**PROGRAMME DESIGN DOCUMENT FORM FOR CDM PROGRAMMES OF ACTIVITIES (F-CDM-PoA-DD) Version 02.0**

# PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

## PART I. Programme of activities (PoA)

### SECTION A. General description of PoA
### A.1. Title of the PoA

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|---|---|
| (a) Title of the proposed PoA: | Standard Bank MSW Composting Programme |
| (b) Current version number of the PoA-DD: | 3.0 |
| (c) Date the PoA-DD was completed: | 20/12/2012 |

### A.2. Purpose and general description of the PoA

**General operating and implementing framework of the proposed PoA**

The Standard Bank MSW Composting Programme (hereafter referred to as "the PoA") aims to promote and support the improvement of waste management practice in Ghana, through the development and operation of Municipal Solid Waste (MSW) sorting and composting plants. The organic fraction of the waste will be recovered into saleable compost for agricultural, horticultural and landscaping activities.

To assist project developers to invest in and to implement MSW sorting and composting plant, Standard Bank Plc has developed the PoA under which individual projects could join as a CDM Project Activities (CPA). The PoA mainly provides a platform for overcoming institutional, financial and structural hurdles for the development of composting projects.

Standard Bank Plc is the coordinating and managing entity (CME) for this PoA. Standard Bank Plc or any of its affiliate will act as the Programme Manager and will assess project activities before submission to the DOE for CPA inclusion.

In quality of programme manager, it will be the responsibility of the CME to:
- design the overall program,
- develop and manage an appropriate operational structure for the PoA,
- provide support and guidance to all stakeholders,
- enforce compliance of the technology and the CPA(s) of potential independent implementers with PoA requirements,
- act as a liaison with Ghana Designated National Authority, Designated Operational Entities, and the CDM Executive Board,
- be responsible for data collection, management and monitoring activities,
- monetize the carbon credits generated by the PoA,
- oversee all institutional communication regarding this PoA.

Standard Bank Plc will enter into a contractual agreement with each CPA implementer, giving Standard Bank Plc the legal rights to deal with the carbon credits that will be generated from these projects and monitor the project implementation and all necessary parameters that are required for the calculation of emission reductions from each CPA. The conditions for participation shall be in line with the eligibility criteria of the projects for inclusion in the PoA and shall be elaborated in the agreements between Standard Bank Plc and the project developers or other entities.

**Policy/measure or stated goal that the PoA seeks to promote**

The stated goal of the PoA is the improvement of waste management practice in Ghana, in order to reduce the emissions of methane resulting from the anaerobic decay of MSW in sanitary landfills.

Emissions from the waste sector constituted an average of 10% between 2000 and 2006, which is approximately 8% higher than the 1990 levels is the third largest contributor to the national emissions. The main sources of emission from this sector are from disposal of solid waste on land (particularly, waste dump site) and wastewater handling. The sector emissions were driven by the increasing per capita solid waste generation among population especially in the urban areas of Ghana.

Disposal of solid waste to land with relatively deeper depth and to sanitary landfill sites is increasingly becoming common practices in urban waste management. This provides suitable conditions for the production of methane, which is not managed in any way in Ghana (Government of Ghana, 2011).

Therefore as mean to durably improve MSW management practice in Ghana, this Programme of Activities will enable MSW operator/contractor to gain additional revenues by entering into an agreement with CME and including their facilities as CDM Project Activities under the PoA framework.

At these specific facilities, emissions from anaerobic decay will be avoided by diverting MSW organic matter from anaerobic landfills where it would have been disposed in the absence of the proposed PoA. Indeed it is estimated that Ghana generates annually more than 3 millions of tonnes of solid waste which collected partly ends up in managed anaerobic landfills and releases methane due to fermentation. (Mensah & Larbi, 2005).

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

The proposed PoA undertaken by Standard Bank Plc is a voluntary action since no laws or regulation in Ghana obligates the composting of MSW.

Historically Ghana's environmental laws have proven deficient and there is no enforced regulatory framework in the area of handling waste, hence inadequate existing infrastructure and budgets result in ever-increasing waste management issues. However Ghana's most recent National Environmental Sanitation Strategy and Action Plan sets at target of composting 50% of biodegradable organic fraction (BOF) of the municipal resource that will be source separated (Ministry of Local Government and Rural Development, 2010). Therefore this PoA by providing additional revenues to composting plant implementer should contribute to the achievement of the objectives set by the Government of Ghana.

The PoA meets the Ghana Sustainable Development requirements as published by the DNA (Ghana DNA, 2012).

| SD Indicators | Sustainable development requirements | PoA Responses |
|---|---|---|
| Social well being | The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to the people and hence leading to improvement in quality of life | CDM Project Activities included under this PoA will generate additional employment opportunities for communities throughout Ghana. Moreover by contributing to the amelioration of MSW management practice in Ghana, this PoA will serve the improvement of quality of life of the Ghanaian people. The proposed PoA will also improve the local sanitation by reducing health hazards created by the present practice of anarchic dumping of waste in open spaces, which regularly results |

| | | |
|---|---|---|
| | of, at least, the people within the community in which the project is sited. | in blocked drainage channels causing fatal flooding in the city. Moreover, many authors attribute the prevalence of parasites, tetanus, malaria, hookworm, cholera, and diarrhoea to unsanitary conditions caused by waste being simply strewn around. |
| Economic well being | The CDM project activity should bring in additional investment that addresses the economic needs of the people. | This Programme of Activities will enable composting plants to be developed throughout Ghana and contributes to additional investment in peripheral and rural areas. |
| Environmental well being | This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general; | With a rate of urbanization of 3.4% per year (CIA, 2012) and a comparable growth for waste, the waste management system implemented in major cities has become obsolete, creating environmental concerns for occupants of a number of local neighbourhoods such as the pollution of nearby streams and under-ground aquifers, let alone the odour inconveniences.<br><br>Thus the proposed PoA is highly desirable for the country: in addition to reducing GHG emissions, diversion of organic waste for compost production will help to increase the lifetime of existing landfills, which have been subject to very short operational periods in recent years. Besides, the compost will be applied as soil conditioner, hence replace the use of chemical fertilizers and enhance the growth of greenery in both agricultural and horticultural activities. |
| Technolo-gical well being | The CDM project activity should lead to development, deployment, diffusion and/or transfer of environmentally safe and sound technologies that are comparable to best practices in order to assist in developing the technological base of the country. | The robust and expensive equipment involved in composting plants will be built likely out of Ghana because they are unavailable at local expertise and experience level. This proposed PoA will contribute to the technology transfer. |

**A.3. CMEs and participants of PoA**

**a) Coordinating or managing entity of the PoA as the entity which communicates with the Board**

The entity that manages and oversees communication with the Designated Operational Entity, the UNFCCC secretariat and the Executive Board is Standard Bank Plc.

Standard Bank Plc is a bank authorised and regulated by United Kingdom Financial Services Authority providing a range of banking and related financial services. It is a member of the London Stock Exchange, the London Bullion Market Association, the London Metal Exchange, the London Platinum and Palladium Market and is Chairman of the London Platinum and Palladium Fixing and has two seats on the New York Mercantile Exchange (COMEX Division). The franchise of Standard Bank Plc and its subsidiaries focuses on emerging markets primarily debt, interest rate, equity and currency products and natural resources.

**b) Project participants being registered in relation to the PoA**

Standard Bank Plc is the only project participant being registered in relation to the PoA.

**A.4. Party(ies)**

| Name of Party involved (host) indicates a host Party | Private and/or public entity(ies) project participants(as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Republic of Ghana (host) | Standard Bank Plc (Private entity) | No |

**A.5. Physical/ Geographical boundary of the PoA**

The boundary of a PoA is defined as the geographical area within which all the CPAs included in the PoA will be implemented. The geographical boundary of the PoA will cover the 10 regions of Ghana.

**Figure 1**: *Global location of the PoA (source: United Nations Cartographic Section)*

The boundary of the programme may be amended post-registration to include additional other countries. As per EB60/Annex 26, in expanding the PoA to other countries the following three conditions will be met:

- The existing registered PoA design document (POA-DD) will be revised to reflect the changes, in particular, the eligibility criteria for inclusion of CPAs;
- A designated operation entity (DOE) will confirm that the baseline established in the POA- DD is applicable to the extended programme boundary; and
- The DNA of the new Host Party issues a letter of approval for the programme and a letter of authorization for the co-ordinating and managing entity.

**A.6. Technologies/measures**

The technology or measures to be employed by each CPA fall into Sectoral Scope 13: "Waste handling and disposal"as it concerns the implementation of state-of-the-art solid waste composting plants for the fresh waste that in a given year would have otherwise been disposed of in a landfill.

A typical CPA will consist in processing Municipal Solid Waste collected from urban or rural areas and composting its organic fraction into useful compost (and optionally, recovery of the plastics and metals for recycling and proper disposal of the remaining non-organic waste in side-landfills).

Composting is defined by human intervention into the natural process of decomposition. With a combination of proper environmental conditions and adequate time, microorganisms turn raw putrescible organic matter into a stabilized product. Through composting, readily available nutrient and energy sources are transformed into carbon dioxide, water, and a complex form of organic matter compost. Process management can be optimized for a number of criteria, including the rate of decomposition (to reduce residence time in reactors and thus minimize facility size requirements), pathogen control, and odor management. The key parameters are the available carbon to nitrogen (C:N) ratio, moisture, oxygen, and temperature.

Most composting systems reconcile these trade-offs between reaction rate, pathogen reduction, and odor generation by an attempt to control temperatures to a narrow range near 55 to 60°C.

A variety of technologies have been adapted for use with MSW, which can be roughly divided into four groups: windrows, static piles, and vertical and horizontal reactors. Each of these composting materials handling technologies (described below (Richard, 1993)) are eligible under this PoA.

**<u>Windrows</u>**

Windrows are defined as regularly turned elongated piles, shaped like a haystack in cross section and up to a hundred meters (yards) or more in length. Process control is normally through pile management as described above, although forced aeration can also be used.

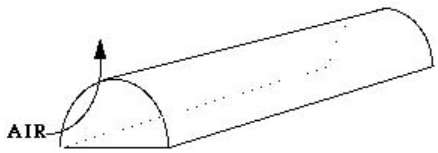


**Figure 2**: *Windrow.*

Windrow composting usually relies on natural convection and diffusion for oxygen supply. Pile size and turning frequency are used to balance heat loss in managing temperature control (Figure 3).

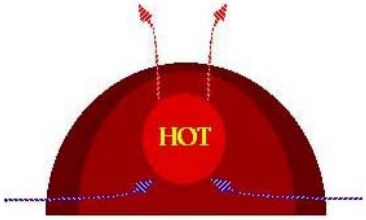


**Figure 3***: Natural Air Circulation in a Compost Windrow.*

The effectiveness and penetration of oxygen supply in a windrow system varies with the rate of microbial activity and porosity of the pile. Anaerobic zones can be minimized by decreasing pile size or increasing its porosity, although in practice fully aerobic conditions are difficult to achieve in windrows during the active composting phase. Pile size may be increased in extremely cold weather or when decomposition slows as compost matures. Mechanically turning the pile releases heat and moisture and can temporarily increase the porosity. Agitation can also help break up clumps of material and thereby increase oxygen transfer. Management of convection and diffusion through pile size and turning frequency can be a cost-effective strategy, although decomposition is generally not as rapid as with forced aeration systems.

**Static piles**

Static piles can be shaped much like windrows or in an elongated pile or bed (Figure 4). The essential difference is in the name; static piles are not mechanically agitated. Once constructed by conveyor, loader or truck, the piles remain in place until the decomposition slows. The lack of agitation requires the maintenance of adequate porosity over an extended period of time.

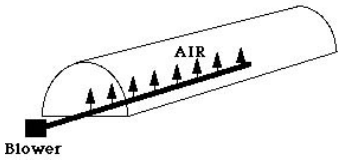


**Figure 4***: Aerated static pile.*

**Vertical reactors**

Vertical composting reactors (Figure 5) are generally over 4 meters (yards) high, and can be housed in silos or other large structures. Organic material is typically fed into the reactor at the top through a distribution mechanism, and flows by gravity to an unloading mechanism at the bottom. Process control is usually by pressure-induced aeration, where the airflow is opposite to the downward materials flow.

