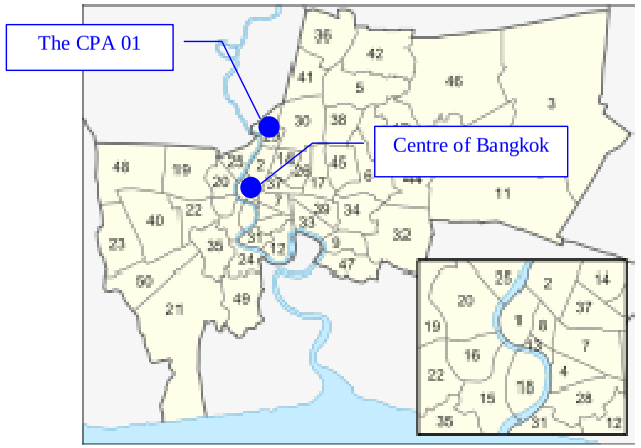

Figure 4.1.2 – Geographical location of CPA 01

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

DD/MM/YYYY , the starting date corresponds to be date when the construction contract was signed.

A.4.2.2. Expected operational lifetime of the small-scale CPA:

>>

10 years

A.4.3. Choice of the crediting period and related information:

>>

Fixed Crediting period

A.4.3.1. Starting date of the crediting period:

DD/MM/YYYY, the starting date corresponds to the date when the emission right transfer agreement contract is completed, and not before the PoA is registered.

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP:

>>

10 years.

NOTE: Please note that the duration of crediting period of any *CPA* shall be limited to the end date of the *PoA* regardless of when the CPA was added..

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

>>

Ex-ante estimated amount of emission reductions over the crediting period of the CPA 01 as illustrated in Table A 4.4.

Table A 4.4 Ex-ante estimated amount of emission reductions

Years	Annual estimation of emission reduction (tCO_2e)
1	1.72
2	2.04
3	2.04
4	2.04
5	2.04
6	2.04
7	2.04
8	2.04
9	2.04
10	2.04
Total of estimated emission reductions (tCO_2e)	20.01
Crediting Period	10
Annual average of estimated emission reduction over the crediting period	2.00

A.4.5. Public funding of the CPA:

>>

This CPA will be partly financed by public funding, with which the entity involved is the Bangkok Metropolitan Administration (BMA).

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

>>

This CPA, is not a de-bundled component of a large-scale activity because the implementer of the project activity is unique for each CPA inserted in the PoA for Biogas generation from food waste in Bangkok. The eligibility criteria has excluded de-bundled project of the large scale activity. In addition, the total size of this CPA is not to exceed 60,000 tCO_2e/year. Moreover, there is no existing the same project owner which is located less than 1 km from another project site. Therefore, CPA is not a de-bundled component.

SMALL-SCALE CDM PROGRAMME ACTIVITY DESIGN DOCUMENT FORM
(CDM-SSC-CPA-DD) - Version 01 (09 Jan 2011)

NAME /TITLE OF THE PoA: Biogas generation from food waste in Bangkok___

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

>>

The project is not registered as an individual CDM project and is not part of another registered PoA. The representative of CPA would have signed a cooperation agreement with BMA, and the agreement confirms that the CPA is neither part of any other CDM program of Activities nor any other CDM activities.

SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

>>

Biogas generation from food waste in Bangkok

B.2. Justification of the why the small-scale CPA is eligible to be included in the Registered PoA :

>>

The project is eligible to be included as a CPA in the proposed PoA as it complies with all the eligibility criteria listed in the PoA-DD as described below.

No.	Eligibility Criteria as defined in the PoA	CPA's Compliance with the eligibility criteria
1	The location and characteristics of the solid waste disposal site (SWDS) of the organic waste (food waste) in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions	The SWDS of this CPA, sanitary landfill, is located at XXXXXX. The volume of the waste is known by the dairy measurement record, and the content ratio of the waste is known by the annual survey.
2	The organization would have sorting organic food waste from inappropriate organic waste and/or other kind of waste such as plastic, animal bone, corncob, and etc.	The staff of the CPA would sort organic food waste from inappropriate organic waste and/or other kind of waste before putting into shedder.
3	The organization would have place designated for a biodigester tank. All the biodigester tanks have enough air and water tightness so that the biodigestion process in the CPA ensures that no leakage of fermented food waste takes place	The CPA has a place for installing the biodigester about 20 m^2 in the proper position and pavement area. This CPA is going to install the same type of biodigester which have enough air and water tightness.
4	For project activities involving controlled anaerobic digestion and production of biogas, technical measures shall be used to ensure that all biogas produced by the digester is captured and gainfully used or combusted/flared. So biogas-fired cooking stoves are used to ensure that all biogas generated by the digester is combusted.	In this CPA, all the biogas produced by the digester is captured and used as fuel for cooking. In order to ensure it, CPA would diary measure the volume of biogas by using gas flow meter and record the data.

No.	Eligibility Criteria as defined in the PoA	CPA's Compliance with the eligibility criteria
5	In case residual waste from the biological treatment are handled aerobically and submitted to soil application, the proper conditions and procedures must be ensured. So the final application of by-product sludge is handled in the proper aerobic condition	This CPA would submit the monthly survey to confirm the proper conditions and procedures to ensure the final application is handled in the proper aerobic condition.
6	The organization shall take responsibility for operating the biodigestion facility. The organization would have signed a cooperation agreement with BMA to participate in the programme, and to transfer the emission reductions' right to BMA	According to signed cooperation agreement, this CPA is obligated to operate the biodigester by mean of the operating guidelines and training courses provided in the program.
7	The participating organization is not a part of any kind of CDM programme of activity or CDM project activity.	The representative of CPA would have signed a cooperation agreement with BMA, and the agreement confirms that the organization has not included in any other CDM program of Activities or not the part of de-bundled.
8	Availability of the necessary data (i.e. amount of food waste etc.) for calculating of emission reduction and the crediting period as for verification of emission reductions there needs to be reliable data at the organization.	The staff of the organization would monitor the relative data such as amount of the waste for calculate the emission reduction according to monitoring plan. And BMA would provide them guidance of the operating and monitoring method of the biodigester.

B.3. Assessment and demonstration of additionality of the small-scale CPA , as per eligibility criteria listed in the Registered PoA:

>>

No.	Eligibility Criteria as per PoA	Situation in
1	The same technology will be introduced into the organization for the CPAs.	The technology to be employed by CPA is anaerobic digester which is new and not commercial for the country. Importantly, this technology is not required by mandatory enforcement of host country.
2	The baseline scenario should be the same at the organization for the CPAs	The baseline scenario of this CPA is defined as atmospheric release of methane (CH_4) from anaerobic decay of food waste and CO_2 from fossil fuel (LPG) combustion by cooking stove during the crediting period in the absence of the CDM programme activities as well as other typical CPAs of the PoA.
3	The common practice for waste disposal, especially for food waste from organization, should be sanitary landfill.	The current practice for the CPA waste disposal is sanitary landfills. Further, the organic waste sorting practice is just only environmental awareness promotion scheme.
4	By conducting investment comparison analysis between the baseline scenario	Net Present Value (NPV) index is chosen as financial indicator for comparison of options since the current

No.	Eligibility Criteria as per PoA	Situation in
	and the proposed programme activity, including waste disposal and heat generation, it has been demonstrated that the activity is not viable from economic point of view without CER revenue	practice of waste disposal into landfills has no additional/unordinary cost for the organization while biodigestion operation has both cost and revenue. Investment analysis demonstrates that this CPA is not financially viable without CDM. It is established that investment in the project activity can yield more viable NPV only if carbon revenue is included.

The CPA is thus proved to be additional.

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA is located within the geographical boundary of the registered PoA.

>>

The CPA is located within the geographical boundary of Bangkok, which is the boundary of the PoA. In the absence of the CDM project, the food waste will be dumped into the sanitary landfill site in Bangkok area. Relevant sources and gases included in boundary of this CPA are listed below.

Table B 4.1 Emission sources within Project Boundary that are considered

	Source	Gas		Justification/Explanation
Baseline emission	Emission from decomposition of waste at the landfill site	CH_4	Included	The major source of emissions in the baseline
		N_2O	Excluded	N_2O emissions are small compared to CH_4 emissions from landfills. Exclusion of the gas is conservative.
		CO_2	Excluded	CO_2 emissions from decomposition of organic waste are not occurred.
	Emissions from fossil fuel (LPG) consumption	CO_2	Included	An important emissions source
		CH_4 N_2O	Excluded	Excluded for simplification. The emission source is assumed to be very small.
Project emission	Emissions from onsite electricity consumption	CO2	Included	The major source of emissions in the project activity
		CH_4 N_2O	Excluded	Excluded for simplification. The emission source is assumed to be very small.
	Emissions from physical leakages of the anaerobic digester	CH_4	Included	May be an important emissions source
		CO_2 N_2O	Excluded	Excluded for simplification. The emission source is assumed to be very small.

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:

Data / Parameter:	$EF_{LPG,CO2}$
Data unit:	tCO2e/TJ
Description:	CO2 emission factor of fossil fuel (LPG) by the cooking stoves in the baseline scenario
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 1: Introduction, TABLE 1.4: DEFAULT CO2 EMISSION FACTORS FOR COMBUSTION
Value applied:	63.1 (Liquefied Petroleum Gases)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value acceptable as per IPCC 2006.
Any comment:	For a): If the fuel supplier does provide the NCV value and the CO2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO2 factor should be used. If another source for the CO2 emission factor is used or no CO2 emission factor is provided, Options b), c) or d) should be used.

Data / Parameter:	φ
Data unit:	-
Description:	Model correction factor to account for the model uncertainties
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	As recommend in the Tool referred to above.
Any comment:	-

Data / Parameter:	OX
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	OX is determined by the following two ways: (1) Conduct a site visit at the solid waste disposal site in order to assess the type of cover of the solid waste disposal site. Use the IPCC 2006 Guidelines for National Greenhouse Gas Inventories for the choice of the value to be applied.

	(2) Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Use 0 for other types of solid waste disposal sites. Since the landfill in baseline scenario can be considered as an unmanaged landfill with soil cover, the OX in this case is 0. The Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site version 4.0 says the OX be taken as 0.
Any comment:	-

Data / Parameter:	F
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
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
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Any comment:	-

Data / Parameter:	MCF
Data unit:	-
Description:	Methane Correction Factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures	Use the following values for MCF: · 1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical

actually applied :	compacting; or (iii) levelling of the waste. · 0.5 for semi-aerobic managed solid waste disposal sites. These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pond age; and (iv) gas ventilation system. · 0.8 for unmanaged solid waste disposal sites – deep and/or with high water table. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste. · 0.4 for unmanaged-shallow solid waste disposal sites. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres. The landfill is unmanaged and >5 m depth
Any comment:	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.

Data / Parameter:	DOC_j
Data unit:	-
Description:	Percent of degradable organic carbon (by weight) in the waste type j
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and 2.5)
Value applied:	**Waste type j** / **DOC_j (% wet waste)** / **DOC_j (% dry waste)** Wood and wood products: 43 / 50 Pulp, paper and cardboard (other than sludge): 40 / 44 Food, food waste beverage and tobacco (other than sludge): 15 / 38 Textiles: 24 / 30 Garden, yard an park waste: 20 / 49 Glass, plastic, metal, other inert waste: 0 / 0 Quantity of food waste to be handled at the facility will be measured on wet or dry basis. Therefore which DOC_j values corresponding to the wet or dry basis will be defined in the CPA-DD. Or more specifically, measure the DOC_j based on food waste sample taken from biodigester annually. Measurement in laboratories according to relevant national/international standards.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	-

Data / Parameter:	k_j
Data unit:	-
Description:	Decay rate for the waste type j
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value applied:	**Waste type j** / **k_j (Tropical: MAT>20°C, Wet: MAP>1000mm)** Slowly degrading — Pulp, paper and cardboard (other than sludge), textiles: 0.07 Slowly degrading — Wood and wood products: 0.035 Moderately degrading — Other (non-food) organic garden and park waste: 0.17 Rapidly degrading — Food, food waste beverage and tobacco (other than sludge): 0.40
Justification of the choice of data or description of measurement methods and procedures actually applied :	Document in the CPA-DD the climatic conditions at the SWDS site (temperature, precipitation and, where applicable, evapotranspiration). Use long-term averages based on statistical data, where available. MAT is 28.2 °C (annual mean temperature) MAP is 1543.2 mm (annual rainfall)
Any comment:	-

B.5.2. Ex-ante calculation of emission reductions:

The emission reductions are calculated according to methodology AMS III.AO-Version 1.0 and AMS-I.C-version19 which are referred to in the PoA-DD. The ex-ante calculation of emission reductions are as follows.

Baseline emissions
The methodological equations for estimation of the baseline emissions are determined below.

$$BE_y = BE_{CH4,SWDS,y} + B_{biogas,PJ,y} * NCV_{biogas} * EF_{LPG,CO2} \quad (1)$$

Where:

BE_y Baseline emissions in year y (tCO_2e)

Methane emission from the landfill site

$BE_{CH4,SWDS,y}$ Yearly methane generation potential of the solid waste (food waste) anaerobically digested by the project activity during the years “x” from the beginning of the project activity (x=1) up to the year y estimated as per the latest version of the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” (tCO_2e). The tool may be used with the factor “f=0.0” assuming that

no biogas is captured and flared. With the definition of year x as 'the year since the landfill started receiving wastes, x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)'

CO_2 emission from the LPG combustion

$B_{biogas,PJ,y}$	Amount of renewable biogas energy-used by the cooking stoves in the project activity (t-biogas)
NCV_{biogas}	The net calorific value of the biogas (TJ/ t-biogas)
$EF_{FF,CO2}$	The CO_2 emission factor of the fossil fuel (LPG) that would have been used by the cooking stoves in the baseline scenario (tCO_2/TJ)

Yearly methane generation potential of the solid waste (food waste) anaerobically digested by the project activity

$$BE_{CH4,SWDS,y} = \varphi * (1-f) * GWP_{CH4} * (1-OX) * \frac{16}{12} * F * DOC_F * MCF * \sum_{x=1}^{y}\sum W_{j,x} * DOC_j * e^{-k*(y-x)} * (1-e^{-k_j}) \quad (2)$$

where:

φ	Model correction factor (default 0.9) to correct for the model uncertainties
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner.
GWP_{CH4}	Global Warming Potential (GWP) of methane, valid for the relevant commitment period.
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	Fraction of degradable organic carbon that can decompose
MCF	Methane Correction Factor (fraction)
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes/year)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	Decay rare for the waste type j
j	Waste type category (index)
x	Year during the crediting period: x runs from first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)
y	Year for which methane emissions are calculated

In this PoA project, organic waste (mostly food waste) is used as the material for biodigestion. Therefore, $W_{j,x}$ is same amount of the waste that are corrected in the boundary of this CPA.

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Table B.5.2-1. Parameters values used to calculate ex-ante baseline emissions

Parameter	Value
φ	0.9
f	0
GWP_{CH4}	21
OX	0
F	0.5
DOC_f	0.5
MCF	1.0
DOC_j: food, food waste	0.15
k	0.40
$B_{biogas,PJ,y}$	0.25 (tons)
NCV_{biogas}	0.048 (TJ/tons)

Table B.5.2-2. Ex-ante emissions of baseline emissions

Year	Baseline emissions(tCO_2e/year)
2011	1.86
2012	2.90
2013	3.60
2014	4.07
2015	4.38
2016	4.59
2017	4.74
2018	4.83
2019	4.89
2020	4.94

Project Activity Emissions

$$PE_y = PE_{y,power} + PE_{y,phy\_leakage} \quad (3)$$

where:

PE_y	Project emissions in the year y (tCO_2e)
$PE_{y,power}$	Project emissions from onsite energy use in the year y (tCO_2e)
$\mathbf{PE_{phy\ leakage,\ y}}$	Methane emissions from physical leakages of the anaerobic digester in year y (tCO2e). Methane emissions due to physical leakages from the digester and recovery system shall be estimated using a default factor of 0.05 m³ biogas leaked/m³ biogas produced.

Project emissions from onsite energy use in the year y (tCO_2e)

$$PE_{y,power} = MWh_{e,y} * EF_{e,CO2} \quad (4)$$

where:

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$PE_{y,power}$ Project emissions from onsite energy use in the year y (tCO_2e)

$MWh_{e,y}$ Amount of electricity consumed from the grid in the project activity, measured using an electricity meter (MWh)

$EF_{e,CO2}$ The CO_2 emission factor of electricity generation (tCO_2/MWh)

Table B.5.2-3. Parameters values used to calculate ex-ante $PE_{y,power}$

Parameter	Value
$MWh_{e,y}$	0.05 (MWh)
$EF_{FF,CO2}$	0.5812 (tCO_2/MWh)

Emission reductions

$$ER_y = \min((BE_y - PE_y), (MD_y - PE_{y,power})) \quad (5)$$

Where:

ER_y Emission reductions achieved by the project activity based on monitored values for year y (tCO2e)

BE_y Baseline emissions calculated using equation (1) using ex post monitored values (tCO2e)

PE_y Project emissions calculated using equation (3) using ex post monitored values. This calculation shall include project emissions from physical leakage (tCO2e)

MD_y Methane captured and destroyed or used gainfully by the project activity in year y (tCO2e)

$PE_{y,power}$ Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO2e)

B.5.3. Summary of the ex-ante estimation of emission reductions:

>>

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2011	0.13	1.86	0.00	1.72
2012	0.02	2.07	0.00	2.04
2013	0.02	2.07	0.00	2.04
2014	0.02	2.07	0.00	2.04
2015	0.02	2.07	0.00	2.04
2016	0.02	2.07	0.00	2.04
2017	0.02	2.07	0.00	2.04
2018	0.02	2.07	0.00	2.04
2019	0.02	2.07	0.00	2.04
2020	0.02	2.07	0.00	2.04
Total (t CO_2 e)				20.10

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B.6. Application of the monitoring methodology and description of the monitoring plan:

B.6.1. Description of the monitoring plan:

>>

The monitoring plan as described in section E.7 of the Biogas generation from food waste in Bangkok PoA-DD, under which this CPA is being proposed, will be followed.

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:

>>

✔ Please tick if this information is provided at the PoA level. In this case section C.2. and C.3. need not be completed this form.

The proposed project activity is not required any environmental impact assessment by the laws or regulations in Thailand since there could not be any negative impacts raised from this proposed activity. Even though, an Initial Environmental Evaluation Report (IEE) and Environmental and Sustainable Development Framework had prepared for submission to the DNA as PoA CDM project approval procedure of the host country. Therefore, each participating organization will adopt Environmental and Sustainable Development Framework in accordance with the IEE of the PoA.

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

>>

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

>>

SECTION D. Stakeholders' comments

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

>>

✔ Please tick if this information is provided at the PoA level. In this case sections D.2. to D.4. need not be completed in this form.

The stakeholder consultation is undertaken at the PoA level.

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

>>

D.3. Summary of the comments received:

>>

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

>>

Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	Bangkok Metropolitan Administration
Street/P.O.Box:	
Building:	
City:	Bangkok
State/Region:	
Postfix/ZIP:	10400
Country:	Kingdom of Thailand
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This PoA and related CPAs will be partly financed by public funding, with which the entity involved is the Bangkok Metropolitan Administration (BMA). The DOE will be provided with the evidence that the same BMA money is not being used for purchasing emission reductions.

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Annex 3

BASELINE INFORMATION

See individual CPA
Project proponents preliminarily estimated GHG emission based on the common practice of the CPA 01 as follows:

Parametric values for the estimation (at this stage):

- Number of schools in the CPA 01: 1 (school)
- Number of operating days of a school per year: 250 (day/year)
- Amount of food waste from a school per day: 20 (kg-waste/school/day)
- Volume of biogas generation from 1 kg of food waste: 0.050 (m^3-biogas/kg-waste)
- Contents of CH_4 in biogas: 55 (%)
- Density of methane: 0.717 (kg-CH_4/m^3-CH_4)
- Net calorific value of methane: 0.048 (TJ/t-CH_4)
- CO_2 emission factor of LPG: 63.1 (tCO_2/TJ)

Step I : Baseline emissions (Methane emission from the landfill site):
38 (tCO_2e/year, Average value) to be estimated from the first order decay model in accordance with "Tool to determine methane emissions avoided from disposal of waste" as below:

Formula and Parameters for calculation of baseline GHG emissions

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j (y-x)} \cdot (1-e^{-k_j})$$

φ=	0.9	: Model correction factor to account for model uncertainties
f=	0	: Fraction of methane captured at the SWDS and flared
GWP=	21	: Global Warming Potential (GWP) of methane
OX=	0	: Oxidation factor
F=	0.5	: Fraction of methane in the SWDS gas
DOCf	0.5	: Fraction of degradable organic carbon (DOC) that can decompose
MCF=	1	: Methane correction factor
Wjx=	**5**	**: Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons)**
>>>Generation of food wastes : 5t/year (= 20 kg/day/school*250days *1 school)		
DOCj=	**0.15**	**: Fraction of degradable organic carbon (by weight) in the waste type j (wet: 15%, dry: 38%)**
kj=	**0.40**	**: Decay rate for the waste type j (tropical and wet: 0.40)**
x=	1～10	: Year during the crediting period (year)
y=	1～10	: Year for which methane emissions are calculated (year)

Estimated baseline GHG emissions (unit : tCO2e)

Year	1year	2year	3year	4year	5year	6year	7year	8year	9year	10year	total	average
GHG emissions (tCO2e/year)	1.56	2.60	3.30	3.77	4.09	4.30	4.44	4.53	4.60	4.64	37.82	3.78

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x= y=	1	2	3	4	5	6	7	8	9	10	total	tCO2e	accumulation	
1	0.25										0.25	1.56	1.56	1 year
2	0.17	0.25									0.41	2.60	4.16	2 year
3	0.11	0.17	0.25								0.52	3.30	7.46	3 year
4	0.07	0.11	0.17	0.25							0.60	3.77	11.23	4 year
5	0.05	0.07	0.11	0.17	0.25						0.65	4.09	15.32	5 year
6	0.03	0.05	0.07	0.11	0.17	0.25					0.68	4.30	19.61	6 year
7	0.02	0.03	0.05	0.07	0.11	0.17	0.25				0.70	4.44	24.05	7 year
8	0.02	0.02	0.03	0.05	0.07	0.11	0.17	0.25			0.72	4.53	28.58	8 year
9	0.01	0.02	0.02	0.03	0.05	0.07	0.11	0.17	0.25		0.73	4.60	33.18	9 year
10	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.11	0.17	0.25	0.74	4.64	37.82	10 year

Step II: Baseline emissions (CO2 emission from the LPG combustion):
$B_{biogas,PJ,y}$ * NCV_{biogas} * $EF_{LPG,CO2}$ = 5,000(kg-waste/yr) * 0.050(m^3-biogas/kg-waste) * 0.55(m^3-CH_4/m^3-biogas) * 0.717(kg-CH_4/m^3-CH_4) * 10^{-3} * 0.048(TJ/t-CH_4) * 63.1(t-CO_2/TJ) = 0.29 (tCO_2e/yr)

Step III: Calculate the combined baseline emission of each activity
Baseline Emission
= Methane emission from the landfill site + CO2 emission from the LPG combustion
= 0.029 (tCO_2e/year) + 0.103 (tCO_2e/yr)
= 0.13 tCO_2e/yr Ave.

