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

CONTENTS

NOTE:

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

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

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

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

>>Vietnam Municipal Solid Waste (MSW) Composting Programme

Version: 1.01
Date: 25th, February 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.

Vietnam has 5 "cities directly under central government" (*Thành phố trực thuộc Trung ương: Hanoi, Ho Chi Minh, Hai Phong, Da Nang, Can Tau*) and 57 provinces (*tỉnh*). Urban population has been increasing over 3.4% per annum in entire Vietnam. As per Census, 25,374,262 people live in local administrative body categorized as "cities directly under central government" and "city directly under provincial government" (*thành phố*) level, accounting for 29.6%of the total population.

One of the significant environmental concerns of the growing urban areas has been the management of municipal solid wastes (MSW). So far as disposal of MSW is concerned, the common practice in Vietnam is to dispose the wastes in landfill or open dumping site. Many of the landfill/dumping sites are located adjacent to river or the residential area. Some cases, there underground water gets contaminated by the leachate generated from the landfills due to heavy rainfalls. These landfills also generate and emit significant amount of methane to the atmosphere. Vietnam Government had set up a target in 2009, to decrease the amount of landfill to prevent the environmental problem to occur and also to cope with difficulties in securing landfill site under rapid urbanization (Decision no. 2149/QD-TTg).

The proposed programme is aiming to recover the organic matter from MSW and produce compost which will avoid methane emission with the support of CDM, but it will also voluntary support the governmental target on decreasing the amount of waste landfill.

As multiple local administrative bodies are expected to participate in this programme, a Programme of Activity (PoA) CDM is being undertaking composting of wastes and using the organic matter in wastes for soil conditioning and plant growth. The operating and implementing framework for the Programme is depicted in the flowchart below:

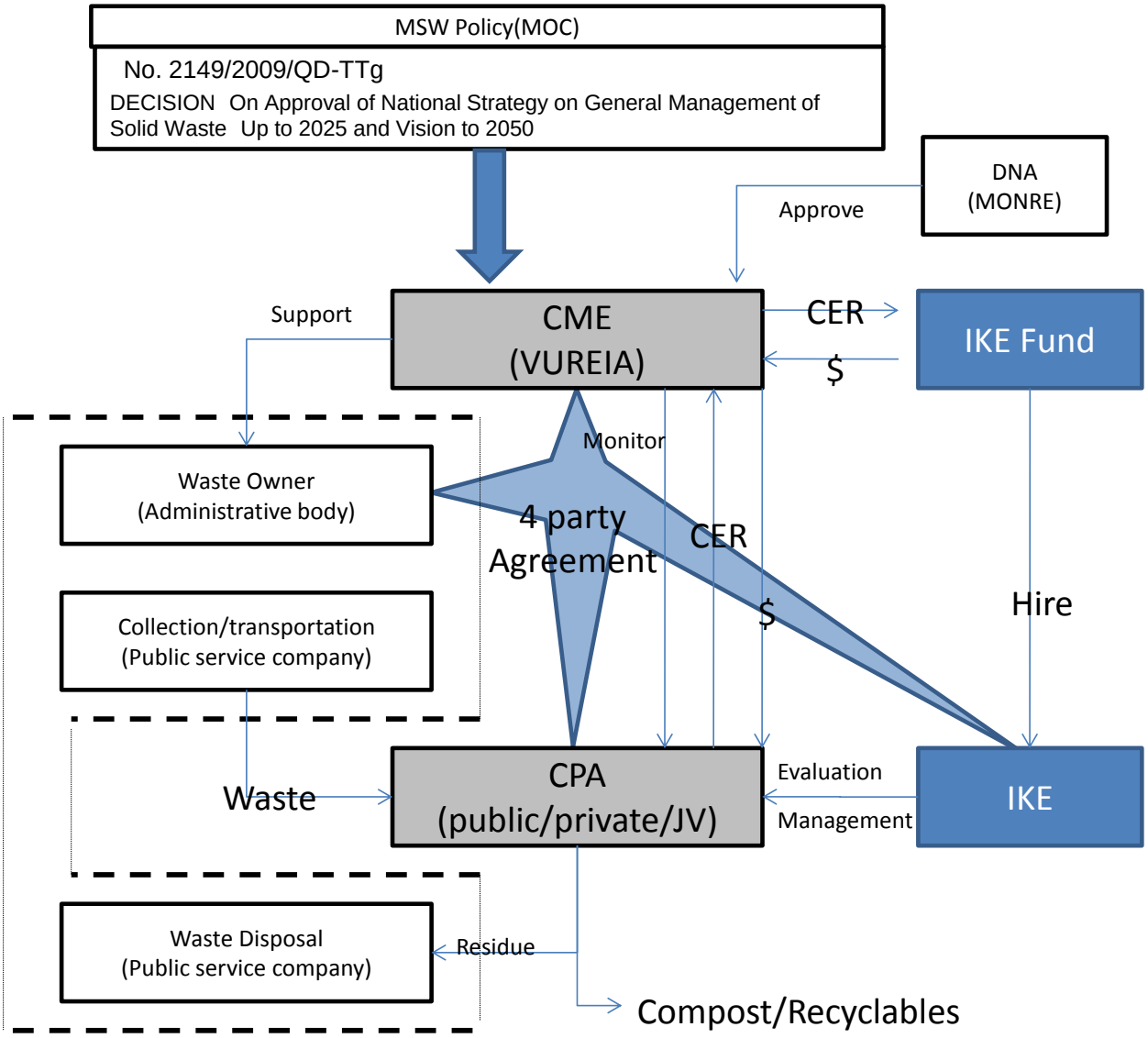

Figure A.2.1 PoA implementation structure

Each of these composting projects is considered as CDM Programme Activity (CPA). CPA can be invested by public, private, or joint venture between public and private.

This PoA is especially aiming for introduction of CPAs in small-medium size local administrative bodies which handles about 50T per day to 200 T per day of MSW. Comparing to large-scale administrative bodies, small-mid scale administrative bodies does not have enough human resource, technology and budget.

"Japanese Private Fund promoted mainly by Ichikawa Kankyo Engineering Co, LTD." (here under "IKE Fund") will be the credit buyer of the CER generated from CPA activities under this PoA.
Vietnam Urban Environment and Industrial Zone Association (VUREIA), which has role to spread better waste management throughout the whole country, will be the Cooperation/Management Entity (CME) and directly support the administrative bodies in planning and promotion of composting facility implementation by introducing the CPA implementer candidates, support CDM registration, conduct monitoring and collect CER.
MSW composting is not a new technology for Vietnam, but not spread throughout the country

not only because of financial reason but also technical reason. Ichikawa Kankyo Engineering Co, LTD. (hereunder "IKE") will evaluate the activity of CPA implementer together with VUREIA and support to transfer technology and operate in good manners during the project period. IKE will also work with CPA implementer and local administrative body in order to control and manage the inflowing collected MSW quality. IKE also has intention to implement the CPA projects under approval and cooperation of the local administrative bodies.

CPAs would transfer their CER rights to VUREIA. VUREIA would sell the CERs to IKE Fund of Japan. Cooperation agreement will be signed between the administrative bodies, VUREIA, IKE and CPA implementer.

Extensive work has already been carried out including the planning and detailed design of the composting facilities in Hung Yen City, Vietnam. VUREIA together with IKE would provide technical support to the local administrative bodies and to CPA implementers to set up and operate the project. The facilities would sustain on the revenues generated from the sales of compost and other recyclable products, and revenues generated from sales of CER

At present the technical requirement as well as the common practice of MSW disposal in Vietnam is landfill, and there are requirements for capturing landfill gas (<50,000ton per year not required gas emission pipe, 50,000tpy< requires gas emission pipe: Vietnam construction standards TCXDVN 261:2001). But there are no specific requirements of flaring and/or utilization the landfill gas. As a result, methane is emitted to the atmosphere, but will be avoided through implementation of the MSW composting programme. Organic matters from the MSW will be recovered through composting. The entire program is voluntary in nature for VUREIA, IKE and the local administrative bodies, as there are no specific regulations that mandate MSW composting as the only means of MSW handling method in the country (Decree No.59/2007/NĐ-CP).

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.

VUREIA would be the CME for the CPAs under this PoA. CME shall be a project participant authorized by participating host country DNAs involved and identified in modalities of communication as the entity which communicates with the Executive Board, including on matters relating to the distribution of CERs.

Table: A.3.1

Name of Party involved (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)
Government of Japan	IKE FUND	
Government of Vietnam	VUREIA	

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

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MSW management is responsible for the local administrative authorities (town/city People's

Committee (PC)) in Vietnam. MSW management is becoming a major concern across all the local urban authorities. At present there are only 9 MSW composting cases is observed in the country, and 6 of them are supported by Official Development Assistance (ODA). This PoA would support project implementers to set up such facilities and the local administrative bodies will obtain better waste and environmental management as a result. The PoA would also generate local employment and help the country develop in an environmentally friendly and sustainable way.

The waste being disposed per capita for the cities as a whole has been assessed at about 0.89 kg. Many of the waste components like paper, cloth are recycled and disposed of to private channels directly from home or during the collection activities. The major waste reaching the collection system is organic in nature. The waste disposed in the landfill in Vietnam contains more than 50% of organic wastes which includes green waste and kitchen wastes. More than 30% is inorganic waste which includes sand, silt, ash, glass, metal and plastics. The waste is disposed at the partially managed dumpsites which are typically designed about 3-5 meter deep. Vietnam standards (TCVN 6696 - 2000) has prescribed that waste in the landfills should be covered and this is being put into practice.

The aerobic composting process produces compost from the waste material that would otherwise have been placed in the landfill and generate large quantities of methane and other noxious gases, as well as leachate that seeps into and pollutes underground and surface waters near the landfill site.

In Vietnam, mainly the public service companies such as "URENCO (Urban Environment Company)" which belongs under the city/town level PC are taking efforts to collect waste generated and transport it to the waste disposal sites. Vietnam has about 50% of organic wastes in nature. This PoA would support setting up of composting plants (CPAs) in the local administrative bodies to undertake aerobic composting to stabilize the MSW, minimize local pollution and the production of methane. The reduction in methane generation proposed in this PoA qualifies for generation of CERs.
This PoA is especially aiming for introduction of CPAs in small-medium size local administrative bodies which handles about 50T per day to 200 T per day of MSW. Comparing to large-scale administrative bodies, small-mid scale administrative bodies does not have enough human resource, technology and budget.

50 tons per day would be 18,250 tons per annum, and about 3,650 tons of compost would be generated per annum resulting in average of 6,965 tons of emission reduction per year for the first 7 year crediting period.

A.4.1. Location of the programme of activities:

>>

A.4.1.1. Host Party(ies):

>>
Social republic of Vietnam

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 Programme of Activity would be implemented in several local administrative bodies of Vietnam. Vietnam is located in the east coast of Indo-China peninsula and next to Cambodia, Lao and south end of China.

Local administrative bodies are spread across the country and the locations of the major provinces are shown in below map. The boundaries of the PoA would be the national borders of Vietnam. This is because the proposed PoA deals with waste management, which is governed by the same set of rules and regulations for the whole country. The location would be within the existing 57 province and 5 cities directly under central government of the country or any new province or new city directly under central government that may be constituted in the future.