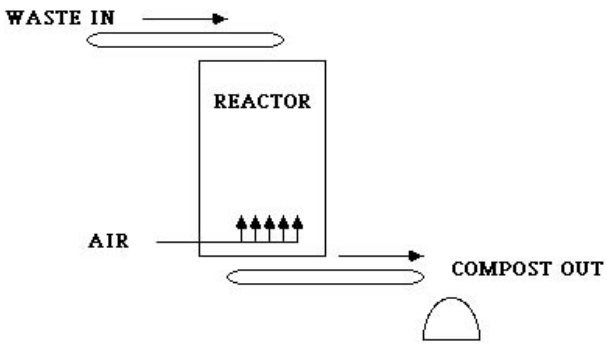


**Figure 5***: Vertical Reactor.*

**Horizontal reactors**

Horizontal reactors avoid the high temperature, oxygen, and moisture gradients of vertical reactors by maintaining a short airflow pathway (Figure 6). They come in a wide range of configurations, including static and agitated, pressure and/or vacuum-induced aeration.

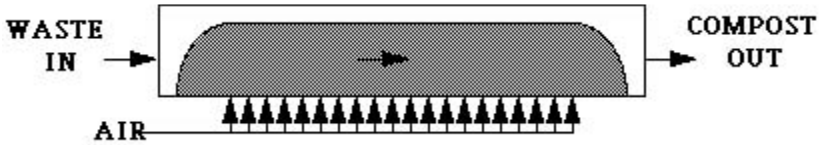


**Figure 6:** *Horizontal Bed Reactor.*

Horizontal and vertical reactors are commonly referred to as in-vessel systems as differentiated from open systems such as windrows and static piles.

**Process Control Options**

The materials handling systems described above must be combined with a process control strategy to produce a workable composting system. Table 1 summarizes the common MSW composting technologies according to these categories.

**Table 1:** *Process control strategy to produce a workable composting system.*

| Materials handling | Example of Process Control Options |
|---|---|
| *Windrow* | Pile size, turning, and oxygen diffusion<br>Forced aeration, with $O_2$ or temperature feedback |
| *Static pile* | Forced aeration, with $O_2$ or temperature feedback |
| *Vertical reactor* | Forced aeration, with $O_2$ or temperature feedback |
| *Horizontal reactor* | Forced aeration, with $O_2$ or temperature feedback<br>Size, turning, and oxygen diffusion |

While vertical or horizontal reactors and rotating drums can play an important role in MSW composting, they are eligible under this PoA only if they are followed by other biological processing (which may include in-vessel, static pile, and/or windrow systems) or if the project participants can demonstrate that the residence time in the reactors is adequate for the production of mature compost.

Each CPA will have state-of-the-art monitoring equipment while the staff involved will be trained to properly operate, maintain and calibrate the monitoring system. Detailed description of the monitoring system is provided in each CPA-DD.

**A.7. Public funding of PoA**

The PoA does not expect to involve any public funding according to the OECD definitions for Official Development Assistance (ODA).

**SECTION B. Demonstration of additionality and development of eligibility criteria**

**B.1. Demonstration of additionality for PoA**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (EB 70, Annex5, Version 02.1):

- *Additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur.*
- Additionality will be demonstrated at CPA level, following the Tool for the demonstration and assessment of additionality (Annex 20, Version 06.1.0, EB69) approach to demonstrate and assess additionality as follows:
    - Identification of alternatives to the project activity;
    - Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible;
    - Barriers analysis; and
    - Common practice analysis.

  ➔ Depending on project-specific circumstances, identification of alternatives is to be performed at CPA level as well as investment or barriers analysis and common practice analysis if applicable. However at PoA level, a selection of relevant barriers faced is outlined at the end of this section.
- *PoAs that consist of one or more microscale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the "Guidelines for demonstrating additionality of microscale project activities".*

  As per paragraph 2 of "*Guidelines for demonstrating additionality of microscale project activities" (Annex 26, Version 04, EB68),* Project activities that aim to achieve emission reductions at a scale of no more than 20 $ktCO_2$ per year are additional if any one of following conditions below is satisfied:

  (a) *The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone of the host country identified by the government in accordance with the paragraph 2 (a) (i) of the guidelines;*

According to UNFCCC, Ghana is not a least developed country, but underdeveloped zones have been identified by the government of Ghana. This area includes the Northern, Upper East and Upper West Regions of Ghana, and the districts that lie to the north of Brong-Ahafo and north of Volta Regions (Government of Ghana, 2011). Indeed, there is an increasing development gap between the Northern Savannah Ecological belt and the rest of the country. By all indications the North lags behind the South and the gap seems to be increasing. On September 17th 2010, the parliament of the Republic of Ghana has established the Savannah Accelerated Development Authority (SADA) to provide a framework for the comprehensive and long-term development of the Northern Savannah Ecological Zone. According to a recent study conducting conducted by the World Bank, the poverty rate in Northern Ghana (defined as the sum of the administrative regions Northern, Upper East and Upper West Regions) which cover 40 percent of Ghana's land area was estimated to 58.3% in 2006. (World Bank, 2011).

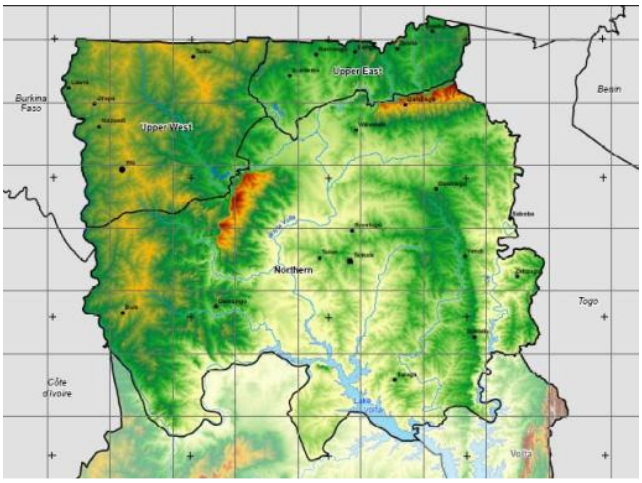


**Figure 7:** *Map of Northern Ghana*

(b) *The project activity is an emission reduction activity with both conditions below satisfied:*

- *Each of the independent subsystems/measures in the project activity achieves an estimated annual emission reduction equal to or less than 600 $tCO_2e$ per year; and*
- *End users of the subsystems or measures are households/communities/SMEs.*

- *The CME shall demonstrate that compliance with the additionality-related eligibility criteria set in the PoA design document will ensure that all the relevant additionality-related guidelines, tools or any requirements embedded in the methodologies are met.*

➔ As required in eligibility criteria (f), any compliant CPA will necessarily meet the relevant additionality-related guidelines, tools or methodological requirements, namely:

- the *Tool for the demonstration and assessment of additionality*
- the *Guidelines for demonstrating additionality of microscale project activities* (when applicable) for CPAs up to 20 $ktCO_2$ emission reductions.

***Barriers faced by the proposed PoA***

Several studies have highlighted the financial, technological and institutional barriers that face alternative waste treatment schemes in Ghana. (Hofny-Collins, 2006) (Öberg, 2011).

Investment barrier

As highlighted by the 18th Session of the United Nations Commission on sustainable development, poor national economic policies and poverty of the rural communities make financial considerations one of the most obvious constraints to developing appropriate waste management systems in Ghana. As the urban areas grow, they exhaust the capacity of existing traditional disposal sites so that waste must be transported greater distances to sites outside the city. Households often complain of unsatisfactory or unreliable waste management services. As a result they often resist paying the charges levied and instead prefer to dispose from their waste by informal dumping. Thus the collection agencies have then less funding for their services (United Nations Commission on Sustainable Development, 2010).

Indeed, composting plants require an intensive capital investment and a long-term financing, proportional to the risks associated with this kind of investment. Specific technical difficulties for construction and operation at the site of the project, and lack of significant experience and feedback in composting programs made it difficult to obtain local financing. These barriers are described by the GOAN[1] in a fact-sheet of November 2005 and their coordinator has confirmed them as still accurate (Mensah & Larbi, 2005).

Technological barrier

The implementation of compost activities will be likely to face a series of technology barriers, as the pioneer character of Composting Plants requires state-of-the-art technologies and capabilities to be imported from overseas (unavailability of the technology in the region, and lack of skilled and/or properly trained labour to operate and maintain the technology).

[1]The Ghana Organic Agriculture Network (GOAN) promotes compost as an option for solid waste management. […] Though a growing horticulture industry has generated some demand for compost the operations of GOAN confirm the long held view that there is low demand for compost and financial sustainability for composting is difficult to attain. The problems with financial sustainability are attributed to: (i) lack of awareness about the soil enriching benefits of compost which means there is little demand for compost and (ii) lack of support from the key agencies who could do most to promote it i.e. the Ministry of Local Government (who are responsible for waste management) and the Ministry of Food and Agriculture (MOFA).

Former public pilot project[2], notwithstanding their modest installed capacity, were abandoned due to constant mechanical failure, equipment breakdown and lack of operational maintenance and as well as the production of low quality compost to market for revenue generation (Oteng-Ababio, 2010).

Barrier due to prevailing practice

Landfill is the prevailing practice of waste treatment in Ghana (United Nations Commission on Sustainable Development, 2010). Accra for instance, with an estimated population of 3 million of people generates about 1,500 tonnes of solid waste per day of which only 55% is collected and disposed off (Ministry of Local Government & Rural Development - EPA, May 2002).

Several alternatives waste management plants have been developed in the country, notably:
- A large scale composting plant in Teshie/Nunga in the Eastern suburbs of Accra
- A small scale NGO initiated waste collection and composting plant in James Town, Central Accra (Hofny-Collins, 2006)
- A pilot co-composting plant of faecal sludge and organic waste solid waste in Kumasi (Sustainable Sanitation Alliance c/o GIZ GmbH, 2011)
- Several small-scale artisanal incinerators which serve as disposal facilities for biological waste associated with medical care (Thompson, 2010).

However most of these high-tech capital intensive plants have been either closed or scaled down and now operate far below their planned capacity. Indeed the failure of transfer of technology and the important level of operation and management expenses coupled with little available resources outside of research and NGO grants doomed these endeavors from the beginning. Besides large scale composting was not seen as priority of Ghana's government and specific communities' local governments until very recently (Sustainable Sanitation Alliance c/o GIZ GmbH, 2011).

Therefore neither at the time of the PoA-DD publication by the DOE for public comments (April 2012) nor at the start date of the first CPA (equipment purchase order: date of the placement of equipment and structure order on 29/06/2012) there was a large scale composting plant in commercial operation in Ghana[3]. There is one project titled "ZOOMLION GHANA LTD Composting of Municipal Solid Waste in Accra area" that is currently implemented in Adjen Kotoku in the Greater Accra Region under the CDM scheme (Government of Ghana, 2012). This sorting and composting plant is expected to be commissioned on October 15th 2012 at the earliest[4]. It will treat annually around 200,000 tonnes of MSW (out of 3 million of MSW produced in Ghana).

➔ Given all the barriers outlined above it is possible to state that in the absence of CDM, none of the implemented CPAs would occur. Therefore the proposed Programme of Activities is additional.

***Assessment of applicable laws, regulations and policy***

| Laws, policies and incentives applicable to MSW | Relevant extracts | Interpretation with regards to the |
|---|---|---|

[2] Teshie Nungua: the only official waste treatment facility, the Teshie Compost Plant, was established in 1979. However, due to lack of electricity, water and other technical problems, it has operated below 10% of its annual installed capacity of 3,800 tonnes and has now become a dumpsite (Oteng-Ababio, 2010).

[3] To the contrary, AMA's Compost plant at Teshie Nungua attempted a method which was inefficient in composting primarily because it was slow and used obsolete equipment, meaning uncertain quality and availability for consumers. (Tsiboe & Marbell, 2004) Also, in this composting method high enough temperatures were not achieved to kill harmful bacteria and seeds that may sprout into weeds. Finally, the AMA composting plant required a lot of ground space which restricts the operation and raised odour problems due to the nearness of local residents.