Project emissions (Onsite energy use):
$PE_{y,power}$ = $MWh_{e,y}$ * $EF_{e,CO2}$ = 20 (kg waste/school/day) * 1 (school) * 250 (day) * 0.01 (kWh/kg waste) * 10^{-3} * 0.5812 (tCO_2/MWh) = 0.05 (tCO_2e/yr)

Project emissions (Physical leakage):
$PE_{phy\ leakage,y}$ = 10 (kg waste/school/day) * 1 (school) * 250 (day) * 0.050(m^3 biogas produced/kg waste) * 0.05 (m^3 biogas leaked/m^3 biogas produced) * 0.55(m^3 CH_4/m^3 biogas) * 0.717(kg CH_4/m^3 CH_4) * 10^{-3} * 21 (tCO_2/tCH_4) = 0.1 (tCO_2e/yr)

MD_y (Methane captured and destroyed or used gainfully by the project activity):
MD_y = 20 (kg waste/school/day) * 1 (school) * 250 (day) * 0.050(m^3 biogas produced/kg waste) *0.55(m^3 CH_4/m^3 biogas) * 0.717(kg CH_4/m^3 CH_4) * 10^{-3} * 21 (tCO_2/tCH_4) = 2.07 (tCO_2e/yr)

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Total GHG emission reductions to be estimated:

$$ER_y = \min((BE_y - PE_y), (MD_y - PE_{y,power}))$$

(unit: tCO_2e)

Year	BE_y	PE_y	MD_y	$PE_{y,power}$	BE_y - PE_y	MD_y -$PE_{y,power}$
1	1.86	0.13	2.07	0.02	1.72	2.04
2	2.90	0.13	2.07	0.02	2.77	2.04
3	3.60	0.13	2.07	0.02	3.47	2.04
4	4.07	0.13	2.07	0.02	3.94	2.04
5	4.38	0.13	2.07	0.02	4.25	2.04
6	4.59	0.13	2.07	0.02	4.46	2.04
7	4.74	0.13	2.07	0.02	4.60	2.04
8	4.83	0.13	2.07	0.02	4.70	2.04
9	4.89	0.13	2.07	0.02	4.76	2.04
10	4.94	0.13	2.07	0.02	4.80	2.04

Financial Analysis

(unit: baht)

Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Investment cost of a digestor	-66,800	0	0	0	0	0	0	0	0	0
O&M cost	-7,400	-7,400	-7,400	-7,400	-7,400	-7,400	-7,400	-7,400	-7,400	-7,400
Saving of LPG purchase cost	2,057	2,057	2,057	2,057	2,057	2,057	2,057	2,057	2,057	2,057
Saving of waste disposal cost	7,750	7,750	7,750	7,750	7,750	7,750	7,750	7,750	7,750	7,750
Balance of payments	-64,393	2,407	2,407	2,407	2,407	2,407	2,407	2,407	2,407	2,407
NPV w/o CDM	**-34,973**									
CERs revenue	869	1,029	1,029	1,029	1,029	1,029	1,029	1,029	1,029	1,029
Balance of payments	-63,524	3,436	3,436	3,436	3,436	3,436	3,436	3,436	3,436	3,436
NPV with CDM	**-33,698**									

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Annex 4

MONITORING INFORMATION

Monitoring Parameters, Frequency, Equipment Archiving and Responsibility

Monitoring action will be act in accordance with QA/QC procedure which is applied from source of information at the CPA information log. The data collection template will be use to record of data for each parameter which is measured following the monitoring plan.

- - - - -

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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):

>>
Biogas generation from food waste in Bangkok
Document Version: 01
Date: … July 2011

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.

Bangkok Metropolitan has more than 10 million of population (include underlying population). One of the significant environmental concerns of the growing urban areas has been the management of municipal solid wastes (MSW). So far as concerns disposal of the MSW, a common practice in Bangkok is to dispose almost the wastes in sanitary landfill sites. Almost 50% of municipality waste is organic waste. Consequently, that practice conducts the potential source of GHG emission reduction and high cost of eliminating waste .

Biogas generation from food waste in Bangkok (hereafter, the "Project") is developed by Bangkok Metropolitan Administration (BMA) of Thailand. The proposed activity will install bio-digesters at public organizations (such as BMA's school) in Bangkok (hereafter, the "organization")in order to use the organic waste from feeding/catering as material input to generate biogas. At this stage, BMA plan to install the biodigester to 84 to 355 schools in Bangkok. This project leads not only avoidance of methane emissions from anaerobic decay, but also reduction of fossil fuel (LPG) consumption for the cooking, thus contributes to reduce GHG emissions. BMA will provide complete CDM service to the participating organization while the technical support for bio-digestor system operation and monitoring will be facilitated by Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy. Closely collaborative support of BMA and DEDE will ensure the long term sustainability of the project activity.

The benefits obtained from CER will be used to improve social and environmental conditions in the organizations, assuring sustainability of both the organizations and the program. The resources generated by this PoA will return to the organizations according to each organization feeding's potential for reducing emissions and will help the organizations cover the equipment and operational costs.

1. Generation operating and implementing framework of PoA

The goals for this Programme of Activities (PoA) improves the organic food waste management practice and reduce GHG emission in BMA organizations. The project is to install anaerobic bio-digester system, which capture and utilize methane to generate heat for cooking strove in participating organizations.
The Bangkok Metropolitan Administration (BMA) would be the Coordinating/ Managing Entity (C/ME)[1] of the PoA. BMA is responsible for the PoA and all the CDM Programme Activities (CPAs) under the

[1] The C/ME shall be a project participant authorized by all participating host country DNAs involved and identified in the modalities of communication as the entity which communicates with the Executive Board, including on matters relating to the distribution of CERs.

PoA. The BMA will support and supervise the organizations in setting up biodigesters, providing the technical know-how, and monitoring the implementation and operation of the each bio-digestors with DEDE technical consulting in equipment specification, installation, and the training for system operator. Figure A.2.1 illustrated the institutional arrangement for the PoA.

The expected result for this project is a significant reduction of GHG emissions compared to the emissions that would occur in the absence of this project. The second expected result is to promote sustainable food waste management at the organizations, generating environmental and social benefits.

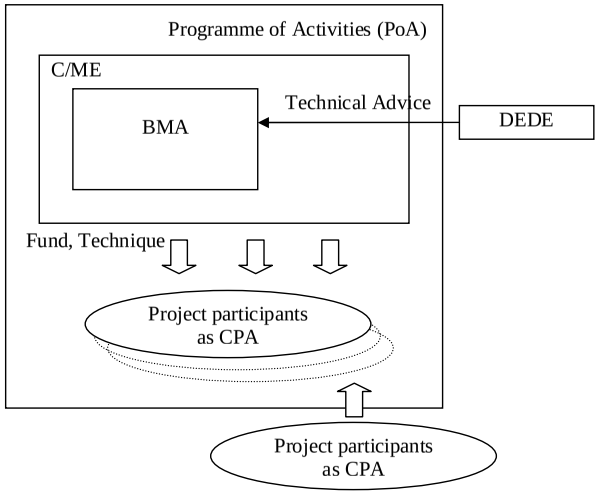

Figure A.2.1 Institutional Arrangement

2. Policy/measure or stated goal of the PoA
The PoA is positive supporting the national and local policies in Thailand.

- Renewable Energy Development Plan for B.E.2551-2565 (2008-2022)[2]. The target of the plan is to increase amount of generated electricity and thermal by municipality solid waste 160 MW and 35 ktoe respectively in 2022 with various measures which will lead to energy sufficiency at the local community level.

- Thailand Climate Change Strategy (2007-2011) greenhouse gas mitigation through development of renewable energy from waste material.

- Bangkok Metropolitan Administration Action Plan on Global Warming Mitigation 2007 – 2012, Initiative 4, Action plan 1 is to increase efficiency in Solid Waste Management for

[2] Announced by Department of Alternative Energy Development and Efficiency (DEDE) on 7June 2007

eliminated GHG emission through methane release during the decomposition process of organic waste.

3. Confirmation that the proposed PoA is a voluntary action by the C/ME.

The proposed PoA is a voluntary action by the C/ME. All participating organizations confirmed their voluntary participation by signing the cooperation agreement with BMA. Furthermore, Thailand legislation and regulation have not enforce the household or government organization to adopt onsite waste management technology or the use of alternative energy as mandatory practice.

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.

BMA would be the C/ME for all the CPAs under the POA and communicates with the Board. Information relating to the parties involved in the CPAs is described in Annex 1. The parties involved are:

Table 1 – Table of the parties involved in the SSC- PoA

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Thailand (host)	Bangkok Metropolitan Administration (BMA)	No
	Funder???	

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

>>

A.4.1. Location of the programme of activities:

>>

The PoA will locate around Bangkok metropolitan area, Thailand

A.4.1.1. Host Party(ies):

>>

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 geographical boundary of the PoA is Bangkok metropolitan area. Figure A 4.1.2 characterizes the included regions of the organizations that will be CPAs and the Bangkok Metropolitan Administration

office. At this stage, BMA plan to install the biodigester to 84 - 355 schools in Bangkok. and BMA will be the C/ME for all the CPAs. Also, BMA will help the schools set up biodigesters, provide know-how and supervise the CPAs.

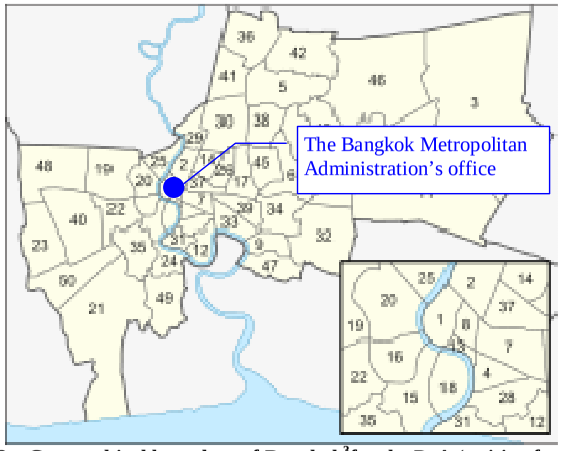

Figure A 4.1.2 – Geographical boundary of Bangkok[3] for the PoA (waiting for BMA's map)

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

>>

A typical CPA will be a group of school or individual school that will implement the project activity which are capture and utilize biogas generated by anaerobic condition of organic food waste decomposition in the bio-digester and then compressed into the biogas container that will be used as cooking fuel.

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

>>

The technology to be employed by all SSC-CPAs in the proposed project activity is anaerobic digesters technologies. Anaerobic digesters technologies capture and utilize biogas generated by methanogenic fermentation of degradable organic carbon (DOC) included in organic food waste in the bio-digester.

Each school will collect food waste, which includes waste oil, from school feeding, restaurants and markets in areas around local community in order to operate a biodigester. Any truck will not be used since project staff will carry manually about 20 kg per day to a site in school. As input material, food waste will be chopped into small pieces by the shedder and put into the anaerobic bio-digester tank.

Anaerobic digesters to be installed in each school will be specified by DEDE and manufactured by Thai suppliers. A digestion tank to be made of polyethylene will have capacity of 20 kg food waste per day with 20 retention days per round. Then generated biogas will be compressed into 162 litre container corresponds to heat quantity of 25-30 minutes cooking. For safety, the flashback arrestor is provided to ensure that combustion of a flame mixture is terminated before it can reach the biogas container. Approximately cost of the anaerobic digester system will be 66,800 TH Baht per unit.

After that by-product sludge from biodigester will be mixed with soil, sawdust, husk and coconut skin, and provided for school garden and nearby community as fertilizer source for planting trees without charge, where methane and nitrous oxide emissions can be considered negligible since there are no anaerobic conditions in these soil applications.

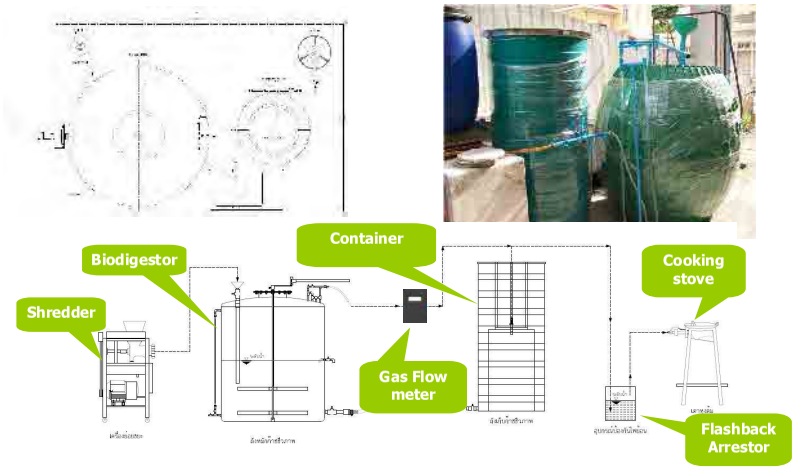

Figure 4.2.1 – A design layout of anaerobic digester technology in the CPA

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 eligibility criteria for enrolling the CPA are following characteristics:

- The location and characteristics of the solid waste disposal site (SWDS) of the organic waste in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions;
- The organization would sort organic food waste from inappropriate organic waste and/or other kind of waste such as plastic, animal bone, corncob, and etc.
- The organization would have place designated for a biodigester tank. All the biodigester tanks have enough air and water tightness so that the biodigestion process in the CPA ensures that no leakage of fermented food waste takes place;
- For project activities involving controlled anaerobic digestion and production of biogas, technical measures shall be used to ensure that all biogas produced by the digester is captured and gainfully used or combusted/flared. So biogas-fired cooking stoves are used to ensure that all biogas generated by the digester is combusted;
- In case residual waste from the biological treatment are handled aerobically and submitted to soil application, the proper conditions and procedures must be ensured. So the final application of by-product sludge is handled in the proper aerobic condition.

- The organization shall take responsibility for operating the biodigestion facility. The organization would have signed a voluntary cooperation agreement with BMA to participate in the programme, and to transfer the emission reductions' right to BMA.
- The participating organization is not a part of any kind of CDM programme of activity or CDM project activity.
- Availability of the necessary data (i.e. amount of food waste etc.) for calculating of emission reduction and the crediting period as for verification of emission reductions there needs to be reliable data at the organization.

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;

>>
BMA implement the proposed project activity as voluntary coordinated action.

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

>>
The current practice for municipal waste disposal, especially for organic waste, in Bangkok is sanitary landfills. The typical landfills have depth of more than 5 metre. However, with regard to the landfills, there is no mandatory requirement pertaining to capturing and flaring of landfill gas in Thailand. In addition, there is no national, provincial or local regulation requiring any GHG emission reduction activities in organic waste disposal businesses. Therefore, the organization staffs are not required to introduce any clean technology to treat the organic waste from organization. As same as, the organic waste sorting practice is just only environmental awareness promotion scheme in Bangkok. This proposed project activity improves the current practice through introducing the decomposition process with bio digestion tanks and capturing the gas for energy use in organizations. That leads methane recovery and GHG emission reductions. The technology (for organic waste treatment in organization) is new for the country.

Since 2006, DEDE implemented Bio-energy in school programme as a pilot project. This programme had installed the bio-digester tank in order to generating biogas from food waste and use biogas as cooking fuel in 40 BMA schools as pilot project. In 2009, other 40 BMA schools were installed bio-digester tanks by BMA financial support and DEDE technical advice. The lesson learned of the pilot project implementation illuminated that many of participating schools have not continuing and relying to operate the system with several factors such as inapplicable of the bio-digester tank material and size, non permanent technician, lack of financial support for equipment maintain cost, labour wage, and monitoring

equipments and actions. That reasons why some participating schools had withdrawn the project or stop to operate the system.

According to 15 years national renewable development plan and 5 years BMA action plan to combat climate change which promote the use of energy from waste to decrease greenhouse gas emission in municipality and community level. BMA aim to extent the producing of bio-gas from food waste in more potential 84-355 BMA's schools as CDM project by using of more applicable design of bio-digester tank and other equipments base on comprehensively feasibility study and employ specified and well trained staff to operate the system. Moreover, this implementation also launch the effectively monitoring system in order to develop high quality of implementation and GHG reduction which will be the best model for all of schools in Thailand. Furthermore, the PoA solve the existing environment problems which might be occurred due to current waste management practice such as air pollution, land degradation, energy security, and also directly foster students to have the climate friendly awareness through the proposed project activity. Nevertheless, the financial constrained and technical deficiently under this sustainable proposed project activity are vital increase more obligations for the project developer.

(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.

BMA is the C/ME of the PoA. Participating organizations will be signed the cooperation agreement. Data of the anaerobic digester system and the monitoring system will be gathered and reported by the participating organizations on a monthly basis. BMA role is PoA information clearing house that secure the proposed project operational information according to regular procedure.

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

>>

The operation of a biodigester system with energy use of a cooking stove is performed by each organization staff of the programme. The training of the system operation is given by the equipments manufacturer. The organization staffs are also responsible for data collection and data storage. The maintenance of the equipments is also provided by the manufacturer.

BMA is responsible for establishment of regular data collection and reporting processes and also provides technical assistance in the use of, and follow up on the data collection and reporting procedures. Moreover, included are activities on staff training and provision of adequate technical knowledge transfer. Data collected from each CPA will be delivered to BMA that designated the Project Implementation Unit for gathering, managing, organizing, and achieving the information in relation to the programme. The managing software ensures protection of the data to be collected in the organizations by the automatic aggregation process to be prevented from the data manipulation. Paper and electronic records will be collected through entire crediting period of each CPA (10 years) and two years after the crediting period.

(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;

>>

Procedure for identification of each organization as a CPA site is realized by BMA's ID numbering system. Each organization will be identified by an ID number as well as the organization name. Besides an ID number and the organization name, all of the organizations will have geographic location references (latitude and longitude) to be stored in the geographic information system.

Each CPA is identified with that information to ensure "single counting" in the PoA. It should be mentioned that all the equipments of the biodigester system has the different serial number for each organization. The each serial numbers will be determined by the manufacturer and linked with the mapping software identification including the geographic location and organization name.

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

>>

The SSC-CPA in the proposed activity is not de-bundled component of another CDM programme activity or CDM project activity according to the eligibility criteria for enrolling the CPA.

(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.

>>

For inclusion of a CPA under the PoA, a cooperation agreement would be signed by each CPA proponent (the organization) with BMA. Proper instruction program will be conducted for the organization staff to make them aware of rules of CDM and PoA scheme. In addition, the agreement would include provisions that make the organization acknowledge that it have agreed with their subscription to the PoA. The agreement would also require the organization to confirm that it has not yet been a part of any CDM project.

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;

(iii) 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.

>>

Procedures to monitor primarily the amount of food waste to be used as input material and generated biogas to be used as methane fuel are described in section E.7.2 in detail. The methodologies AMS-III.AO and AMS-I.C are conformed to in the monitoring activities. The amount of biogas and methane content will be monitored by a gas flow meter and gas analyzer.

Besides monitoring at food waste injection and generated biogas extraction, periodical sampling will be conducted to analyze compositions both of food waste and generated biogas. The monitoring devices shall be subjected to regular calibration, testing and maintenance to ensure accuracy of the monitoring according to the manufacturer specifications.

The specific parameters to be monitored in this PoA, extending to all the CPAs, are described in section E.7.1. More details of the monitoring plan are described in section E.7.2, which provides an explanation of the essential procedures to ensure the data reliability. All the data obtained in the monitoring activities will be stored electronically.

(iv) 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;

>>

Not Applicable

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

>>

There is no public funding support this PoA yet.

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

>>

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

>>

The project starting date is YYYY/MM/DD, when BMA signed the Letter of Intent (LoI) with DNA .

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

>>

The length of the PoA is 28 years.

SECTION C. Environmental Analysis

>>

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 ■

The proposed project activity is not required any environmental impact assessment by the laws or regulations in Thailand since there could not be any negative impacts raised from this proposed activity. Even though, an Initial Environmental Evaluation Report (IEE) and Environmental and Sustainable Development Framework had prepared for submission to the DNA as PoA CDM project approval procedure of the host country. Therefore, each participating organization will adopt Environmental and Sustainable Development Framework in accordance with the IEE of the PoA.

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

>>

The each programme activity is carried out in the organization's property. So the environmental impacts from the proposed activity are considered potentially limited to the organization's property only. Furthermore the locations of the organizations to be involved in this PoA are at least 50 km far from the international boundary. Hence the direct environmental impacts are considered negligible outside the Thai national territory.

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),:

>>

On the one hand, Thai environmental laws and regulations are not required any Environmental Impact Assessment (EIA) for this kind of proposed project activity. On the other hand, The PoA have undertaken an Initial Environmental Evaluation (IEE) which analyzes the environmental impact of the proposed project activity to ensure that all significant impacts are minimized by effectively measures such as accidental contamination, undesirable odour from by –product.

SECTION D. Stakeholders' comments

>>

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 ■

Stakeholder consultations have been undertaken at the PoA level. The main agenda at the consultations will be to explain the program's purpose, its scheme and its activity's detail regarding especially environmental conservation and sustainable development.

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

Local stakeholder consultation will be organized at the CPA level. Each participating organization with guidance from BMA will be responsible for communicate with local government and nearby community.

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

>>

The stakeholders are invited by the invitation letters and announcements to be made in local news. The stakeholders were informed that the public consultations will provide an opportunity to clarify any possible doubt concerning the programme activity. The public consultation was held on …….. at the BMA office, The consultation was good cooperated by (….) stakeholders from (.....) of organizations (Table D.2.1.). Also, the comments were compiled by distributing and collecting the questionnaires during the public consultations with …..% of return rate.

Table D.2.1 Number of the attendances and organizations participated in the consultation meeting

Group of Stakeholders	No. of Participants	No. of Organization
Participating organization		
BMA		
Related Government Organization		
Academic Institute		
NGOs		
Media		

Noted: List of attendance will be shown in the annex ….

D.3. Summary of the comments received:

>>

The stakeholder consultation agenda was divided into 3 sessions: 1) Objective of the consultation meeting 2) CDM-PoA development 3) Biogas generation from food waste in Bangkok Project.

The comments and suggestions were received during the public consultations to clarify the programme scheme and its operational activity had addressed (as shown in D.4). As result of the questionnaire survey, the participants concur and support the proposed project activity. In addition, they are satisfied with transparently public participation and information provide in the stakeholder consultation meeting.

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

>>

All questions were addressed during the explanation and discussion at the public consultations as below:

Questionnaire	Response
Program Design	
Program Eligibility	
Program Operational	

Program Recommendations	

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:

>>

NOTE: The approved SSC baseline and monitoring methodology should be approved for use in a PoA by the Board.

The proposed activity described in this document uses the AMS III.AO-Version 01 methodology, "Methane recovery through controlled anaerobic digestion" and the AMS I.C.-Version 19 methodology, "Thermal energy production with or without electricity".