Figure A.4.1.2
Map of Vietnam

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

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Public sector (local administrative body and/or its public service company) would undertake MSW collection within their geographical boundary. MSW collected would be transported to the

composting facilities, which most cases would be located adjacent to the landfills where the MSW would usually be disposed of in the absence of the program. The investment and operation of the CPA can be public, private or joint venture. The incoming MSW would be classified and aerobically composted. The compost product and recovered recyclable materials such as plastics and papers will be sold or given free (depends on quality and market demand). Residues from the composting process will be disposed of to the landfill sites owned by local administrative body. The organic components of the waste would not be land filled subsequent to the implementation of the PoA and the potential methane generation from the landfills would be avoided. However the residue composition will be analyzed periodically to confirm the possibility of organic components to flow into the landfill as residue.

Each CPA will be identified by following;
(1) Name of local administrative body where CPA will be located
(2) Implementer of the CPA, Operator of the CPA
(3) Latitude and longitude of the location of the CPA
(4) The size in CO2 emission reduction of the CPA must be under 60,000 t-CO2/year.

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

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The technology that would be used for solid waste composting is the aerobic windrow composting with additional air blowing by blower for supplying sufficient air. This involves formation of windrows of specific dimensions, regular turning of windrows, additional air blow by blower and final removal of composted material from the windrows at the end of composting/maturation cycle for screening, etc. It is proposed to set up compost facilities within the geographical boundary of each local administrative body with necessary equipment and facilities to undertake aerobic composting. The facility would be covered with a roof to avoid run-off and excess leachate generation due to rain water percolation through the wastes. The lechate from the waste would be collected then use for wetting the windrows. The compost will be screened using simple manual sieving equipment or trammel. During the initial periods, when the market of compost is still being developed, portion of the matured compost which is unsold would be given to urban agriculture and government agencies for demonstration purposes. It will also be send to landfill site if there are no compost users within the range of 100km from the composting plant. However, to improve the economics of the individual compost plants, efforts will be directed to sell a major portion of the compost in the long run. Financial/budgetary provisions to develop the compost market through awareness and education of the households and farming community have been made in overall program.
For producing better compost products, local administrative bodies, CPA implementer and IKE will cooperate in controlling the quality of inflow of MSW such as avoidance of hazardous waste to flow into the process during the waste collection. Especially in the initial fermentation stage will be strictly managed and controlled to prevent odor.

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 following criteria will be followed to enrol a CPA.

a. The CPA would be located in the local administrative body under provincial level and/or cities directly under central government of Vietnam. Only one CPA can belong to one local administrative body.
b. The local administrative body should be able to provide a land and infrastructure for the CPA facility.
c. The local administrative body, CPA implementer, VUREIA and IKE shall sign a cooperation

agreement in order to; 1) Participate to the program including transferring all the emission reduction rights to VUREIA, 2) Have CPA implementer to operate the facility in good manners by evaluation from IKE.
d The local administrative body shall sign a cooperation agreement with CPA implementer on delivering MSW to the composting facility, pay agreed MSW treatment fee, accept residues (in some case, compost product) discharged from the composting facility to landfill site operated by the local administrative body.
e. "Investment Report", which is necessary to start investment activities under the Vietnam law is not yet approved by the provincial/ cities directly under central government level nor the local administrative body level on the proposed CPA project.

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.

The present practice for MSW disposal in Vietnam is landfill. The typical landfills have depths of 3-5 meters. Further with regard to the landfills, there are no specific requirements pertaining utilization and flaring of landfill gas.
Composting of MSW is not new to Vietnam, but not spread widely in the country because of shortage of budget and technology. There are only 9 officially known composting facilities in Vietnam comparing to 87 officially known landfill sites. 6 out of 9 composting facilities are supported by ODA (either grant or loan), and the remaining also had technical support directly or indirectly. The local administrative bodies of Vietnam are extremely resource constrained and most of their budgets are not funded though local taxes but funded by the state. There are very limited funds to undertake up gradation of the MSW facilities. MSW composting is thus not and would not become a natural choice for the local administrative bodies in Vietnam. There is also no regulation that requires the cities to follow composting as the only option for processing the MSW, so the cities are not obliged to set up composting facilities.

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;

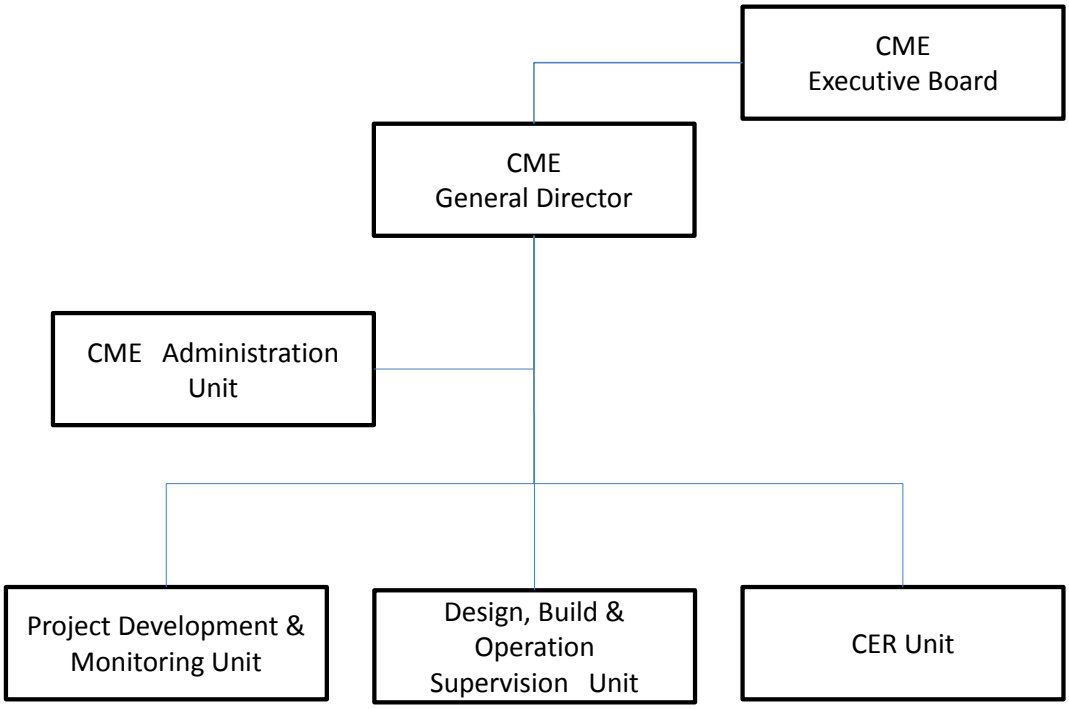

Figure A.4.4.1-1:CME Organization chart for the PoA Management

<Roles of the management>
(1) CME Executive Board
- Supervision of overall activities of CME

(2) CME General Director
- Registration of PoA
- Overall Implementation and Management of PoA

(3) CME Administration Unit
- General affairs of CME

(4) CDM Project Management Unit
- Baseline identification
- Identification, listing and inclusion of eligible CPAs under PoA
- CPA-DD development
- CPA Validation and Verification supporting
- Inclusion of CPA under PoA
- Check the monitored data
- Preparation of monitoring report
- Training program development and operation

(5) Design Build & Operation Supervision Unit
- Design and build support/suggestion to CPAs
- Operation supervision to CPAs

(6) CER Unit
- CPA operation confirmation from finance
- Financial document confirmation
- Management of CER transaction
- Reporting

<PoA Operation structure>
The CPAs participating to the program are responsible for implementing the MSW composting

activity. Investment and construction of the composting facility, processing of the waste in the composting facility, selling of compost produced and disposal of residues from the composting production line, etc. are the prime responsibilities of the CPA implementer.

As part of the inclusion of the CPA under the PoA, a "Cooperation Agreement" would be signed by each of the local administrative body, CPA implementer, IKE and VUREIA (4party agreement). Suitable training programs will be conducted for the local administrative authorities and CPA implementers to make them aware of the rules of the CDM and PoA. In addition, the 4 party Agreement would include specific provisions and declarations which make CPA implementers acknowledge that they are aware and have agreed that their activity is being subscribed under the PoA. The agreement would also require the CPA implementers to confirm that they have not previously been a part of any CDM project.

Also local administrative body and CPA proponent will be signing "Project Evaluation and Management Agreement" under the Cooperation Agreement with IKE (on behalf of IKE fund), to assure the project operation and management capacity of the CPA implementer is enough, and to train the CPA implementers to operate the facility in good manners throughout the agreed period. IKE will also cooperate with local administrative bodies in order to maintain and upgrade the quality of inflowing MSW to the CPA facility.

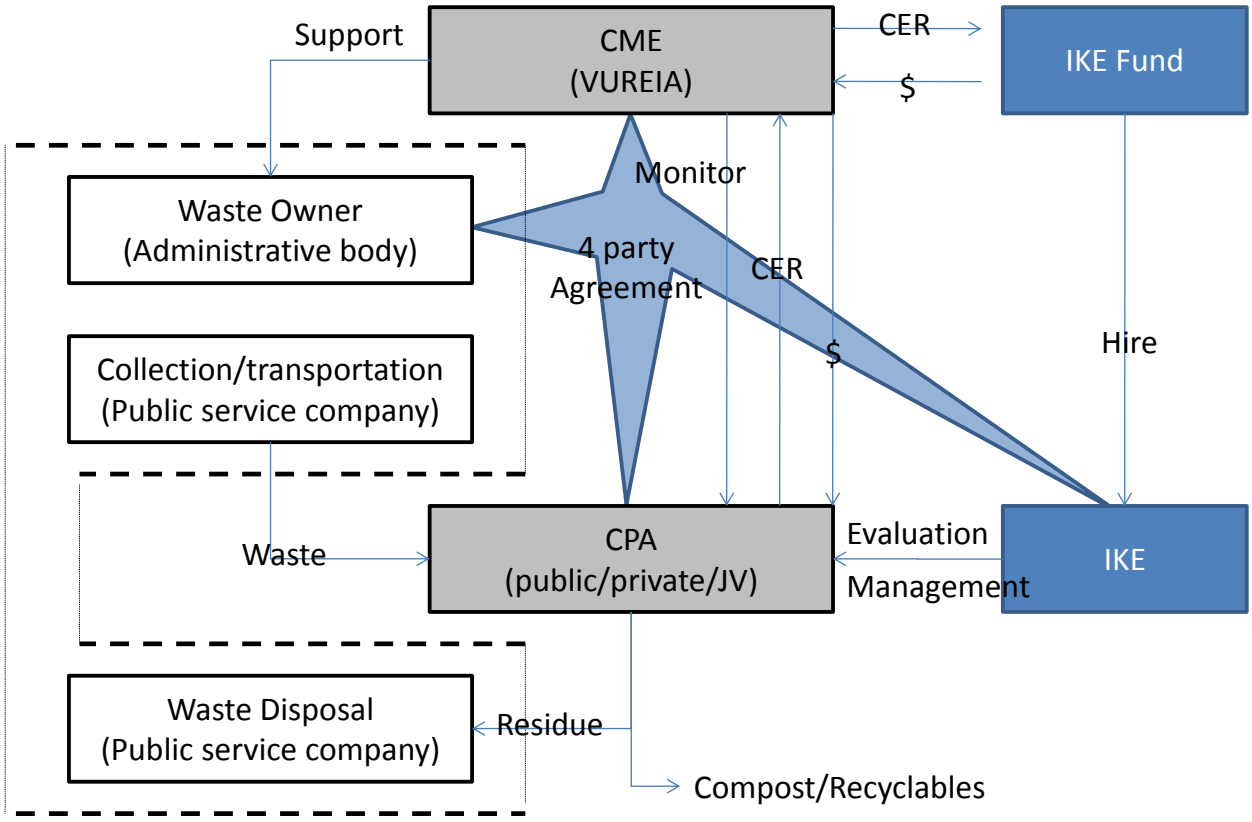

Figure A.4.4.1-2: PoA Operation Structure

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

The record keeping system will be designed by CME and each CPA must follow the rules. CPAs will be identified by (1) Name of CPA owning company, (2) Location of the facility (name of city), (3) Latitude and longitude of composting facility.