[4] A statement from Mr. Owurra K. SARFO, managing Director of ACARP (Accra Compost and Recycling Plant Ltd) dated 11th September 2012 has been provided to the DOE.

| management<br>and to composting if any | | proposed PoA |
|---|---|---|
| **Environmental Sanitation Policy**,<br>promulgated in 2010 by the Ministry of Local Government & Rural Development (Ministry of Local Government and Rural Development, 2010). | "Composting plants: installation of windrow composting plants as part of MRFs is to reduce the transport cost of input-material to stand-alone plants. The target is to compost 50% of biodegradable organic fraction (BOF) of the proportion of municipal refuse that will be source separated (i.e. 15% by 2015)."<br>(§608 of ESP and §610 of NESSAP). | The proposed Programme of Activities will contribute to the achievement of the stated goal. |
| **National Environmental Sanitation Strategy and Action Plan**,<br>elaborated by the Ministry of Local Government and Rural Development and published in September 2010 (Ministry of Local Government and Rural Development, 2010). | | |
| **Landfill Guidelines**,<br>promulgated in May 2002 by the Ministry of Local Government & Rural Development and the Environmental Protection Agency. (Ministry of Local Government & Rural Development - EPA, May 2002). | "Annex D: Glossary of Technical Terms"<br>This is the only section where composting is explicitly mentioned, only in brackets "(including composting)" as part of a list of examples of Recovery and Recycling techniques.<br><br>"3.2.2 Gas<br>The decomposition of organic waste produces a mixture of methane and carbon dioxide known as landfill gas. This can be dangerous if allowed to build up in the body of the waste, as it may cause explosions in the landfill. It can also seep out through subterranean fissures and collect in nearby buildings, again causing a risk of explosion.<br>These risks may be reduced either by reducing landfill gas formation by promoting aerobic processes or by containing the gas within the boundaries of the landfill and venting it to atmosphere or collecting and burning it (with the possibility of energy generation)." | Composting of MSW is barely mentioned in the most recent piece of legislation about waste in Ghana.<br><br>Combustion of landfill gas is advised by the guidelines yet by no mean made mandatory. |

As described in I.A.2, methane avoidance through composting in Ghana landfills is not mandatory, thus the proposed PoA is a voluntary coordinated action from the CME to promote the implementation of composting of MSW in Ghana.

### B.2. Eligibility criteria for inclusion of a CPA in the PoA

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (EB 70, Annex 5, Version 02.1).
The eligibility criteria for inclusion of a CPA in the PoA are specified in Table 2.

**Table 2:** *Eligibility criteria of the proposed PoA*

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **Standard Ref.** | **Description** |
| Boundary and location of the CPA | a | The geographical boundaries of the CPA are within Ghana, in consistence with the geographical boundary set in the PoA. |
| No double counting | b.1 | The CPA is not already included in another PoA or developed as a stand-alone CDM project. |
| | b.2 | There is a unique identification of the CPA composting plant. |
| Specification of technology | c.1 | The CPA-DD describes the waste management and methane avoidance technologies in the CPA including their performance and technical specifications. |
| | c.2 | All waste management and methane avoidance technologies within the CPA (will) comply with national and/or international equipment and services certificates. |
| CPA start date | d | The starting date of the CPA is verifiable through documentary evidence and is or will not be prior to the start of PoA validation. |
| Compliance and application of the methodology AM0025 | e.1 | The CPA consists in the construction and operation of a composting plant (no other waste treatment option is expected). |
| | e.2 | The composting plant will treat fresh waste that in a given year would have otherwise been disposed of in a landfill. |
| | e.3 | The produced compost is either used as soil conditioner or disposed of in landfills. |
| | e.4 | The proportions and characteristics of different types of organic waste processed in the CPA can be determined. |
| | e.5 | Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill despite environmental regulation that mandates the treatment of the waste. |
| | e.6 | The compliance rate of the environmental regulations during (part of) the crediting period is below 50%. |
| | e.7 | The CPA does not involve thermal treatment process of neither industrial nor hospital waste. |
| Additionality | f | The CPA is additional, in compliance with the relevant requirements pertaining to the demonstration of additionality. |
| Local stakeholder consultation | g.1 | A local stakeholder consultation has been conducted prior to the inclusion of the CPA. |
| Environmental impact analysis | g.2 | If applicable, an environmental impact analysis has been conducted prior to the inclusion of the CPA. |
| Non-diversion of ODA in case of Public funding | h | Confirmation that the CPA does not involve any public funding from Annex I Parties or that in case public funding is used, it does not result in diversion of Official Development Assistance (ODA). |
| Target Group / distribution mechanisms | i | N/A |
| Sampling requirements | j | The sampling method for monitoring the parameters $z_x$, $ECC_{CH4,c,}$, $ECC_{N2O,c}$ and [$p_{n,j,x}$ *or* $p_{n,j,i}$] if applied in the CPA (e.g. in the monitoring plan) shall follow the latest the requirement outlined in the methodology AM0025 version 13.0.0 and referred tools. |
| Thresholds criteria | k | As per requirements pertaining to the demonstration of additionality as specified in Section B.1. Part I., some CPA may fall under the microscale threshold criteria as following:<br>• Emission reductions generated by CPA are below |

| | | |
|---|---|---|
| | | or equal to 20 $ktCO_2$<br>AND<br>• The proposed CPA is undertaken in a special underdeveloped zone (SUZ) identified by the Government in official notifications for development, assistance including for planning, management, and investment satisfying any one of the following conditions using most recent available data:<br>o The proportion of population with income less than USD 2 per day (PPP)[5] in the region is greater than 50%;<br>o The GNI per capita in the country is less than USD 3000[6] and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures[7].<br><br>If applicable, CPA implementer has demonstrated that the CPA-DD remains within this threshold throughout the corresponding crediting period. |
| Debundling check | 1 | If the proposed CPA is microscale project activities, CPA implementer has demonstrated that the CPA is not a debundled component of a small scale activity as described in the "Guidelines on assessment of debundling for SSC project activities". |
| **Supplemental eligibility criteria required by the CME** | | |
| Awareness and agreement of those operating a CPA on PoA subscription | 1 | The CPA is either implemented by the Coordinating/managing entity or by another entity that has signed a binding agreement with the CME that ensures that they are aware and agree that their activity is subject to a PoA. |
| Approval of CPA by CME | 2 | The CPA-DD has been reviewed by the CME and submitted to a DOE for inclusion into the PoA. |
| Crediting period | 3 | The crediting period of the CPA shall not exceed the length of the PoA (i.e. 28 years) regardless of the time of inclusion of CPA in the PoA. |
| CER ownership | 4 | The CPA is either implemented by the Coordinating/managing entity or by another entity that has signed a binding agreement with the CME which ensures that they are aware and agree that their carbon rights have to be relinquished to the CME. |

Prior to the start of the inclusion process for a new CPA under the PoA, the proposed CPA-DD will be reviewed by an independent compliance team appointed by CME. This compliance team, which shall be composed of personnel with adequate competencies, shall check if the CPA-DD is drafted following the lines of the Generic CPA and if the proposed CPA does comply with the eligibility criteria stated above.

[5] Purchasing power parity
[6] PPP or the World Bank atlas method or another comparable method
[7] Information on per capita income or other economic indicators used for the ranking purposes shall be provided in USD

The compliance team shall also check that the proposed CPA is neither registered or being registered under another PoA, nor registered or being registered as a standalone CDM Project Activity.

To be eligible, the CPA shall comply with all eligibility criteria provided above in table 2.

For each proposed CPA the findings of the compliance team will be summarized in a short report and submitted to CME management for final approval. In case the conclusion of the compliance team are not positive, the CPA implementer will have to carry out the requested changes in its proposed CPA before submitting again the project document for inclusion.

A CPA Inclusion Procedure that encompasses all provisions and procedures related to pre-inclusion due diligence shall be used as the foundation of compliance team activities.

**B.3. Application of methodologies**

As detailed in I.A.6 above, the proposed PoA is an initiative to implement state-of-the-art comprehensive solid waste and composting plants from a baseline of deficient waste management practices in the major cities of Ghana.

Accordingly, the chosen methodology is approved baseline and monitoring methodology AM0025 - Avoided emissions from organic waste through alternative waste treatment processes (Version 13.0.0).
Its appropriateness to the CPAs to be included in the PoA is analyzed in II.B below.

No CPA sampling plan is applicable since the CPAs to be included in the PoA are expected to be large industrial facilities uniquely designed and operated, thus individually monitored.

**SECTION C. Management system**

(a) **Definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies**

Standard Bank Plc is the programme manager, the Coordinating and Managing Entity (CME). As stated in paragraph A.2., it is responsible for:

- recruiting CPA implementers;
- ensuring that the proposed CPA is in compliance with PoA eligibility criteria;
- write the present PoA-DD and CPA-DD through service agreements with CDM consultants;
- collecting documents and supporting evidence required for PoA-DD and CPA-DD validation;
- communicating with the Ghana DNA and the CDM Executive Board;
- hiring DOE to conduct validation and verification;
- finding CERs buyers and distributing CERs revenues to CPA implementers;
- implementing a monitoring database;
- training of personnel;
- collecting periodically monitoring data;
- preparing the monitoring reports.

Note: The CPAs will be implemented by project developers, building on the Standard Bank Plc's relationship with individual project developers. Standard Bank Plc will enter into a contractual agreement with each CPA implementer. The contract would give Standard Bank Plc the legal rights to deal with the carbon credits that will be generated from these projects and monitor the project implementation and all necessary parameters that are required for the calculation of emission reductions from each CPA. The conditions for participation shall be in line with the eligibility criteria of the projects for inclusion in the PoA and shall be elaborated in the agreements between Standard Bank Plc and the project developers.

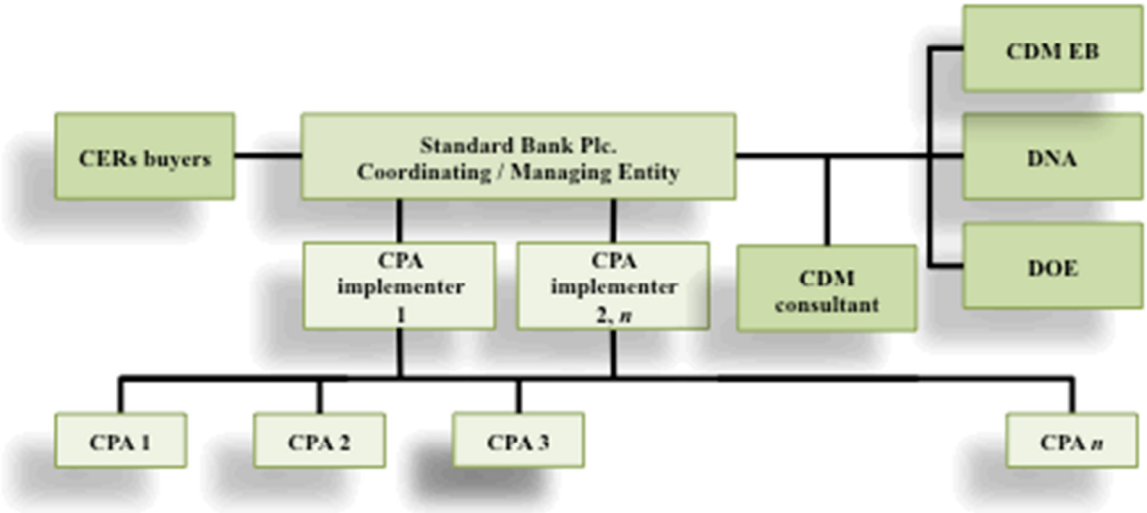


**Figure 8:** *Operational and management diagram.*

CPA implementer is responsible for:

- Construction, installation, operation and maintenance of composting plant(s);
- Data checking and monitoring;
- Facilitate the CME and DOE required documents and access to sites as needed.

In addition, the CME shall set up the following operational elements to ensure management and oversight of the proposed PoA.

(b) **Records of arrangements for training and capacity development for personnel**

In order to ensure that the competencies of the members of the compliance team remain current, training and capacity development records in which all instruction sessions and workshops related to CDM procedures and project management shall be established. The training and capacity development records shall be part of the CPA Inclusion Procedure.

(c) **Procedures for technical review of inclusion of CPAs**

All new CPAs proposed for inclusion in the PoA and monitoring reports proposed for verification will be reviewed by the CME using a technically competent, independent reviewer to ensure that the new CPA or monitoring report fully complies with the registered design requirements and the CDM. This process can also be used by the intermediaries or CPA owners on new CPAs and monitoring reports before they are sent to the CME for approval. The review can be completed by either a fully competent individual reviewer or by a team of reviewers formed to include all necessary competencies.

- **<u>The following Technical Review procedure is observed for CPA inclusion:</u>**

| |
|---|
| 1. Verify that all eligibility criteria for inclusion in the PoA are met. |
| 2. Check the procedure to avoid double counting. |
| 3. Check if EIA has been undertaken (if required). |
| 4. Check if stakeholder consultation has been undertaken (if required). |
| 5. Check if all supporting documentation quoted in PoA-DD are in accordance with CPA details. |
| 6. Complete all the sections of the CPA-DD. |
| 7. Reviewer shall check emission reduction calculation. |
| 8. The person responsible shall seek CME and PoA manager approval for the draft CPA-DD. |
| 9. Delivery of approval and contact agreement for CPA inclusion. |
| 10. A DOE is contracted. |
| 11. CPA-DD is submitted to the DOE. |
| 12. CARs & CLRs closed. |
| 13. The inclusion of the CPA in the PoA is confirmed. |

(d) **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 database described above will be used to perform a double accounting check. Every new CPA will be compared to the already existing database and the list of project activities that are under validation or registered at the UNFCCC.