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

>>

The AMS III.AO-Version 01 and AMS I.C.-Version 19 methodologies are used for the PoA. Based on preliminary estimations, the amount of emission reductions does not exceed the threshold of 60 kt CO_2e/year as the methodologies' requirement for each CPAs. The project activity meets the applicability of those methodologies as follows:

Applicability of AMS III.AO-Version 01	Project Activity
This methodology is to avoid the emission of methane to the atmosphere from biomass or other organic matter that would have otherwise been left decay anaerobic condition in a solid waste disposal site (SWDS). In the project activity, controlled biological treatment of biomass or other organic matters is introduced through anaerobic digestion in closed reactors equipped with biogas recovery and combustion/flaring system.	The project activity reduces methane emission from organic food waste by controlled anaerobic bio-digester system then biogas and combust at the cooking stove for heat utilization.
Digestion of biomass or other organic matter (excluding animal manure and sludge generated in the wastewater treatment works) as a single source of substrate is included;	Organic food waste is a single source of substrate for the project activity.
If for one or more sources of substrates, it can not be demonstrated that the organic matter would otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero, whereas project emissions shall be calculated according to the procedures presented in this methodology for all co-digested substrates;	By-product of the project activity is not left to decay anaerobically condition.
Project participants shall apply the procedures related	The general guidance on leakage in biomass

Applicability of AMS III.AO-Version 01	Project Activity
to the "competing use for the biomass" according to the latest "General guidance on leakage in biomass project activities";	project activity will be applied.

Applicability of AMS I.C.-Version 19	Project Activity
This methodology comprises renewable energy technologies that supply users[2] with thermal energy that displaces fossil fuel use. These units include technologies such as solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.	The project activity use anaerobic bio- digester technology that supplies users with thermal energy that provide thermal energy displaces LPG for cooking stove.
The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal	Installed anaerobic bio- digester technology generated thermal energy less than 45 MW thermal.
If the project activity recovers and utilizes biogas for power/heat production and applies this methodology on a standalone basis i.e. without using a Type III component of a SSC methodology, any incremental emissions occurring due to the implementation of the project activity (e.g. physical leakage of the anaerobic digester, emissions due to inefficiency of the flaring), shall be taken into account either as project or leakage emissions.	The project activity recovers and utilizes biogas for heat production and applies this methodology with using a Type III of a SSC methodology.

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

	Source	Gas		Justification/Explanation
Baseline emission	Emission from decomposition of waste at the landfill site	CH_4	Included	The major source of emissions in the baseline
		N_2O	Excluded	N_2O emissions are small compared to CH_4 emissions from landfills. Exclusion of the gas is conservative.
		CO_2	Excluded	CO_2 emissions from decomposition of organic waste are not occurred.
	Emissions from fossil fuel (LNG) consumption	CO_2	Included	An important emissions source
		CH_4 N_2O	Excluded	Excluded for simplification. The emission source is assumed to be very small.
Project emission	Emissions from onsite electricity consumption	CO2	Included	The major source of emissions in the project activity
		CH_4 N_2O	Excluded	Excluded for simplification. The emission source is assumed to be very small.
	Emissions from physical	CH_4	Included	May be an important emissions source
		CO_2	Excluded	Excluded for simplification. The emission source

[2] That is residential, industrial or commercial facilities.

	leakages of the anaerobic digester	N_2O		is assumed to be very small.

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

>>

The baseline scenario is identified based on review of current practice of food waste disposal, and assessment of technical feasibility and economic attractiveness compared to other alternatives within the organizations in Thailand. The alternatives considered in section E.5.1 are consistent with the Thai laws/regulations. However, those except for the current practice are considered neither technically feasible nor economically attractive.

Moreover, the programme activity, which was not implemented as a CDM, faces several technical barriers, and is not a financially attractive proposition for the resource-constrained organizations in Thailand. Therefore, continuation of the current practice (i.e. disposal of food wastes in landfills) is considered the baseline scenario. This would mean that the food waste would be dumped into the landfills, and anaerobic decay of organic fraction of the food waste would generate methane to be emitted to the atmosphere.

Therefore, the baseline scenario of organization feeding are defined as atmospheric release of methane (CH_4) from anaerobic decay of food waste and CO_2 from fossil fuel (LPG) combustion by cooking stove during the crediting period in the absence of the CDM programme activities. In the baseline scenario, sanitary dumping of the food waste into landfills is considered as the prevailing practice owing to low level of investment and labour costs being needed.

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.

The purpose of this analysis is to demonstrate that the proposed programme activity is not business as usual scenario for prevailing practice of food waste disposal. The analysis demonstrates the additionality of a typical CPA, which shall be indicated by the latest version of the "Tool for the demonstration and assessment of additionality" including investment analysis, barrier analysis and common practice analysis.

Step 1. Identification of alternatives to the programme activity consistent with current laws and Regulations

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

The CDM Programme Activity involves biodigestion of organization's food waste. The following are initially considered as possible alternatives in Thailand.

1. Composting of the food waste;
2. Disposal of the food waste into a landfill where landfill gas is captured and flared;

3. Biodigestion of the food waste and use of the generated biogas for energy use not implemented as a CDM Programme Activity;
4. Disposal of the food waste into a landfill without capture of the landfill gas (business as usual).

Within above options, option 1, 2 and 3, are neither considered technically feasible nor economically viable in the context of management of organizations in Thailand, thus are eliminated without any further evaluation.

Alternative 1, involving composting is initially considered as one of the options due to high organic content of food waste in organizations. Composting of food waste is a new technology, and costly in terms of the initial investment. The organizations do not have ability to incur the investment or the technology. Alternative 1 is therefore dropped from identification of the baseline scenario.

Alternative 2, although considered initially, should be dropped from further evaluation on the ground that any municipalities in Thailand is not required to make needed investment for landfill gas collection and flaring.

Alternative 3 involving biodigestion is initially considered as one of the options due to high organic content of food waste in organizations. Biodigestion of food waste is a new technology, and costly in terms of the initial investment. The organizations, where the programme is to be applied for, independently do not have ability to incur the investment or the technology. Alternative 3 is therefore dropped from identification of the baseline scenario.

Thus the plausible alternative scenario, which is considered for further evaluation, is Alternative 4, disposal of food waste into landfills without capture of the landfill gas (i.e. continuation of current practice).

Sub-step 1b. Consistency with mandatory laws and regulations:

The plausible alternative defined in Sub-step 1a, which merits further consideration, is consistent with the mandatory laws and regulations of Thailand. Thus the option has been subject to both investment and barrier analysis to demonstrate additionality of the typical programme activity. The same analysis would be used to justify additionality of each CPA.

Step 2. Investment Analysis

Sub-step 2a. Determine appropriate analysis method:

Generation of biogas from food waste as material input is currently not practised in Thai. While initial investment for biodigestion equipments will be costly, the organization potentially will be able to save cost for purchasing LPG of cooking stove and cost of waste disposal, so investment comparison analysis is applied to compare the alternatives.

Sub-step 2b. Investment Comparison Analysis:

Net Present Value (NPV) index is chosen as financial indicator for comparison of options since the current practice of waste disposal into landfills has no additional/unordinary cost for the organization while biodigestion operation has both cost and revenue. The financial analysis carried out for a typical programme activity shows that the current practice of waste disposal are the most plausible alternative scenario. Although the biodigestion operation has negative NPV without CDM revenue, NPV becomes more viable with CDM revenue.

Investment comparison analysis will be conducted between the baseline scenario and the proposed programme activity scenario. The current practice, sanitary landfill site, which requires basically few

operation or management to achieve, is considered as a financially attractive and commonly prevailing practice in Thailand.

The relatively high investment cost for the biodigester and container, compared to the sanitary landfills, discourages the organizations to introduce the proposed technology. Those high costs come from diversity of the equipments installed in order to create the entire system. Hence, it will be clearly proven that, the proposed activity is additional. This investment comparison analysis will be conducted for each organization in the PoA.

Step 3. Barrier Analysis
Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity:
The biodigester system will be installed to manage the food waste within proper retention time in the biodigester. The retention time of microbes enables the extraction of methane through the fermentation process and capture of the biogas. The provisions for installation, operation, maintenance and monitoring activity of this technology are considered more complicated and demanding compared to the current practice.

The equipments of the biodigester system is not necessarily a proven technology in Bangkok, but conceptually applicable to the SSC methodology. In addition, the proposed activity will contribute to innovation and dissemination of the new technology, and environmental conservation, which are highly demanded in the nation.

Technological risk of the proposed activity is relatively greater than that of the current practice, because of long-term effects of the installation of equipments highly demanding operational requirements, which will also hinder the organizations from the installation of equipments. Hence it is established that there are technological barriers that would prevent the implementation of the proposed activity from being carried out if the proposed activity was not registered as a CDM programme activity.

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 only alternative scenario that needs to be analysed here is continuation of the current practice of disposal of waste into landfills without LFG capture and flare. The prevailing practice of waste disposal into landfills does not involve any technical sophistication or additional investment. Thus the barriers identified for the programme activity would not prevent the continuation of the current practice.

Step 4. Common practice analysis
As there is no biodigester facility of food waste from feeding except for the pilot project's facility in Bangkok, so digestion of food waste is not a common practice.

Impact of the CDM registration
Investment analysis demonstrates that the typical programme activity have more unviable of financial without CDM. It is established that investment in biodigestion equipment can yield more optimistic NPV only if carbon revenue is included.

Barrier analysis shows that there are significant barriers against implementation of the typical programme activity. Transfer of technological know-how including familiarization training for organization staff to operate and maintain biodigestion equipments puts additional financial burden on the organization. The programme of activity intends to achieve this financial support for the success with CDM.

CDM registration directly impacts each organization's decision-making to apply for the programme of activity. Plus, CDM registration of the programme of activity will serve as a role model for other programmes and promote dissemination of the sustainable practice for appropriate food waste management.

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.

Since additionality has been established at the PoA level, it is not required to check for each typical CPA. The C/ME, BMA, has prospect for inclusion of the schools into this PoA, and such an eligible organization's activity should have the same technology/measure, legal background and investment condition. For this purpose, the following criteria are defined regarding how to decide inclusion of a organization's activity as a CPA and to assess additionality of a CPA:

- The baseline scenario should be the same at the organizations for the CPAs, so the current practices are sanitary landfill for food waste disposal and LPG combustion for feeding and there is no additional requirement from environmental law/regulation in terms of measure of food waste disposal or recycle.
- The same technology will be introduced into the organizations for the CPAs. To take part in the programme, BMA need to sign a contract with the manufacture licensed for purchase and maintenance of the equipments. In the contract, the technology will be specified. So the same technology of biodigester will be applied in the CPAs which had signed the cooperation agreement with BMA.
- The common practice for waste disposal, especially for food waste from organization, should be sanitary landfill.
- By conducting investment comparison analysis between the baseline scenario and the proposed programme activity, including waste disposal and heat generation, it has been demonstrated that the activity is not viable from economic point of view without CER revenue. If the tank is designed for a different capacity than the standard one considered in the program, investment comparison analysis should be conducted for the CPA in the section B.3 of the SSC-CPA-DD.

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

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

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Baseline, project and leakage emissions and are estimated in accordance with the equations determined by the AMS III.AO-Version 01, "Methane recovery through controlled anaerobic digestion" because controlled biological treatment of biomass or other organic matters is introduced through anaerobic digestion in closed reactors equipped with biogas recovery and combustion/flaring system in the project activity.

And the AMS I.C.-Version 19, "Thermal energy production with or without electricity" because this category comprises renewable energy technologies that supply users with thermal energy that displaces fossil fuel use. These units include solar thermal water heaters and dryers, solar cookers, renewable biomass. These methodologies are described in Section E.6.2 of the SSC-PoA-DD.

Yearly methane generation potential of the food waste to be anaerobically digested is estimated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"

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

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Baseline emissions

The methodological equations for estimation of the baseline emissions are determined below.

$$BE_y = BE_{CH4,SWDS,y} + B_{biogas,PJ,y} * NCV_{biogas} * EF_{LPG,CO2} \quad (1)$$

Where:

BE_y Baseline emissions in year y (tCO_2e)

Methane emission from the landfill site

$BE_{CH4,SWDS,y}$ Yearly methane generation potential of the solid waste (food waste) anaerobically digested by the project activity during the years "x" from the beginning of the project activity (x=1) up to the year y estimated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (tCO_2e). The tool may be used with the factor "f=0.0" assuming that no biogas is captured and flared. With the definition of year x as 'the year since the landfill started receiving wastes, x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)'

CO2 emission from the LPG combustion

$B_{biogas,PJ,y}$ Amount of renewable biogas energy-used by the cooking stoves in the project activity (t-biogas)

NCV_{biogas} The net calorific value of the biogas (TJ/t-biogas)

$EF_{LPG,CO2}$ The CO_2 emission factor of the fossil fuel (LPG) that would have been used by the cooking stoves in the baseline scenario (tCO_2/TJ)

Yearly methane generation potential of the solid waste (food waste) anaerobically digested by the project activity

$$BE_{CH4,SWDS,y} = \varphi * (1-f) * GWP_{CH4} * (1-OX) * \frac{16}{12} * F * DOC_f * MCF * \sum_{x=1}^{y} \sum W_{j,x} * DOC_j * e^{-k_j*(y-x)} * (1-e^{-k_j}) \quad (2)$$

where:

φ	Model correction factor (default 0.9) to correct for the model uncertainties
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner.
GWP_{CH4}	Global Warming Potential (GWP) of methane, valid for the relevant commitment period.
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	Fraction of degradable organic carbon that can decompose
MCF	Methane Correction Factor (fraction)
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes/year)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	Decay rare for the waste type j
j	Waste type category (index)
x	Year during the crediting period: x runs from first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)
y	Year for which methane emissions are calculated

In this PoA project, organic waste (mostly food waste) is used as the material for biodigestion. Therefore, $W_{j,x}$ is same amount of the waste that are corrected in the boundary of this CPA.

Project Activity Emissions

$$PE_y = PE_{y,power} + PE_{phy\ leakage,y} \quad (3)$$

where:

PE_y Project emissions in the year y (tCO_2e)

$PE_{y,power}$ Project emissions from onsite energy use in the year y (tCO_2e)

$\mathbf{PE_{phy\ leakage,\ y}}$ Methane emissions from physical leakages of the anaerobic digester in year y (tCO2e). Methane emissions due to physical leakages from the digester and recovery system shall be estimated using a default factor of 0.05 m^3 biogas leaked/m^3 biogas produced.

Project emissions from onsite energy use in the year y (tCO_2e)

$$PE_{y,power} = MWh_{e,y} * EF_{e,CO2} \quad (4)$$

where:

$MWh_{e,y}$ Amount of electricity consumed from the grid in the project activity, measured using an electricity meter (MWh)

$EF_{e,CO2}$ The CO_2 emission factor of electricity generation (tCO_2/MWh)

Leakage
There is no leakage.

Emission reductions
In case of controlled anaerobic digestion and biogas production, the emission reductions will be calculated as follows and the following monitoring requirements apply:

The emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of biogas fuelled, flared or gainfully used. It is possible that the project activity involves biomass treatment with higher methane conversion factor (MCF) than the MCF for the biomass which otherwise would have been left to decay in the baseline situation. Therefore the emission reductions achieved by the project activity is limited to the ex post calculated baseline emissions minus project and leakage emissions using the actual monitored data for the project activity. The emission reductions achieved in any year are the lowest value of the following:

$$ER_y = \min((BE_y - PE_y), (MD_y - PE_{y,power})) \quad (5)$$

Where:

ER_y	Emission reductions achieved by the project activity based on monitored values for year y (tCO2e)
BE_y	Baseline emissions calculated using equation (1) using ex post monitored values (tCO2e)
PE_y	Project emissions calculated using equation (3) using ex post monitored values. This calculation shall include project emissions from physical leakage (tCO2e)
MD_y	Methane captured and destroyed or used gainfully by the project activity in year y (tCO2e)
$PE_{y,power}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO2e)

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

(Copy this table for each data and parameter)

Data / Parameter:	**$EF_{LPG,CO2}$**
Data unit:	tCO2e/TJ
Description:	The CO_2 emission factor of the fossil fuel (LPG) that would have been used by the cooking stoves in the baseline scenario
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 1: Introduction, TABLE 1.4: DEFAULT CO2 EMISSION FACTORS FOR COMBUSTION
Value applied:	63.1 (Liquefied Petroleum Gases)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value acceptable as per IPCC 2006
Any comment:	For a): If the fuel supplier does provide the NCV value and the CO2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO2 factor should be used. If another source for the CO2 emission factor is used or no CO2 emission factor is provided, Options b), c) or d) should be used.

Data / Parameter:	φ
Data unit:	-
Description:	Model correction factor to account for the model uncertainties
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	As recommend in the Tool referred to above.
Any comment:	-

Data / Parameter:	OX
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	OX is determined by the following two ways: (1) Conduct a site visit at the solid waste disposal site in order to assess the type of cover of the solid waste disposal site. Use the IPCC 2006 Guidelines for National Greenhouse Gas Inventories for the choice of the value to be applied. (2) Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Use 0 for other types of solid waste disposal sites. Since the landfill in baseline scenario can be considered as an unmanaged landfill with soil cover, the OX in this case is 0.
Any comment:	-

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

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This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.

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
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Any comment:	-

Data / Parameter:	MCF
Data unit:	-
Description:	Methane Correction Factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Use the following values for MCF: •1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste. •0.5 for semi-aerobic managed solid waste disposal sites. These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system. •0.8 for unmanaged solid waste disposal sites – deep and/or with high water table. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste. •0.4 for unmanaged-shallow solid waste disposal sites. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres. The landfill is unmanaged and > 5 m depth.
Any comment:	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.

Data / Parameter:	DOC_j
Data unit:	-
Description:	Percent of degradable organic carbon (by weight) in the waste type j

Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and 2.5)
Value applied:	**Waste type j** / **DOC_j (% wet waste)** / **DOC_j (% dry waste)** Wood and wood products: 43 / 50 Pulp, paper and cardboard (other than sludge): 40 / 44 Food, food waste beverage and tobacco (other than sludge): 15 / 38 Textiles: 24 / 30 Garden, yard an park waste: 20 / 49 Glass, plastic, metal, other inert waste: 0 / 0 Quantity of food waste to be handled at the facility will be measured on wet or dry basis. Therefore which DOC_j values corresponding to the wet or dry basis will be defined in the CPA-DD. Or more specifically, measure the DOC_j based on food waste sample taken from biodigester annually. Measurement in laboratories according to relevant national/international standards.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	-

Data / Parameter:	k_j
Data unit:	-
Description:	Decay rate for the waste type j
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value applied:	**Waste type j** / **k_j, (Tropical: MAT>20°C, Wet: MAP>1000mm)** Slowly degrading — Pulp, paper and cardboard (other than sludge), textiles: 0.07 Slowly degrading — Wood and wood products: 0.035 Moderately degrading — Other (non-food) organic garden and park waste: 0.17 Rapidly degrading — Food, food waste beverage and tobacco (other than sludge): 0.40
Justification of the choice of data or description of	Document in the CPA-DD the climatic conditions at the SWDS site (temperature, precipitation and, where applicable, evapotranspiration). Use long-term averages based on statistical data, where available.

measurement methods and procedures actually applied :	
Any comment:	-

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

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

(Copy this table for each data and parameter)

Data / Parameter:	**$W_{j,x}$**
Data unit:	tonnes
Description:	Amount of organic waste type j prevented from disposal in the SWDS in the year x
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	2.5 tons/organization Number of operating days of the organization: 250 (day) Processing capacity of food waste by the biodigester: 20 (kg-waste/organization/day)
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. Continuously, aggregated at least annually
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**f**
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data to be used:	Site visits to solid waste disposal sites in the corresponding municipality hosting the CPA
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:	The CPA will be visited annually to check if any of the sites is implementing landfill gas capture and flaring schemes. Information on the fraction of gas being captured and flared will be collected from such facilities. CDM projects will not be considered for this.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e / tCH_4

Description:	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
Source of data used:	Decisions under UNFCCC and the Kyoto Protocol (a value of 21 is to be applied for the first commitment period of the Kyoto Protocol)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	21
Description of measurement methods and procedures to be applied:	Value to be checked annually
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$EF_{e,CO2}$**
Data unit:	tCO_2e/MWh
Description:	CO2 emission factor of electricity generation (tCO2/MWh)
Source of data used:	Default CO2 emission factor as per the national emission factor data, entitled "The estimation of emission factor for an electricity system in Thailand 2007", issued on 26 January 2009. (http://www.tgo.or.th/download/publication/GEFReport_EN.pdf)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.5812 kgCO2/kWh
Description of measurement methods and procedures to be applied:	Value to be checked annually
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$B_{biogas,PJ,y}$**
Data unit:	tons-biogas
Description:	Amount of renewable biogas energy-used by the cooking stoves in the project activity
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	125 m^3-biogas/organization Number of operating days of the organization: 250 (day) Processing capacity of food waste by the biodigester: 20 (kg-waste/organization/day) Volume of biogas generation from 1 kg of food waste: 0.050 (m^3-biogas/kg-waste) (source: DEDE Feasibility study report)

Description of measurement methods and procedures to be applied:	Measure directly by flow meter.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**NCV_{biogas}**
Data unit:	TJ/tons-biogas
Description:	Net calorific value of biogas
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	0.048 (TJ/t-CH_4) 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1: Introduction, Volume 2: Energy, TABLE 1.2: DEFAULT NET CALORIFIC VALUES (NCVs) AND LOWER AND UPPER LIMITS OF THE 95% CONFIDENCE INTERVALS
Description of measurement methods and procedures to be applied:	Measurement in laboratories according to relevant national/international standards. Measure the NCV based on biogas sample taken from biodigester annually.
QA/QC procedures to be applied:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	-

Data / Parameter:	**$MWh_{e,y}$**
Data unit:	MWh
Description:	Amount of electricity consumed from the grid in the project activity, measured using an electricity meter
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	0.025 MWh/organization Number of operating days of the organization: 250 (day) Processing capacity of food waste by the biodigester: 20 (kg-waste/organization/day) Amount of electricity consumed in the biogas digester: 0.01 (kWh/kg waste treated) (source: DEDE Feasibility study report)
Description of measurement methods and procedures to be applied:	Continuously, aggregated at least annually, using electricity meter or the electric power bill.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$PE_{phy\ leakage,\ y}$**
Data unit:	tCO2e
Description:	Methane emissions from physical leakages of the anaerobic digester in year y
Source of data to be used:	AMS-III.AO: Methane recovery through controlled anaerobic digestion
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6.25 m^3 biogas leaked/organization Number of operating days of the organization: 250 (day) Processing capacity of food waste by the biodigester: 20 (kg-waste/organization/day) Volume of biogas generation from 1 kg of food waste: 0.050 (m^3 biogas produced/kg waste) (source: DEDE Feasibility study report) Methane emissions due to physical leakages from the digester and recovery system shall be estimated using a default factor of 0.05 (m^3 biogas leaked/m^3 biogas produced). (source: AMS-III.AO.)
Description of measurement methods and procedures to be applied:	For ex ante estimation the expected biogas production of the digester may be used, for ex post calculations the effectively recovered biogas amount measured by project participants shall be used for the calculation.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**MD_y**
Data unit:	tCO2e
Description:	Methane captured and destroyed or used gainfully by the project activity in year y
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	1.035 tCO2e/organization Number of operating days of the organization: 250 (day) Processing capacity of food waste by the biodigester: 20 (kg-waste/organization/day) Volume of biogas generation from 1 kg of food waste: 0.050 (m^3 biogas produced/kg-waste) (source: DEDE Feasibility study report) Contents of CH_4 in biogas: 55 (%)(source: DEDE Feasibility study report) Density of methane: 0.717 (kg-CH_4/m^3-CH_4) Global Warming Potential of methane: 21
Description of measurement methods and procedures to be applied:	Measure directly by flow meter.
QA/QC procedures to be applied:	-
Any comment:	-

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

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The purpose of the monitoring planning is to formulate the guidance for proper operation and maintenance of the equipments and devices to measure and report the parametric values as (shown in E7.1) for estimation and vilification of the GHG emission reductions from the proposed activity. The BMA will be a C/ME for all CPAs under the PoA. C/ME will help each CPA monitor biodigester system. All monitoring data will be archived in the each organization's and BMA's data collection system.