Monitoring will be conducted under monitoring procedures described in E.7 and Annex 4. The electronic data received from each CPAs through the monitoring activity will be accumulated to

the server of CME, and analysed by the CDM Project Management Unit of CME. The individual CPA data, accumulated and analysed data can be accessed by CME executive board and CME managements for the review. CME shall share the same with IKE Fund, IKE and DoE as required.
Besides electronic data send to CME server, CPA will keep the back-up file of electronic data in their main computer. CPA also must record the same data manually, and keep the record though out the operation period of CPA.

(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,

The CME will confirm that the projects included in CPAs is not registered in any other CPA of the PoA or any other registered CDM project activity and avoid the double counting of CPA under any other CDM or PoA activity by confirming to CPAs and also checking the public information sources such as UNFCCC website periodically. Also as mentioned in above, 4party agreement will be the declaration from CPA owner.

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

Following approach shall be applied as per the guidance for determining the occurrence of de bundling under PoA (EB 54, Annex 13). The following para no. 8 of EB 54, Annex 13 are given below:

Para 8. For the purposes of registration of a Programme of Activities (PoA) [11] *a proposed small-scale CPA of a PoA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity[12], which satisfies both conditions (a) and (b) below:*
(a) Has the same activity implementer as the proposed small scale CPA or has a Coordinating or Managing entity, which also manages a large scale PoA of the same technology/measure, and;
(b) The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

(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.

The CPA operator will provide the mandate by 4party agreement to CME stating that, they are aware and have agreed that their activity is subscribed to the PoA. The CPA operator has to give a declaration to CME that the Project activity is not a de-bundled component of large scale 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;

The CME has opted for verification of each CPA.
The transparent system is defined to ensure that no double counting occurs (refer section A.4.4.1).

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

>>

PoA is not expecting to use public funding.

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

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

>>
DD/MM/YY

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

>>
28 years

SECTION C. Environmental Analysis

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

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

The Environmental Analysis would be carried out at the SSC-CPA level, due to the nature of the individual CPA activities and the potential site specific concerns and as applicable under Vietnamese Law.

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

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Based on the assessment of the operations to be included in the program, the following aspects have been considered in the Programme design.

Table C.2.1 Analysis of the environmental impacts

Environmental or Social Impact	Proposed Environmental Mitigation and Management Measures
Composting Plant	
Air emissions and odor control	1. Adopt proper composting management system with a roof for the composting yard to minimize odours and leachate generation. 2. Good housekeeping and maintenance of equipment 3. regular washing of work areas after completion of daily processing 4. Clearing of spilled wastes 5. Immediate transportation of rejects to the landfill 6. Control dust with water sprays during the dry season
Control of leachate	1. installation of concrete lined composting pad with leachate drains and sump 2. Reuse the leachate by spraying onto compost windrows 3. adopt aerobic composting technique with use of compost to control leachate
Control compost quality	1. regular monitoring of compost quality parameters 2. regular monitoring of process parameters 3. use modern composting techniques 4. Use off-spec compost for agricultural uses

	5. develop horticultural uses
Vector control	1. use modern composting techniques 2. good housekeeping and maintenance of equipments 3.pest control program
Worker health and safety	1.health and hygiene training and posters 2. adequate lighting and ventilations 3. provision of personal protection equipment 4. health monitoring
Aesthetics	1. plant tree buffer zone one the boundary of the plant 2. remove waste rejects daily from the plant area and do not allow to accumulate

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),:

>>

Yes and environmental impact assessment is required for a typical CPA and the same is to be carried for each of the site as per the host party laws and regulations.

- Circular No.490/1998/TT-BKHCNMT dated 29/4/1998 guiding on setting up and assessment on EIA report for investment projects.
- Circular No.05/2008/TT-BTNMT dated 08/12/2008 by MONRE.

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

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

Stakeholder consultation process is not required by regulation/laws in the host country.

Stakeholder's consultations will be undertaken at the PoA level. The details of the consultation at the PoA level will include stakeholder consultation at local administrative bodies which have shown interest in participation in PoA.

The CPAs are for local administrative bodies so it is required to include their views into the program formulation. The program also addresses multiple local administrative body level stakeholders consultations will be also undertaken.

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

>>

The stakeholder comments have been taken through multiple mechanisms. The process adopted is given below with a chronological outline highlighting the stakeholder consultations that have been on-going.

Stakeholders are selected by local administrative body. Comments will be received from the stakeholders through 1) Stakeholder meeting which will be held in the local administrative area at least once, with announcement to the selected stakeholders by one month before, and 2) Comment will be collected through the comment form, which will be delivered to all stakeholders together with announcement of stakeholder meeting and the form will be collected by CPA implementer during 2 weeks after the stakeholder meeting.
Comments received which needs to be replied to the stake holders must be replied by CPA implementers by one month or less. It has to mention about how the CPA implementers will handle to the comment received.
The summary of above procedure will be reported to each stakeholder before the project implementation.

The report on how the comments are received will be described here.

D.3. Summary of the comments received:

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Summary of the comments received from the interviewees will be .described here.

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

>>
The report on how the comments are received will be described here.

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 following methodologies and tools will be used in the CPAs.

- AMS III.F Version 9 Sectoral Scope 13 EB 58 titled “Avoidance of Methane emission through composting”
- “Tools to determine methane emissions avoided from disposal of waste at a solid waste disposal site” Version 05

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

>>
NOTE: In the case of CPAs which individually do not exceed the SSC threshold, SSC methodologies may be used once they have first been reviewed and, as needed, revised to account for leakage in the context of a SSC-CPA.

AMS III. F is applicable for the following reasons:

- The Programme activity involves the following waste treatment option for the organic waste that in a given year would have otherwise been disposed of in a landfill, namely: a composting process in aerobic conditions;
- The proportions and characteristics of different types of organic waste processed in the Programme activity can be determined, in order to apply a multiphase landfill gas generation model to estimate the quantity of landfill gas that would have been generated in the absence of the programme activity;
- Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill and environmental regulation does not mandate the treatment of the waste using composting;
- The CPA is small scale as the emission reduction of less than or equal to 60kt-CO2e reduction.

This baseline methodology shall be used in conjunction with the approved monitoring methodology.

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

>>

The extent of CPA boundary as per the AMS III.F/ version 9 would be the following.

a. Where the solid waste would have been disposed and methane emission occurs in the absence of the proposed CPA activity;
b. In the case of projects co-composting wastewater, where the co-composting wastewater would have been treated anaerobically in the absence of the project activity;
c. Where the treatment of biomass through composting takes place;
d. Where the products from composting (compost) is handled, disposed, submitted to soil application, or treated thermally/mechanically;
e. And the itineraries between them (a, b, c, and d), where the transportation of waste, wastewater, where applicable manure, product of treatment (compost) occurs.

The gases and sources relevant to the CPA are listed below based on the AMS-III.F/version 9 methodology.

Table E.3.1 Emissions sources within CPA boundary

	Source	Gas		Justification/Explanation
Baseline	Emissions from decomposition of waste at the landfillsite	CH4	Included	The major source of emissions in the baseline
		N2O	Excluded	N2O emissions are small compared to CH4 emissions from landfills. Exclusion of the gas is conservative.
		CO2	Excluded	CO2 emissions from decomposition of organic waste are not accounted
	Emissions from electricity consumption	CO2 N2O CH4	Excluded	Electricity is not consumed or generated in the baseline scenario
	Emissions from thermal energy generation	CO2 N2O CH4	Excluded	Thermal energy is not consumed or generated in the baseline scenario
Project activity	Fossil fuel consumption	CO2	Included	May be an important emission source
		CH4	Excluded	Excluded for simplification. The emission

	due to the CPA activity			source is assumed to be very small
		N2O	Excluded	Excluded for simplification. The emission source is assumed to be very small
	Emissions from on-site electricity use	CO2	Included	May be an important emission source
		CH4	Excluded	Excluded for simplification. The emission source is assumed to be very small
		N2O	Excluded	Excluded for simplification. The emission source is assumed to be very small
	Direct emissions from the waste treatment process	CO2	Excluded	CO2 emissions from decomposition of organic waste are not accounted
		CH4	Included	Included for composting, run off and residual disposal processes.
		N2O	Excluded	Excluded as the activity is a small scale

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

>>

The baseline scenario is identified based on a review of current practices of disposal of wastes in Vietnam and an assessment of feasibility and economics attractiveness of other alternatives (as provided in the following section E.5.1) within the technical and financial capabilities of the local administrative bodies in Vietnam.

The five alternatives considered in section E.5.1 are consistent with the laws and regulations in Vietnam. However some of them are either not considered technically feasible in the context of Vietnam or are technologically advanced and expensive to be realistically absorbed by the resource constrained local administrative bodies in Vietnam. Such options were thus not considered as baseline scenarios. Moreover, implementation of the Programme activity (composting of MSW) in Vietnam faces several barriers (as discussed in the following section E.5.1) and is not a financially attractive proposition for the resource constrained local administrative bodies. Therefore, continuation of the current practice, i.e. disposal of waste in landfills is considered the baseline scenario.

This would mean that the MSW collected by the local administrative bodies would be disposed of at the landfills. Anaerobic degradation of the organic fraction of the MSW in the landfill would generate methane which would be emitted to the atmosphere.

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 latest version of the "Tool for the demonstration and assessment of additionality" (version 05.2) is used to demonstrate the additionality of a typical CPA.

Step1. 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 composting of MSW. The following were initially considered as possible alternatives to composting in Vietnam.

1. The Programme activity, composting (not implemented as a CDM programme);
2. Disposal of waste at a landfill where landfill gas captured is flared or utilized;
3. Bio methanation of the waste and use of the methane for heat or electricity;
4. Disposal of waste on a landfill without flaring/utilization of landfill gas (Business as Usual).
5. Incineration

Some of above options, particularly alternatives 3 and 5 are either not considered technically feasible in the context of Vietnam or are technologically advanced and expensive to be able to be absorbed realistically by the cities in Vietnam and were thus eliminated without any further evaluation.

Alternative 2, although considered initially was dropped from further evaluation on the ground that most of local administrative bodies in Vietnam are small in size and would not justify investments for landfill gas collection and flaring particularly as this is not a requirement in Vietnam.

Similarly, alternative 3 involving bio-methanation was initially considered as one of the options due to the high organic contents of waste in Vietnam. Bio-methanation of MSW is a new technology to Vietnam, with the initial investment costs more than 10 times to the composting alternative. The local technological competence required to absorb the technology is also very high. The local administrative bodies where these Programmes have to be adopted do not have the ability to absorb this investment or high technology and the alternative is not considered feasible. Alternative 3 was therefore dropped from further consideration.
Thus the plausible alternatives that were considered for further evaluation are:

Alternative 1: The Programme activity, composting, (not implemented as a CDM programme);
Alternative 4. Disposal of waste on a landfill without flaring/utilization of landfill gas (Business as Usual).