Moreover, as shown in Table below, the CPA implementers will be made aware of the double accounting principle and will guarantee to the CME that the proposed CPA is not registered under the Clean Development Mechanism of the UNFCCC or any voluntary scheme. Should such a case occur, the CME will not proceed with inclusion of the corresponding CPA in the proposed PoA.

**Table 3:** *Procedure to avoid double-counting*

| Criteria | ? | Source | Result |
|---|---|---|---|
| 1. No similar CPA already submitted as CPA under another PoA or CDM project.<br>a. Research on UNFCCC's database;<br>b. Research with the Ghana DNA. | True/False | a. Programme of Activities and CDM projects registries (UNFCCC);<br>b. DNA projects/PoA portfolio. | If "False", the CPA is not eligible to the PoA. |
| 2. The CPA implementer's participation to the PoA is voluntary and the proposed CPA is not registered or under validation under the Clean Development Mechanism of the UNFCCC or any voluntary scheme as a single project activity or as a component activity under another program. | True/False | Confirmation by CME review (project assessment and/or interviews). | If "False", the CPA is not eligible to the PoA. |
| 3. Unique identification number based on unique geographic coordinates for each CPA under the PoA. | True/False | Confirmation by CME review (project assessment). | |

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

In order to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA, a contractual agreement shall be established between the CPA implementer and the CME, confirming the following provisions:

- The CPA implementer agrees and confirms his voluntary participation to the present PoA;
- The CPA implementer cedes its rights to claim and own emission reductions under the CleanDevelopment Mechanism of the UNFCCC to Standard Bank Plc.

(e) **Records and documentation control process for each CPA under the PoA**

The CME will establish and maintain a database for each CPA. The CME will record CPA information detail delivered by CPA implementer, as follows:

- Name of the CPA;
- Name of CPA implementer;
- Contact details of CPA implementer;
- Capacity of the composting plant and other relevant technical specifications of each CPA;
- GPS coordinates of each CPA;
- Verification status (number of verification and associated monitoring period);
- Emission reductions monitored and issued each monitoring period.

The CME will be responsible for the management of records and data associated with each CPA. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period.The database will be updated using the data supplied by the CPA implementer. It will form the basis for the verification of CPA and be available for inspection by the DOE at any point in time.

Four categories of documents with specific procedures for collection, approval processes, document identification, storage, are:

1. documents which directly support implementation of the system;
2. documents from external parties that are required to develop and manage the inclusion of CPAs;
3. documents from external parties to be collected during, and/or immediately post-, project implementation; and
4. Documents from external parties to be collected on an ongoing basis for the crediting period of the CPA.

Documents are controlled by making sure they are clearly identified, complete and up to date, properly approved, and that they are available where they need to be used.

Records are the evidence of what was done to operate the PoA in accordance with the requirements of the registered project design and the CDM requirements. A document master list will be constantly filled in order to centralize all records of documents regarding the PoA.

Conformity of proposed CPA-DD with Generic CPA-DD will be checked by the compliance team. All evidences related to baseline identification, additionality and stakeholder consultation (if applicable) will be collected from the CPA implementer in electronic format and checked during technical review of the proposed CPA.

These documents, evidences and all other records related to documentation control process shall be kept for the duration of the PoA under the supervision and responsibility of the compliance supervisor. Those documents will be made available for the DOE during the formal inclusion of the CPA into the PoA or afterwards if required.

(f) **Measures for continuous improvements of the PoA management**

Tracking what happens in the PoA is critical to being able to effectively improve and provide consistent performance. This section describes a general commitment or guidance to continual improvement.

- **Internal audit**

The internal audit processes are used to measure and improve the performance of management and personnel. Internal audits are a structured review by observation and interview of a critical activity. The internal audit process is managed by planning the audit of critical activities

- at a frequency based on risk (the higher the potential for error and the higher the impact on the integrity of the PoA, the more frequent the audit);
- using competent auditors independent of the area being audited;
- by providing timely and comprehensive audit reports; and
  by ensuring that any corrective action that result from the audit is effective and actually implemented.

**Measures for continuous improvement**

- Periodic meetings will be held under the supervision of the compliance supervisor in which will be discussed:A review of the previous period and the latest developments,
- Recurring issues related to the inclusion process,
- Comments provided by the members of the compliance team and CME,
- Feedback from the CPA implementers,
- Potential improvements to be implemented for the next period.

Furthermore in case a CPA is internally approved for inclusion and yet finds itself rejected by DOE, an extraordinary meeting shall be convened by the compliance supervisor in which the reasons of such outcome shall be analysed and provisions for improvements of the technical review process shall be proposed to the CME.

**SECTION D. Duration of PoA**
**D.1. Start date of PoA**

The PoA start date is set at 25/04/2012, the date of publication of the PoA-DD and first CPA-DD in GSC.

**D.2. Length of the PoA**

The expected length of the PoA is 28 years.

**SECTION E. Environmental impacts**
**E.1. Level at which environmental analysis is undertaken**

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at CPA level √

According to the Environmental Assessment Regulations 1999, an Environmental Impact Assessment (EIA) is mandatory for the construction of a composting plant for Municipal Solid Waste treatment and disposal. Environmental Analysis will thus be performed at CPA level given the singularity of each CPA to be included in the PoA and its presumably unique environmental impacts related to specific project context.

**E.2. Analysis of the environmental impacts**

*Legal, Regulatory and Administrative Requirements in Ghana*

The key relevant laws and regulatory requirements governing the construction, operation and decommissioning of the Waste Recycling Facility include the following:

- Environmental Assessment Regulations, L.I. 1652 (1999);
- Environmental Assessment Regulation (Amendment) L.I. 1703 (2002);
- Factories, Offices and Shops Act of 1970 (Act 328).

Environmental Assessment Regulations, L.I. 1652 (1999) and L.I. 1703 (2002) (Environmental Assessment Regulations, L.I. 1652 , 1999) (Environmental Assessment Regulation (Amendment) L.I. 1703 , 2002) require that all undertakings in Ghana comply with the EIA procedures in the planning, implementation, operation and decommissioning phases of the project. An EIA on any proposed project is prepared with the objectives of providing adequate the identified impacts, mitigation measures proposed, or serve as basis for granting the necessary Environmental Permit for the project In line with L.I. 1652.

The factories, Offices and Shops Act of 1970 (Factories, Offices and Shops Act of 1970 (Act 328) , 1970) mandates factory Inspectorate Department to register factories and ensure that internationally accepted standards of providing safety, health and welfare of persons are adhered to in all premises covered but the Act.

A summary of the analysis of the environmental impacts, including transboundary impacts and references to all related documentation will be provided at the CPA level.

**E.3. Environmental impact assessment**

If an environmental impact assessment is required, conclusions and references to all related documentation will be provided at the CPA level.

**SECTION F. Local stakeholder comments**
**F.1. Solicitation of comments from local stakeholders**

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at CPA level √

Stakeholder consultation will be performed at the CPA level to ensure that a wider group of stakeholders is reached since each CPA affects different geographical positions and different groups of stakeholders.

A description of the process by which comments from local stakeholders were invited and compiled will be provided at CPA level.

**F.2. Summary of comments received**

Identification of stakeholders and summary of comments will be provided at the CPA level.

**F.3. Report on consideration of comments received**

Information demonstrating that all comments received have been considered comments will be provided at the CPA level.

**SECTION G. Approval and authorization**

The letter of approval from Party which wishes to be involved in the PoA is not available at the time of submitting the PoA-DD to the validating DOE.

## PART II. Generic component project activity (CPA)

### SECTION A. General description of a generic CPA
### A.1. Purpose and general description of generic CPAs

A typical CPA consists in the installation and operation of a state-of-the art Municipal Solid Waste (MSW) composting plant. The organic fraction of the sorted waste will be recovered into saleable compost for agricultural, horticultural and landscaping activities. Methane emissions from anaerobic decay will be avoided by diverting this organic fraction from anaerobic landfill(s) where it would have been disposed in the absence of the PoA.

In the baseline scenario (identical to the scenario existing prior to the implementation of the CPA), a lack of capacity and expertise in landfill management prevails and waste is disposed without methane mitigation or recovery and flaring systems on the landfill(s), as it is neither a common practice nor required by any law or regulation in Ghana.

The typical CPA, under the framework of the proposed PoA voluntarily coordinated by the CME, introduces advanced methane avoidance practises by the mean of sorting and aerobic-design composting of the fermentable materials which make up the largest portion of the collected MSW.

Each CPA will have state-of-the-art monitoring equipment while the staff involved will be trained to properly operate, maintain and calibrate the monitoring system. Detailed description of the monitoring system is provided in each CPA-DD.

### SECTION B. Application of a baseline and monitoring methodology
### B.1. Reference of the approved baseline and monitoring methodology(ies) selected

The approved baseline and monitoring methodology selected for to the proposed Programme of Activities is: AM0025 - Avoided emissions from organic waste through alternative waste treatment processes (Version 13.0.0).

This methodology also refers to the latest approved versions of the following tools:

- “Tool for the demonstration and assessment of additionality” (Version 06.1.0);
- “Emissions from solid waste disposal sites” (Version 06.0.1);
- “Tool to calculate the emission factor for an electricity system” (Version 02.2.1);
- “Project and leakage emissions from composting” (Version 01.0.0);
- “Tool to determine the mass flow of a greenhouse gas in gaseous stream” (Version 2.0.0).
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)

### B.2. Application of methodology(ies)

The selected methodology is AM0025: Avoided emissions from organic waste through alternative waste treatment processes.

This methodology addresses project activities where fresh waste (i.e. the organic matter present in new domestic and commercial waste/municipal solid waste) originally intended for landfilling, is treated either through one or a combination of the following process: composting, gasification, anaerobic digestion, RDF processing/thermal treatment without incineration, and incineration. As required by the methodology each CPA will avoid methane emissions by diverting organic waste from disposal at a landfill, where methane emissions are caused by anaerobic processes, and by displacing electricity/ thermal energy through the utilization of biogas, syngas captured, RDF/stabilized biomass produced from the waste, combustion heat generated in the incineration process. By treating the fresh waste through

alternative treatment options these methane emissions are avoided from the landfill. The GHGs involved in the baseline and project activity are $CO_2$, $CH_4$ and $N_2O$.

| | Applicability conditions of the methodology AM0025 | CPA specifications |
|---|---|---|
| 1 | • The project activity involves one or a combination of the following waste treatment options for the fresh waste that in a given year would have otherwise been disposed of in a landfill:<br>(a) A composting process in aerobic conditions;<br>(b) Gasification to produce syngas and its use;<br>(c) Anaerobic digestion with biogas collection and flaring and/or its use;<br>(d) Mechanical/thermal treatment process to produce refuse-derived fuel (RDF)/stabilized biomass (SB) and its use. The thermal treatment process (dehydration) occurs under controlled conditions (up to 300 degrees Celsius). In case of thermal treatment process, the process shall generate a stabilized biomass that would be used as fuel or raw material in other industrial process. The physical and chemical properties of the produced RDF/SB shall be homogenous and constant over time;<br>(e) Incineration of fresh waste for energy generation, electricity and/or heat. The thermal energy generated is either consumed on-site and/or exported to a nearby facility. Electricity generated is either consumed on-site, exported to the grid or exported to a nearby facility. The incinerator is rotating fluidized bed or circulating fluidized bed or hearth or grate type. | Each CPA will consist in the installation and operation of a municipal solid waste sorting and **composting** plant only.<br><br>The compost will be produced aerobically and will be intended for soil application in agricultural, horticultural and landscaping activities (depending on its quality grade). |
| 2 | • In case of composting, the produced compost is either used as soil conditioner or disposed of in landfills; | |
| 3 | • The proportions and characteristics of different types of organic waste processed in the project 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 project activity; | Ex-ante proportions and characteristics of different types of organic waste will have to be provided for each CPA and will have to be sampled during the monitoring for ex-post calculation purposes. |
| 4 | • Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill despite environmental regulation that mandates the treatment of the waste, if any, using any of the project activity treatment options mentioned above; | At the time of PoA validation, Environmental regulations in Ghana do not mandate the use of any waste treatment option mentioned in AM0025, thus CPAs included in the PoA does not fall under any compliance trend to enforced regulation. |
| 5 | • The compliance rate of the environmental regulations during (part of) the crediting period is below 50%; if monitored compliance with the MSW rules exceeds 50%, the project activity shall receive no further credit, since the assumption that the policy is not enforced is no longer tenable; | |
| 6 | • Local regulations do not constrain the establishment of RDF production plants/thermal treatment plants nor the use of RDF/stabilized biomass as fuel or raw material; | |
| 7 | • In case of RDF/stabilized biomass production, project proponent shall provide evidences that no GHG emissions occur, other than biogenic $CO_2$, due to chemical reactions during the thermal treatment process (such as Chimney Gas Analysis report); | CPAs included in the PoA will neither involve RDF/ stabilized biomass production neither |

| | | |
|---|---|---|
| 8 | • The project activity does not involve thermal treatment process of neither industrial nor hospital waste; | industrial/hospital waste thermal treatment process nor waste incineration. Note: All relevant policies and circumstances will be monitored at the beginning of each crediting period and the baseline will be adjusted accordingly. |
| 9 | • In case of waste incineration, if auxiliary fossil fuel is added into the incinerator, the fraction of energy generated by auxiliary fossil fuel is no more than 50% of the total energy generated in the incinerator. | |

In addition to the applicability conditions of AM0025, all the CPAs included in the PoA will also meet the applicability conditions of the following tools:

*Tool for the demonstration and assessment of additionality (Version 06.1.0):*
All potential alternative scenarios to the proposed project activity included in the additionality assessment and available to project participants cannot be implemented in parallel to the proposed project activity.