Monitoring of the equipments is conducted by the organization staffs who visit the site regularly. When it is necessary to repair or replace any equipment or device, or anything incorrect in the system, the manufacturers' technicians in charge will provide maintenance service. This maintenance information will be registered in the monitoring record. The maintenance record will be also used to identify what to improve in the system. BMA will be responsible for collecting and monitoring data and drafting the monitoring report of the CPA and PoA level by working with the organization staff.

To ensure the reliable field measurements and data collection quality, Standard system operating, maintenance and monitoring of the proposed activity is provided for the participating organizations as follows.

PartI: Food waste injection and biodigestion:

- The organization's food waste will be crushed ant put in to the biodigester, where it will ferment, and then biogas will be generated and used at cooking stove. The by-product sludge to be remaining inside the biodigester is removed and provided to the proper soil application as fertilizer source for planting trees in the neighbouring, and it shall be monitored to digest aerobically and not to emit methane to the atmosphere at representative sample of user sites.

Part II: Biogas provision

- Training of operation of the waste digestion should be provided by the field engineer team according to the manufacturer specifications to derive proper operation performance of the biodigester. The training will be comprised of instruction of food waste preparation, standard operation and maintenance of the system. Moreover, the staff involved will be trained on the field data collection procedure and data analysis. Furthermore, any new staff will be trained adequately also.

- Inspections should be carried out at least monthly by the organization staff, against the inlet cover, digestion tank and outlet cover to check pressure and temperature, and to find any leakage of biogas. If any leakage is found, the equipments will be promptly repaired by the maintenance team. In case of the occurrence of too high pressure biogas in the biodigester, an emergency procedure is provided for preventing failure of the biodigester tank.

- BMA will be in charge to achieved data recording in electronically as excel sheets form where equations of the methodology are integrated then it will be presented in the monitoring report accordingly until after 2 year of crediting period.

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)

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Date of completing this baseline section: .....

Name of person/entity determining the baseline:

JICA Expert

JICA is not considered as project participant.

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	Bangkok Metropolitan Administration
Street/P.O.Box:	
Building:	
City:	Bangkok
State/Region:	
Postfix/ZIP:	10400
Country:	King of Thailand
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This PoA and related CPAs will be partly financed by public funding, with which the entity involved is the Bangkok Metropolitan Administration (BMA). The DOE will be provided with the evidence that the same BMA money is not being used for purchasing emission reductions.

Annex 3

BASELINE INFORMATION

Project proponents preliminarily estimated GHG emission based on the common practice of the 84 potential participating organizations as follows:

Parametric values for the estimation (at this stage):

- Number of organizations in the programme activities: 84 (organization)
- Number of operating days of a organization per year: 250 (day/year)
- Amount of food waste from a organization per day: 20 (kg-waste/organization/day)
- Volume of biogas generation from 1 kg of food waste: 0.050 (m^3-biogas/kg-waste)
- Contents of CH_4 in biogas: 55 (%)
- Density of methane: 0.717 (kg-CH_4/m^3-CH_4)
- Net calorific value of methane: 0.048 (TJ/t-CH_4)
- CO_2 emission factor of LPG: 63.1 (tCO_2/TJ)

Step I : Baseline emissions (Methane emission from the landfill site):
317.68 (tCO_2e/year, Average value) to be estimated from the first order decay model in accordance with "Tool to determine methane emissions avoided from disposal of waste" as below:

○Formula and aarameters for calculation of baseline GHG emissions

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j (y-x)} \cdot (1-e^{-k_j})$$

φ=	0.9	:Model correction factor to account for model uncertainties
f=	0	:Fraction of methane captured at the SWDS and flared
GWP=	21	:Global Warming Potential (GWP) of methane
OX=	0	:Oxidation factor
F=	0.5	:Fraction of methane in the SWDS gas
DOCf	0.5	:Fraction of degradable organic carbon (DOC) that can decompose
MCF=	1	:Methane correction factor
Wjx=	**420**	**:Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons)**
	>>>Generation of food wastes :	**420 t/year(20 kg/day/school 250 days * 84 schools)**
DOCj=	**0.15**	**:Fraction of degradable organic carbon (by weight) in the waste type j (wet: 15%, dry: 38%)**
kj=	**0.40**	**:Decay rate for the waste type j (tropical and wet: 0.40)**
x=	1～10	:Year during the crediting period (year)
y=	1～10	:Year for which methane emissions are calculated (year)

○ Estimated baseline GHG emissions (unit tCO2e)

Year	1year	2year	3year	4year	5year	6year	7year	8year	9year	10year	total	average
GHG emissions	131	219	277	317	343	361	373	381	386	390	3,177	317.68

y= \ x=	1	2	3	4	5	6	7	8	9	10	total	tCO2e	accumulation	
1	21										21	130.85	131	1year
2	14	21									35	218.56	349	2year
3	9	14	21								44	277.36	627	3year
4	6	9	14	21							50	316.77	944	4year
5	4	6	9	14	21						54	343.19	1,287	5year
6	3	4	6	9	14	21					57	360.89	1,648	6year
7	2	3	4	6	9	14	21				59	372.76	2,020	7year
8	1	2	3	4	6	9	14	21			60	380.72	2,401	8year
9	1	1	2	3	4	6	9	14	21		61	386.06	2,787	9year
10	1	1	1	2	3	4	6	9	14	21	62	389.63	3,177	10year

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Step II: Baseline emissions (CO2 emission from the LPG combustion):
$B_{biogas,PJ,y}$ * NCV_{biogas} * $EF_{LPG,CO2}$ = 420,000(kg-waste/yr) * 0.050(m^3-biogas/kg-waste) * 0.55(m^3-CH_4/m^3-biogas) * 0.717(kg-CH_4/m^3-CH_4) * 10^{-3} * 0.048(TJ/t-CH_4) * 63.1(t-CO_2/TJ) = 25.08 (tCO_2e/yr)

Step III: Calculate the combined baseline emission of each activity
Baseline Emission
= Methane emission from the landfill site + CO2 emission from the LPG combustion
= 317.68 (tCO_2e/year) + 25.08 (tCO_2e/yr)
= 342.76 tCO_2e/yr Ave.

Project emissions (Onsite energy use):
$PE_{y,power}$ = $MWh_{e,y}$ * $EF_{e,CO2}$ = 20 (kg waste/organization/day) * 84 (organization) * 250 (day) * 0.01 (kWh/kg waste) * 10^{-3} * 0.5812 (tCO_2/MWh) = 2.44 (tCO_2e/yr)

Project emissions (Physical leakage):
$PE_{phy\ leakage,y}$ = 20 (kg waste/organization/day) * 84 (organization) * 250 (day) * 0.050(m^3 biogas produced/kg waste) * 0.05 (m^3 biogas leaked/m^3 biogas produced) * 0.55(m^3 CH_4/m^3 biogas) * 0.717(kg CH_4/m^3 CH_4) * 10^{-3} * 21 (tCO_2/tCH_4) = 8.70 (tCO_2e/yr)

MD_y (Methane captured and destroyed or used gainfully by the project activity):
MD_y = 20 (kg waste/organization/day) * 84 (organization) * 250 (day) * 0.050(m^3 biogas produced/kg waste) *0.55(m^3 CH_4/m^3 biogas) * 0.717(kg CH_4/m^3 CH_4) * 10^{-3} * 21 (tCO_2/tCH_4) = 173.91 (tCO_2e/yr)

Total GHG emission reductions to be estimated:

$$ER_y = \min((BE_y - PE_y), (MD_y - PE_{y,power}))$$

(unit: tCO_2e)

Year	BE_y	PE_y	MD_y	$PE_{y,power}$	BE_y - PE_y	MD_y -$PE_{y,power}$
1	130.85	11.14	173.91	2.44	119.71	171.47
2	218.56	11.14	173.91	2.44	207.42	171.47
3	277.36	11.14	173.91	2.44	266.22	171.47
4	316.77	11.14	173.91	2.44	305.63	171.47
5	343.19	11.14	173.91	2.44	332.05	171.47
6	360.89	11.14	173.91	2.44	349.76	171.47
7	372.76	11.14	173.91	2.44	361.63	171.47
8	380.72	11.14	173.91	2.44	369.59	171.47
9	386.06	11.14	173.91	2.44	374.92	171.47
10	389.63	11.14	173.91	2.44	378.49	171.47

Annex 4

MONITORING INFORMATION

Monitoring Parameters, Frequency, Equipment Archiving and Responsibility

Monitoring action will be act in accordance with QA/QC procedure which is applied from source of information at the CPA information log. The data collection template will be use to record of data for each parameter which is measured following the monitoring plan.

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES
(CDM-SSC-AR-PDD)
(Version 02)

CONTENTS

Annexes

SECTION A. General Description of the proposed small-scale A/R CDM project activity:

A.1. Title of the proposed small-scale A/R CDM project activity:

Title: Mangrove Reforestation for Carbon Sequestration in Chantaburi Province, Thailand

Version: Version 1.0

Date: 25 February, 2012

A.2. Description of the proposed small-scale A/R CDM project activity:

The main purpose of this project is to increase the mangrove forest through reforestation in degraded mangrove area. In this project, the government will collaborate with local community to plant and maintenance the reforestation sites, which are participated from the households. Through this project activity, not only GHG removals but also various local benefits are expected, i.e. natural shields against disaster, protect soil erosion, wood utilization, and local community could learn a new system and initiates community participation to cooperate with government.

In Thailand, mangrove forest is located in 23 coastal provinces, or 2,670 kilometers along the coastal line, both Gulf of Thailand and Andaman. In the past, the mangrove forest used to cover 368,000 ha, in 1961, and dramatically decrease to 240,000 ha, in 2002. Timber and charcoal industries are the major cause, but the land conversion is the important causes, such as they converted to urbanization, agriculture, and aquaculture, especially shrimp farm. In order to preserve the mangrove forest, five-year Action Plan for Mangrove Management was established in 2004, as well as to promote the sustainable use of mangrove resources.

Welu wetland, the project sites, is located in Klung district, Chantaburi province. The total area of Chataburi province is 63.38 ha, which contain the forest area 33.74%. There are 17 species were found in the area, such as *Rhizophora apiculata* Bl., *Rhizophora mucronata* Poir, *Xylocarpus rumphii* (Kostel.), etc. Welu wetland was identified to be a "Reserve Forest" by the Ministerial regulations of Royal Forest Department. It was designated as a forest reserve on 18 October 1962 under the forest

Reserve and Protection An Article 10 and 26 (1938) and declare by the government gazette on 30 October 1962. It was took care by Mangrove Development Station 2 (Tha Son, Chantaburi) and 3 (Klung Chantaburi), Department of Marine and Coastal Resources (DMCR). The physical qualities include mangrove forest, mud plat, shrimp farms, rivers, mountain and farm garden and complete natural mangrove forest (1,567.57 ha). Some part of mangrove forest scatter in mouth of the river where outside area is completely and the inside is trespass by local villager for adequate farming or settle down.

The proposed small-scale A/R CDM project activity aims to remove CO_2 through reforestation of mangrove in Welu Wetland, Chantaburi Province, Thailand. The expected area subject to plant is 525.44 ha (3,284 Rai) and estimated amount of CO_2 removal during the 30 years period for this project is 190,281 tCO_2. The project activity well qualifies for small-scale A/R CDM scheme since the expected annual removal of the project activity is estimated to be 6,343 tCO_2/ year under the threshold value of 16,000 t-CO_2/ year.

The project scheme is expected to provide many of benefits to local people. Although, community cannot utilize wood from mangrove directly but they can greatly receive indirect benefit from forest such as minor forest product (non wood, catch fish or shrimp, and herb) which reduces the expense of household. Reforestation, to remove GHG, is an alternative land use for farmers to plant tree besides doing fish and shrimp farms. Moreover, community/farmers will also be able to bring investment fund from government.

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
The Kingdom of Thailand	Chantaburi Province	Yes

(host)		
	Department of Marine and Coastal Resources (DMCR)	Yes
	Royal Forest Department (RFD)	No

Chantaburi province: was established in 1933. The province is the one of the organizations that supported to implement this project. The province also collaborates with the local administration to support this project. Chantaburi province is the main implementing agency in this A/R CDM project. In April, 2010, a memorandum of understanding (MoU) between DMCR, RFD and Chantaburi Province was signed.

Department of Marine and Coastal Resources (DMCR): one of the organizations under the Ministry of Natural Resources and Environment (MNRE). The DMCR missions are to conserve, reforest and manage coastal resources in Thailand. The MNRE has been promoting mangrove reforestation as one of their national policies, and shows understanding and willingness to support this project. Many of staff members have knowledge and experience in planting mangrove tree. The DMCR will keep in contract with the local residents around the project areas in collaboration with Royal Forest Department (RFD) and Chantaburi Province

Royal Forest Department (RFD): was established under MNRE over a hundred year ago. RFD is the right owner of the project sites. Their missions are preventing an illegal cutting, researching, promoting forest plantation, conserving and managing land use. RFD has a lot of experiences in the forest plantation, especially in land plantation. In this project, they also support the information, knowledge and staffs to implement the project.

A.4. Description of location and boundary of the small-scale A/R CDM project activity:

A.4.1. Location of the proposed small-scale A/R CDM project activity:

A.4.1.1. Host Party(ies):

The Kingdom of Thailand

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

Chantaburi province

A.4.1.3. City/Town/Community etc.:

Khlung and Laemsing district

A.4.2. Detail of geographical location and project boundary, including information allowing the unique identification(s) of the proposed small-scale A/R CDM project activity:

The project is a mangrove reforestation project covering a total of 525.44 ha (3,284 Rai). The project sites were voluntary participation from the local community, fishermen, and DMCR will take care of all the technological and knowledge support. The sites will be scattering along Welu River.

The boundaries of the project areas are based on the voluntary participation of the local community and suitable area by the expertise decision. DMCR started to plant since February, 2011 based on Thai law and applicable procedures of A/R CDM projects. This project was explained to Thailand Greenhouse Gas Management Organization (TGO), the Designated National Authority (DNA) in Thailand, which approved it.

Surce: http://www.forbeslebrock.com/map-of-thailand,
http://maps.google.co.th/maps?hl=th&tab=wl

Figure A 4.2.1 Location of project site

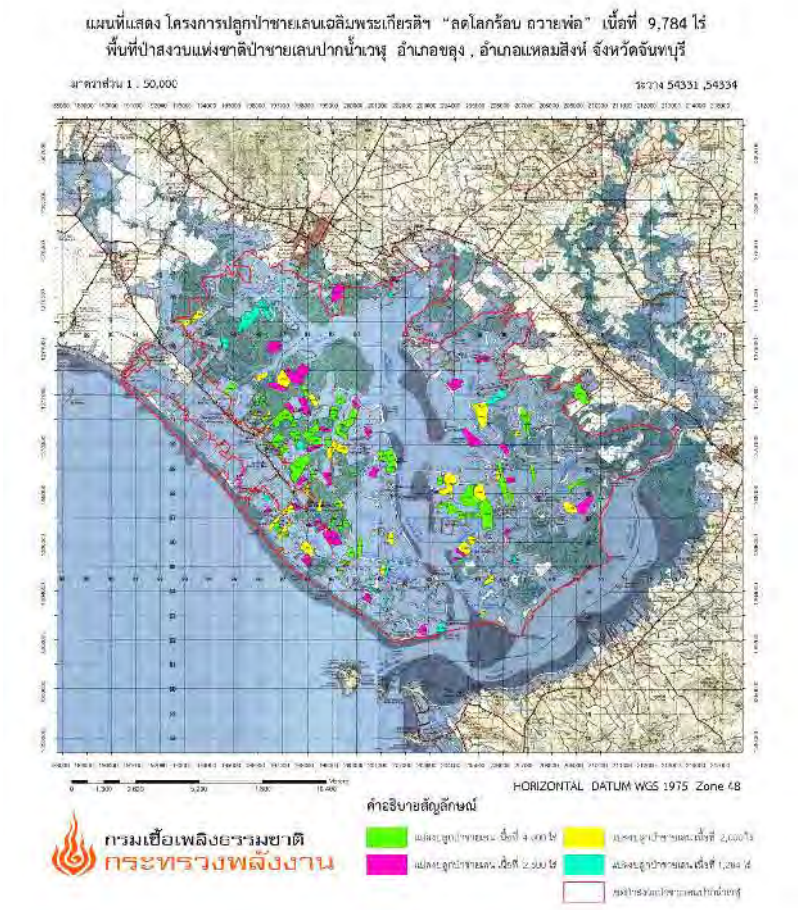


Figure A 4.2.2 The project sites show as yellow and blue color

A.5. Technical description of the small-scale A/R CDM project activity:

A.5.1. Type(s) of small-scale A/R CDM project activity:

From wetland to forested land (select from Decision 14/CP.10)

A.5.2. A concise description of present environmental conditions of the area, which include information on climate, soils, main watershed, ecosystems, and the possible presence of rare or endangered species and their habitats:

Climate:

>> The climate of Klung District is profoundly influenced by the monsoon and is classified into 3 seasons as follows:

Rainy season: Starting from May to October, around 6 months, this is the period influenced by southwest monsoon, which flows from Indian Ocean to the Gulf of Thailand, and to Klung district. There is a lot of rain in this period with the average of 535.8 mm. The maximum rainfall is in September with an average relative humidity 89% and the temperature during 6 months is almost the same level.

Winter Season: Starting from November to mid of February, around 3 months, this is the period influenced by northeastern monsoon which is dry and cool flowing from China. But Klung District is located in Southeast of the country and has the influence from sea wind, this makes the climate not so cold in this season and the lowest temperature is in December around 24.8 degree Celsius, with an average relative humidity 72%. The average minimum rainfall is in January at 13.1 mm.

Summer Season: Starting from mid of February, around 3 months, in this period the monsoon from northeastern is very weak and there is hot wind from China Sea flow. The maximum temperature is in April around 27.7 degrees Celsius, with an average rainfall 119.4 mm.

Hydrology:

>>The area is on the watershed of The Welu river.

Soils:

>> The physical and chemical characteristics of soil in Klung District vary with distance from estuary to land. Bulk density of soil will decreases from outside mangrove forest

through the end of mangrove forest edge. At the distance more than 80 meters from the edge of mangrove forest boundaries Soil is clay loam and sandy clam loam at 80 meters from the edge of mangrove boundaries through mangrove forests. Acidity of surface soil is higher outside the mangrove forests than inside. The organic matter of the surface soil was found to be greater at the estuary edge than inland (Kitakorn, 1979).

Ecosystems:

>> The proposed project area are classified as "wetlands" according to Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003) and current land use falls under the land use title of "Reserve Forest". Currently the area is highly fragment which consisted of very small strips of naturally occurring mangrove forest and highly developed "fish farms" and "shrimp farms". Rehabilitation exercises have been carried out on the area by the DMCR which consist of approximately 4,000 ha to date and planting in on-going in designated areas. Evidence has been found of encroachment by local villagers who are practicing "fish farming" where the area is cleared of naturally growing mangrove trees (and maintain to be devoid of tree by the farmers) in order to provide a "clear" area for the fish to breed. This is supported by the Final Report of Feasibility Study on Mangrove Afforestation/Reforestation for Carbon Sequestration in Chantaburi Province (Assert University, 2009).

There is no record of rare and endangered species of flora and fauna in the project area.

A.5.3. Species and varieties selected:

In the project activity, the following mangrove species, which are dominant ones in Thailand, were planned to be used for reforestation. The main species planted was *Rhizophora apiculata.*

Rhizophora apiculata Blume (local name: Kong Kang Bai Lek),
Rhizophora mucronata Poir. (local name: Kong Kang Bai Yai),
Avicennia alba Bl. (local name: Sa mare Khao)
Sonneratia ceseolaris (L.) Engl (local name: Lam Phu), and
Bruguiera gymnorrhiza (L.) Savigny (local name: Pra Sak Dok Daeng)

Rhizophora apiculata Blume

Rhizophora mucronata Poir.

Avicennia alba Bl.

Sonneratia ceseolaris (L.) Engl

Bruguiera gymnorrhiza (L.) Savigny

A.5.4. Technology to be employed by the proposed small-scale A/R CDM project activity:

Operation Item	Content
Site preparation	The clearing of vegetation is not necessary because the planting sites are in fish/ shrimp ponds.
Collection of Propagules	The seed of the planting trees were collected in the natural mangrove forest nearby the project sites. Flowing year of these species are in June up to August during the rainy season in Thailand. The maturity of the propagules can be assessed by examining the cap-color. The local community has been engaged through collaboration to do collection the propagule.
Storage of Propagules	Collected propagules were kept moist by seawater pumped up in the temporary nursery, which were established near the sites. The nursery that kept the rest of the propagules was taking cared by the local community.
Planting (direct sawing)	Collected propagules were planted directly in February and April, 2011, propagules stored in the nursery in September to April. The planting area was in the middle of ponds, which is 70 % of the pond area. Propagules were planted into the holes of 10 cm in depth in the soil with small sticks.
Tending	Dead propaguleling will be placed with new ones within 2 ~ 3 years after planting.

A.5.5. Transfer of technology/know-how, if applicable:

Residents and fish farmers organize small groups and belong to the Community Association. Mangrove planting and maintenance skill will be transferred to them from DMCR and RFD. The DMCR has been planting the mangrove trees in Thailand for long time. The project areas are taken care by Mangrove Development Station 3 (Klung, Chantaburi Province), DMCR and staffs in the project site have a lot of knowledge and experiences about planting mangrove trees.

A.5.6. Proposed measures to be implemented to minimize potential leakage as applicable:

There is no farm or crop area on this project site. According to the conditions indicated in (a) of Section 19 in AR-AMS0003/Version 01, the leakage is expected to be zero.

A.6. A description of legal title to the land, current land tenure and land use and rights to tCERs/lCERs issued:

The land is owned by the RFD. The Thai government designated the Welu Wetland as "Reserve Forest", which is prohibited any economic activities and residences, on 18 October 1962 by Ministerial regulations (by Royal Forest Department, Ministry of Natural Resources and Environment (RFD, MNRE)) which falls under the Forest Reserve and Protection Act Article 10 and 26 (1938) and declared by the government gazette on 30 October 1962. There are currently about 3,000 residents in Welu wetland and they have the right to live in the area. The proposed project area is currently used as fish ponds. In the project activity, the communities are employed by the DMCR, who have the mandate to plant the mangrove tree, to plant and maintain the forest in their areas. It is agreed under the MoU that all emission rights within this project are belong to the provincial government and DMCR which is the implementing agency.