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

The two plausible alternatives defined in the Sub-step1a which merited further consideration are fully consistent with the mandatory laws and regulations of Vietnam. Thus the two options have been subject to investment analysis and the barrier analysis to demonstrate the additionality of the Programme activity. The same analysis would be used to justify the additionality of each CPA

Step 2 Investment analysis

Sub-step 2a. Determine appropriate analysis method

Production of compost using MSW as the input raw material is presently not widely practiced in Vietnam. Although there is potential for sale of compost in Vietnam, the program is designed with expectation that the compost market would develop as the program gets implemented. The investment comparison analysis is used to compare the alternatives.

Sub-step 2b. Investment comparison analysis

The Internal Rate of Return (IRR) is chosen as the relevant financial indicator for comparing the options. For equal evaluation, pre condition of the financial analysis is set as follows;

- Compared by IRR during 2 years of preparation + 7 years of operation
- All cases receive same MSW treatment fee from the local administrative body (200VND/kg),
- All cases newly construct the facility, 50 tons per day MSW acceptable for 15 years

The financial analysis result shows the current practice of disposing wastes in the landfill is the least cost alternative and will be chosen in business as usual condition. Without CDM revenues, the composting operations have a negative return comparing to the benchmark given (Base interest rate, State Bank of Vietnam: 9.75% (2868/QD-NHNN 29/11/2010)), and composting activity becomes viable only with the CDM revenues.

Table E.5.1.1 Investment comparison analysis

	Options considered		
	Continuation of current practice	Composting without CDM	Composting with CDM
Quantity of MSW	50 tons per day (18,250 tons per year)		
Investment amount	10,360,238,000VND	21,338,000,000VND	
Operating costs per year (7years average)	908,192,000VND	3,347,242,000VND	3,957,543,000VND
Income per year	3,650,000,000VND	6,763,450,000VND	
CER Income per year (7 years average)	0VND	0 VND	2,034,338,000VND
Accumulated Free Cash Flow	9,053,018,000VND	3,507,130,000VND	13,475,338,000VND
FIRR	17.18%	3.73%	12.12%

A typical CPA is thus proved to be additional based on the investment analysis.

Sensitivity analysis

The sensitivity analysis is carried out for different scenarios with variations in capital costs and total income price from CPA activity (sales of compost/recyclables, MSW treatment fee) for alternative 1 (The Programme activity, composting, (not implemented as a CDM programme)). The sensitivity analysis concludes that the compost facility is not viable without carbon revenues in any of the scenarios comparing to the benchmark.

Table E.5.1.2 Assumptions for sensitivity analysis for alternative 1

Sensitivity analysis (capital cost)		
Description of scenarios	IRR	Values
Base case	3.73%	21,338,000,000VND
Decrease by 5%	5.31%	20,271,232,000 VND
Decrease by 10%	7.01%	19,204,325,000 VND
Sensitivity analysis (Total income)		
Description of scenarios	IRR	-
Base case	3.73%	6,763,450,000VND
Increase by 5%	5.93%	7,101,623,000 VND
Increase by 10%	8.03%	7,439,795,000 VND

The sensitivity analysis concludes that the Programme without CDM is not the least cost option for the local administrative bodies.

Step3: Barrier analysis

Sub-step 3a Technology barrier

The proposed CDM program would introduce composting for processing of MSW in Vietnam. The fact that there are only few facilities in Vietnam that process MSW to produce compost is, that the technological risk associated with composting operation by the local administrative bodies are considered high. Technology appropriate for Vietnam is available in the other developing countries but they need to be localised and adapted to Vietnam. There is a need for demonstration of the technology at multiple locations to check out its appropriateness and acceptability. Transfer of the technical know-how including training the manpower in Vietnam to construct and to operate MSW composting facilities puts additional financial burden on the program. The technology requires financial support for its demonstration and success. The proposed program activity intends to achieve this objective with support from CDM.

Barriers due to prevailing practice

Composting is a new idea compared to the prevailing practice of dumping/disposing the MSW in landfill sites. The prevailing practice is very common in Vietnam as almost all of the MSW in Vietnam is disposed of in this manner.

Sub-Step 3b: How identified barriers would not prevent the alternative scenarios

The only alternative scenario that needs to be analysed here is the continuation of the current practice of disposal of wastes in landfill site without landfill gas flaring/utilization. This practice is very common. The present practice of disposing waste in landfill sites does not involve any technical sophistication and the local administrative bodies have been following this as a common practice. This does not require any additional technology or investment input. Thus the barriers identified for the Programme activity would not prevent the continuation of the current practice.

Step 4. Common practice analysis

As there are only 9 official MSW composting plants, in which 6 of them are supported by ODA, comparing to 87 official landfill sites, composting of MSW is not a common practice.

Impact of CDM registration

The investment analysis demonstrates that the programme is not financially viable without the CDM. It is established that investment in a composting facility can yield positive returns only if carbon revenues are included. The returns are always negative in all scenarios without carbon revenues. The barriers analysis shows that there are significant barriers to implementation of the Programme. Thus, CDM registration directly impacts the decisions to implement the Programme activity.

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 Program level for typical CPA, it is not required to carry out further additionality analysis for the individual CPAs, provided they fall within the framework of the Program. For this purpose, the following criteria would be used for assessing additionality of CPA:

1) There should not be any existing composting operations of capacity greater than 5tons per day (input amount) of MSW handled per day in the local administrative body geographical boundary where the proposed CPA will be located in.
2) The common practice for MSW disposal in the geographical boundary of local administrative body should be disposal of MSW at landfill sites.
3) The financial analysis of composting operations should prove the Programme to be unviable without carbon revenues, if the facility is designed for a different capacity than the standard 50tons per day considered in the program.

As demonstrated in the section E.5.1 the key criteria for assessing the Additionality of a SSC-CPA would be either Approach 1 or Approach 2 as mentioned below:
Approach 1: Demonstrating additionality for very small- small scale CPAs
- The CPA to demonstrate compliance with the applicability conditions listed under Annex-15 to EB 54, as may be updated from time to time
OR
Approach 2: Demonstrating additionality for Small scale CPAs
- barrier analysis such as Investment barrier as mentioned below:
Investment Barriers
The investment barrier shall be demonstrated based on the investment analysis as per sub-step 2 b, option II-Investment Comparison Analysis of 'Tool for the demonstration and assessment of additionality'.
Any one of the above Approach will be demonstrated in the SSC CPA. The main criteria and data necessary to be provided by each CPA to fulfil the eligibility criteria are mentioned in section A.4.2.2 of the PoA-DD.
This PoA is not implementing any mandatory policy or regulation of the Government of India and there are no policies or schemes which supports biomass combustion based thermal (steam/heat) energy generation Project activities in India.

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

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

>>
The emission reductions caused by the proposed composting Programme are calculated according to the approved methodology AMS III.F version 9 EB 58"Avoidance of Methane production from biomass decay through composting" with "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site version 05".

The CPAs would constitute new composting facilities to avoid methane emission in landfill. Residual wastes would be landfilled.

The CPA boundary is the facility where the landfill and compost operation and the transport of compost and recyclables take place. In case the composting facility will be constructed in different location from next to the present landfill site, incremental distance of waste transportation to the composting facility and residue transportation to the landfill site will also be included in the CPA boundary.

Project emissions are considered for the transportation of compost and recyclables, electricity and fuel use in the composting facility, and incremental distance of waste transportation to the composting facility and residue transportation to the landfill site, in case he composting facility will be constructed in different location from next to the present landfill site.

Methane emissions that would have occurred if the wastes were to be landfilled are considered the baseline emission. A multi phase first order decay model as per tools is used to calculate this baseline emission.

No leakage is considered as there is no equipment being transferred from existing composting facility and the proposed CPAs are completely new facilities.

Provisions regarding the revisions of the CPAs in case the methodology is put on hold or withdrawn

- If the approved methodology is put on hold or withdrawn, for any reason other than for the purpose of inclusion in a consolidated methodology, no new CPAs shall be included to the PoA.
- If the methodology is subsequently revised or replaced by inclusion in a consolidated methodology, the PoA shall be revised accordingly and the changes shall be validated by DOA and approved by the Board if new CPAs are to be included. The Board's approval defines a new version of the PoA and the PoA specific CDM-CPA-PDD.
- Once changes have been approved by the Board, each new CPA shall use the latest version of the PoA specific CDM-CPA-DD.
- CPAs that were included before the methodology was put on hold, shall apply the latest version of the PoA specific CDM-CPA-DD at the time of the renewal of the crediting period.

Changes required for methodology implementation in 2nd and 3rd crediting periods

The baseline situation will be re-assessed during the renewal of the crediting period. If changes in the regulations with respect to waste disposal practices have resulted in implementation of new compost facilities without considering CDM or has resulted in capture and flare/utilization of landfill gas from the landfills without considering CDM, then the baseline emissions shall be re-estimated.
At the renewal of the crediting period, the following data should be updated according to default values suggested in the most recently published IPCC Guidelines for National Greenhouse Gas Inventories:

- Oxidation factors (OX);
- Fraction of methane in the SWDS gas (f);
- Fraction of degradable organic carbon (DOC) that can decompose (DOCf);
- Methane correction factor (MCF);
- Fraction of degradable organic carbon (by weight) in each waste type j (DOCj);
- Decay rate for the waste type j (kj)

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

>>

Project Emissions (PEy):

The project emissions in year y for each CPA will be calculated as below:

PEy = PE y, transp + PE y,power + PE y.comp + PE y, phy leakage + PE y, runoff + PE y,reswaste (1)

Where:

PEy	is the project emissions during the year y (tCO2e)
PE y, transp	is the emission due to incremental transportation in the year y (tCO2e)
PE y,power	is the emission from electricity or fossil fuel consumption in the year y (tCO2e)
PE y.comp	is the methane emission during composting process in the year y (tCO2e)
PE y, phy leakage	is methane emission from physical leakages of anaerobic digester in year y (tCO2e) (Not considered here as no anaerobic digester is proposed) (tCO2e)
PE y, runoff	is the methane emission from run off water in the year y (tCO2e)
PE y,reswaste	is the methane emission from anaerobic decay of the residual wastes/products in case they are subjected to anaerobic storage or disposed in a landfill (tCO2e)

1 Emission due to incremental transport

Emission due to incremental transportation is calculated using the formula below:

PE y, transp = (Q y /CT y) * DAF w * EF co2 + (Q y,comp, i / CT y,comp, i) * DAF comp, i *EF co2 (2)

Where:

Q y	Quantity of raw waste treated in the year y (tonnes)
CT y	Average truck capacity for waste transportation (tonnes/truck)
DAF w	Average incremental distance for raw solid waste (km/truck)
EF co2	CO2 emission factor from fossil fuel use due to transportation (kgCO2/km)
i	Type of items shipped out from the facility
Q y,comp, i	Quantity of residual waste, recycled products and compost produced in the year y (tonnes)
CT y,comp, i	Average truck capacity for residual waste, recycled products and compost transportation (tonnes/truck)
DAF comp, i	Average distance for residual waste, recycled products and compost transportation (km/truck)

IPCC default values will be used for the net calorific value and CO2 emission factor for diesel fuel.