*Tool to determine Emissions from solid waste disposal sites (Version 06.0.1):*
The application B of the tool is applicable in cases where the CDM project activity avoids or involves the disposal of waste at a SWDS.

*Tool to calculate the emission factor for an electricity system (Version 2.2.1):*
This tool will be applicable for those CPAs which will consume electricity from the grid.

*Tool to determine Project and leakage emissions from composting (Version 01.0.0):*
This tool provides procedures to calculate project and/or leakage emissions from composting and co-composting. Typical applications of the tool include projects composting municipal solid wastes, agricultural wastes and digestate.

Therefore, each CPA which involve composting of waste that would have otherwise been disposed of in a landfill, avoiding emissions from organic waste through alternative waste treatment processes, meets AM0025 methodology requirements as reflected in the table above. It also meets the requirements of the tools mentioned above.

There is no need to provide a general description of the sampling plan in this section of the PoA as there will be no sampling plan since the CPAs to be included in the PoA are expected to be large industrial facilities uniquely designed and operated, thus individually monitored.

## B.3. Sources and GHGs

**Emissions sources and greenhouse gases included in each CPA boundary**

***Baseline emissions***
- $CH_4$ emissions produced in the landfills in the absence of the CPA.

***Project emissions:***
- $CO_2$ emissions from electricity consumption on-site due to the CPA;
- $CO_2$ emissions on-site due to fuel consumption on-site;
- $N_2O$ and $CH_4$ emissions during the composting process;
- $CH_4$ emissions from waste water treatment.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline scenario | Emissions from decomposition of waste at the landfill site | $CO_2$ | No | $CO_2$ emissions from the decomposition of organic waste are not accounted. |
| | | $CH_4$ | Yes | The major source of emissions in the baseline |
| | | $N_2O$ | No | $N_2O$ emissions are small compared to $CH_4$ emissions from landfills. Exclusion of this gas is conservative. |
| | Emissions from electricity consumption | $CO_2$ | No | No electricity is consumed from the grid or generated onsite/offsite in the baseline scenario. |
| | | $CH_4$ | No | Excluded for simplification. This is conservative. |
| | | $N_2O$ | No | Excluded for simplification. This is conservative. |
| | Emissions from thermal energy generation | $CO_2$ | No | No thermal energy is generated in the baseline scenario. |
| | | $CH_4$ | No | Excluded for simplification. This is conservative. |
| | | $N_2O$ | No | Excluded for simplification. This is conservative. |
| Project scenario | On-site fossil fuel consumption due to the project activity other than for electricity generation | $CO_2$ | Yes | It includes vehicles used on-site. |
| | | $CH_4$ | No | Excluded for simplification. This emission source is assumed to be very small. |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small. |
| | Emissions from on-site electricity use | $CO_2$ | Yes | It includes electricity consumed from the grid or generated onsite. |
| | | $CH_4$ | No | Excluded for simplification. This emission source is assumed to be very small. |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small. |
| | Emissions from thermal energy generation | $CO_2$ | No | Not applicable as there is no thermal energy generated under the Project activity. |
| | | $CH_4$ | No | Excluded for simplification. This emission source is assumed to be very small. |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small. |
| | Direct emissions from the waste treatment processes. | $CO_2$ | No | The Project activity does not include incineration, gasification or combustion of fossil based. In addition, $CO_2$ emissions from the decomposition or combustion of organic waste are not accounted. |
| | | $CH_4$ | Yes | The composting process may not be complete and result in anaerobic decay. |
| | | $N_2O$ | Yes | $N_2O$ can be emitted as part of the composting process itself. |
| | Emissions from waste water treatment | $CO_2$ | No | $CO_2$ emissions from the decomposition of organic waste are not accounted. |
| | | $CH_4$ | Yes | Only applicable if an anaerobic wastewater treatment plant is implemented under the CPA. |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small. |

*Emissions sources and GHGs included in the project boundary*

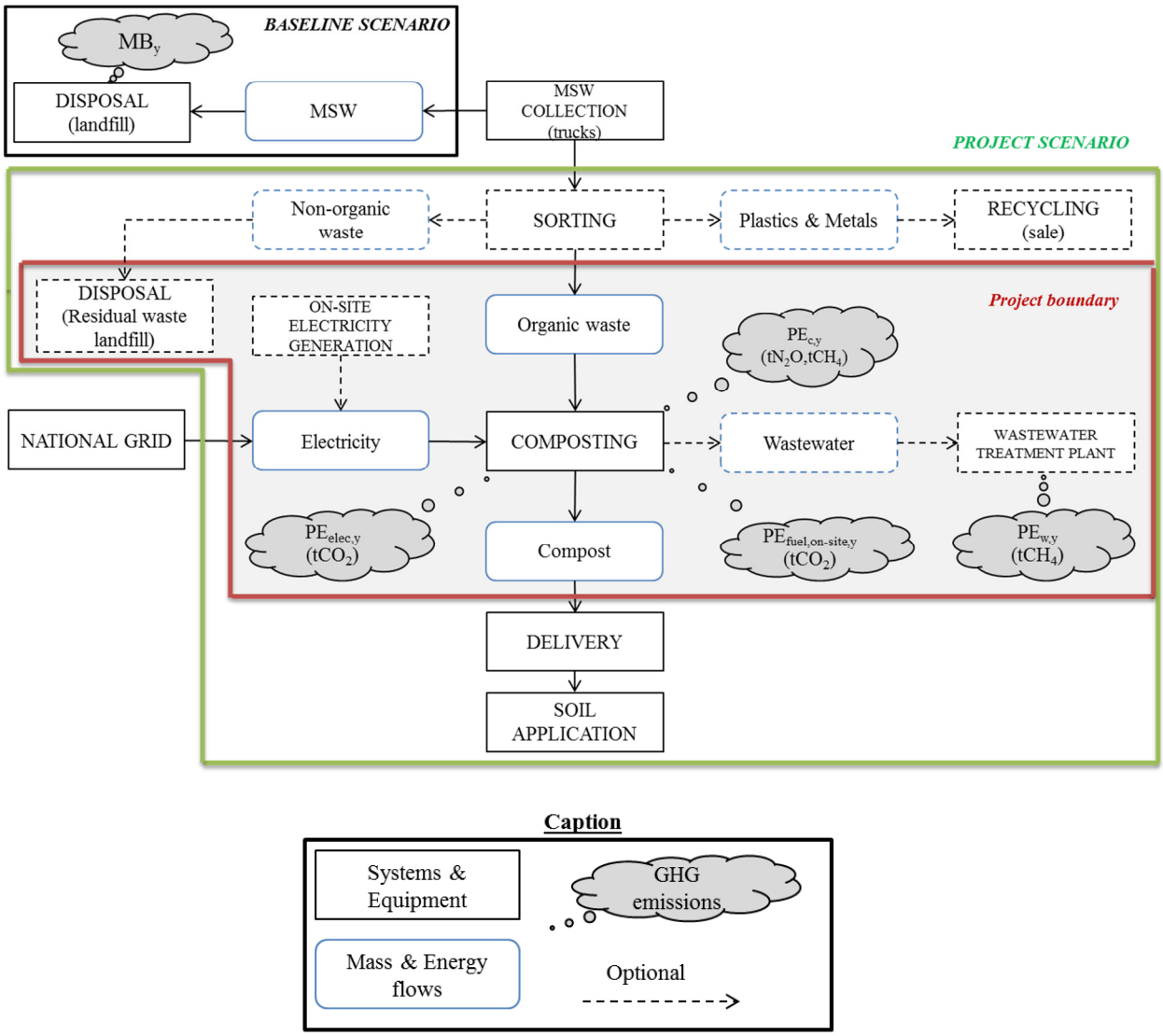


**Figure 9:** *Project boundary of a typical CPA.*

## B.4. Description of baseline scenario

Assessment and demonstration of additionality will follow the "Tool for the demonstration and assessment of additionality" (Version 06.1.0) for Greenfield projects.

However for projects with emission reductions generated by CPA below or equal to 20 kt$CO_2$, "Guidelines for demonstrating additionality of microscale project activities" (Version 04.0) can also be applied as detailed in eligibility criteria (f) and (k1).

"Guidelines on additionality of first-of-its-kind project activities" version 02.0 may be applied to demonstrate additionality.

Project participant shall follow the "**Procedure for the selection of the most plausible baseline scenario"** described in the methodology to identified the baseline scenario of each CPA.

***Step 1: Identification of alternative scenarios***

As required by the methodology, Step 1 of the latest version of the "*Tool for demonstration and assessment of additionality*" is used to identify all realistic and credible baseline alternatives.

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

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

The following alternatives were identified as realistic and credible alternatives available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity (disposal/treatment of the fresh waste):

M1: The project activity (i.e. composting) not implemented as a CDM project;

M2: Disposal of the waste at a landfill where landfill gas captured is flared;

M3: Disposal of the waste on a landfill without the capture of landfill gas (i.e. continuation of the current situation);

[If energy is exported to a grid and/or to a nearby industry, or used on-site, realistic and credible alternatives should also be separately determined for:

- Power generation in the absence of the project activity;
- Heat generation in the absence of the project activity.

For power generation, the realistic and credible alternative(s) may include, inter alia:

P1: Power generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity;
P2: Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant;
P3: Existing or Construction of a new on-site or off-site renewable based cogeneration plant;
P4: Existing or Construction of a new on-site or off-site fossil fuel fired captive power plant;
P5: Existing or Construction of a new on-site or off-site renewable based captive power plant;
P6: Existing and/or new grid-connected power plants.

For heat generation, the realistic and credible alternative(s) may include, inter alia:

H1: Heat generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity;
H2: Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant;
H3: Existing or Construction of a new on-site or off-site renewable based cogeneration plant;
H4: Existing or new construction of on-site or off-site fossil fuel based boilers;
H5: Existing or new construction of on-site or off-site renewable energy based boilers;
H6: Any other source such as district heat;
H7: Other heat generation technologies (e.g. heat pumps or solar energy).

However, power generation and heat generation are not part of the proposed PoA, thus no power/heat generation alternatives need to be identified. ]

***Assessment of the potential waste management alternatives***

M1. The project activity (i.e. composting) not implemented as a CDM project;

*[Assessment of alternative at CPA level]*

M2. Disposal of the waste at a landfill where landfill gas captured is flared;

*[Assessment of alternative at CPA level]*

M3. Disposal of the waste on a landfill without the capture of landfill gas (i.e. continuation of the current situation);

*[Assessment of alternative at CPA level]*

***Outcome of Step 1a:*** [*Establishment of the realistic and credible alternative scenarii*].

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

The plausible alternative scenarios must be in compliance with all mandatory applicable laws and regulatory requirements. A review of their consistency with these laws and regulations is presented hereafter.

| | Regulatory analysis | Consistency with laws & regulations? |
|---|---|---|
| M1 | The project activity (i.e. composting) not implemented as a CDM project: *[assessment of alternative's consistency with mandatory laws and regulations]* | YES |
| M2 | Disposal of the waste at a landfill where landfill gas captured is flared: *[assessment of alternative's consistency with mandatory laws and regulations]* | YES |
| M3 | Disposal of the waste on a landfill without the capture of landfill gas (i.e. continuation of the current situation): *[assessment of alternative's consistency with mandatory laws and regulations]* | YES |

***Conclusion of sub-step 1b:*** [*Confirmation that "All the credible alternatives identified above comply with the current laws and regulatory requirements of Ghana. The CPA is not the only alternative that is in compliance with all regulations"*].

***Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable***

Not applicable since no electricity generation from waste is included in the CPA.

***Step 3: Step 2 and/or Step 3 of the latest approved version of the "Tool for demonstration and assessment of additionality" shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive):***

As specified in the Tool ("*Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis)), Project participants may also select to complete both Steps 2 and 3.*" [*choice of the CPA implementer*]

➔ **Step 2: Investment analysis**

Determine whether the proposed project activity is not:

(a) The most economically or financially attractive; or
(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

To conduct the investment analysis, use the following Sub-steps:

**Sub-step 2a: Determine appropriate analysis method**

As proposed project activity generates financial and economic benefits other than CDM related income, the simple cost analysis cannot be applied. Benchmark analysis should preferably be used to demonstrate additionality (Option III). Otherwise, the investment comparison analysis (Option II) may be used if justified.

***Sub-step 2b. Apply Benchmark analysis***

The investment analysis should preferably be performed by using project IRR as the financial/economic indicator most suitable for the project type and decision-making context.

IRR for scenario 1 will be compared with the relevant pre or post tax financial benchmark[8], namely the usual rate of return available to an investor in the host country and for this specific project type. This rate represents the minimum rate of return that would justify the financial viability of the project and therefore the implementation of Scenario 1.

Composting plant projects are financed using variable proportion of equity and fixed income funding, thus as the appropriate benchmark rate should enable the variable characteristics of the different source of funding, the Weighted Average Cost of Capital (WACC) is chosen. The WACC is the rate of return that a company should expect to pay on average to all its creditors (stock holders, bond holders, banks and other providers of capital). It is the minimum rate of return that a company should earn in order to represent a viable investment[9].

In general the WACC is calculated using the following formula:

$$WACC = \frac{\sum_i r_i MV_i}{MV_i}$$

With:

| | |
|---|---|
| $r_i$ | the required rate of return for security or provider of capital *i* |
| $MV_i$ | the market value of all outstanding securities i or the remaining balance of loan *i* |

In the usual case where the sources of capital narrow themselves to standard equity, fixed income securities and bank loans, WACC may be calculated by using the following formulas:

$$WACC_{at} = \frac{MV_d}{MV_d+MV_e} \cdot r_d(1-t) + \frac{MV_e}{MV_d+MV_e} \cdot r_e$$ for after-tax comparison

$$WACC_{bt} = \frac{MV_d}{MV_d+MV_e} \cdot r_d + \frac{MV_e}{MV_d+MV_e} \cdot r_e$$ for pre-tax comparison

With:

| | |
|---|---|
| $r_d$ | the required rate of return of all debt financing |
| $r_e$ | the required rate of return of all equity financing |
| t | the applicable corporate tax rate in the host country |

The required rate of return of equity financing may be estimated by using one of the following three methods:

[8] Calculated in nominal terms

[9] If all data needed to calculate the WACC are not available equity IRR may be used in conjunction with other benchmark such as the expected rate of return on equity.

1. The Capital Asset Pricing Model (CAPM):

$$r_e = r_f + \beta_e \cdot r_p$$

$r_f$ the applicable risk-free rate in the host country. If no investment may be deemed as risk-free in the considered country, a risk-free rate shall be estimated by starting with a risk-free rate based on the 10-year U.S. government bond yield and then by adding projected difference over time between U.S. and local inflation to develop a nominal risk-free rate in local currency. As per the Guidelines on the Assessment of Investment Analysis (Version 05), a default value of 3.0% may be used.

$r_p$ the applicable equity risk premium, namely the excess rate of return of equity investments over the risk-free rate[10]. As per the Guidelines on the Assessment of Investment Analysis (Version 05), a default value of 6.5% may be applied.

$\beta_e$ the sensitivity of project returns to the variation of market returns.
$\beta_e$ is affected by the systematic component of business risk and financial risk. Therefore it is project specific and depends on the proportion of equity to debt financing. For each project it may be determined using the following formula: $\beta_e = \beta_u \cdot \left[1 + (1-t)\frac{MV_d}{MV_e}\right]$, with $\beta_u$ being a measure of the business risk applicable to a specific industry.

2. The Build-up Approach:

$$r_e = r_f + r_p + r_c$$

$r_c$ the host country risk premium, which is estimated as the yield on the host country market bonds (denominated in the currency of the host country market) minus the yield on long-term US government bonds.

3. The default approach:
Expected return on equity is estimated using default values stated for various countries in the Appendix of the Guidelines on the Assessment of Investment Analysis (Version 05).As the PoA only covers composting projects which fall under the sectoral scope 13. Waste handling and disposal, each CPA using the default approach will use the value defined for Group 1. (Ghana: 13.25%)

**Table 4:** *Parameters for benchmark calculation*

| Parameters | Description | Source and explanation |
|---|---|---|
| $r_f$ | Risk-free rate in a developed country | The risk-free rate should be determined using reputable sources of financial information such as Reuters, Morningstar of Bloomberg databases. |
| $r_d$ | Cost of debt | The cost of debt is determined as the usual commercial lending rate in the host country for power plant projects or the yield of a 10 year bond issued by the government of the host country with the addition of a relevant yield spread based on company rating. |
| $r_p$ | Equity risk premium | The equity risk premium should be determined using reputable sources of financial information such as Reuters, Morningstar of Bloomberg databases or data from academic research[11].<br>If data is not available from those sources of info, experts' opinions may be used as a replacement. |

[10] Calculation of the equity risk premium should be consistent with the determination of the risk-free rate. If the risk-free rate is chosen as a local rate then the equity risk premium should be calculated using local equity rate of return. If the risk-free rate is based on the 10-year U.S. government bond yield then the equity risk premium should be calculated as the excess return of major US equity index over the 10-year U.S. government bond yield.
[11] E.g. http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/implpr.html

| Parameters | Description | Source and explanation |
|---|---|---|
| $\beta_u$ | Unlevered beta (environmental sector) | The unlevered beta should be determined using reputable sources of financial information such as Reuters, Morningstar of Bloomberg databases or data from academic research[12] If data is not available from those sources of info, experts' opinions may be used as a replacement. |
| $r_c$ | Country risk premium | The country risk premium should be determined using reputable sources of financial information such as Reuters, Morningstar of Bloomberg databases or data from academic research[13]. If data is not available from those sources of info, experts' opinions may be used as a replacement. |
| $MV_d$ | Percentage of financing from debt | As per the Guidelines on the Assessment of Investment Analysis (Version 05), paragraph 17 and 18. |
| $MV_e$ | Percentage of financing from equity | |
| $t$ | Applicable corporate tax rate | Official documentation. |

For the assessment of the additionality of each CPA, all parameters should be determined by using the latest info available.

***Sub-step 2c. Calculation and comparison of financial indicators***

Project IRR shall be calculated as the discount rate that makes the present value of the future after-tax cash flows equal the investment outlay.

$$\sum_i \frac{CF_i}{(1+IRR)^i} = Investment\ Outlay$$

With:

$CF_i$ — the annual pre or after-tax[14] operating[15] cash flow expected from the proposed project activity in the year i

*Investment Outlay* — this includes all costs required to set the compost plant operational): land cost, project development costs (e.g. consultancy fees, license fees, engineering costs), equipment cost, construction costs, etc.

**Table 5:** *Parameters for IRR calculation*

| Parameter | Unit | Sources |
|---|---|---|
| Investment decision date | | Board decision notes, loan agreement, feasibility study. |
| First spending year | | |
| First operation year | | |
| Project lifetime | year | |
| Annual compost generation | tonnes | As per guidelines for the reporting and validation of plant load factors. |
| Other revenues | Local Currency/year | Feasibility study (if applicable). |

[12] E.g. http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html
[13] E.g. http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html
[14] The definition of $CF_i$ shall be consistent with the definition of WACC
[15] The cash inflow for the last year of project life shall include the expected profit realisable from the sale of project assets as per the Guidelines on the Assessment of Investment Analysis (Version 05), paragraph 4

| Parameter | Unit | Sources |
|---|---|---|
| Compost price | Local Currency/tonne | Market research, off-take agreement. |
| Expected increase in compost price | %/year | |
| Inflation | %/year | Forecasts from official governmental statistics, international reputable sources (IMF, WB) or academic research. |
| Exchange rate | Local Currency/USD | If applicable. |
| Investment outlay | Local Currency | Board decision notes, loan agreement, feasibility study. |
| Other Capex | Local Currency | Board decision notes, loan agreement, feasibility study (if applicable). |
| Operation & Maintenance Cost | Local Currency/year | Feasibility study. |
| Other operating expenditure | Local Currency/year | |
| Salvage value of assets | Local Currency | |
| Insurance | % of Capex | If applicable. |

All relevant data used for the calculation of the IRR shall be expressed in Local Currency. Thus all financial information denominated in Foreign Currency shall be converted in Local Currency using the 12-month trailing average exchange rate at the date of investment decision for investment outlay and other capital expenditures. For future revenues and costs the exchange rate is forecasted for each year by using the long-term average real exchange rate and the inflation forecasts in Local Currency and Foreign Currency.

The parameters listed in the table shall be obtained from the most recent sources, if there is any substantial gap between the date of investment decision and the date at which the corresponding sources was produced, the value of the relevant parameter shall corrected appropriately by using the host country price index.

***Sub-step 2d. Sensitivity analysis***

After the determination of the base case IRR, a sensitivity analysis shall be done by modifying monetary parameters that constitute more than 20% of either total project costs or total project revenues (such as investment outlay or O&M cost amongst others) by +/- 10%. The full array of the derived IRR will be reported in the CPA-DD. If the IRR of one the scenarios considered for the sensitivity analysis exceeds the benchmark, CPA implementer shall demonstrate that that the probability of such a scenario is negligible. If no sufficient evidence is provided the CPA shall be deemed as not additional.

***Outcome of Step 2:*** [*If after the sensitivity analysis it is concluded that: (1) the proposed CDM project activity is unlikely to be the most financially/economically attractive or is unlikely to be financially/economically attractive, then proceed to Step 4 (Common practice analysis).*]

➔ ***Step 3: Barrier analysis***

The "Guidelines for objective demonstration and assessment of barriers", Version 1 shall be taken into account when applying this step.

The CPA carrier is to determine whether the Project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives; using the following sub-steps:

For barriers other than barriers due to project being "first of its kind" as defined in paragraph 40(c)(i), the identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed project activity undertaken without being registered as a CDM project activity.

Use the following Sub-steps:

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

Establish that there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity. Such realistic and credible barriers may include, among others:

- **Investment barriers**, other than the economic/financial barriers in Step 2 above, inter alia:
  (a) For alternatives undertaken and operated by private entities: Similar activities have only been implemented with grants or other non-commercial finance terms. Similar activities are defined as activities that rely on a broadly similar technology or practices, are of a similar scale, take place in a comparable environment with respect to regulatory framework and are undertaken in the relevant country/region;
  (b) No private capital is available from domestic or international capital markets due to real or perceived risks associated with investment in the country where the proposed CDM project activity is to be implemented, as demonstrated by the credit rating of the country or other country investments reports of reputed origin.

- **Technological barriers**, inter alia:
  (a) Skilled and/or properly trained labour to operate and maintain the technology is not available in the relevant country/region, which leads to an unacceptably high risk of equipment disrepair and malfunctioning or other underperformance;
  (b) Lack of infrastructure for implementation and logistics for maintenance of the technology (e.g. natural gas cannot be used because of the lack of a gas transmission and distribution network);
  (c) Risk of technological failure: the process/technology failure risk in the local circumstances is significantly greater than for other technologies that provide services or outputs comparable to those of the proposed CDM project activity, as demonstrated by relevant scientific literature or technology manufacturer information;
  (d) The particular technology used in the proposed project activity is not available in the relevant region.

- **Barriers due to prevailing practice**, inter alia: The project activity is the "first of its kind".
  (a) For the measures identified under paragraph 6, a proposed project activity is the First-of-its-kind in the applicable geographical area if :
    i. The project is the first in the applicable geographical area that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project; and
    ii. Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal;
  (b) For the measures identified under paragraph 6, a proposed project activity that was identified as the First-of-its-kind project activity is additional and Sub-step 3 b does not apply.

(c) For other measures, the project proponents shall propose approach for demonstrating that a project is a "first-of-its-kind" and Sub-step 3 b applies.

***Outcome of Step 3a:*** [*Identified barriers that may prevent one or more alternative scenarios to occur.*]

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

In applying Sub-steps 3a and 3b, provide transparent and documented evidence, and offer conservative interpretations of this documented evidence, as to how it demonstrates the existence and significance of the identified barriers and whether alternatives are prevented by these barriers. Any alternative that would be prevented by the barriers identified in Sub-step 3a is not a viable alternative, and shall be eliminated from consideration.