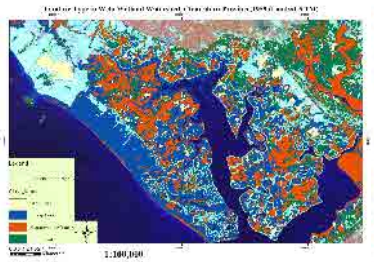
A.7. Assessment of the eligibility of land:

Land eligibility is assessed using AR-AMS0003/Version 01

The government of Thailand has released its values for forest definition which is:

- A minimum area of 0.16ha
- A minimum tree crown cover of 30%
- A minimum height of 3m

According to the result of participatory study, the areas of the land have not been forest before the end of 1989 till present. In addition, the lands are shown from satellite images (17.March, 1989) to have been grassland in 1990. These images are shown in Figure A.7.1. Therefore, the project sites are eligible for A/R CDM project activity.



Figue A.7.1.a
Satellite image of the project area in 1989 (Landsat TM)

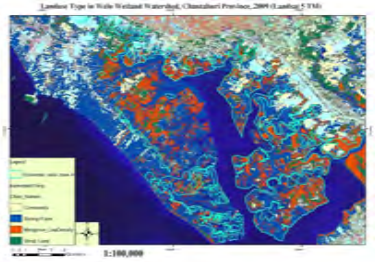


Figure A.7.1.b
Satellite image of the project area in 2009 (Landsat TM)

Interpretation:

1. Green areas represent shrub land
2. Orange areas represent low density mangrove vegetation
3. Blue areas represent aquaculture ponds
4. White areas represent community residence area

The approximate area of the proposed project is marked with 525.44 ha (3,284 Rai)

A.8. Approach for addressing non-permanence:

Issuance of lCERs

A.9. Duration of the proposed small-scale A/R CDM project activity/ Crediting period:

This projects credit period as well as its implementation period will be 30 years.

A.9.1. Starting date of the proposed small-scale A/R CDM project activity and of the (first) crediting period, including a justification:

Starting date of the proposed project and the crediting period is 21 February 2011.

A.9.2. Expected operational lifetime of the proposed small-scale A/R CDM project activity:

30 years.

A.9.3. Choice of crediting period and related information:

1. Renewable crediting period ☐
2. Fixed Crediting period ■

A.9.3.1. Duration of the first crediting period (in years and months), if a renewable crediting period is selected:

N/A

A.9.3.2. Duration of the fixed crediting period (in years and months), if selected:

30 years

A.10. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:

Expected net anthropogenic GHG removals by the sinks during the crediting period (30 years) are 190,281 t CO2. The annual net anthropogenic GHG removals by the sinks are expected to be 6,343 t CO2.

Information on the net anthropogenic GHG removals by sinks shall be indicated using the following tabular format.

Years	Annual estimation of net anthropogenic GHG removals by sinks in tonnes of CO2 e (ton CO2-e /525.44ha/yr)
2011	0
2012	732
2013	1,465
2014	2,061
2015	2,876
2016	3,971
2017	5,402

2018	7,199
2019	9,339
2020	11,700
2021	14,033
2022	15,979
2023	17,152
2024	17,284
2025	16,343
2026	14,549
2027	12,273
2028	9,892
2029	7,683
2030	5,798
2031	4,281
2032	3,111
2033	2,234
2034	1,591
2035	1,126
2036	793
2037	557
2038	391
2039	274
2040	191
Total estimated net anthropogenic GHG removals by sinks (tonnes of CO2 e)	190,281
Total number of crediting years	30 years
Annual average over the crediting period of estimated net anthropogenic GHG removals by sinks (tonnes of CO2e)	6,343

A.11. Public funding of the proposed small-scale A/R CDM project activity:

No public funding used for the proposed project activities will result in the diversion of official development assistance (ODA) or financial obligations of any parties under UNFCCC. The planting activities are financed by donation from the Department of mineral fuels foundation but maintenance cost isn't included in the donation.

A.12. Confirmation that the small-scale A/R CDM project activity is not a debundled component of a larger project activity:

This is first A/R CDM project in Thailand. According to Decision 6/CMP.1, Annex Appendix C2, a, b and c, this project site doesn't satisfy these conditions, so it is clear that the land is not a part of debandled area in a larger scale afforestation project.

SECTION B. Application of a baseline and monitoring methodology:

B.1. Title and reference of the approved baseline and monitoring methodology applied to the proposed small-scale A/R CDM project activity:

"The simplified baseline and monitoring methodology for small-scale CDM afforestation and reforestation project activities implemented on wetlands (AR-AMS0003 / Version 01)" is applied.

B.2. Justification of the applicability of the baseline and monitoring methodology to the proposed small-scale A/R CDM project activity:

The proposed A/R CDM project activity can apply the proposed methodology because the facts below mach the elements paragraph 1 (a)-(g) in AR-AMS0003/Version 01.

- The type of the proposed project activity is mangrove reforestation in intertidal zones. The Welu wetland is not designated as protected area of Ramsar site.
- For the past 50years, there has been no woods or herbaceous species
- The area is not used for agriculture and animal farming
- The project activities don't modify hydrology
- Land preparation for planting isn't needed

B.3. Specification of the greenhouse gases (GHG) whose emissions will be part of the proposed small-scale A/R CDM project activity:

The proposed project is implemented for the purpose to sequester CO2. The illegal

logging is prohibited in the Reserved Forest, where the sites are located in. The forest fire is not occurred in mangrove forest, because the sites are located in the existing ponds.

B.4. Carbon pools selected:

In "The simplified baseline and monitoring methodology for small-scale CDM afforestation and reforestation project activities implemented on wetlands (AR-AMS0003 / Version 01)", selected carbon pools are above ground biomass (AGB) and below ground biomass (BGB) as shown Table B.4.1.

Table B.4.1 Selected carbon pool

Carbon pool	Selected (answer with yes or no)
Above ground	Yes
Below ground	Yes
Dead wood	No
Litter	No
Soil organic carbon	No

B.5. Description of strata applied for ex ante estimations:

The project activity started to implement in existing fish/ shrimp ponds in tidal flats. The existing environment conditions of all project sites are almost same. Same species was selected and planting for all sites was planted within around 2 months. Therefore it is not necessary to apply the strata for this project.

B.6. Application of baseline methodology to the proposed small-scale A/R CDM project activity:

According to AR-AMS0003/Version 01, the baseline of the project can be taken as zero.

B.7. Description of how the actual net GHG removals by sinks are increased above those that would have occurred in the absence of the registered small-scale A/R CDM project activity:

The demonstration of additionality follows the AR-AMS0003/Version 01. The project activity would not have occurred without the CDM component due to the following barriers.

Investment barriers;

No credit mechanisms are in place for fisherman to pay for planting and maintenance cost. This is due to the fact that payback period for the investment is long in the project area where fishery productivity is low.

The lack of public funding for the reforestation activity is also another barrier. RFD and DMCR have been promoted the planting activity and the survival rate of the seedlings after 2~3 years is low, because there are no budget for maintenance. Local people are not motivated to take care of seedlings without incentives.

As shown in the MoU contracted in 2010, the donation from Department of Mineral Fuels Foundation & Operations of Petroleum is only for planting and not for maintenance. In addition, they would not be able to undertake this project without the expectation of obtaining credit.

Institutional barriers;

Thai government designated the Welu wetland as "reserved forest", however the residents who lived before 1962 and their offspring are allowed to live in reserved forest. They opened the mangrove forest for aquaculture and only 10% of the "reserved forest" is covered by mangrove forest. There are no laws or regulations of reforestation which enforce on residents.

Technical barriers;

Local residents are mainly fishermen and they have some knowledge of mangrove planting through experience to join former planting activities. However, maintenance and conservation of mangrove plantation is not secured. It is difficult to grow mangroves from propagules, which raising seedlings are also difficult as they are easily affected by environmental factors such as tidal levels, salt levels and so on. Being inexperienced in forestation, and lacking knowledge and means to collect information, it would be hard for the local communities to establish mangrove ecosystems by themselves.

Barriers due to Prevailing practice;

The small-scale A/R CDM project activity is the "first of its kind" in Thailand. No project activity of this type is currently running in the country. This means the initial learning curve is steep and transaction costs to get the project on the ground will be very high. This pilot project activity will level the playing field for other investors to establish CDM forestry project.

Barriers due to Social Conditions;

Local communities are mainly fishermen and they recognized that the natural aquaculture is suitable for sustainable development and started to participate in mangrove planting activities. Mangrove afforestation requires vast amount of manpower for collection, transportation, planting, and management, however, local people are not accustomed to organizing themselves into unions and working together as a team. It is necessary to provide knowledge of the proper mangrove planting and its management in order to actualize sustainable usage of the ecosystem and continuous management of this project.

B.8. Application of monitoring methodology and monitoring plan to the small-scale A/R CDM project activity:

B.8.1 Data to be monitored: Monitoring of the actual net GHG removals by sinks and leakage.

B.8.1.1 Actual net GHG removals by sinks data:

Monitoring of baseline net GHG removals by sinks is not necessary according to the applied methodology AR-AMS0003/Version 01. All data will be kept for 2 years after the end of the last crediting period in the paper and electronic files. The provision for quality assurance (QA) and quality control (QC) will be applied.

1. Monitoring of forest establishment

(1) Location of the project boundary

Location of the area, where the project activity has been implemented, will be measured in the field using GPS. It will be conducted every 5 years before the verification.

(2) Size of planted area

The size of the area, where the project activity has been implemented, will also be measured in the field using GPS. It will be conducted every 5 years before the verification. The planted area will be visited by forest experts at least every year for checking the condition and quality of the plantation.

(3) Size and location of permanent sample plot

The size of the permanent sample plot is to be at least 20 m x 20 m, which is considered

the standard area for a sample plot. The number of sample plots, that will be needed to estimate the project biomass stocks to the target precision of level of +- 10 % of the mean at a 95 % confidence level will be determined according to the methodological tool, "Calculation of the number of sample plots for measurements within A/R CDM project activity" or "Sourcebook for Land Use, Land-Use Change and Forestry projects (Pearson T., Walker S. and Brown S., 2005)." Pre-monitoring will be conducted to obtain the parameters necessary for the calculation with the tool such as standard deviation of the diameter at breast height of trees before the first monitoring.

The location of the permanent sample plots will be determined using GPS and marked on maps. It will be checked every 5 years at the monitoring operation for verification.

2. Carbon stock

The monitoring of the carbon stock in the above and below ground biomass pools will be conducted according to the applied methodology.

(1) Above ground biomass

To estimate the above ground biomass, the diameter at breast height (1.3 m, DBH) of all trees in the permanent sample plots will be measured every 5 years before the verification. At the same time, the mortality rate will be checked. Above ground biomass will be calculated using the allometric equation (Putz and Chan (1986), an applied methodology.

(2) Below ground biomass

Below ground biomass will be calculated by using the T/R (top/root biomass) ratio (2.0 ~ 3.0) reported on common mangrove forest (Komiyama et al., 2008). The most conservative value of the T/R ratio of 3.0 was selected. This T/R ratio can be converted into the Rj value (R/T ratio) to become 0.33, shown in AR-AMS0003.

B.8.1.1.1 Data to be collected or used in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary from the proposed small-scale AR-CDM project activity, and how this data will be archived:

Data variable	Source	Data unit	Measured (m),	Frequency	Proportion	Archiving	Comment

			calculated (c) or estimated (e)				
Location of the areas where the project activity has been implemented	Field survey or cadastral information or aerial photographs or satellite imagery	Lat-long	(m)	5 years	100%	Electronic, paper, photos	GPS can be used for field survey.
Ai - Size of the areas where the project activity has been implemented for each type of strata	Field survey or cadastral information or aerial photographs or satellite imagery or GPS	ha	(m)	5 years	100%	Electronic, paper, photos	GPS can be used for field survey.
Location of the permanent sample plots	Project maps and project design	Lat-long	defined	5 years	100%	Electronic, paper	Plot location is registered with a GPS and marked on the map.
Diameter at breast height (1.30 m)	Permanent plot	cm	(m)	5 years	Each tree in the sample plot	Electronic, paper	Measure diameter at breast height (DBH) for each tree that falls within the sample plot and applies to size limits
Height	Permanent plot	m	(m)	5 years	Each tree in the sample plot	Electronic, paper	Measure height (H) for each tree that falls within the sample plot and applies to size limits
Total CO2	Project activity	Mg	(c)	5 years	All project data	Electronic	Based on data collected from all plots and carbon pools

B.8.1.2 Data for monitoring of leakage (if applicable)

As shown in A.5.6., leakage is expected to be zero.

B.8.1.2.1 If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed small-scale A/R CDM project activity

N/A

B.8.2 Describe briefly the proposed quality control (QC) and quality assurance (QA) procedures that will be applied to monitor actual GHG removals by sinks:

For the sake of data quality, the following QA and QC measures should be implemented. As stated in the IPCC GPG for LULUCF (page 4.111) monitoring requires provisions for QA and QC to be implemented via a QA/QC plan.

The plan will be part of project documentation and will cover procedures as described below for:

a) Collecting reliable field measurements;
b) Verifying methods used to collect field data;
c) Verifying data entry and analysis techniques; and
d) Data maintenance and archiving. This point is especially important for small-scale A/R CDM project activities, as time scales of project activities are much longer than technological improvements of electronic data archiving can allow. Each point of importance for small-scale A/R CDM project activities is treated in the following section.

Procedures to ensure reliable field measurements

Collecting reliable field measurement data is an important step in the QA plan. Those responsible for the measurement work are trained in all aspects of the field data collection and data analyses. It is good practice to develop Standard Operating

Procedures (SOPs) for each step of the field measurements, which should be adhered to at all times. These SOPs describe in detail all procedures to be followed in the field measurements and contain provisions for documentation for verification purposes so that future field personnel can check past results and repeat the measurements in a consistent fashion. To ensure the collection and maintenance of reliable field data:

a) Field-team members are fully aware of all procedures and the importance of collecting data as accurately as possible;
b) Field teams install test plots if needed in the field and measure all pertinent components using the SOPs to estimate measurement errors;
c) The document will list all names of the field team and the project leader will certify that the team is trained;
d) New staff adequately trained.

Procedures to verify field data collection

To verify that plots have been installed and the measurements taken correctly, it is good practice to remeasure independently every 10 plots and to compare the measurements. The following quality targets should be archived for the re-measurements for comparison with the original measurements:

- Missed or extra trees no error within the plot
- Tree species or groups no error
- D.B.H. < ± 0.5 cm or 3 % whichever is greater
- Height < ± 10/ and -20%
- Circular plot radius/sides of rectangular plot < ± 1% of horizontal (angle-adjusted)

At the end of the fieldwork independently, 10 – 20 % of the plots will be checked. Field data collected at this stage will be compared with the original data. Any errors found will be corrected and recorded. Any errors discovered will be expressed as a percentage of all plots that have been re-checked to provide an estimate of the measurement error.

Reliable carbon estimates require proper entry of data into the data analyses spreadsheets. Possible errors in this process can be minimized if the entry of both field data and laboratory data are cross checked and, where necessary, internal tests incorporated into the spreadsheets to ensure that the data are realistic. Communication between all personnel involved in measuring and analyzing data should be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot should not be used in the analysis.

Data maintenance and storage

Because of the relatively long-term nature of these project activities, data archiving (maintenance and storage) will be an important component of the work. Data archiving should take several forms and copies of all data should be provided to each project participant.

Copies (electronic and/or paper) of all field data, data analyses, and models; estimates of the changes in carbon stocks and corresponding calculations and models used; any GIS products; and copies of the measuring and monitoring reports should all be stored in a dedicated and safe place, preferably offsite.

Given the time frame over which the project activity will take place and the pace of production of updated versions of software and new hardware for storing data, it is recommended that the electronic copies of the data and report be updated periodically or converted to a format that could be accessed by any future software application.

Training

Training on how to monitor quality control (QA) and quality assurance (QA) will be provided through "On the job training" by DMCR, and their academic partners in Assert University.

B.8.3 Please describe briefly the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks by the proposed small-scale A/R CDM project activity:

The implementation chart for project monitoring is shown in figure B.8.3.1. DMCR give CA members on the job training under the supervision of Assert University. The staffs in DMCR have many experiences for mangrove planting and management and they are well-trained. The CA with DMCR will have field survey and collect data from the permanent sample plot, and DMCR will process and calculate in accordance with the applied methodology. KUFF will supervise the monitoring activities and review the monitoring report.

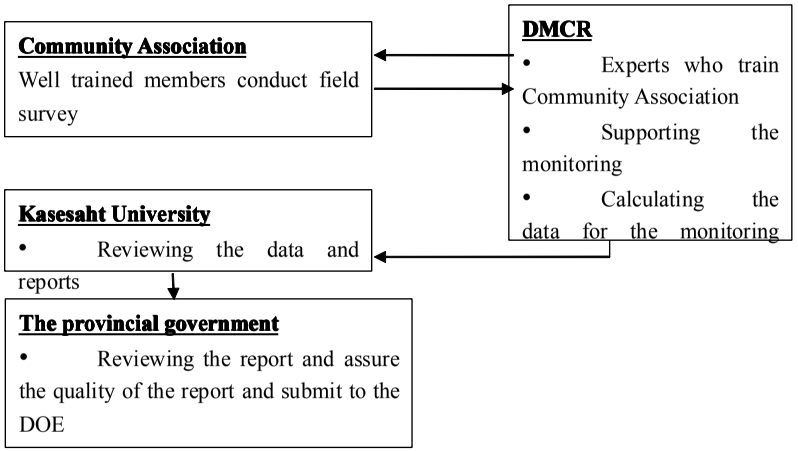


Figure B.8.1 Organization Chart for Project Implementation

B.9. Date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline and the monitoring methodology:

The baseline study was completed on 26 February 2012. DMCR determined by the methodology AR-AMS0003/Version 01.

SECTION C. Estimation of ex ante net anthropogenic GHG removals by sinks:

C. 1. Estimated baseline net GHG removals by sinks:

>> The project sites are in existing fish/ shrimp ponds and there is no vegetation. According to Paragraph 5 of the methodology AR-AMS0003/Version 01 the baseline of the proposed project can be taken as zero.

C. 2. Estimate of the actual net GHG removals by sinks:

>> Actual GHG removals by this proposed project are estimated to be 190.281 ton CO_{2-e}. The average value of annual CO_2 fixation is estimated to be 6,343 ton CO_{2-e}/ 525.44 ha/yr.

Actual net greenhouse gas removals by sinks (*ex ante*)

Changes in above and below ground carbon pools for trees should be calculated as follows:

$\triangle C_{PROJ,t} = (C_t - C_{t-1})/T$

where :

$\triangle C_{PROJ,t}$ = Removal component of actual net GHG removals by sinks at time *t*; ton CO_{2-e} yr^{-1}

C_t = Carbon stocks in the above and below ground carbon pools for trees at time *t*; ton CO_{2-e}

T = Time difference between *t* and *t-1*; years

For above-ground biomass

$C_{AB,I,t}$ is calculated per stratum I as follows:

$C_{AB,I,t} = B_{AB,I,t} * 0.5$

where:

$C_{AB,i,t}$ = Carbon stocks in above-ground biomass of trees for stratum *i*, at time *t*; ton C ha^{-1}

$B_{AB,i,t}$ = Above-ground biomass of trees in stratum *i*, at time *t*; ton dry matter ha^{-1}

0.5 = Carbon fraction of dry matter; ton C (t dm) $^{-1}$

In the applied methodology AR-AMS0003/Version 01, calculation method for CO_2 fixation estimation using stand volume and wood density is introduced. The stand volume data for above calculations for mangrove do not exist. Instead, the allometry equation described in the methodology AR-AMS0003/Version 01 was employed for the estimation of CO2 fixation in the newly-afforested mangrove forest. This equation needs DBH (diameter at breast height) to calculate biomass. Although changes in DBH over time are uncertain, growth of DBH was forecasted by adopting the growth curve reported by Okimoto et al. (2008). The growth curve is perceived as the most conservative estimation method. DBH changes obtained through the growth curve are substituted into allometry equation in order to evaluate biomass amount, then annual CO2 fixation is estimated from annual biomass stocks calculated by incremental biomass amounts from one year to the next. CO2 fixation each year for the 30-year project period is evaluated this way, and then grand total of the 30-year long CO2 fixation is estimated.

The applied methodology introduces both Option 1 and Option 2 for biomass estimation regarding prediction of annual net anthropogenic GHG removals by sinks. Option 2 was selected in this project because stand volume data on mangrove are lacking, and which we cannot use Option 1.

Option 2:

Alternatively, local, national, or regional sources on aboveground biomass accumulation through time for the species planted in the project area that can be fitted into standard biomass growth equations (biomass in ton ha^{-1} versus time) may exist. These can be used directly for $B_{AB,i,t}$:

$B_{AB,i,t} = Sps\Sigma j=1\ B_{AB,i,t}$

$B_{AB,i,t=n} = B_{AB,i(,t=n-1)} + g * \triangle t$

Where:

$B_{AB,i,t}$ = Above-ground biomass of trees in stratum I at time t; ton dry matter ha^{-1}

$B_{AB,i,t=n}$ = Above-ground biomass of trees of species j in stratum I at time t=n; ton dry matter ha^{-1}

g = Annual increment in biomass; ton dry matter ha^{-1} yr^{-1}

$\triangle t$ = time increment; years

n = Running valuable that increases by $\triangle t$ for each interactive step

j = Index for species (Sps = total number of species in stratum)

In this project, the following allometric equation was used to calculate biomass growth:

Log10AGB = 2.516 log10(DBH) – 0.767

Where:

AGB = Above-ground biomass (ton dry matter $stand^{-1}$)

DBH = Diameter at breast height measured at height approximately 1.3 m, or above the highest prop-root of *Rhizophora apiculata*

In regards to biomass growth equation, we applied allometric method in Appendix D of AR-AMS0003/Version 01. In this project, we selected the allometric equation reported by Putz and Chan (1986) for the following reasons, 1) Thailand located in tropical wet region, 2) the main planting species is *Rhizophora apiculata*, and 3) to avoid over-estimation of biomass.

For below-ground biomass

CBB,i,t is calculated per stratum I as follows:

CBB,i,t = Spes△J=1 CBB,i,j,t

CBB,i,j,t = BAB,i,j,i * Rj * 0.5

Where:

CBB,i,t = Carbon stocks in below-ground biomass of trees for stratum I at time t; ton C ha^{-1}

CBB,i,j,t = Carbon stocks in below-ground biomass of trees of species j in stratum i at time t; ton C ha^{-1}

BAB,i,j,I = Above-ground biomass of trees of species j in stratum I at time t; ton dry matter ha^{-1}

Rj = Root to shoot ratio for species or group of species j; dimensionless

0.5 = Carbon fraction of dry matter; ton C (ton dry matter) $^{-1}$

The rule is that documented local or national values of Rj should be used T/R (top to root) ratios of 2.0 ~ 3.0 of mangrove trees in general were reported by Komiyama et al. (2008). Rj is equal to the reciprocal of the T/R ratio, so the most conservative value was taken as the Rj value of 0.33.