2 Emission due to electricity or fossil fuel consumption on site

The composting process involves electricity consumption for lighting and water pumping, and blowers. Emissions associated with consumption of electricity and fossil fuel is calculated using the following formulae:

PE y, power = PE electricity, y + PE fuel, onsite, y
(3)

PE electricity, y MWh e,y * EF co2, grid,y
(4)

Where:

MWh e,y is the amount of electricity consumed from the grid in the project activity,
measured using an electricity meter (MWh)

EF co2, grid,y is the emission factor for electricity generation of the national grid (tCO2/MWh). EF co2, grid,y shall be calculated annually using either of following method in AMS-I.D ver16.

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system"

OR

(b) The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations shall be based on data from an official source (where available) and made publicly available.

The project selected (a) to calculate the emission factor or electricity generation of the national grid, therefore **$EF_{grid,CM,y}$** take place for EF co2, grid,y **.** The calculation procedure is noted on Annex 3. As a result,

$EF_{grid,CM,y}$ = 0.58015 tCO_2/MWh

PE fuel, onsite, y = F cons, y * EF fuel
(5)

On-site fuel is used for front end loaders used for turning waste.

Where:

F cons, y is the fuel consumption on the site in year y

EF fuel is the CO2 emissions factor of the fuel (kgCO2/litre). Default CO2 emission factor of diesel used in road transport as per IPCC (2006 IPCC Guideliens for National Greenhouse Gas Inventories) is 74,100 kgCO2/TJ. Calorific value of diesel used in Vietnam is 10,478kcal/kg (or 43.8Mj/kg) and weighted average density of diesel oil is 839.7g/Litre, which means 36.78Mj/Litre. The results of EF fuel will be 2.73 kgCO2/litre.

3 Emissions from composting process

Emissions from composting process are calculated using the following formula:

PE y, comp = Qy * EF composting * GWP_CH4
(6)

Where:

EF composting is the methane emission factor of composting waste taken at 4 kg methane / ton wet waste

GWP_CH4 is the Global Warming Potential (GWP) of methane valid for the relevant commitment period, taken at 21 for the first commitment period of Kyoto Protocol

$EF_{composting}$ can be set to zero for the portions of *Qy* for which the monitored oxygen content of the composting process in all points within the windrow are above 8%.

4 Emission from run-off water

Methane emission from run-off water is calculated using the following formula:

PE y, runoff = Q y, ww, runoff * COD y, ww, runoff * B o, ww * MCF ww, trteatment * UF b * GWP_CH4 (7)

Where:

Q y, ww, runoff is volume of runoff water in year y (m3)

COD y, ww, runoff is chemical oxygen demand of runoff water leaving the composting facility in year y (tonnes/m3)

B o, ww is methane producing capacity of waste water taken at IPCC default value of 0.25kg/kgCOD

MCF ww, trteatment is methane correction factor for waste water treatment plant as per table AMS III F.1 in the methodology AMS III.F/version 16

UF b is model correction factor to account for uncertainties default of 1.12

5 Emission from anaerobic storage/disposal or residual waste

The emission from landfill of residuals from composting process PE y, rewaste are calculated using the following formula:

BE CH4, swds,y =

$$\Psi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot 16/12 \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-kj \cdot (y-x)} \cdot (1-e^{-kj}) \quad (8)$$

The quantity of waste and the composition of waste in the above formula correspond to the residual waste. “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” (version 05) is used.

Compost and inert material are the two types of residual wastes expected to be generated in the project activity. Only the inert material will be disposed of in the landfill site once in 3 days which would not lead to any methane emissions unlike disposal of sludge and compost in the landfill. Compost produced in the facility is not intended to be disposed of in the landfill. If necessary, compost may be sold at a low or no price in initial years when the market is still

being developed. Therefore emission associated with anaerobic storage/disposal of residual waste is mostly not applicable. However provisions have been made to analyse and monitor the type of residual waste that would be disposed of at the landfill and calculate the emission if relevant.

Baseline emissions:

There is no waste water co-composting, no electricity or thermal energy consumed at the site in the absence of the project activity and finally no methane which requires to be captured and combusted. The baseline emission for the composting activity is calculated using the following formula:

BE y = BE CH4, swds, y – (MD y, reg * GWP_CH4) + (MEP y, ww * GWP_ CH4) (9)

Where:

BE y is the baseline emission in year y (tCO2e)
BE CH4, swds, y is yearly methane generation potential of the solid waste composted by the project during the years "x" from the beginning of the project activity (x=1) up to the year "y" estimated as described in "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 05).
MD y, reg is methane emissions that would be captured and destroyed to comply with national or local safety requirement or legal regulations in the year "y" (tCO2e). In Vietnam there is no requirement or regulation to capture and destroy methane and this value is zero and not considered further.
MEP y, ww is methane emission potential in the year y of the wastewater co-composted. The value of this term is zero as co-composting of waste water is not included in the project activity (tonne)

Hence:

BEy = BE CH4, swds, y (10)

The amount of methane that would in the absence of the project activity be generated from disposal of waste at the solid waste disposal site (BE CH4, swds, y) is calculated with a multi-phase model. The calculation is based on a first order decay (FOD) model. The model differentiates between the different types of waste j with respectively different decay rates kj and different fractions of degradable organic carbon (DOCj). The model calculates the methane generation based on the actual waste streams W j, x disposed in each year x, starting with the first year after the start of the project activity until the end of the year y, for which baseline emissions are calculated (years w with x=1 to x=y)

The amount of methane produced in the year y (BE CH4, swds, y) is calculated as follows:

BE CH4, swds,y =

$$\Psi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot 16/12 \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-kj \cdot (y-x)} \cdot (1-e^{-kj}) \quad (11)$$

Where:

ϕ is model correction factor (default 0.9) to correct the model uncertainties
f is fraction of methane captured at the SWDS and flared combusted or used in another manner
OX is oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F is fraction of methane in the SWDS gas (volume fraction, 0.5)
DOCj is fraction of degradable organic carbon (by weight) in the waste type j
MCF is methane correction factor (fraction)
W j, x is amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes/ year)
DOC f is fraction of degradable organic carbon that can decompose
kj is decay rate for the waste stream type j
j waste type category
x is year during the crediting period: x runs for the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)
y is year for which methane emissions are calculated

Where different waste types j are prevented from disposal, determine the amount of different waste types (W j, x) through sampling and calculate the mean from samples, as follows:

$$W_{j,x} = W_x \cdot \frac{\sum_{n=1}^{z} P_{n,j,x}}{z} \quad (12)$$

Where:

W j, x is amount of organic waste type j prevented from disposal in the year x (tonnes)
W x is total amount of organic waste prevented from disposal in the year x (tonnes/year)
P n,j,x is weight fraction of the waste type j in the sample n collected during the year x
Z is number of samples taken during the year x

Emission reductions – composting process:

The following equation will be used to calculate emission reductions for the composting process:

$$ERy = BE\ y - PE\ y \quad (13)$$

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

Parameters related to Project emission

(Copy this table for each data and parameter)

Data / Parameter:	EF CO2
Data unit:	kg CO2/km

Description:	Emission factor for diesel vehicles
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Aquarium science and technology journal no.01/2008 of Nha Trang University IEA Energy statistics, 2004
Value applied:	0.455
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default CO2 emission factor for diesel used in road transportation is 74,100 kg CO2/TJ. Calorific value of diesel used in Vietnam is 10,478kcal/kg (or 43.8Mj/kg) and weighted average density of diesel oil is 839.7g/Litre, which means 36.78Mj/Litre. The above data results in emission coefficient of 2.73 kgCO2/litre for diesel considering an average efficiency of transport vehicle as 6 km/litre, the emission factor will be 0.455kgCO2/km.
Any comment:	

Data / Parameter:	**EF fuel**
Data unit:	kg CO2 / litre
Description:	Emission factor for diesel used in on-site vehicles
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Aquarium science and technology journal no.01/2008 of Nha Trang University IEA Energy statistics, 2004
Value applied:	2.73
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default CO2 emission factor for diesel used in road transportation is 74,100 kg CO2/TJ. Calorific value of diesel used in Vietnam is 10,478kcal/kg (or 43.8Mj/kg) and weighted average density of diesel oil is 839.7g/Litre, which means 36.78Mj/Litre. The above data results in emission coefficient of 2.73 kgCO2/litre for diesel oil.
Any comment:	

Data / Parameter:	**$EF_{grid,CM,y}$**
Data unit:	tCO_2e/MWh
Description:	Carbon emission factor of electricity in Vietnam
Source of data used:	Official sources
Value applied:	**0.58015** See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**EF m, ipcc2006**
Data unit:	kg CO2/TJ
Description:	Emission factor of diesel fuel Emission factor for heavy oil
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	Diesel: 74,100 kgCO2/TJ

	Heavy Oil: 77,400kg CO2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF composting
Data unit:	Kg CH4/ ton waste
Description:	Methane emission per ton wet waste composted
Source of data used:	table 4.1, chapter 4, Volume 5,2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	4kg/ton wet waste
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	B o, ww
Data unit:	Kg methane / kg COD
Description:	Methane producing capacity of waste water
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	MCF ww, treatment
Data unit:	Factor
Description:	Methane correction factor for waste water treatment plant
Source of data used:	As per table III.H.1 of AMS III.H
Value applied:	0.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	The composting process is proposed under a roof. No rain run-off is expected. The process management would ensure that no leachate from excess watering is generated. Leachate generated due to moist the waste input would be sprayed back onto the older waste windrows. In this context no treatment plant is proposed. In case leachate does get produced and which cannot be sprayed back an aerobic treatment system based on reed bed or similar botanical treatment system would be undertaken without use of power. The number for “Anaerobic shallow lagoon (depth less than 2 meters)”is adopted.

Any comment:	
Monitoring frequency	Anually check if any run off exists.

Data / Parameter:	**UF b**
Data unit:	Factor
Description:	Model correction factor to account for uncertainties
Source of data used:	AMS III.F Version 9
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Parameters related to baseline emissions

Data / Parameter:	ϕ
Data unit:	Factor
Description:	The model correction factor to correct for the model uncertainties
Source of data used:	Tool to determine emissions avoided from disposal of waste at a solid waste disposal site (version 05)
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**OX**
Data unit:	Factor
Description:	Oxidation factor
Source of data used:	Tool to determine emissions avoided from disposal of waste at a solid waste disposal site (version 05)
Value applied:	0.1
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 MSW disposal site in order to assess the type of covering method and materials. Use IPCC 2006 guidelines for national greenhouse gas inventories for the choice of value to be applied. 2) Use 0.1 for managed MSW disposal site that are covered with oxidizing material such as soil or compost, Use 0 for other materials.
Any comment:	

Data / Parameter:	**F**
Data unit:	Fraction
Description:	Fraction of methane in the SWDS gas (volume fraction)

Source of data used:	Tool to determine emissions avoided from disposal of waste at a solid waste disposal site (version 05)
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**DOC f**
Data unit:	Factor
Description:	The fraction of DOC that can decompose
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories and "Tool to determine emissions avoided from disposal of waste at a solid waste disposal site (version 05)"
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**MCF**
Data unit:	Factor
Description:	Methane correction factor
Source of data used:	2006 IPCC 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 (waste directed to specific decomposition 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; (iii) levelling of the waste. - 0.8: for unmanaged MSW 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. - 0.5: for semi aerobic managed MSW 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 pndage; (iv) gas ventilation system. - 0.4: for unmanaged shallow MSW disposal sites. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5meters.