Anecdotal evidence can be included, but alone is not sufficient proof of barriers. The type of evidence to be provided should include at least one of the following:

(a) Relevant legislation, regulatory information or industry norms;
(b) Relevant (sectoral) studies or surveys (e.g. market surveys, technology studies, etc) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc;
(c) Relevant statistical data from national or international statistics;
(d) Documentation of relevant market data (e.g. market prices, tariffs, rules);
(e) Written documentation of independent expert judgments from industry, educational institutions (e.g. universities, technical schools, training centres), industry associations and others.

***Step 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario.***

*[assessment of Step 4].*

***Conclusion of Step 4:*** *The baseline scenario is as follows:*

| Baseline | | | Situation description |
|---|---|---|---|
| **Waste** | **Electricity** | **Heat** | |
| *[baseline sub-scenario]* | - | - | *[summary of the waste baseline sub scenario].*No electricity or heat is consumed or generated in the project activity. |

**B.5. Demonstration of eligibility for a generic CPA**

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **N°** | **Description** |
| Boundary and location of the CPA | a | **The geographical boundary of the CPA is Ghana which is consistent with the geographical boundary set in the PoA.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>Location and boundary are specified in the specific CPA-DD.<br>The specific CPA-DD states that the composting plant is located in Ghana.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Detailed project Report;<br>- Contract for equipment supply/civil works;<br>- EIA report;Other credible documents.<br>**Tick when met:**<br>☐ |
| No double counting | b.1 | **The CPA is not already included in another PoA or developed as a stand-alone CDM project.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA-DD confirms that the CPA is not already included in another PoA or developed as a stand-alone CDM project.<br>**Mean of proof / Evidence Document:**<br>The "Procedure to avoid double-counting" formulated in the PoA-DD is applied and the assessment is conclusive.<br>**Tick when met:**<br>☐ |
| | b.2 | **There is a unique identification of the composting plant.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer will erect a sign stating that the CPA is part of the PoA developed by the CME at project commissioning or at CPA inclusion whichever is later.<br>**Mean of proof / Evidence Document:**<br>Confirmation by the CME that a sign stating that the CPA is part of the PoA developed by the CME is to be erected at the composting plant.<br>**Tick when met:**<br>☐ |
| Specification of technology | c.1 | **The CPA-DD describes the waste management and methane avoidance technologies in the CPA including their performance and technical specifications.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>Evidence is provided.<br>**Mean of proof / Evidence Document:**<br>Waste management and methane avoidance technologies including their performance and technical specifications are specified in CPA-DD. Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Detailed project Report;<br>- Contract for equipment supply;<br>- EIA report;<br>- Other credible documents. |

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **N°** | **Description** |
| | | **Tick when met:**<br>☐ |
| | c.2 | **All the waste management and methane avoidance technologies within the CPA (will) comply with national and/or international equipment and services certificates.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>Evidence is provided.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>-Government approvals of the design and/or manufacturing permits;<br>-Regional or national testing papers, evidence of compliance with standards or certificates;<br>-International testing papers, certificates or documents confirming compliance with international standards;<br>-The approved EIA report;<br>- Contract for equipment supply;<br>-Statement in the CPA-DD;<br>-Other credible documents.<br>**Tick when met:**<br>☐ |
| CPA start date | d | **The starting date of the CPA is verifiable through documentary evidence and is or will not be prior to the start of PoA validation.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA-DD indicates the start date.<br>**Mean of proof / Evidence Document:**<br>Supporting documentary evidence for the starting date is provided.<br>**Tick when met:**<br>☐ |
| Compliance and application of the methodology AM0025 | e.1 | **The CPA consists in the construction and operation of a composting plant (no other waste treatment option is expected).** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer confirms and states in the CPA-DD that the composting plant is to be built with no other waste treatment option.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Detailed Project Report;<br>- Contract for equipment supply;<br>- Other credible documents.<br>**Tick when met:**<br>☐ |
| | e.2 | **The composting plant will treat fresh waste that in a given year would have otherwise been disposed of in a landfill.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer states in the CPA-DD the provenance of the fresh waste to be composted in the plant.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents: |

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **N°** | **Description** |
| | | - Supply/collection agreement between the CPA implementer and a waste collector or a waste management authority;<br>- Detailed project Report;<br>- Contract for equipment supply;<br>- EIA report;<br>- Other credible documents.<br>**Tick when met:**<br>☐ |
| | e.3 | **The produced compost is either used as soil conditioner or disposed of in landfills.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer states in the CPA-DD that compost to be produced will be used as soil conditioner.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Statement from the CPA implementer confirming that compost to be produced will be used as soil conditioner;<br>- Detailed project Report;<br>- Contract for equipment supply;<br>- EIA report;<br>- Other credible documents.<br>**Tick when met:**<br>☐ |
| | e.4 | **The proportions and characteristics of different types of organic waste processed in the CPA can be determined.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer states in the CPA-DD the quantity and the characteristics (composition) of the fresh waste to be processed.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Detailed project Report;<br>- Contract for equipment supply;<br>- EIA report;<br>- Other credible documents.<br>**Tick when met:**<br>☐ |
| | e.5 | **Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer confirms in the CPA-DD that the baseline scenario shows a continuation of the current practice of disposing waste.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Detailed project Report;<br>- EIA report;<br>- Other credible documents.<br>**Tick when met:** |

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **N°** | **Description** |
| | | ☐ |
| | e.6 | **The compliance rate of the environmental regulations during (part of) the crediting period is below 50%** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer confirms in the CPA-DD that the compliance rate of the environmental regulations during (part of) the crediting period is below 50%. Note: inapplicable if Environmental regulations in Ghana do not mandate the use of any waste treatment at the time of inclusion and the CPAs do not fall under any compliance trend to enforced regulation.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Detailed project Report;<br>- Applicable regulations;<br>- EIA report;<br>- Other credible documents.<br>**Tick when met:**<br>☐ |
| | e.7 | **The CPA does not involve thermal treatment process of neither industrial nor hospital waste.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer shall state in the CPA-DD that no thermal treatment process of neither industrial, nor hospital waste is supposed to be implemented<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- Detailed project Report;<br>- Contract for equipment supply;<br>- EIA report;<br>- Other credible documents.<br>**Tick when met:**<br>☐ |
| Additionality of CPAs | f | **The CPA is additional, in compliance with the relevant requirements pertaining to the demonstration of additionality.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA meets the requirements pertaining to the demonstration of additionality as specified in Section B Part II of the PoA-DD:<br>☐ *Guidelines for demonstrating additionality of microscale project activities (when applicable) for CPAs below or equal to 20 ktCO2;*<br>*OR*<br>☐ *Tool for the demonstration and assessment of additionality.*<br>**Mean of proof / Evidence Document:**<br>Completion of the step-by-step additionality demonstration below:<br>(a)Identification of alternatives to the project activity;<br>(b) Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible;<br>(c) Barriers analysis; and |

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **N°** | **Description** |
| | | (d) Common practice analysis;<br>unless microscale threshold criteria is verified (criteria k.1).<br>**Tick when met:**<br>☐ |
| Local stakeholder consultation | g.1 | **A local stakeholder consultation has been conducted prior to the inclusion of the CPA.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>In each CPA-DD, details pertaining to the stakeholder consultation shall be available in section C of the CPA-DD.<br>**Mean of proof / Evidence Document:**<br>Compliance with this criterion may be substantiated with one (or more) of the following documents:<br>- EIA report;<br>- Stakeholder consultation report;<br>- Other credible documents.<br>**Tick when met:**<br>☐ |
| Environmental impact analysis | g.2 | **An environmental impact analysis has been conducted prior to the inclusion of the CPA.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>Information on EIA requirement and details pertaining to the EIA development shall be available in section B of the CPA-DD.<br>**Mean of proof / Evidence Document:**<br>Evidence showing the start of EIA, EIA report or Environmental Permit.<br>**Tick when met:**<br>☐ |
| Non-diversion of ODA in case of Public funding | h | **Confirmation that the CPA does not involve any public funding from Annex I Parties or that in case public funding is used, it does not result in diversion of Official Development Assistance (ODA)** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA-DD confirms that the CPA does not involve any public funding or that in case public funding is used a confirmation that official development assistance is not being diverted to the implementation of the PoA.<br>**Mean of proof / Evidence Document:**<br>Confirmation of No diversion of ODA in case of public funding, as per CPA-DD section A.11 statement.<br>**Tick when met:**<br>☐ |
| Target Group / distribution mechanisms | i | N/A |
| Sampling requirements | j | **The sampling method for monitoring the parameters $z_x$, $ECC_{CH4,c}$, $ECC_{N2O,c}$ and [$p_{n,j,x}$ *or* $p_{n,j,i}$] if applied in the CPA (e.g. in the monitoring plan) shall follow the latest the requirement outlined in the methodology AM0025 version 13.0.0 and referred tools.** |

<table>
<tr><th colspan="3">Eligibility criteria required by the Standard</th></tr>
<tr><th>Category</th><th>N°</th><th>Description</th></tr>
<tr><td></td><td></td><td>

**How each generic CPA meets the eligibility criteria?**

a) The sampling plan contains information relating to: (i) sampling design; (ii) data to be collected; and (iii) implementation plan.

b) Data variables included in the CPA sampling plan follow the latest the requirement outlined in the methodology AM0025 version 13.0.0 and referred tools for recording frequency and measurement method (tick when met).

<table>
<tr><th>Data variable</th><th>Tick when met:</th><th>Tick if not applicable:</th></tr>
<tr><td>[$p_{n,j,x}$ or $p_{n,j,i}$]</td><td>☐</td><td>☐</td></tr>
<tr><td>$z_x$</td><td>☐</td><td>☐</td></tr>
<tr><td>$ECC_{CH4,c,}$</td><td>☐</td><td>☐</td></tr>
<tr><td>$ECC_{N2O,c}$</td><td>☐</td><td>☐</td></tr>
</table>

</td></tr>
<tr><td>Thresholds criteria</td><td>k.1</td><td>

**As per requirements pertaining to the demonstration of additionality as specified in Section B.1. Part I., some CPA may fall under the microscale threshold criteria as following:**

☐ Emission reductions generated by CPA are below or equal to 20 $ktCO_2$

<u>AND</u>

☐ The proposed CPA is undertaken in a special underdeveloped zone (SUZ) identified by the Government in official notifications for development, assistance including for planning, management, and investment satisfying any one of the following conditions using most recent available data:

- The proportion of population with income less than USD 2 per day (PPP)[16] in the region is greater than 50% ;
- The GNI per capita in the country is less than USD 3000[17] and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures[18].

CPA implementer has demonstrated that the CPA-DD remains within this threshold throughout the corresponding crediting period.

</td></tr>
</table>

[16] Purchasing power parity

[17] PPP or the World Bank atlas method or another comparable method

[18] Information on per capita income or other economic indicators used for the ranking purposes shall be provided in USD

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **N°** | **Description** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA-DD confirms that the CPA fulfils the eligibility conditions for microscale project activities as stated in the latest version of "Guidelines for demonstrating additionality of microscale project activities".<br>**Mean of proof / Evidence Document:**<br>Bibliographic evidence to confirm the proposed CPA is undertaken in a special underdeveloped zone (SUZ) with one of the two conditions above fulfilled.<br>**Tick when met if applicable:**<br>☐<br>**Tick if not applicable:**<br>☐ |
| Debundling check | k.2 | **If the proposed CPA is microscale project activities, CPA implementer has demonstrated that the CPA is not a debundled component of a small scale activity as described in the "Guidelines on assessment of debundling for SSC project activities".** |
| | | **How each generic CPA meets the eligibility criteria?**<br>It is demonstrated in the CPA-DD following the "Guidelines on assessment of debundling for SSC project activities" that the proposed CPA is not a debundled component of a small scale activity.<br>**Mean of proof / Evidence Document:**<br>Bibliographic evidence.<br>**Tick when met if applicable:**<br>☐<br>**Tick if not applicable:**<br>☐ |
| **Supplemental eligibility criteria required by the CME** | | |
| Awareness and agreement of those operating a CPA on PoA subscription | 1 | **The CPA is either implemented by the Coordinating/managing entity or by another entity which has signed a binding agreement with the CME which ensures that they are aware and agree that their activity is subject to a PoA.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA-DD shall states the name of the CPA implementer and shall confirm that it is the CME or that a binding agreement has been signed with the CME that ensures that CPA implementer is aware and agree that the project activity is subject to a PoA.<br>**Mean of proof / Evidence Document:**<br>Binding agreement signed by CPA implementer and the CME.<br>**Tick when met:**<br>☐ |
| Approval of CPA by CME | 2 | **The CPA-DD has been reviewed by the CME and submitted to a DOE for inclusion into the PoA.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA implementer shall submit a CPA-DD to the CME with all underlying evidence for review.<br>If the conclusion of CME review is positive, the CME shall notify the CPA implementer of the submission of the CPA-DD to the DOE for inclusion. Otherwise conclusion of the CME review shall be sent to the |

| Eligibility criteria required by the Standard | | |
|---|---|---|
| **Category** | **N°** | **Description** |
| | | CPA implementer<br>**Mean of proof / Evidence Document:**<br>Technical review report drafted by the CME review team.<br>**Tick when met:**<br>☐ |
| Crediting period | 3 | **The crediting period of the CPA shall not exceed the length of the PoA (i.e. 28 years) regardless of the time of inclusion of CPA in the PoA.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>In each CPA-DD, it shall be confirmed that the crediting period of the CPA does not exceed the length of the PoA.<br>**Mean of proof / Evidence Document:**<br>CPA implementer's statement regarding the chosen crediting period.<br>**Tick when met:**<br>☐ |
| CER ownership | 4 | **The CPA is either implemented by the Coordinating/managing entity or by another entity which has signed a binding agreement with the CME which ensures that they are aware and agree that their carbon rights have to be relinquished to the CME.** |
| | | **How each generic CPA meets the eligibility criteria?**<br>The CPA-DD shall states that the CPA implementer has signed a binding agreement with the CME that ensures that CPA implementer is aware and agrees that its carbon rights have to be relinquished to CME.<br>**Mean of proof / Evidence Document:**<br>Binding agreement signed by CPA implementer and the CME.<br>**Tick when met:**<br>☐ |

*Confirmation of additionality of the CPA for its inclusion into the PoA:*

The CPA demonstrates to comply with all eligibility criteria and thus can be included in the PoA.