Project emissions are assumed to be negligible hence, they are accounted for as zero in this methodology. The ex ante actual net greenhouse gas removals by sinks in year t are therefore equal to:

△CACTUAL,t = △CPROJ,t

Where:

△CACTUAL,t = annual actual net greenhouse gas removals by sinks at time t; ton CO2-e yr^{-1}

△CPROJ,t = removal component of actual net GHG removals by sinks at time t; ton CO2-e yr^{-1}

C. 3. Estimated leakage:

>> The leakage of the proposed project will be zero according to Section 19 in AR-AMS0003/Version 01 as shown in A.5.6.

C. 4. The sum of C. 2. minus C.1. minus C.3. representing the net anthropogenic GHG removals by sinks of the proposed small-scale A/R CDM project activity:

>> Actual net GHG removal by sinks is estimated to be 190,281 ton CO2-e. The average value of annual CO2 fixation is estimated to be 6,343 tonCO2-e/525.44ha/yr.

C. 5. Table providing values obtained when applying equations from the

approved methodology:

The result of the application of equations from approved methodology above shall be indicated using the following tabular format:

Year	Estimation of baseline net GHG removals by sinks (tonnes of CO_2 e)	Estimation of actual net GHG removals by sinks (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of net anthropogenic GHG removals by sinks (tonnes of CO_2 e)
2011	0	0	0	0
2012	0	732	0	732
2013	0	1,465	0	1,465
2014	0	2,061	0	2,061
2015	0	2,876	0	2,876
2016	0	3,971	0	3,971
2017	0	5,402	0	5,402
2018	0	7,199	0	7,199
2019	0	9,339	0	9,339
2020	0	11,700	0	11,700
2021	0	14,033	0	14,033
2022	0	15,979	0	15,979
2023	0	17,152	0	17,152
2024	0	17,284	0	17,284
2025	0	16,343	0	16,343
2026	0	14,549	0	14,549
2027	0	12,273	0	12,273
2028	0	9,892	0	9,892
2029	0	7,683	0	7,683
2030	0	5,798	0	5,798
2031	0	4,281	0	4,281
2032	0	3,111	0	3,111
2033	0	2,234	0	2,234
2034	0	1,591	0	1,591
2035	0	1,126	0	1,126
2036	0	793	0	793
2037	0	557	0	557
2038	0	391	0	391
2039	0	274	0	274
2040	0	191	0	191
Total (tonnes of CO_2 e)	0	190,281	0	190,281

SECTION D. Environmental impacts of the proposed small-scale A/R CDM project activity:

D.1. Provide analysis of the environmental impacts, including transboundary impacts (if any):

The proposed project will restore forest in degraded land. The proposed project is not to have construction of artificial features and geographical changes, because the proposed project activities will be implementing in the existing fish/ shrimp ponds. The selected species to be planted is dominant species in this area and common mangrove species not only in Thailand but also in Southeast Asia. Therefore it is expected that the project will provide positive environmental impacts such as reducing erosion as a result of the vegetation cover to be developed.

D.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

Although it is not required by Thai laws for the reforestation to conduct an environmental impact assessment, Thailand's Designated National Authority (DNA) requires an Initial Environmental Evaluation (IEE) report to be submitted along with this PDD in order to obtain the host country approval. The Initial Environmental

Evaluation conducted by a qualified engineer is developed to assess the Project' environmental impacts to the criteria as identified in the DNA's sustainable development criteria. It should be found that the project activity will contribute major positive environmental impacts to the neighboring environment and neighboring residences. The impacts are as follows:

1) Improving fish catches (fish, prawn, crabs etc) with habitat formation through mangrove forests,
2) Adaptation to global warming (dissolve the vulnerability caused by coastal erosion due to sea level rise),
3) Breakwater against Tsunamis (demonstrated by Sumatra earthquake), and
4) Protection and improvement of biodiversity

D.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section D.2. above:

N/A

Section E. Socio-economic impacts of the proposed small-scale A/R CDM project activity:

E.1. Provide analysis of the socio-economic impacts, including transboundary impacts (if any):

- Implementation of the proposed project will cause the significant positive socio-economic impacts rather than negative impacts. The income of the residents will increase by the labor fees from the planting and maintenance of the forest. The benefit from CER will use for residents after discussion between Chantaburi Province and the residents.

- This is the first of its kind in A/R CDM project not only in Chantaburi Province but also in Thailand. The knowledge of system on A/R CDM and the awareness of importance of mangrove forest will be spread in Thailand.
- The main economic activity engaged by the residents around the sites is fishery. Their main fishery products are fishes, shrimps, crabs and shellfishes and mangrove planting will provide good condition for them. The harvest from fishery is expected to increase and, consequently, increase income of local community.
- Mangrove forest will have the improvement of ecosystem and biodiversity around the proposed sites. The opportunity to increase eco-tourism, which is already trying around the sites, is expected.

E.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socio-economic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

According to the socio-economic impact study, no negative impacts were found. The local community people are well aware of the climate change and faces sea level rise in everyday life. Most of the people have positive view on reforestation through the survey. The reasons for this were mostly attributed to the image of reforestation conserving marine resources such as fish, crab and shrimps and expectation for new employment opportunities. The reasons for the motivation to participate in reforestation activity were the same.

E.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section E.2. above:

N/A

SECTION F. Stakeholders' comments:

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

Before implement this project, public hearing may be required in order to gather opinions from the stakeholders. The meeting with representatives of the village was held on 16 August and 15 September 2010 at Mangrove Development Station 2, Chantaburi province. The procedure of the meeting as follow;

1) The project concept and benefits of the CDM project was explained to the local community by the head of Mangrove Development 2.
2) All of stake holders went to site seeing in the project area to see the existence of environment.

After explanation of the proposed project and site visit, comments are received at the Q/A session.

F.2. Summary of the comments received:

>> The comments received from the local community as follow;

Benefit issues:

1) They think the reforestation is the good activity to increase the forest area because they know that the mangrove forests have a lot of benefit for people who live in the coastal area.
2) Reforestation will make their life better, such as increasing the production and protecting from the storm, and decreasing soil erosion.
3) They will gain more income from their own business, as fish and shrimp pond, and the CERs income, as the employment to plant and maintain the forest in their area.
4) The will gain the updated techniques and knowledge to plant the mangrove trees.

Concerning issue:

1) The government will take the land back from the community after they plant the trees to be the forest.
2) Do they have to spend their own money to implement the project?
3) They think AR-CDM scheme is too difficult to understand for them.
4) After participation of the project, will they receive the money from the project?

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

All stakeholders agreed the proposed project activities through the meetings. The

concerning issues are resolved as follows:

1) Status of forested land

The government and residents already agreed that the land use rights in Reserved Forest are belonging to the residents, therefore the forested land is not taken by the government.

2) Budget for the project

The budget for the project is secures by the PPs.

3) Difficulties of the implementation of project under CDM scheme

PPs will have some meeting with the residents to support for the implementation of project under CDM scheme.

4) Usage of CER

Basically the rights to have CER will be the Foundation as a donor. The Foundation will give CER to Chantaburi Province, and the Province will discuss with the residents how to make efficient use of the CER.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED SMALL-SCALE A/R CDM PROJECT ACTIVITY

Organization:	Chantaburi province
Street/P.O.Box:	
Building:	
City:	Mueng
State/Region:	Chantaburi
Postfix/ZIP:	22000
Country:	Thailand
Telephone:	66 3931 1571
FAX:	66 3931 1571
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Royal Forest Department
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	

Country:	
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:	Department of Marine and Coastal Resources
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
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

Annex 3

DECLARATION ON LOW-INCOME COMMUNITIES

Please provide a written declaration that the proposed small-scale afforestation or reforestation project activity under the CDM is developed or implemented by low-income communities and individuals as determined by the host Party.
(Letter of confirmation)

History of the document

Version	Date	Nature of revision
02	EB35, Annex 22 19 October 2007	• Sections A and B were restructured; • Requirement to repeat equations has been removed from section C; • Sections D and E have been aligned with the requirements of the Modalities and Procedures.
01	EB 23, Annex 16(a) and	Initial adoption

	16(b) 24 February 2006	

Annex 4

COORDINATES OF PROJECT BOUNDARY

Site	Area (rai (ha))	Way point #	Longitude (E)	Latitude (N)

Output 4: Database structure

Properties

DateCreated:	24/5/2553 11:08:35	DefaultView:	2
DisplayViewsOnSharePointSite		1	FilterOnLoad: False
GUID:	{guid {8BA2BDDB-0764-4551-9E91-C22A356CC472}}	HideNewField:	False
LastUpdated:	22/9/2554 10:18:41	NameMap:	Long binary data
OrderBy:	[AD_Energy].[Year], AD_Energy.RecId	OrderByOn:	False
OrderByOnLoad:	True	Orientation:	Left-to-Right
RecordCount:	602	TotalsRow:	False
Updatable:	True		

Columns

Name	Type	Size
RecId	Long Integer	4
Sect_Lev0	Text	50
Sect_Lev1	Text	50
Sect_Lev2	Text	50
Sect_Lev3	Text	50
Sect_Lev4	Text	50
SectCode	Text	50
FuelId	Long Integer	4
Year	Long Integer	4
ADVal	Single	4
Unit	Text	50
Reference	Long Integer	4
DataStatus	Long Integer	4

Properties

DateCreated:	15/7/2553 17:15:27	DefaultView:	2
GUID:	{guid {0D321FFF-718B-43DE-82F9-69FD5F47A810}}	LastUpdated:	17/11/2553 16:18:28
NameMap:	Long binary data	OrderByOn:	True
Orientation:	Left-to-Right	RecordCount:	223
Updatable:	True		

Columns

Name	Type	Size
RecId	Long Integer	4
Sect_Lev0	Text	50
Sect_Lev1	Text	50
Sect_Lev2	Text	50
Sect_Lev3	Text	50
Sect_Lev4	Text	50
SectCode	Text	50
Prod_Indust	Long Integer	4
Year	Long Integer	4
Production	Date/Time	8
Import	Single	4
Export	Single	4
Destroy	Single	4
ADVal	Single	4
Unit	Text	50
Reference	Long Integer	4
DataStatus	Long Integer	4

Properties

DateCreated:	8/7/2553 14:11:23	DefaultView:	2
GUID:	{guid {FAAA40D4-FDD7-4970-B4E8-9FB75AFEA696}}	LastUpdated:	17/11/2553 10:31:33
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	41
Updatable:	True		

Columns

Name	Type	Size
RecId	Long Integer	4
SectId	Text	50
Year	Long Integer	4
FuelId	Integer	2
GHGId	Long Integer	4
HeatingValue	Single	4
CarbonEmissionFactor	Single	4
FractionCarbonOxidized	Single	4
CO2MolecularWeight	Single	4
CMolecularWeight	Single	4
Unit	Text	50

Properties

DateCreated:	30/6/2553 17:04:09	DefaultView:	2
GUID:	{guid {181E92CB-36B9-490A-906D-18408D441D5A}}	LastUpdated:	17/11/2553 10:35:02
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	66
Updatable:	True		

Columns

Name	Type	Size
RecId	Long Integer	4
SectId	Text	50
Year	Long Integer	4
ProductId	Integer	2
GHGId	Long Integer	4
AvgEmissionFactor	Single	4
LowerEmissionFactor	Single	4
UpperEmissionFactor	Single	4
Remark_EF	Text	50
Unit	Text	50

Properties

DateCreated:	8/7/2553 14:53:48	DefaultView:	2
GUID:	{guid {BB1AC98A-C6BD-4A73-81D2-EB253B0439D0}}	LastUpdated:	8/7/2553 18:35:55
NameMap:	Long binary data	OrderBy:	EnergyType_1996.EnergyTypeId
OrderByOn:	True	Orientation:	Left-to-Right
RecordCount:	41	SubdatasheetName:	[Auto]
Updatable:	True		

Columns

Name	Type	Size
EnergyTypeId	Integer	2
EnergyType	Text	100
EnergyType_Eng	Text	100
Desc	Text	255
StdUnit	Text	50
TJ_unit	Single	4

Properties

DateCreated:	26/3/2553 11:17:26	DefaultView:	2
GUID:	{guid {72441328-60AC-49B9-8543-A5268A70491E}}	LastUpdated:	26/3/2553 11:23:34
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	8
Updatable:	True		

Columns

Name	Type	Size
EnergyTypeGroupId	Integer	2
EnergyTypeGroup_Eng	Text	100
EnergyTypeGroup_Tha	Text	100

Properties

DateCreated:	16/2/2553 14:52:55	DefaultView:	2
GUID:	{guid {0BE2EAB3-434E-49E7-9E95-65DAA1A4A9EF}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderBy:	GHG.GHG_Id
OrderByOn:	True	Orientation:	Left-to-Right
RecordCount:	25	Updatable:	True

Columns

Name	Type	Size
GHG_Id	Long Integer	4
GHG	Text	50
GHG_Name	Text	50
GHG_Group	Integer	2
GWP	Long Integer	4

Properties

DateCreated:	19/2/2553 22:38:44	DefaultView:	2
GUID:	{guid {761BE2C7-6B78-4A71-981C-43559CB89E5B}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	7
Updatable:	True		

Columns

Name	Type	Size
GHG_Group_Id	Integer	2
Chemical_Formular	Text	50
GHG_Group_Name	Text	50

Properties

DateCreated:	15/7/2553 18:58:57	DefaultView:	2
GUID:	{guid {185A63F4-70E0-461C-B245-3F3643A4B618}}	LastUpdated:	16/11/2553 17:31:07
NameMap:	Long binary data	OrderBy:	IPPUType_1996.IPPUTypeId
OrderByOn:	True	Orientation:	Left-to-Right
RecordCount:	54	SubdatasheetName:	[Auto]
Updatable:	True		

Columns

Name	Type	Size
IPPUTypeId	Integer	2
IPPUType	Text	100
IPPUType_Eng	Text	100
Desc	Text	255
StdUnit	Text	50

Properties

DateCreated:	16/2/2553 15:05:49	DefaultView:	2
GUID:	{guid {347305D2-EF92-45B1-8669-3889F41B4BFA}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	8
RowHeight:	285	Updatable:	True

Columns

Name	Type	Size
M_catid	Integer	2
Desc	Text	100
Definition	Memo	-

Properties

DateCreated:	16/2/2553 15:29:46	DefaultView:	2
GUID:	{guid {28E3DA9E-04C3-4E30-A8CB-B286593E658C}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	29
RowHeight:	555	Updatable:	True

Columns

Name	Type	Size
M_catid	Integer	2
1st_catid	Text	5
Desc	Text	100
Definition	Memo	-

Properties

DateCreated:	19/2/2553 22:26:19	DefaultView:	2
GUID:	{guid {90F62784-17C4-416B-8FB5-6095A408E243}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	88
RowHeight:	510	Updatable:	True

Columns

Name	Type	Size
M_catid	Integer	2
1st_catid	Text	5
2nd_catid	Text	5
Desc	Text	100
Definition	Memo	-

Properties

DateCreated:	19/2/2553 22:26:46	DefaultView:	2
GUID:	{guid {E8466B80-CA14-4F2F-8CEE-36B74163A733}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderBy:	L3_Catagory1996.[3rd_catid]
OrderByOn:	False	Orientation:	Left-to-Right
RecordCount:	65	Updatable:	True

Columns

Name	Type	Size
M_catid	Integer	2
1st_catid	Text	5
2nd_catid	Text	5
3rd_catid	Text	5
key	Text	50
Desc	Text	255
Definition	Memo	-

Properties

DateCreated:	25/5/2553 17:04:41	DefaultView:	2
GUID:	{guid {1C3F7B62-D9A3-4B67-89DC-F79B44C77EB5}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderByOn:	True
Orientation:	Left-to-Right	RecordCount:	43
Updatable:	True		

Columns

Name	Type	Size
M_catid	Integer	2
1st_catid	Text	5
2nd_catid	Text	5
3rd_catid	Text	50
4th_catid	Text	5
key	Text	50
Desc	Text	255
Definition	Memo	-

Properties

DateCreated:	9/7/2553 12:29:14	DefaultView:	2
GUID:	{guid {4FA26C7D-4DD4-4D36-891B-C30FCBE8AC44}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderBy:	ReferenceOrganization.OrgId
OrderByOn:	True	Orientation:	Left-to-Right
RecordCount:	13	Updatable:	True

Columns

Name	Type	Size
OrgId	Long Integer	4
Organization	Text	255

Properties

DateCreated:	9/7/2553 11:29:37	DefaultView:	2
Filter:	((ReferenceReport.ReportName Like "รายงานน้ำมันเชื้อเพลิงของประเทศไทย*"))	GUID:	{guid {50B371C8-BBF7-4CA9-AB76-7DC4D44AADD5}}
LastUpdated:	27/2/2555 0:12:09	NameMap:	Long binary data
OrderBy:	ReferenceReport.RepId	OrderByOn:	True
Orientation:	Left-to-Right	RecordCount:	36
Updatable:	True		

Columns

Name	Type	Size
RepId	Long Integer	4
ReportName	Text	255
ReportYear_Tha	Long Integer	4
ReportYear_Eng	Long Integer	4
OrgId	Long Integer	4

Properties

DateCreated:	25/5/2553 9:19:05	DefaultView:	2
GUID:	{guid {6283A820-0A2A-4977-A55C-5E1C871C22E3}}	LastUpdated:	27/2/2555 0:12:09
NameMap:	Long binary data	OrderByOn:	False
Orientation:	Left-to-Right	RecordCount:	233
Updatable:	True		

Columns

Name	Type	Size
SectCode	Text	50
Desc	Text	255

List of query for NAI reporting format

Category	Data file	GHG	Query for inventory estimation	Field of result
4 · Agriculture	GHG_Inventory _AFOLU	CH4,N2O, NOx,CO	Not use(Sum)	Not use(Sum)
4A ·Enteric fermentation		CH4	4A&4B_CH4_Livestock_Total_ 1996IPCC	CH4Gg_EF
4B Manure management		CH4	4A&4B_CH4_Livestock_Total_ 1996IPCC	CH4Gg_MM
		N2O	4B_N2O_Total-AWMS_1996IPCC	N2OGg
4C Rice cultivation		CH4	4C_CH4_Flooded_Rice_Fields_ Total_1996IPCC	CH4Gg
4D Agricultural soils		N2O	4D_N2O_Agricultural_Soils_Step9_ 1996IPCC	N2OGg
4E Prescribed burning ... of Savanna				
4F Field burning of agricultural residues	GHG_Inventory _AFOLU	CH4,CO	4F_CH4&CO_Field_Burning_Step6_ 1996IPCC	EmissionGg
		N2O,NOx	4F_N2O&NOx_Field_Burning_Step6_ 1996IPCC	EmissionGg
4G others				
5 -LULUFC	GHG_Inventory _AFOLU	CO2,CH4, N2O,NOx,CO	Not use(Sum)	Not use(Sum)
5A Changes in forest and other woody biomass stock		CO2	5A_C_CF&OWBS_Step3_to_4_ 1996IPCC	CO2Emissions, CO2Removals
5B Forest and grassland conversion		CO2	5B_CO2_F&GLC_Biomass_Step6_ 1996IPCC	CO2Gg
		CH4,CO	5B_Non-CO2_Gas_Emissions_C_ 1996IPCC	EmissionGg
		N2O,NOx	5B_Non-CO2_Gas_Emissions_N_ 1996IPCC	EmissionGg
5C Abandonment managed land		CO2	5C_CO2_Removals_Abandoned_ Lands_Total_1996IPCC	CO2Removals
5D Emissions and removal of soil				
5E others				
6 - Waste	GHG_Inventory _WASTE	CH4,N2O, CO2	Not use(Sum)	Not use(Sum)
6A Solid waste disposal on land		CH4(JGSEE)	SWDS_CH4_Total_2000-2005_ JGSEE	CH4Gg
	GHG_Inventory Form	CH4(IPCC)	Not use(Calculated in Form)	Not use
6B Waste water handling	GHG_Inventory _WASTE	CH4	WW_CH4_Total_1996IPCC	CH4Gg
		N2O	DWW_N2O_Result_1996IPCC	N2OGg
6C Waste incineration		CO2	IOB_CO2_Result_1996IPCC	CO2Gg
		N2O	IOB_N2O_Result_2006IPCC	N2OGg
6D others				

List of query for 1996 IPCC reporting format

No.	Category	Data file	GHG	Query for inventory estimation	Field of result
4s1	4 Agriculture	GHG_Inventory _AFOLU	CH4,N2O, NOx,CO	Not use(Sum)	Not use(Sum)
	A Enteric fermentation		CH4	4A&4B_CH4_Livestock_Total_ 1996IPCC	CH4Gg_EF
	A1-A10		CH4	4A&4B_CH4_Livestock_GRP_ 1996IPCC	CH4Gg_EF
	B Manure management		CH4	4A&4B_CH4_Livestock_Total_ 1996IPCC	CH4Gg_MM
			N2O	4B_N2O_Total-AWMS_1996IPCC	N2OGg
	B1-B9		CH4	4A&4B_CH4_Livestock_GRP_ 1996IPCC	CH4Gg_MM
4s2	B10-B13	GHG_Inventory _AFOLU	N2O	4B_N2O_Each-AWMS_Total_ 1996IPCC	N2OGg
	C Rice cultivation		CH4	4C_CH4_Flooded_Rice_Fields_ Total_1996IPCC	CH4Gg
	C1-C4		CH4	4C_CH4_Flooded_Rice_Fields_ Subtotal_1996IPCC	CH4Gg
	D Agricultural soils		N2O	4D_N2O_Agricultural_Soils_Step9_ 1996IPCC	N2OGg
	E Prescribed burning of Savanna				
	F Field burning of agricultural residues	GHG_Inventory _AFOLU	CH4,CO	4F_CH4&CO_Field_Burning_Step6_ 1996IPCC	EmissionGg
			N2O,NOx	4F_N2O&NOx_Field_Burning_Step6_ 1996IPCC	EmissionGg
	F1-F5				
	G others				
5s1	LULUFC	GHG_Inventory _AFOLU	CO2,CH4, N2O,NOx,CO	Not use(Sum)	Not use(Sum)
	A Changes in forest and other woody biomass stock		CO2	5A_C_CF&OWBS_Step3_to_4_ 1996IPCC	CO2Emissions, CO2Removals
	A1-A5				
	B Forest and grassland conversion	GHG_Inventory _AFOLU	CO2	5B_CO2_F&GLC_Biomass_Step6_ 1996IPCC	CO2Gg
			CH4,CO	5B_Non-CO2_Gas_Emissions_C_ 1996IPCC	EmissionGg
			N2O,NOx	5B_Non-CO2_Gas_Emissions_N_ 1996IPCC	EmissionGg
	B1-B5				
	C Abandonment managed land	GHG_Inventory _AFOLU	CO2	5C_CO2_Removals_Abandoned_ Lands_Total_1996IPCC	CO2Removals
	C1-C5		CO2	5C_CO2_Removals_Abandoned_ Lands_Total_1996IPCC	CO2Removals
	D Emissions and removal of soil				
	E others				