Any comment:	The baseline system is anaerobic managed solid waste disposal site with all three of following: (i) cover material; (ii) mechanical compacting; (iii) levelling of the waste.

Data / Parameter:	**DOC j**
Data unit:	%
Description:	Percent of degradeable organic carbon (by weight) in the waste type j
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories (volume 5 table 2.4 and 2.5)
Value applied:	

Waste type	DOC (%)
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food, food waste, beverages and tobacco (other than sludge)	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal other inert waste	0

Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**kj**
Data unit:	Factor
Description:	Decay rate of the waste stream type j
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories (volume 5 table 3.3)
Value applied:	

Waste type *j*		**Boreal and Temperate (MAT≤20°C)**		**Tropical (MAT>20°C)**	
		Dry (MAP/PET <1)	Wet (MAP/PET >1)	Dry (MAP< 1000mm)	Wet (MAP> 1000mm)
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07
	Wood, wood products and straw	0.02	0.03	0.025	0.035

	Moderately degrading	Other (non-food) organic putrescible, garden and park waste	0.05	0.10	0.065	0.17
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

Justification of the choice of data or description of measurement methods and procedures actually applied :	MAT for **Hung Yen** city is 24.18 C (2009) MAP for **Hung Yen** city is 1,564 mm (2009)
Any comment:	

Data / Parameter:	**Solid waste composition (percentage of waste type *j*)**
Data unit:	
Description:	
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.3) regional default values for South-Eastern Asia
Value applied:	Average of composition analysis conducted by using Hung Yen City MSW in 2010 by IKE.
Justification of the choice of data or description of measurement methods and procedures actually applied :	

Waste type	Composition by weight (%)
Wood and wood products	0.83%
Pulp, paper and cardboard (other than sludge)	2.29%
Food, food waste, beverages and tobacco (other than sludge)	15.24%
Textiles	3.29%
Garden, □ard and park waste	59.28%
Glass, plastic, metal oth□r inert waste	19.08%

Any comment:	

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

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

(Copy this table for each data and parameter)

Data / Parameter:	**Q y, comp, i**
Data unit:	Tonnes
Description:	Total quantity of compost produced and transported out of the site in year x
Source of data to be used:	Compost production data and double check by sales data managed by the operator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The quantity of compost taken out of the composting facility includes sale and free lifting shall be recorded in compost production and sales register. In case of large volume sales/lifting, truck scale is used and data will be recorded. To record the small volume sales/lifting, a standard box (of fixed volume) shall be used to estimate the volume sold/lifted. The volume of compost sold/lifted shall be recorded on a daily basis. Density of compost shall be measured to convert the volume sold/lifted to weight. The density shall be measured by weighing the compost contained in standard box in a calibrated weighing scale install at the site. The density shall be measured once in a month and the annual average density shall be used for converting the annual volume of compost transported.
QA/QC procedures to be applied:	
Any comment:	The volume data will be reported on monthly basis

Data / Parameter:	**CT y, comp, i**
Data unit:	Tonnes/truck
Description:	Average truck capacity for transportation of compost
Source of data to be used:	Compost production data and double check by sales data managed by the operator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Data on number of trip/loads will be recorded in the composting production and sales register. The aggregated annual compost sold/lifted in tons as shall be divided by the number of trip/loads to calculate the average truck capacity (tonnes/truck).
QA/QC procedures to be applied:	
Any comment:	Annually calculated

Data / Parameter:	**DAF comp, i**

Data unit:	km
Description:	Average distance for compost transportation to end users
Source of data to be used:	Compost production data and double check by sales data managed by the operator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	For each load/trip of compost taken out of the plant, the operator shall record the distance to destination by speaking to the carrier. The total distance will be divided by the total number of trips to calculate the average distance.
QA/QC procedures to be applied:	
Any comment:	Annually calculated

Data / Parameter:	**i**
Data unit:	
Description:	Type of items shipped out from the facility
Source of data to be used:	Sales categorization data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	Periodically confirmed

Data / Parameter:	**MWh e, y**
Data unit:	MWh
Description:	Amount of electricity consumed from the grid in the project activity
Source of data to be used:	Electricity meter and the bills from the power company
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Consumption of electricity recorded by the meter will be the prime source of this data. Monthly consumption will be recorded. The electricity bills received from the power company may be used as an alternative source of data.
QA/QC procedures to	Electricity consumption recorded at the plant shall be checked with power

be applied:	bills received from the power company
Any comment:	Monthly basis recording

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO2e/MWh
Description:	CO2 emission factor of the grid supplying electricity to the project
Source of data to be used:	Calculated as per AMS I.D ver 16
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system"
QA/QC procedures to be applied:	
Any comment:	Annually calculated

Data / Parameter:	F cons
Data unit:	Liters
Description:	Fuel consumption for the equipment used in the composting process
Source of data to be used:	Fuel purchase records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Records will be kept for the fuel purchased for the facility. Data will be recorded on a monthly basis.
QA/QC procedures to be applied:	
Any comment:	Fuel usage is only for equipment that is operating in-site. Emission associated with transport of compost is calculated separately.

Data / Parameter:	GWP CH4
Data unit:	tCO2e/CH4
Description:	Global Warming Potential of methane
Source of data to be used:	Decisions under UNFCCC and 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:	
QA/QC procedures to be applied:	
Any comment:	Value to be checked annually

Data / Parameter:	**Q y, ww., runoff**
Data unit:	M3
Description:	Volume of runoff water in year y
Source of data to be used:	Records of the compost plant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (no rain run off is expected)
Description of measurement methods and procedures to be applied:	Generation of leachate will be avoided by compost production management, although small amount may remain. Leachate accumulated in the tank over a period of 24 hours shall be calculated (on volume basis) with measurements for the area of the tank and the depth of the leachate accumulated in the tank using the standard measuring scales and tapes. The measurement will be carried out once in a week and the average leachate generation rate (m3/day) shall be converted to annual leachate generation.
QA/QC procedures to be applied:	
Any comment:	Measurement to be taken once in a month and the annual average will be used.

Data / Parameter:	**COD y, ww, runoff**
Data unit:	Tonnes / m3
Description:	Chemical oxygen demand of runoff water leaving the composting facility
Source of data to be used:	Monthly measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Analytical technique for COD measurement.
QA/QC procedures to be applied:	Sample given to laboratories recognised by government.
Any comment:	Measurement to be taken once in a month and the annual average will be used.

Data / Parameter:	**F**
Data unit:	Fraction

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 MSW disposal sites in the corresponding local administrative body hosting the CPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.5
Description of measurement methods and procedures to be applied:	Solid waste disposal sites located in the corresponding city hosting the CPA will be visited 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 facility operation data. CDM projects will not be considered for this.
QA/QC procedures to be applied:	
Any comment:	Annually checked

Data / Parameter:	**W x**
Data unit:	Tonnes
Description:	Total quantity of organic waste prevented from disposal in year x (tonnes)
Source of data to be used:	Records of incoming waste and measurements at the facility
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Incoming and outgoing truck with raw waste will be measured at the truck scale. The quantity of residue disposed of to the landfill site (W x, residual) is also weighed at the truck scale, and shall be deducted to calculate the total quantity of organic waste prevented from disposal. For the purpose of calculating baseline emission, it is not required to do these adjustments because the waste composting of mixed incoming waste is used in the calculation which automatically considers only the organic present.
QA/QC procedures to be applied:	Calibration of truck scale
Any comment:	The volume data will be reported compiled and reported on a monthly basis.

Data / Parameter:	**P n, j, x**
Data unit:	-
Description:	Weight fraction of the waste type j in the incoming waste in sample n collected during the year x
Source of data to be used:	Waste composition analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of	Standardized procedures for determining the waste composition shall be

measurement methods and procedures to be applied:	used. The composition of incoming waste will be determined by sampling and analysis. Samples will be taken once a month, which translates to 12 samples a year. The average composition will e used in all calculations.
QA/QC procedures to be applied:	
Any comment:	Monthly composition analysis

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

>>

The purpose of the monitoring plan is to provide a standard by which VUREIA will conduct monitoring and verification of the proposed CPA activity. The monitoring plan will be in accordance with all relevant rules and regulations of the CDM. The monitoring plan forms an integral part of PDD and will facilitate accurate and consistent monitoring of Programme's CERs. VUREIA will used the monitoring plan for the duration of the Programme activity and will refine and expand it from time to time, as may be required. CDM management unit has been established within VUREIA which is the organizational structure to manage the preparation and implementation phases of the proposed CDM program of activity. During implementation it will be responsible for organizing and supervising all the monitoring activities required for accurate and timely verification and reporting of CERs generated.

Specific objectives of the monitoring plan

Specifically, the objectives of the monitoring plan are the following:

- Establishing and maintaining a reliable and accurate monitoring system
- Provide guidance for the implementation of necessary measurement and record management operations
- Guidance for meeting CDM requirements for verification and certification

Operational and monitoring obligations

The monitoring plan will be supported by a CDM operation and monitoring manual which will be prepared before the start of the first crediting period and will be tested during start up of the components of the Programme activity. This will provide an opportunity to correct any deficiencies and further refine the monitoring and recording procedures. It will also provide an opportunity to train laboratory and operating personnel for the strict requirements for accuracy in collecting and recording data for CDM purposes.

Management and operational systems

In order to ensure a successful operation of the Programme and the credibility and verifiability of the CERs achieved, the Programme will have a well-defined management and operational system, which will be documented in the CDM operations and monitoring manual. A system will be put in place for the Programme activity and include the operation and management of the monitoring and record keeping system that is described in the monitoring plan.

A CDM steering committee will be constituted with management and operational structures as listed below.

- Management structure composition:
  - VUREIA representative,
  - City representative where CPA belongs

- CPA implementer Representative
- IKE Representative

- Operational/technical structure composition:
  - VUREIA secretary general, accountant chief, inspection department chief
  - CPA PC jurisdiction department representative, inspector, accountant representative,
  - CPA implementer technical chief, accounting chief,
  - IKE Representative

This steering committee will meet periodically to review the CDM program of activity.

- The first line of responsibility for implementing the monitoring plan will be the Director of the CPA implementer. VUREIA will take a leading role in preparing the CDM programme and obtaining necessary approval for proceeding. VUREIA would have a team of inspectors and monitoring staff, together with IKE, to ensure that all monitoring and data recording for programme activity meet the requirements for CER verification and certification.

The monitoring plan for the Programme activity is described in detail in Annex 4 and is not repeated here.

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

>>

Date of completion:

December 12th, 2010

Person/entity determining the baseline:
XXXXXXXXXXX

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY AND PARTICIPANTS IN THE PROGRAMME OF ACTIVITIES

Organization:	VUREIA
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:	IKE
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

PUBLIC FUNDING IS NOT EXPECTED IN THIS POA.

ANNEX 3

BASELINE INFORMATION

DETERMINATION OF THE GRID EMISSION FACTOR IN VIETNAM ($EF_{grid\ y}$)

The methodological *Tool to calculate the emission factor for an electricity system* is applied to determine the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM).

STEP 1 Identify the relevant electricity systems

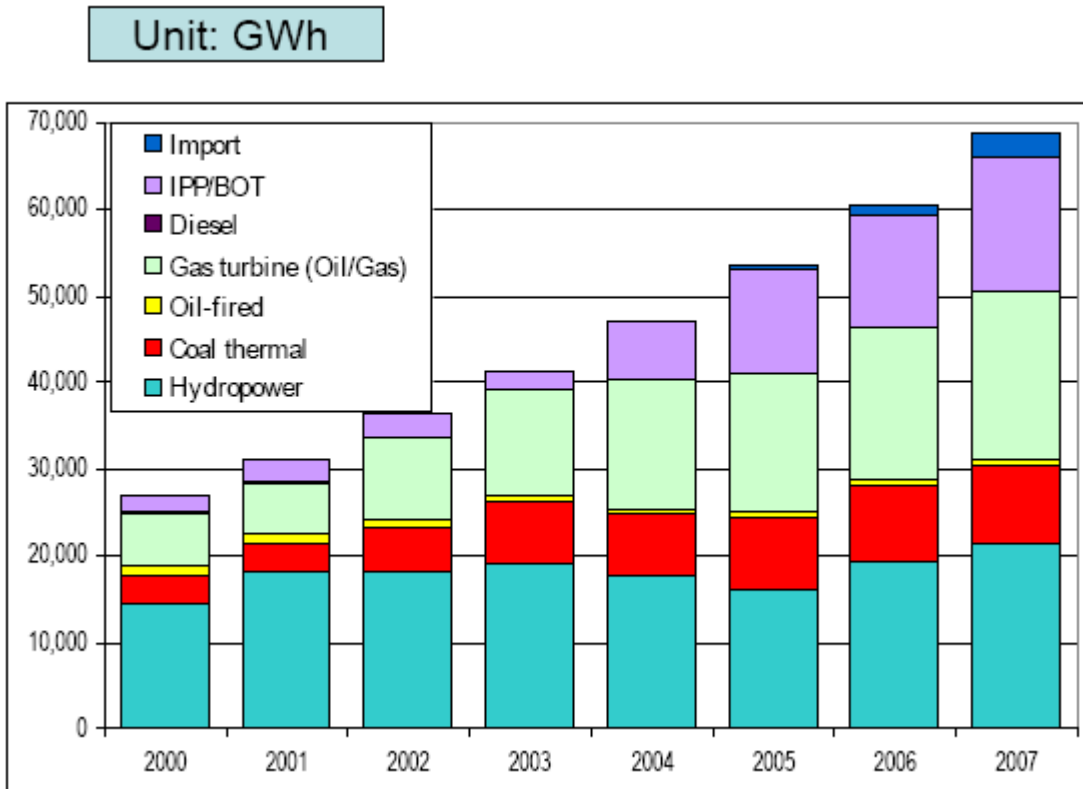
The relevant electricity system is identified as the Vietnamese national grid: the Electricity of Vietnam or EVN. The EVN is a state-owned utility which plans and controls generation, transmission and distribution of electricity in the whole country.

STEP 2 Choose whether to include off-grid power plants in the project electricity system (optional)

We choose Option I: only grid power plants are included in the calculation.

STEP 3 Select a method to determine the operating margin (OM)

As shown on the diagram below, low cost/must-run resources constitute less than 50% of total grid generation in the five most recent years. Thus we will use the simple OM method. We choose to apply the ex-ante option: the emission factor is determined once at the validation stage.



Source : http://www.adb.org/documents/events/2009/Climate-Change-Energy-Workshop/VIE.pdf or http://www.bionersis.com/links/24 ADB 2009: Workshop on Climate and Energy March 2009, Country Report,

Energy and Climate Change in Vietnam

STEP 4 Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units.

It will be calculated according to Option B, i.e. based on the total net electricity generation of all power plants serving the system and fuel types and total fuel consumption of the project electricity system.

Option B can be used as the necessary data for Option A is not available.

Hence, the simple OM emission factor is calculated as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power plant / unit *m* in year *y* (MWh)
m	All power plants / units serving the grid in year *y* except low-cost/must-run power plant /units
i	All fossil fuel types combusted in power plant / unit *m* in year y
y	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

The source used to calculate the OM is the "CDM Baseline construction for Vietnam National Electricity Grid" report by Tran Minh Tuyen and Axel Michaelowa. (Source: http://ageconsearch.umn.edu/bitstream/26393/1/dp040295.pdf table V.4 page 16 or http://www.bionersis.com/links/23 Tuyen T.M., Michaelowa A. 2004: CDM Baseline Construction for Vietnam National Electricity Grid.)

This report makes reference to official sources (government statistics). Although this report has been published in 2004, it provides projections up to the year 2010 by using sources such as the expansion plan of the state-owned power company 'Electricity of Vietnam', EVN). Thus, the source used to calculate the grid emission factor for the proposed project activity can be deemed applicable.

Fuel type		2006	2007	2008
Hydropower	GWh	19,502	21,602	24,139
Coal	GWh	8813	11692	14958
5700 kcal/kg-Vietnam	kt	4129	5493	6946
26.8 TC/TJ – IPCC	kt CO_2	9,498	12,636	15,978
Gas	GWh	29180	30438	35894
8500 kcal/m^3 – VN	Million m^3	6418	6667	7934
15.3 TC/TJ – IPCC	kt CO_2	12,697	13,189	15,696
DO	GWh	155	152	153
10200 kcal/kg – VN	kt	45	45	45
20.2 TC/TJ – IPCC	kt CO_2	141	141	141
FO	GWh	2284	3431	127
9900 kcal/kg – VN	kt	524	782	36
21.1 TC/TJ – IPCC	kt CO_2	1,665	2,485	114
Total CO_2 emission from Vietnam grid, kt CO_2		24,001	28,451	31,929
Total thermal output generated, GWh		40,432	45,713	51,132
OM: Weighted thermal average, gCO_2/kWh		**594**	**622**	**624**

Hence, **$EF_{grid,OM,2006-2008}$ = 0.6135 tCO_2/MWh**

STEP 4 Identify the group of power units to be included in the build margin

According to the *Tool to calculate the emission factor for an electricity system*, the sample group of power units m used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The same report stated above has been used as a source to identify the group of power units to be included in the build margin. The set of power units that comprises the larger annual generation is identified as option (b) and is listed below:

End of year	Grid cap., MW		Last five plants		Last 20% plants	
	Total	20%	Plant	MW	Plant	MW

2008	16,627	3325.4	1. Ban La, hdropower	300	1. Ban La, hdropower	300
			2. PleiKrong, hydropower	110	2. PleiKrong, hydropower	110
			3. Cua Dat, hydropower	97	3. Cua Dat, hydropower	97
			4. Srepok 3, hydropower	90	4. Srepok 3, hydropower	90
			5. Dai Ninh, hydropower	300	5. Dai Ninh, hydropower	300
					6. Nhon Trach, gas	600
					7. Expansion Ninh Binh, coal	300
					8. Quang Ninh, coal	600
					9. Hai Phong, coal	600
					10. A Vuong, hydropower	170
					11. Tuyen Quang, hydropower	342
			Total	**897**	**Total**	**3509**

Source: http://ageconsearch.umn.edu/bitstream/26393/1/dp040295.pdf table V.3 page 15, Tuyen T.M., Michaelowa A. 2004: CDM Baseline Construction for Vietnam National Electricity Grid.

We choose to apply the ex-ante option (option 1): the build margin emission factor is determined once at the validation stage, without requirement to monitor and recalculate it during the crediting period.

STEP 6 Calculate the build margin emission factor

The build margin emission factor BM is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year y (tCO_2/GJ)
m	Power units included in the build margin
y	Most recent year for which power generation is data available

According to the report, the 2008 BM is calculated as following:

Name of power plant	Type of fuel	Capacity (MW)	$EG_{m,y}$ (GWh)	CO_2emissions ($ktCO_2$)	$EF_{EBM,2008}$ (tCO_2/MWh)
1. Ban La	hydro	300	328	0	
2.PleiKrong	hydro	110	175	0	
3. Cua Dat	hydro	97	165	0	
4. Srepok 3	hydro	90	198	0	
5. Dai Ninh	hydro	300	1 143	0	
6. Nhon Trach	gas	600	3 512	1389	
7. Expansion Ninh Binh	coal	300	334	342	
8. Quang Ninh	coal	600	1 878	1 922	
9. Hai Phong	coal	600	3 512	3 595	
10. A Vuong	hydro	170	715	0	
11. Tuyen Quang	hydro	342	1 296	0	
Total		3,509	13 256	**7,248**	**0.5468**

Hence, **$EF_{grid,BM,y}$ = 0.5468 tCO_2/MWh**

STEP 6 Calculate the combined margin emission factor

The combined margin emission factor CM is calculated as follows:

$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$

Where:

$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emission factor (%)
w_{BM}	Weighting of build margin emission factor (%)

Using default values set in the *Tool to calculate the emission factor for an electricity system:*

$w_{OM} = w_{BM} = 50\%$
$EF_{grid,OM,y} = 0.6135$
$EF_{grid,BM,y} = 0.5468$

Hence, $EF_{grid,CM,y} = 0.58015\ tCO_2/MWh$

Annex 4

MONITORING INFORMATION

Chart Annex 4.1-1 Monitoring items and implementation structure (project emissions)

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use way of measurement	QA/QC measure What	QA/QC procedure who	 How	person in charge	manager frequency
	$PE_{y,transp} = (Q_y/CT_y)* DAFw* EFCO2 + (Q_{y,comp,i}/CT_{y,comp,i}) * DAFcomp,i * EF_{CO2}$											
annual accumulation of daily monitoring	Q_y	Quantity of raw waste treated in the year y	t	Sum of inflow MSW weighed by the truck scale	Entrance of the facility	Paper and electronic data	The weight difference before and after unloading MSW is measured at the truck scale which will be located at the entrance of the facility. The data will be also noted in paper (Date, car number, in coming time and weight, out going time and weight).	Truck scale	truck scale manufacturer	Periodical calibration	Truck management Division	Weekly
annually	CT_y	Average truck capacity for waste transportation	t/truck	(Sum of inflow MSW weighed by the truck scale) / (sum of MSW transportation truck entered)	Entrance of the facility	Electronic data	Llicence plate number and other data of vehicles (company name, car sizes) will be registered initially. Truck scale operator will visually confirm and enter the licence plate number to the database each time when the truck delivers MSW. Weight data will be recorded in the database.	1) Truck scale 2) Registrated Information	1) Truck scale manufacturer 2) Truck scale operater	1) Periodical calibration 2) Annual confirmation of information to the truck owner	Truck management Division	Annually
annual accumulation of daily monitoring	DAF_w	Average incremental distance for raw solid waste	km/truck	If the CPA facility is build adjacent to present landfill, it will be zero. If not: (Sum of transportation distance after CPA) / (sum of truck numbers after CPA) − (sum of MSW transportation distance before CPA) / (sum of truck numbers before CPA)	Truck management dicvision	Paper and electronic data	Driver will note the distance meter amount everyday when starting and after working. Data will be accumulated in computer database on weekly basis.	1) Truck distance meter 2) Daily driver report	Truck management dicvision	1) Run test 2) Weekly meeting with drivers	Truck management Division	1) Annually 2) Weekly
annually	EF_{CO2}	CO2 emission factor from fossil fuel use due to transportation	kg/CO2/km	Calorific value * Density * CO2 emission amout	Technical Division	Paper and electronic data	Value will be calculated	Calculated result	More than 2 people re-calculate	excel, calculater	Technical Division	Annually
Periodically	i	Type of items shipped out from the facility	-	count number of types	Sales division	Paper and electronic data	Count numbers of shipping items from shipping list				the person in charge of technology	Anually
annual accumulation of daily monitoring	$Q_{y,comp,i}$	Quantity of residual waste, recycled products and compost produced in the year y	t	Sum of outflow residual waste, recycled product and compost weighed by the truck scale	Entrance of the facility Sales Division Truck Management Division	Paper and electronic data	The weight difference before and after loading residual waste, recycled products and compost is measured at the truck scale which will be located at the entrance of the facility. The data will be also noted in paper (Date, car number, in coming time and weight, out going time and weight).	Truck scale	truck scale manufacturer	Periodical calibration	Truck management Division	Anually
annually	$CT_{y,comp,i}$	Average truck capacity for residual waste, recycled products and compost transportation	t/truck	(Sum of out flow residual waste, recycled products and compost weighed by the truck scale) / (sum of residual waste, recycled products and compost transportation truck entered)	Entrance of the facility	Electronic data	Llicence plate number and other data of vehicles (company name, car sizes) will be registered initially. Truck scale operator will visually confirm and enter the licence plate number to the database each time when the truck ships residual waste, recyclable products and compost. Weight data will be recorded in the database.	Truck scale	truck scale manufacturer	Periodical calibration	Truck management Division	Anually
annual accumulation of daily monitoring	$DAF_{comp,i}$	Average distance for residual waste, recycled products and compost transportation	km/truck	(Sum of transportation distance of residual waste, recycled products and compost) / (sum of truck numbers)	Truck management dicvision	Paper and electronic data	Driver will note the distance meter amount everyday when starting and after working. Data will be accumulated in computer database on weekly basis.	1) Truck distance meter 2) Daily driver report	Truck management dicvision	1) Run test 2) Weekly meeting with drivers	the person in charge of weighing	Anually
					Sales division	Paper and electronic data	The place of sales will be kept in the shipping record (according to sales slips).	Location of the desitnation	Sales division	confirm map information	Sales division	Periodically