List of query for 1996 IPCC reporting format

No.	Category	Data file	GHG	Query for inventory estimation	Field of result
6s1	Waste	GHG_Inventory_WASTE	CO2,CH4,N2O	Not use(Sum)	Not use(Sum)
	A Solid waste disposal on land		CH4(JGSEE)	SWDS_CH4_Total_2000-2005_JGSEE	CH4Gg
		GHG_Inventory Form	CH4(IPCC)	Not use(Calculated in Form)	Not use
	A1-A3	GHG_Inventory_WASTE	CH4(JGSEE)	SWDS_CH4_SubTotal_2000-2005_JGSEE	CH4Gg
		GHG_Inventory Form	CH4(IPCC)	Not use(Calculated in Form)	Not use
	B Waste water handling	GHG_Inventory_WASTE	CH4	WW_CH4_Total_1996IPCC	CH4Gg
			N2O	DWW_N2O_Result_1996IPCC	N2OGg
	B1 Industrial		CH4	IWW_CH4_Result_1996IPCC	CH4Gg
	B2 Domestic & Commercial		CH4	DWW_CH4_Result_1996IPCC	CH4Gg
			N2O	DWW_N2O_Result_1996IPCC	N2OGg
	B3 others				
	C Waste incineration	GHG_Inventory_WASTE	CO2	IOB_CO2_Result_1996IPCC	CO2Gg
			N2O	IOB_N2O_Result_2006IPCC	N2OGg
	D others				
7As2 (7Bs1)	Agriculture	GHG_Inventory_AFOLU	CH4,N2O,NOx,CO	Not use(Sum)	Not use(Sum)
	A Enteric fermentation		CH4	4A&4B_CH4_Livestock_Total_1996IPCC	CH4Gg_EF
	B Manure management		CH4		CH4Gg_MM
			N2O	4B_N2O_Total-AWMS_1996IPCC	N2OGg
	C Rice cultivation		CH4	4C_CH4_Flooded_Rice_Fields_Total_1996IPCC	CH4Gg
	D Agricultural soils		N2O	4D_N2O_Agricultural_Soils_Step9_1996IPCC	N2OGg
	E Prescribed burning of Savanna				
	F Field burning of agricultural residues	GHG_Inventory_AFOLU	CH4,CO	4F_CH4&CO_Field_Burning_Step6_1996IPCC	EmissionGg
			N2O,NOx	4F_N2O&NOx_Field_Burning_Step6_1996IPCC	EmissionGg
	G others				
	5 LULUFC	GHG_Inventory_AFOLU	CO2,CH4,N2O,NOx,CO	Not use(Sum)	Not use(Sum)
	A Changes in forest and other woody biomass stock		CO2	5A_C_CF&OWBS_Step3_to_4_1996IPCC	CO2Emissions, CO2Removals
	B Forest and grassland conversion		CO2	5B_CO2_F&GLC_Biomass_Step6_1996IPCC	CO2Gg
			CH4,CO	5B_Non-CO2_Gas_Emissions_C_1996IPCC	EmissionGg
			N2O,NOx	5B_Non-CO2_Gas_Emissions_N_1996IPCC	EmissionGg
	C Abandonment managed land		CO2	5C_CO2_Removals_Abandoned_Lands_Total_1996IPCC	CO2Removals
	D Emissions and removal of soil				
	E others				
	6 Waste	GHG_Inventory_WASTE	CH4,N2O,CO2	Not use(Sum)	Not use(Sum)
	A Solid waste disposal on land		CH4(JGSEE)	SWDS_CH4_Total_2000-2005_JGSEE	CH4Gg
		GHG_Inventory Form	CH4(IPCC)	Not use(Calculated in Form)	Not use
	B Waste water handling	GHG_Inventory_WASTE	CH4	WW_CH4_Total_1996IPCC	CH4Gg
			N2O	DWW_N2O_Result_1996IPCC	N2OGg
	C Waste incineration		CO2	IOB_CO2_Result_1996IPCC	CO2Gg
			N2O	IOB_N2O_Result_2006IPCC	N2OGg
	D others				

List of query 2006 IPCC reporting format

No.	Category	Data file	GHG	Query for inventory estimation	Field of result
As5, As6 (Bs1, Bs2)	3 Agriculture, Forestry and other landuse	GHG_Inventory_AFOLU	CH4,N2O	Not use(Sum)	Not use(Sum)
	3A Live stock		CH4	3A1&3A2_CH4_Livestock_Total_2006IPCC	CH4Gg
			N2O	3A2_N2O_Livestock_Animal_Total_2006IPCC	N2OGg
	3A1 Enteric fermentation		CH4	3A1&3A2_CH4_Livestock_Total_2006IPCC	CH4Gg_EF
	3A2 Manure management		CH4	3A1&3A2_CH4_Livestock_Total_2006IPCC	CH4Gg_MM
			N2O	3A2_N2O_Livestock_Animal_Total_2006IPCC	N2OGg
	G Land		CO2	3B_NetCO2_Emissions_Year	Net_CO2_Gg
	3B1-3B5		CO2	3B_NetCO2_Emissions_SectCode1	Net_CO2_Gg
	3B6 Other land				
	3C Aggregate Sources and Non-CO2 Emissions Sources on Land	GHG_Inventory_AFOLU	N2O	3C4_Direct_N2O_Emissions_2006IPCC	N2O_Gg
			CH4	3C7_CH4_Emission_Rice_Total_2006IPCC	CH4_Gg
	3C1-3C3				
	3C4 Direct N2O emissions from managed soils	GHG_Inventory_AFOLU	N2O	3C4_Direct_N2O_Emissions_2006IPCC	N2O_Gg
	3C5-3C6				
	3C7 Rice cultivation	GHG_Inventory_AFOLU	CH4	3C7_CH4_Emission_Rice_Total_2006IPCC	CH4_Gg
	3C8 Others				
	3D Others				
	3D1-3D2				
	4 Waste	GHG_Inventory_WASTE	CO2,CH4,N2O	Not use(Sum)	Not use(Sum)
	4A Solid waste disposal		CH4	Not use(Calculated in Form)	Not use
	4B biological treatment				
	4C Incineration and open burning	GHG_Inventory_WASTE	CO2	IOB_CO2_Result_2006IPCC	CO2Gg
			CH4	IOB_CH4_Result_2006IPCC	CH4Gg
			N2O	IOB_N2O_Result_2006IPCC	N2OGg
	4D Waste water treatment and discharge		CH4	WW_CH4_Total_2006IPCC	CH4Gg
			N2O	DWW_N2O_Result_2006IPCC	N2OGg
	4E others				

List of query for 2006 IPCC reporting format

No.	Category	Data file	GHG	Query for inventory estimation	Field of result
3s1	3 Agriculture, Forestry and other landuse	GHG_Inventory_AFOLU	CO2,CH4, N2O	Not use(Sum)	Not use(Sum)
	3A Live stock		CH4	3A1&3A2_CH4_Livestock_Total_2006IPCC	CH4Gg
			N2O	3A2_N2O_Livestock_Animal_Total_2006IPCC	N2OGg
	3A1 Enteric fermentation		CH4	3A1&3A2_CH4_Livestock_Total_2006IPCC	CH4Gg_EF
	3A1a-3A1j		CH4	3A1_CH4_Livestock_SectCode	CH4Gg
	3A2 Manure management		CH4	3A1&3A2_CH4_Livestock_Total_2006IPCC	CH4Gg_MM
			N2O	3A2_N2O_Livestock_Animal_Total_2006IPCC	N2OGg
	3A2a-3A2j		CH4	3A2_CH4_Livestock_SectCode	CH4Gg
			N2O	3A2_N2O_Livestock_SectCode	N2OGg
	3B Land		CO2	3B_NetCO2_Emissions_Year	Net_CO2_Gg
	3B1 Forest		CO2	3B_NetCO2_Emissions_SectCode1	Net_CO2_Gg
	3B1a-3B1b		CO2	3B_NetCO2_Emissions_SectCode2	Net_CO2_Gg
	3B1b-3B1bv				
	3B2 Cropland	GHG_Inventory_AFOLU	CO2	3B_NetCO2_Emissions_SectCode1	Net_CO2_Gg
	3B2a Remaining cropland		CO2	3B_NetCO2_Emissions_SectCode2	Net_CO2_Gg
	3B2b-3B2bv				
	3B3 Grassland	GHG_Inventory_AFOLU	CO2	3B_NetCO2_Emissions_SectCode1	Net_CO2_Gg
	3B3a-3B3b		CO2	3B_NetCO2_Emissions_SectCode2	Net_CO2_Gg
	3B3bi-3B3bV				

List of query for 2006 IPCC reporting format

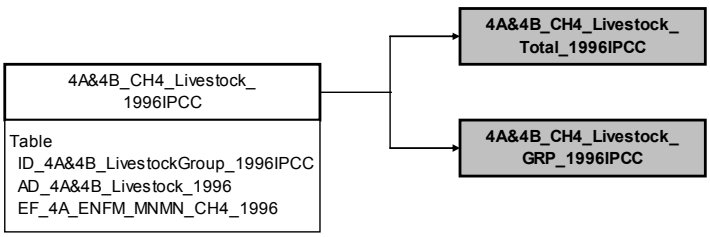
No.	Category	Data file	GHG	Query for inventory estimation	Field of result
3s2	3B4 Wetland	GHG_Inventory_AFOLU	CO2	3B_NetCO2_Emissions_SectCode1	Net_CO2_Gg
	3B4a-3B4bi				
	3B4bii Land converted to wetland	GHG_Inventory_AFOLU	CO2	3B_NetCO2_Emissions_SectCode2	Net_CO2_Gg
	3B4bii Land converted to wetland				
	3B5 Settlement	GHG_Inventory_AFOLU	CO2	3B_NetCO2_Emissions_SectCode1	Net_CO2_Gg
	3B5a Settlements remaining				
	3B5b Land converted to settlements	GHG_Inventory_AFOLU	CO2	3B_NetCO2_Emissions_SectCode2	Net_CO2_Gg
	3B5bi-3B5bv				
	3B5a converted to other land				
	3B6a-3B6bv				
	3C Aggregate sources and non-Co2 Emissions sources on land	GHG_Inventory_AFOLU	CH4	3C7_CH4_Emission_Rice_Total_2006IPCC	CH4_Gg
			N2O	3C4_Direct_N2O_Emissions_2006IPCC	N2O_Gg
	3C1 biomass burning				
	3C1a-3C1d				
	3C2 Liming				
	3C3 Urea Fertilization				
	3C4 Direct N2O emission from managed soils	GHG_Inventory_AFOLU	N2O	3C4_Direct_N2O_Emissions_2006IPCC	N2O_Gg
	3C5 Indirect N2O emission from managed soils				
	3C6 Indirect N2O emission from manure management				
	3C7 Rice cultivation	GHG_Inventory_AFOLU	CH4	3C7_CH4_Emission_Rice_Total_2006IPCC	CH4_Gg
	3C8 Others				
	3D Others				
	3D1 Harvested wood products				
	3D2 Others				

List of query for 2006 IPCC reporting format

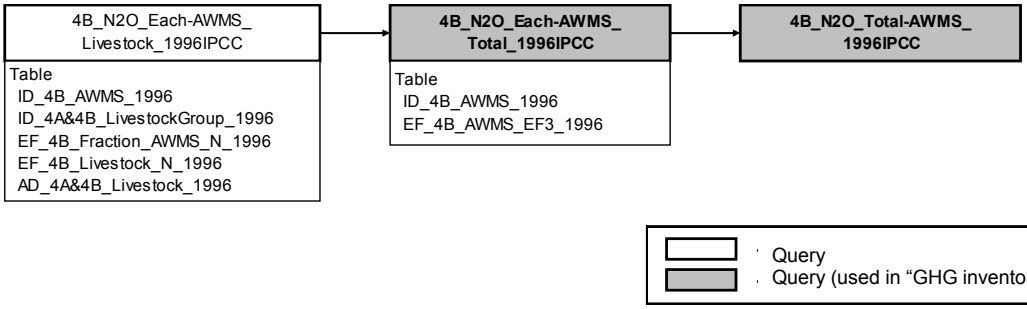
No.	Category	Data file	GHG	Query for inventory estimation	Field of result
4s1	4A Waste	GHG_Inventory_WASTE	CO2,CH4, N2O	Not use(Sum)	Not use(Sum)
	4A Solid waste disposal	GHG_Inventory_Form	CH4	Not use(Calculated in Form)	Not use
	4A1Managed waste disposal site	GHG_Inventory_Form	CH4	Not use(Calculated in Form)	Not use
	4A2 Unmanaged disposal site				
	4A3 Uncategorised waste disposal sites	GHG_Inventory_Form	CH4	Not use(Calculated in Form)	Not use
	4B biological treatment				
	4C Incineration and Open burning of waste	GHG_Inventory_WASTE	CO2	IOB_CO2_Result_2006IPCC	CO2Gg
			CH4	IOB_CH4_Result_2006IPCC	CH4Gg
			N2O	IOB_N2O_Result_2006IPCC	N2OGg
			CO2	IOB_CO2_Result_2006IPCC	CO2Gg
	4C1 Waste incineration		CH4	IOB_CH4_Result_2006IPCC	CH4Gg
			N2O	IOB_N2O_Result_2006IPCC	N2OGg
	4C2 Open burning of waste				
	4D Wastewater treatment and discharge	GHG_Inventory_WASTE	CH4	WW_CH4_Total_2006IPCC	CH4Gg
			N2O	DWW_N2O_Result_2006IPCC	N2OGg
	4D1 Domestic Wastewater Treatment		CH4	WW_CH4_Total_2006IPCC	DWW_CH4Gg
			N2O	DWW_N2O_Result_2006IPCC	N2OGg
	4D2 Industrial Wastewater		CH4	WW_CH4_Total_2006IPCC	IWW_CH4Gg
	4E Others				

Structure of query – 1996IPCC – 4 Agriculture (1)

4A Enteric Fermentation (CH4)
4B Manure Management (CH4)

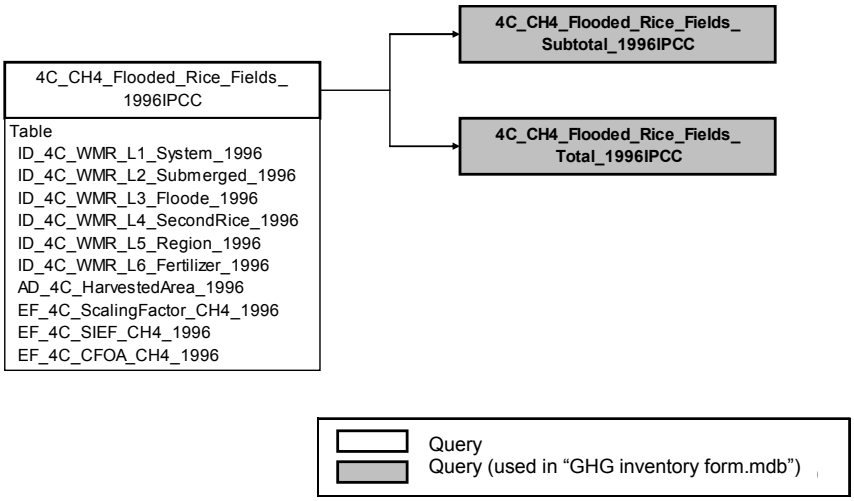


4B Manure Management (N2O)



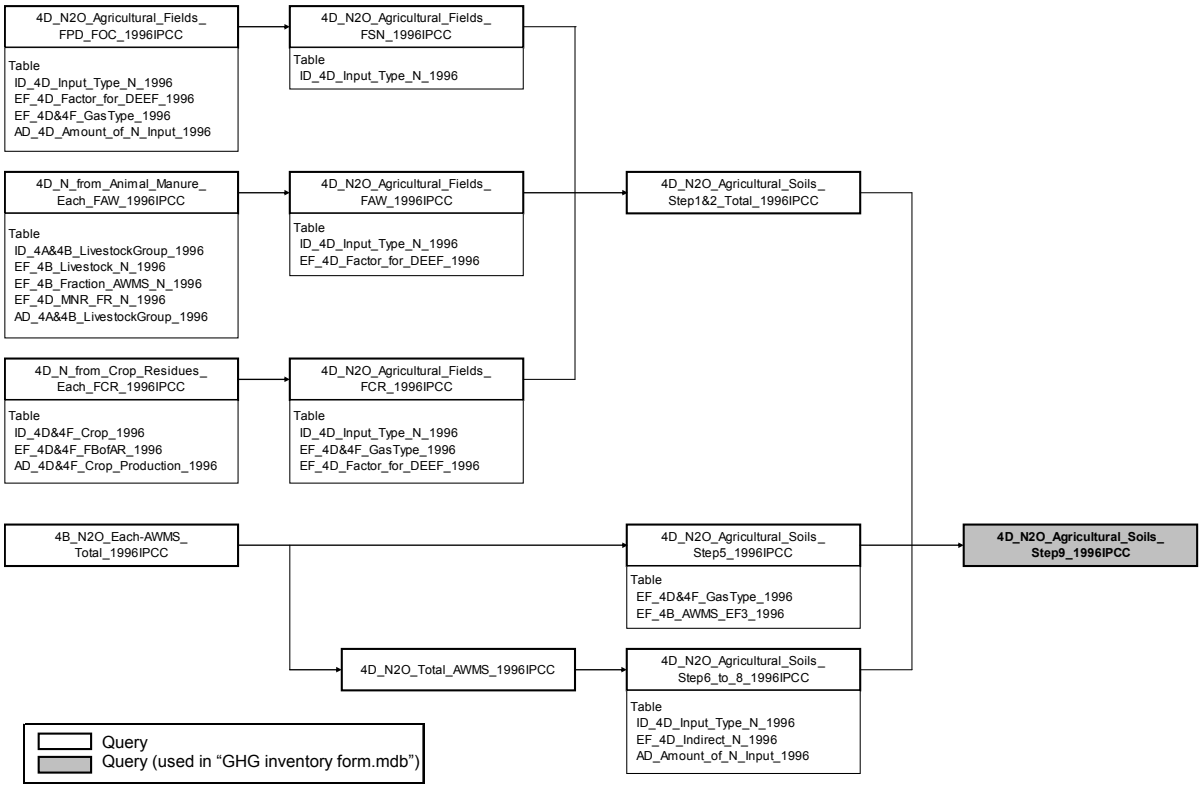
Structure of query – 1996IPCC – 4 Agriculture (2)

4C Rice Cultivation (CH4)



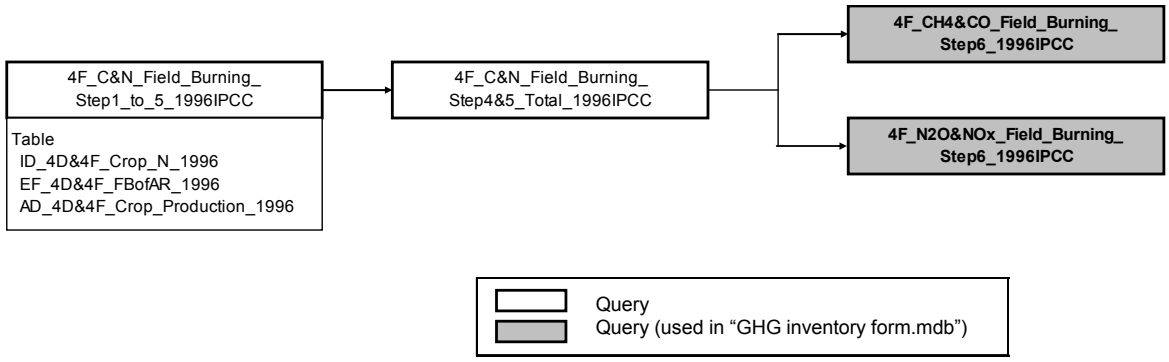
Structure of query – 1996IPCC – 4 Agriculture (3)

4D Agricultural Soils (N2O)



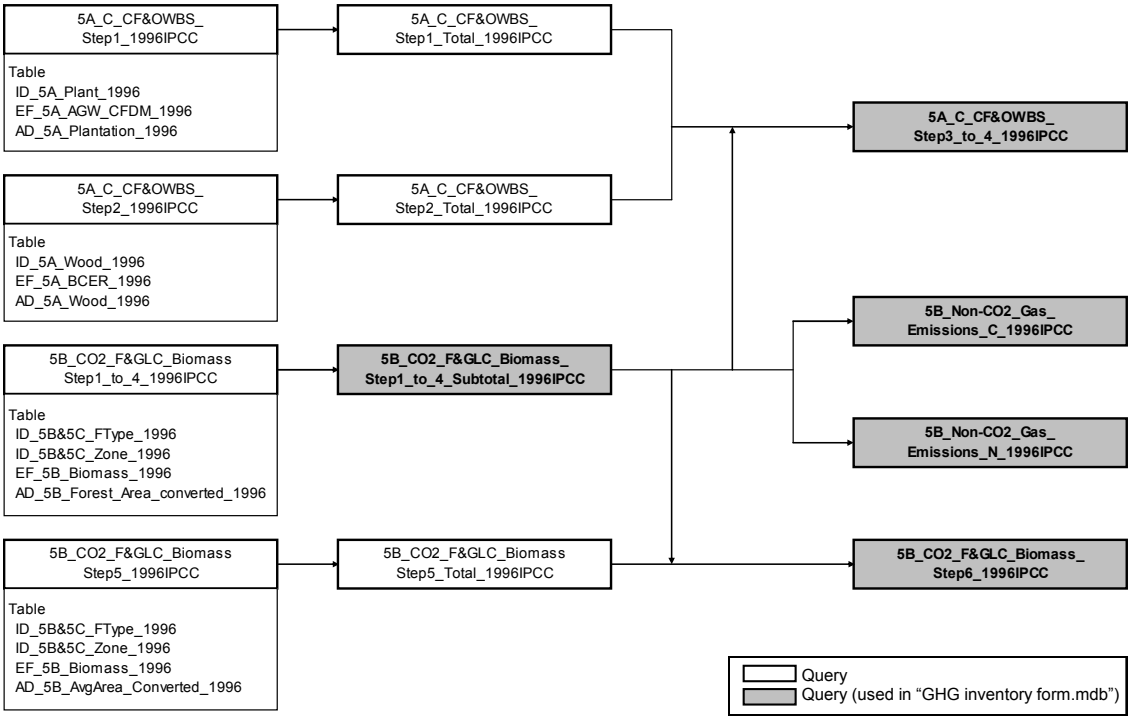
Structure of query – 1996IPCC – 4 Agriculture (4)

4F Field Burning of Agricultural Residues (CH4, CO, N2O, NOx)