Chart Annex 4.1-2 Monitoring items and implementation structure (project emissions)

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use / way of measurement	QA/QC measure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	PE y, power = PE electricity, y + PE fuel, onsite, y											
	PE electricity, y = MWh e,y * EF co2, grid,y											
Annual accumulation of monthly data	*MWh e,y*	Amount of electricity consumed from the grid in the project activity, measured using an electricity meter	MWh	Sum of purchased electricity amount stated on bill of the power company	General affairs division	Paper and electronic data	Confirmation of quantity of purchased electricity by checking the record of the bills	1) Watt-hour meter 2) Cross check between technical division	1) Power company 2) Technical division	1) Periodical calibration 2) Check operation report and compare with average power consumption data	General affairs division	monthly
Annually	*EF co2, grid,y*	Emission factor for electricity generation of the national grid	tCO_2/MWh	A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system"	Technical Division	Paper and electronic data	Collect necessary data from official database. Calculate the value based on the instruction of "Tool to calculate the Emission Factor for an electricity system"	Calculated result	More than 2 people re-calculate	excel, calculater	Technical Division	Annually
	PE fuel, onsite, y = F cons, y * EF fuel											
Annual accumulation of monthly data	*F cons, y*	Fuel consumption on the site in year y	L/Y	Sum of purchased fuel amount stated on bill of the fuel company	General affairs division	Paper and electronic data	Confirmation of quantity of purchased fuel by checking the record of the bills	Cross check between truck management division	Truck Management Division	Check driver report and compare with average consumption data	General affairs division	monthly
Annually	*EF fuel*	CO2 emissions factor of the fuel	kgCO2/L	Calorific value * Density * CO2 emission amout	Technical Division	Paper and electronic data	Value will be calculated	Calculated result	More than 2 people re-calculate	excel, calculater	Technical Division	Annually

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use / way of measurement	QA/Qcmeasure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	PE y, comp = Qy * EF composting * GWP_CH4											
Annually	Q_y	Quantity of raw waste treated in the year y	t	Sum of inflow MSW weighed by the truck scale	Entrance of the facility	Paper and electronic data	The weight difference before and after unloading MSW is measured at the truck scale which will be located at the entrance of the facility. The data will be also noted in paper (Date, car number, in coming time and weight, out going time and weight).	Truck scale	truck scale manufacturer	Periodical calibration	Truck management Division	Weekly
Annually	$EF_{composting}$	Methane emission factor of composting waste taken at 4 kg methane / ton wet waste	tCH4/ton wet	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*GWP_CH4*	Global Warming Potential (GWP) of methane valid for the relevant commitment period, taken at 21 for the first commitment period of Kyoto Protocol	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use / way of measurement	QA/Qcmeasure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	PE y, runoff = Q y, ww, runoff * COD y, ww, runoff * B o, ww * MCF ww, trteatment * UF b * GWP_CH4											
once in a week	$Q_{y,ww,runoff}$	Volume of runoff water in year y	m3	on-site measurement by waste water pit	Technical Division	Paper and electronic data	Check the amount of wastewater accumulated in waste water pit by level.	Wastewater pit	Technical Division	Periodically confirm the leak	Technical Division	Monthly
once in 2weeks	$COD_{y,ww,runoff}$	Chemical oxygen demand of runoff water leaving the composting facility in year y	t/m3	on-site measurement by simple COD measure	Technical Division	Paper and electronic data	Recorfing the value indicated in the simple COD measure	simple COD measure	manufacturer of COD measure	Periodical calibration	Technical Division	Monthly
Annually	$B_{o,ww}$	Methane producing capacity of waste water taken at IPCC default value of 0.25kg/kgCOD	kgCH4/kg COD	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	$MCF_{ww,treatment}$	Methane correction factor for waste water treatment plant	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	UF_b	Model correction factor to account for uncertainties default of 1.12	-	confirmation of methodology (AMS.III.F)	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*GWP_CH4*	Global Warming Potential (GWP) of methane valid for the relevant commitment period, taken at 21 for the first commitment period of Kyoto Protocol	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually

Chart Annex 4.1-3 Monitoring items and implementation structure (project emissions)

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use way of measurement	QA/Qcmeasure What	QA/QC procedure who	 How	person in charge	manager frequency
	$PE_{y,landfill} = \varphi \cdot (1-f) \cdot GWPCH4 \cdot (1-OX) \cdot 16/12 \cdot F \cdot DOC f \cdot MCF \cdot \Sigma\Sigma_j W_{j,x} \cdot DOC_j \cdot e^{-kj} \cdot (y-x) \cdot (1-e^{-kj})$											
Annually	φ	Model correction factor to account for model uncertainties (0.9)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value	baseline scenario	Technical Division	confirm weather or not any change has been made (see monitoring items of additionality)	Technical Division	Annually
Annually	$GWPCH4$	Global Warming Potential (GWP) of methane, valid for the relevant commitment period(21)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	OX	Oxidation factor (reflecting the amount of methane from SWDSthat is oxidised in the soil or other material covering the waste)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	F	Fraction of methane in the SWDS gas (volume fraction) (0.5)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	$DOC f$	Fraction of degradable organic carbon (DOC) that can decompose(0.5)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	MCF	Methane correction factor	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
once in 3months	$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x	t	(Composition analysis by weight) * (Q y)	Technical Division	Paper and electronic data	Annual average of composition of each organic fractions in mixed waste analyzed every 3 months multiplied by waste volume of 3 months.	Truck scale	truck scale manufacturer	Periodical calibration	Technical Division	Annually
Annually	DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	kj	Decay rate for the waste type j	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
once in 3months	j	Waste type catetgory (index)	-	Composition analysis by weight	Technical Division	Paper and electronic data	Composition analysis by weight				Technical Division	Annually
Annually	x	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)	-	-								
Annually	y	Year for which methane emissions are calculated	-	-								

Chart Annex 4.2 Monitoring items and implementation structure （baseline emissions）

frequency of	monitoring items				monitoring location		monitoring method				responsibility personnel	
							how to use	QA/QC measure	QA/QC procedure		person in charge	manager
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	way of measurement	What	who	How		frequency
BEy = BECH4,SWDS,Y-(MDy,reg*GWP_CH4)+(MEPy,ww*GWP_CH4)+BECH4,manure,y												
	BECH4,SWDS,Y	yearly methane generation potential of the solid waste composted or anaerobically digested by the project activity during the years "x" from the biginning 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(tCO2e)"	t	see items below								
	MDy,reg	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne)	t	There is no regulation on this matter in Viet Nam, and methane gas will not be recovered or incinerated, thus the value of this parameter is 0 in the baseline scenario.								
	MEPy ww	Methane emission potential in the year y of the wastewater co-composted. The value of this term is zero if co-composting of wastewater is not included in the project activity (tonne)	t	The value is 0 because runoff waste water will not be co-composted.								
	BE CH4, manure, y	Where applicable, baseline emissions from manure composted by the project activities, as per the procedures of AMS-III.D		The value is 0 because this project will not treat manure.								
	BECH4,SWDS,Y=φ・(1-f)・GWPCH4・(1-OX)・16/12・F・DOCf・MCF・ΣΣjWj,x・DOCj・e-kj・(y-x)・(1-e-kj)											
Annually	*φ*	Model correction factor to account for model uncertainties (0.9)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*f*	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value	baseline scenario	Technical Division	confirm weather or not any change has been made（see monitoring items of additionality）	Technical Division	Annually
Annually	*GWPCH4*	Global Warming Potential (GWP) of methane, valid for the relevant commitment period（21）	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*OX*	Oxidation factor (reflecting the amount of methane from SWDSthat is oxidised in the soil or other material covering the waste)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*F*	Fraction of methane in the SWDS gas (volume fraction) (0.5)	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*DOC f*	Fraction of degradable organic carbon (DOC) that can decompose（0.5）	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*MCF*	Methane correction factor	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Once in 3 months	*Wj,x*	Amount of organic waste type j prevented from disposal in the SWDS in the year x	t	(Composition analysis by weight) * (Q y)	Technical Division	Paper and electronic data	Annual average of composition of each organic fractions in mixed waste analyzed every 3 months multiplied by waste volume of 3 months.	Truck scale	truck scale manufacturer	Periodical calibration	Technical Division	Annually
Annually	*DOC j*	Fraction of degradable organic carbon (by weight) in the waste type j	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Annually	*kj*	Decay rate for the waste type j	-	confirmation of IPCC default value	Technical Division	Paper and electronic data	confirmation of the value				Technical Division	Annually
Once in 3 months	*j*	Waste type catetgory (index)	-	Composition analysis by weight	Technical Division	Paper and electronic data	Composition analysis by weight				Technical Division	Annually
Annually	*x*	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)	-	–								
Annually	*y*	Year for which methane emissions are calculated	-	–								

Chart Annex 4.3 Monitoring items and implementation structure（additionality）

frequency of monitoring	monitoring items				monitoring points		way of monitoring				person who implements monitoring	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use way of measurement	QA/Qcmeasure What	QA/QC procedure who	 How	person in charge	manager frequency
Annually		Confirmation fo existence of legal documents directs to reduce GHG from MSW	-	Confirmation of legal documents	Technical Division	Paper and electronic data	research of laws and regulations at related ministries				Technical Division	Annually
every 6 months		diffusion rate of composting	-	(Number of MSW composting facility in city level) / (Number of city level local administration bodies)	Technical Division	Paper and electronic data	Update of information from Vietnam Urban Environment and Industrial Zone Assosiation(CME)				Technical Division	Annually

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