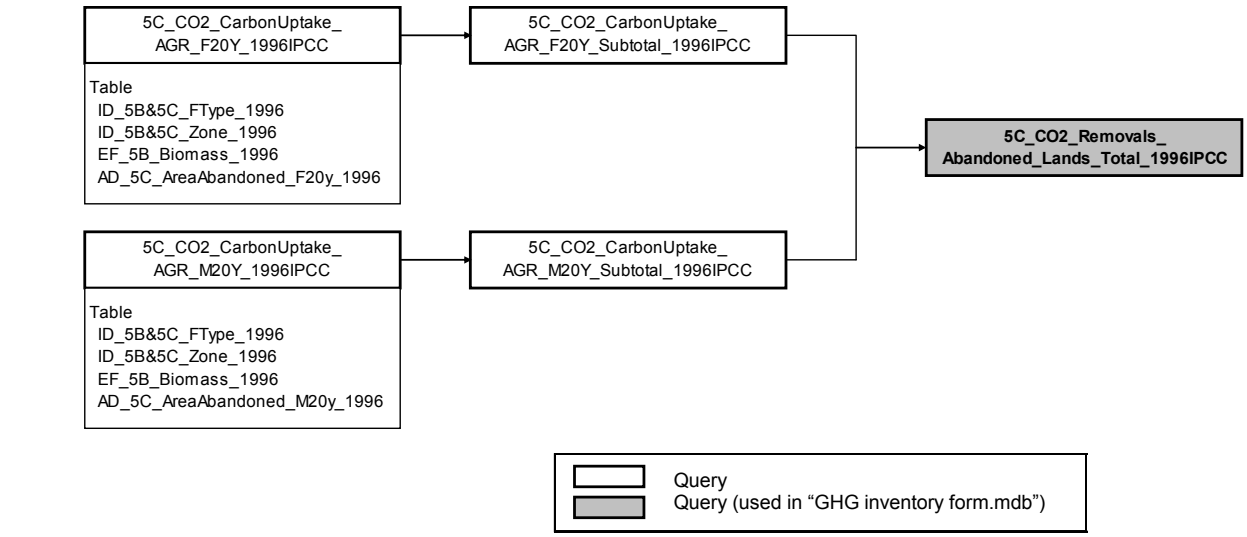
Structure of query – 1996IPCC – 5 Land-Use Changes and Forestry (1)

5A Changes in Forest and Other Woody Biomass Stocks (CO2)
5B Forest and Grassland Conversion (CO2, CH4, CO, N2O, NOx)



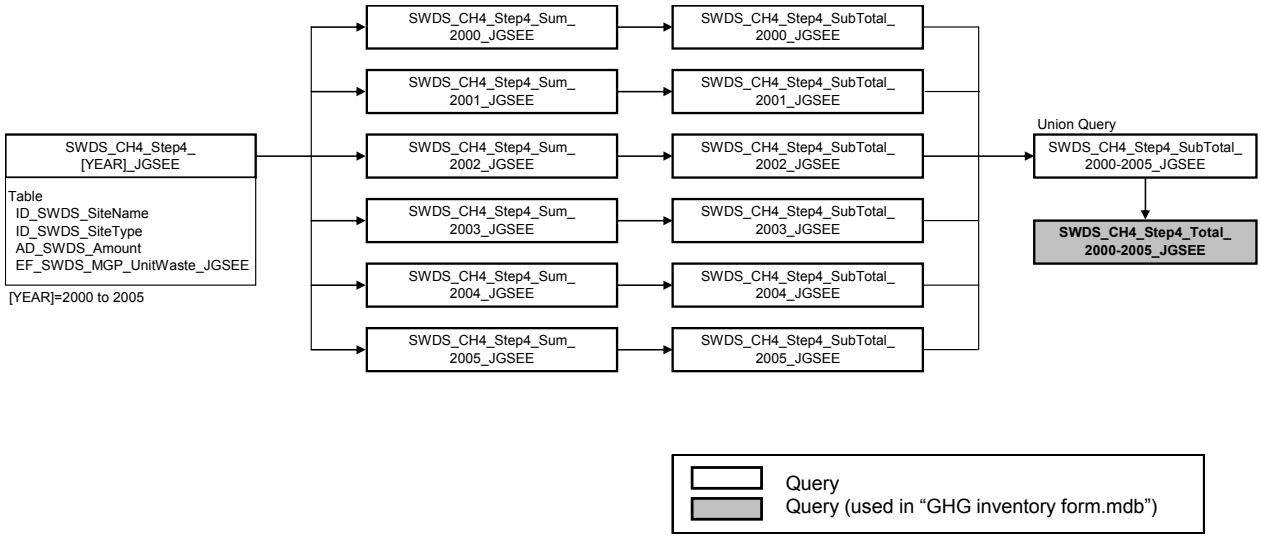
Structure of query – 1996IPCC – 5 Land-Use Changes and Forestry (2)

5C Abandonment of Managed Lands (CO2)



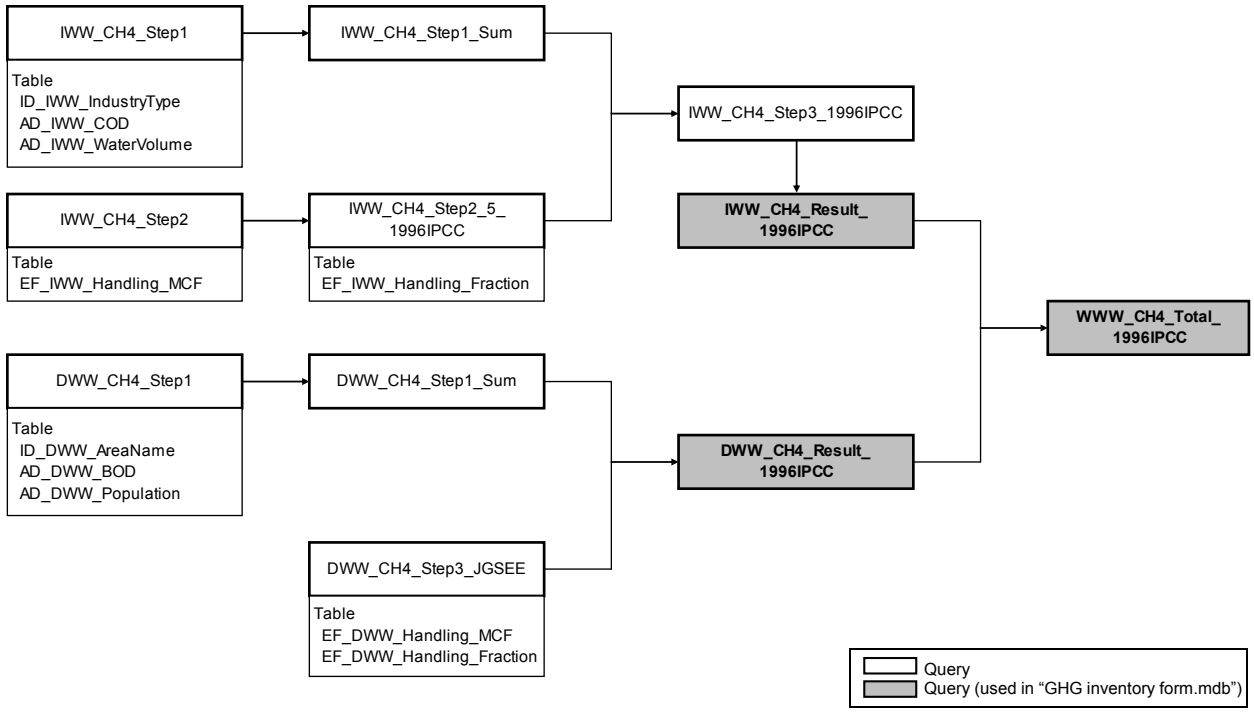
Structure of query – 1996IPCC – 6 Waste (1)

6A Solid Waste Disposal on Land (CH4)



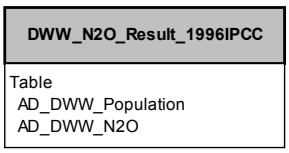
Structure of query – 1996IPCC – 6 Waste (2)

6B Wastewater Handling
6B1 Industrial Wastewater (CH4)
6B2 Domestic and Commercial Wastewater (CH4)

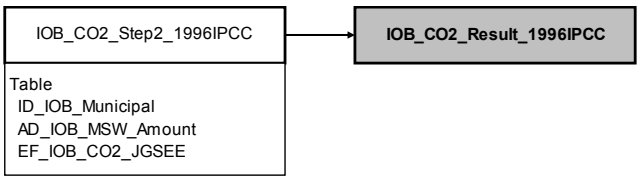


Structure of query – 1996IPCC – 6 Waste (3)

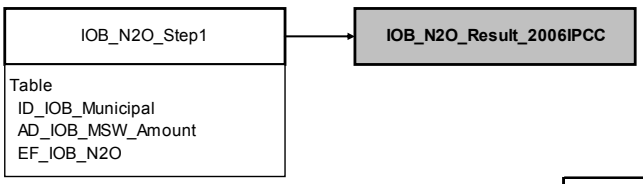
6B Wastewater Handling
6B2 Domestic and Commercial Wastewater (N2O)



6C Waste Incineration (CO2)

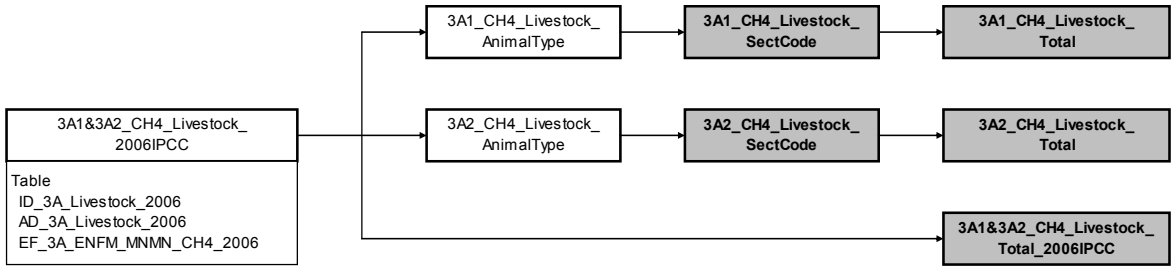


6C Waste Incineration (N2O)

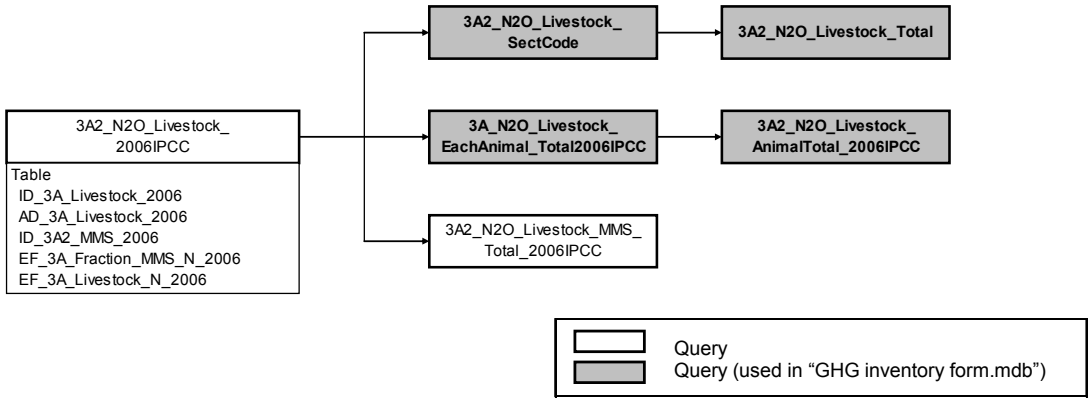


Structure of query – 2006IPCC – 3 AFOLU (1)

3A Livestock(CH4)

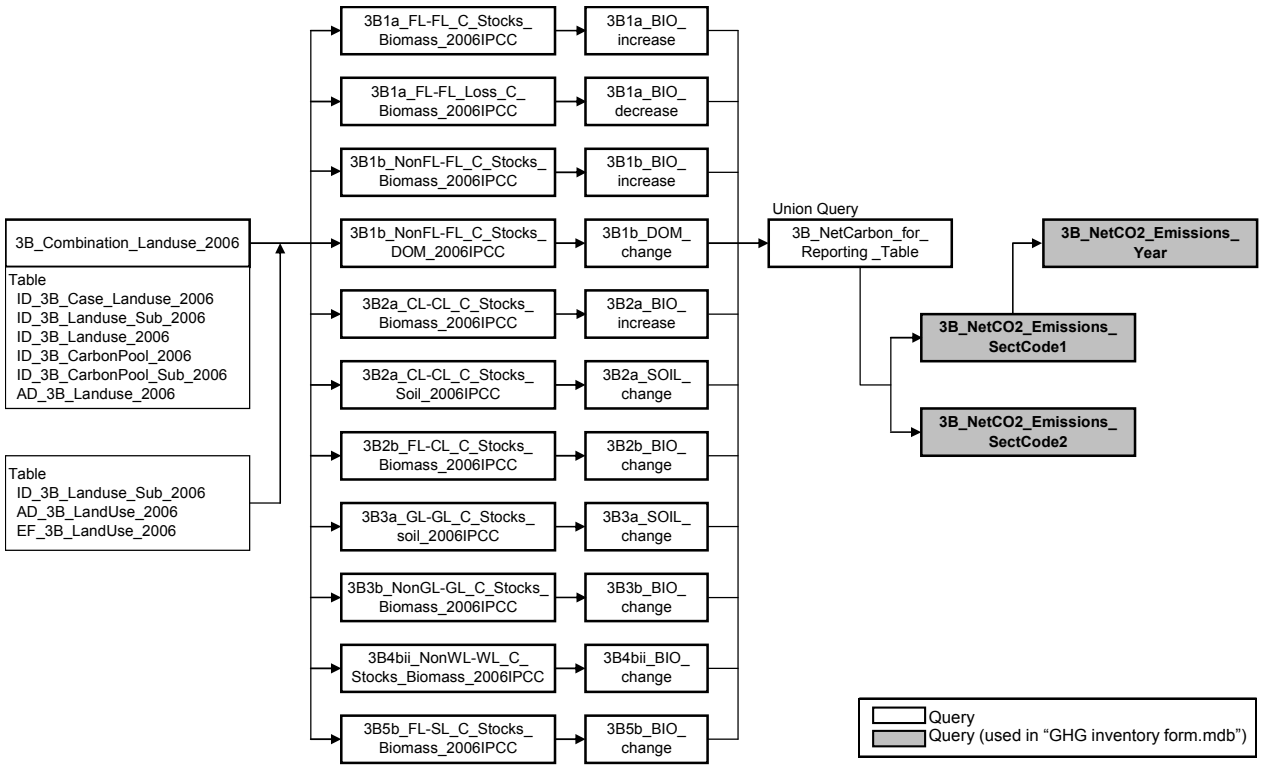


3A Livestock(N2O)



Structure of query – 2006IPCC – 3 AFOLU (2)

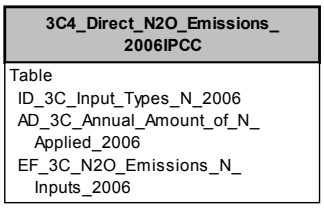
3B Land(CO2)



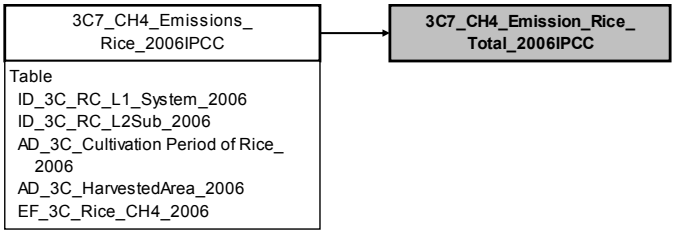
Structure of query – 2006IPCC – 3 AFOLU (3)

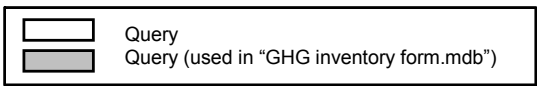
3C Aggregate Sources and Non-CO2 Emissions Sources on Land

3C4 Direct N2O Emissions from Managed Soils (N2O)



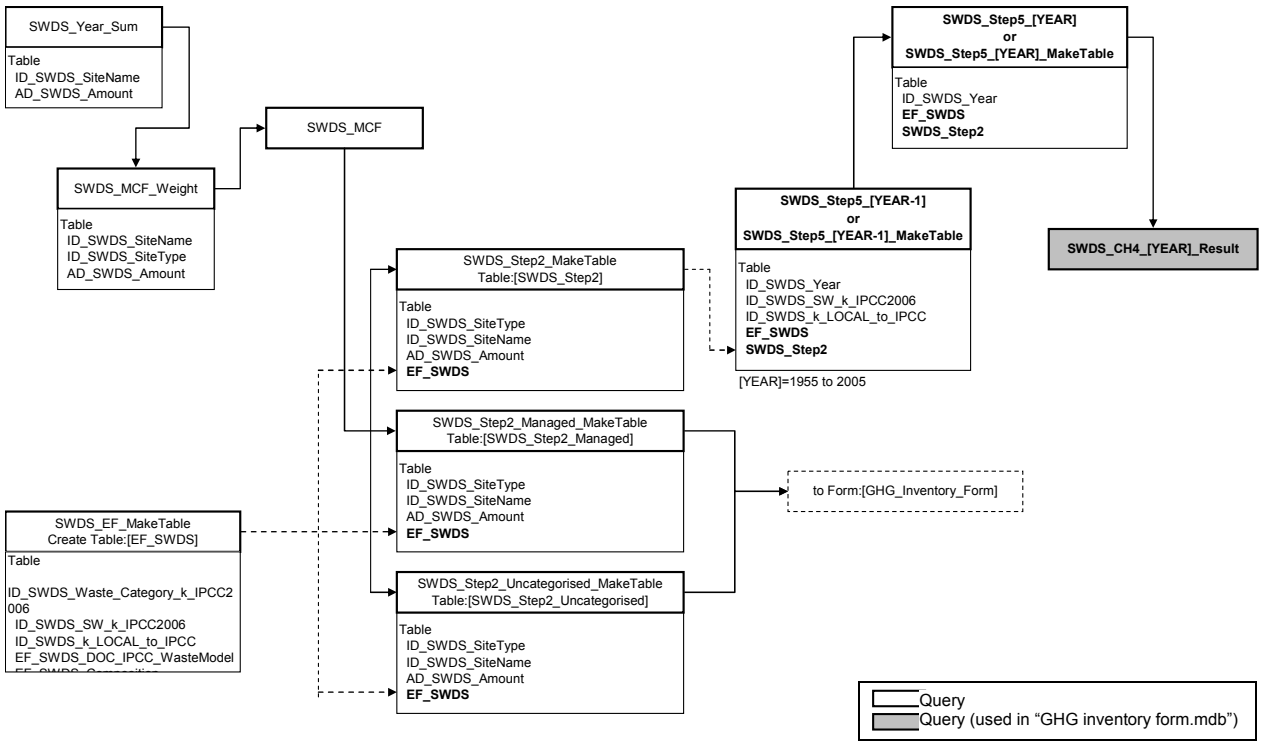
3C7 Rice Cultivations (CH4)





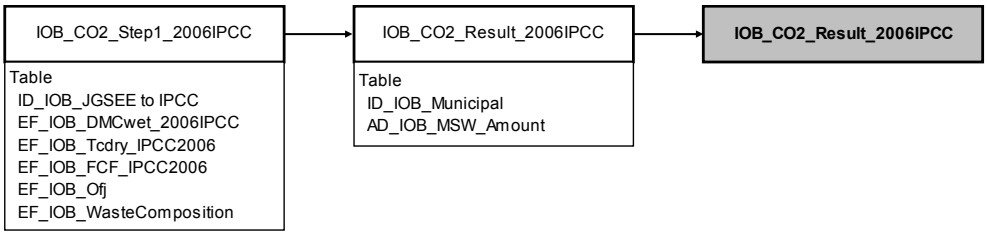
Structure of query – 2006IPCC – 4 Waste (1)

4A Solid Waste Disposal (CH4)

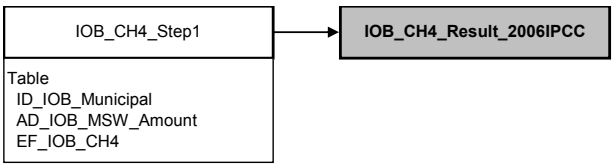


Structure of query – 2006IPCC – 4 Waste (2)

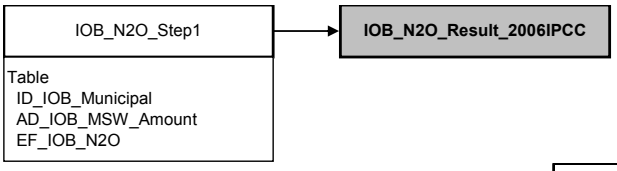
4C Incineration and Open Burning of Waste (CO2)



4C Incineration and Open Burning of Waste (CH4)

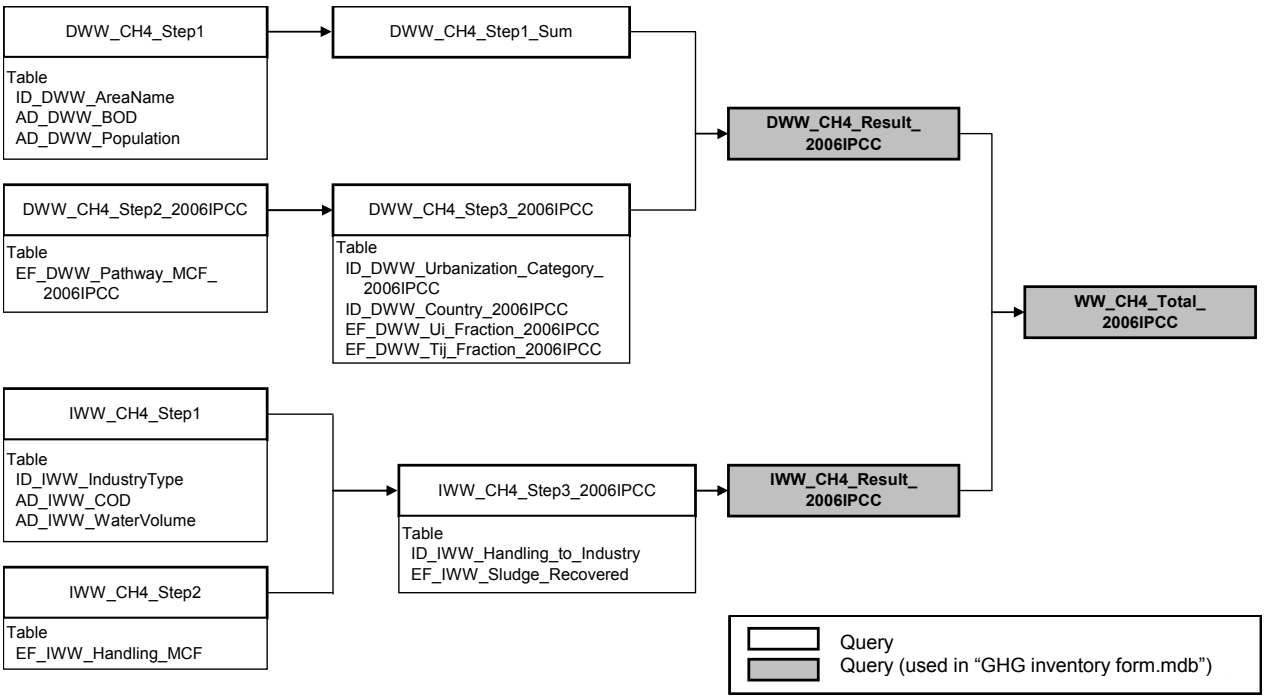


4C Incineration and Open Burning of Waste (N2O)



Structure of query – 2006IPCC – 4 Waste (3)

4D Wastewater Treatment and Discharge
4D1 Domestic Wastewater Treatment and Discharge (CH4)
4D2 Industrial Wastewater Treatment and Discharge (CH4)



Structure of query – 2006IPCC – 4 Waste (4)

4D Wastewater Treatment and Discharge

4D1 Domestic Wastewater Treatment and Discharge (N2O)