As required by the methodology, the additionality of the Project activity is demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board.

The following steps from the additionality tool were completed in section B.4 above:

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations
STEP 2 – Investment analysis
STEP 3 – Barrier analysis

***STEP 4 – Common practice analysis***

[*common practice analysis for the CPA – unless it demonstrated to be the first-of-its-kind*

***Sub-step 4a: Analyze other activities similar to the proposed project activity***

Provide an analysis of any other activities that are operational and that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly

similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.

Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.

For the purpose of this analysis, "similar activities" will be defined as compost technologies.

***Sub-step 4b: Discuss any similar Options that are occurring***

According to the Tool for the demonstration and assessment of additionality, essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects were carried out.

The following step shall be applied:

***Step 1:*** Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity;

***Step 2:*** In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project[19]. Note their number $N_{all}$. Registered CDM project activities and projects activities undergoing validation shall not be included in this step;

***Step 3:*** Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number $N_{diff}$;

***Step 4:*** Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity. ]

**Conclusion:** The proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

a) the factor F is greater than 0.2; and
b) $N_{all}-N_{diff}$ is greater than 3.

Or

The proposed project activity is not regarded as "common practice", then the proposed project activity is additional.

**B.6. Estimation of emission reductions of a generic CPA.**
**B.6.1. Explanation of methodological choices**

The following equations are used to calculate emission reductions, baseline emissions, project emissions and leakage of the CPA:

[19] While identifying similar projects, project participants may also use publically available information, for example from government departments, industry associations, international associations, on the market penetration of different technologies, etc.

**Emission Reductions**

$$\mathbf{ER_y = BE_y - PE_y - L_y} \qquad \text{Equation 1}$$

Where:

$ER_y$ Is the emissions reductions in year *y* ($tCO_2e$)
$BE_y$ Is the emissions in the baseline scenario in year *y* ($tCO_2e$)
$PE_y$ Is the emissions in the project scenario in year *y* ($tCO_2e$)
$L_y$ Is the leakage in year *y* ($tCO_2e$)

**Baseline Emissions**

$$BE_y = (MB_y - MD_{reg,y}) + BE_{EN,y} \qquad \text{Equation 2}$$

Where:

$BE_y$ Is the baseline emissions in year *y* ($tCO_2e$)
$MB_y$ Is the methane produced in the landfill in the absence of the project activity in year *y* ($tCO_2e$)
$MD_{reg,y}$ Is methane that would be destroyed in the absence of the project activity in year *y* ($tCO_2e$)
$BE_{EN,y}$ Baseline emissions from generation of energy displaced by the project activity in year *y* ($tCO_2e$)

*Adjustment Factor* (AF)

In cases where regulatory or contractual requirements do not specify $MD_{reg,y}$, an Adjustment Factor (AF) shall be used and justified, taking into account the project context. In doing so, the project participant should take into account that some of the methane generated by the landfill may be captured and destroyed to comply with other relevant regulations or contractual requirements, or to address safety and odour concerns.

$$MD_{reg,y} = MB_y * AF \qquad \text{Equation 3}$$

Where:

AF Is Adjustment Factor for $MB_y$ (%)

The parameter AF shall be estimated as follows:

- In cases where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements, the ratio between the destruction efficiency of that system and the destruction efficiency of the system used in the project activity shall be used;
- In cases where a specific percentage of the "generated" amount of methane to be collected and destroyed is specified in the contract or mandated by the regulation, this percentage divided by an assumed efficiency for the collection and destruction system used in the project activity shall be used.

The 'Adjustment Factor' shall be revised at the start of each new crediting period taking into account the amount of GHG flaring that occurs as part of common industry practice and/or regulation at that point in the future.

[*Case 1:* In the context of this CPA, no Adjustment Factor is accounted for since no methane capture and destruction practises are mandated by regulatory or contractual requirements in Ghana at the time of CPA inclusion. Therefore, AF = 0 and so $MD_{reg,y} = 0$.

*or*

*Case 2:* In the context of this CPA, an Adjustment Factor of [*value of AF*] is accounted for since methane capture and destruction practises are mandated by regulatory or contractual requirements in Ghana at the time of CPA inclusion. Therefore $MD_{reg,y}$ = [*Value of* $MD_{reg,y}$]].

*Rate of compliance*

In cases where there are regulations that mandate the use of one of the project activity treatment options and which is not being enforced, the baseline scenario is identified as a gradual improvement of waste management practices to the acceptable technical options expected over a period of time to comply with the MSW Management Rules. The adjusted baseline emissions ($BE_{y,a}$) are calculated as follows:

$$BE_{y,a} = BE_y * ( 1 - RATE^{Compliance}_y) \quad \text{Equation 4}$$

Where:

| | |
|---|---|
| $BE_y$ | Is the $CO_2$-equivalent emissions as determined from equation 20 of the methodology |
| $RATE^{Compliance}_y$ | Is the state-level compliance rate of the MSW Management Rules in that year *y*. The compliance rate shall be lower than 50%; if it exceeds 50% the project activity shall receive no further credit. In such cases $BE_{y,a}$ should replace $BE_y$ to estimate emission reductions. |

The compliance ratio $RATE^{Compliance}_y$ shall be monitored *ex post* based on the official reports for instance annual reports provided by municipal bodies.

[*Case 1:* In the context of this CPA and at the time of CPA inclusion, there are no regulations that mandate the use of the project activity treatment option at the time of CPA inclusion. Therefore $RATE^{Compliance}_y = 0$

*or*

*Case 2:* In the context of this CPA and at the time of CPA inclusion, there are regulations that mandate the use of the project activity treatment option. Therefore $RATE^{Compliance}_y$ = [*Value of* $RATE^{Compliance}_y$].]

*Methane generation from the landfill in the absence of the project activity* ($MB_y$)

The amount of methane that is generated each year ($MB_y$) is calculated as per the latest version of the approved methodological tool "*Emissions from solid waste disposal sites*" considering the following additional equation:

$$MB_y = BE_{CH4,SWDS,y} \quad \text{Equation 5}$$

Where:

| | |
|---|---|
| $BE_{CH4,SWDS,y}$ | Is the methane generation from the landfill in the absence of the project activity at year *y*, *y* that is methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site during the period from the start of the project activity to the end of the year *y* ($tCO_2e$) as calculated using application B in the methodological tool "*Emissions from solid waste disposal sites*". The tool estimates methane generation adjusted for, using adjustment factor ($f_y$) any landfill gas in the baseline that would have been captured and destroyed to comply with relevant regulations or contractual requirements, or to address safety and odor concerns. As this is already accounted for the methodology, "$f_y$" in the tool shall be assigned a value 0. |

<u>Note</u>: Where for a particular year it cannot be demonstrated that the waste would have been disposed of in the landfill, the waste quantities prevented from disposal ($W_{j,x}$) in the tool should be assigned a value 0 (zero).

The approved methodological tool "*Emissions from solid waste disposal sites*" provides procedures to calculate baseline, project or leakage emissions of methane from solid waste disposed or prevented from disposal at a SWDS.

The tool can be used to determine emissions for [the following types of applications:

- **Application A:** The CDM project activity mitigates methane emissions from a specific existing SWDS. Methane emissions are mitigated by capturing and flaring or combusting the methane (e.g. ACM0001). The methane is generated from waste disposed in the past, including prior to the start of the CDM project activity. In these cases, the tool is only applied for an ex-ante estimation of emissions in the CDM-CPA-DD. The emissions will then be monitored during the crediting period using the applicable approaches in the relevant methodologies (e.g. measuring the amount of methane captured from the SWDS).

- **Application B:** The CDM project activity avoids or involves the disposal of waste at a SWDS. An example of this application of the tool is AM0025, in which MSW is treated with an alternative option, such as composting or anaerobic digestion, and is then prevented from being disposed of in a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period. In these cases, the tool can be applied for both ex-ante and ex-post estimation of emissions.

All CPAs that will be included in proposed PoA will refer to Application B.]

Amount of methane that would in the absence of the project activity be generated from disposal of waste at the solid waste disposal site ($BE_{CH4,SWDS,y}$)

$$BE_{CH4,SWDS,y} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \times \sum_{x-1}^{y} \sum_{j} A_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1 - e^{-k_j})$$

Equation 6

$$BE_{CH4,SWDS,m} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,m} \times MCF_y \times \sum_{x-1}^{m} \sum_{i} A_{j,x} \times DOC_j \times e^{-\frac{k_j}{12} \times (m-i)} \times (1 - e^{-\frac{k_j}{12}})$$

Equation 7

Where:

| | |
|---|---|
| $BE_{CH4,SWDS,y}$ | Baseline methane emissions occurring in year *y* generated from waste disposal at the solid waste disposal site (SWDS) during a time period ending in the year *y* ($tCO_2e/yr$) |
| *x* | Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (*x* = 1) to the year *y* (*x* = *y*) |
| *y* | Year of the crediting period for which methane emissions are calculated (*y* is a consecutive period of 12 months) |
| $DOC_f$ | Fraction of degradable organic carbon (DOC) that can decompose |
| $A_{j,x}$ | is the amount of organic waste type *j* prevented from disposal in the landfill in the year *x* (tonnes/year), this is the value to be used for variable $W_{i,x}$ in the methodological tool "*emissions from solid waste disposal sites*" |

Where, for the monthly model:

| | |
|---|---|
| $BE_{CH4,SWDS,m}$ | Baseline, project or leakage methane emissions occurring in month *m* generated from waste disposal at a SWDS during a time period ending in month *m*($t\ CO_2e$ / m) |
| *m* | Month of the crediting period for which methane emissions are calculated |
| *i* | Months in the time period in which waste is disposed at the SWDS, extending from the first month in the time period (*i* = 1) to month *m* (*i* = m) |
| $DOC_{f,m}$ | Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for month *m* (weight fraction) |
| $A_{j,i}$ | Amount of organic waste type *j* disposed/prevented from disposal in the SWDS in the month *i* (t) |

And, where for both the yearly and monthly models:

| | |
|---|---|
| $\varphi_y$ | Model correction factor to account for model uncertainties for year *y* |
| $f_y$ | Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y* |
| $GWP_{CH4}$ | Global Warming Potential (GWP) of methane |
| OX | Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste) |
| F | Fraction of methane in the SWDS gas (volume fraction) |
| $MCF_y$ | Methane correction factor for the year *y* |
| $DOC_j$ | Fraction of degradable organic carbon in the waste type *j* (weight fraction) |
| $k_j$ | Decay rate for the waste type *j (1 / yr)* |
| j | Type of residual waste or types of waste in the MSW |

The multi-phase model of the methodological tool "*Emissions from solid waste disposal sites*" is applied with a [monthly *or* yearly] time period for this CPA.

**Determining the model correction factor ($\varphi_y$)**

The model correction factor ($\varphi_y$) depends on the uncertainty of the parameters used in the FOD model. If baseline emissions are being calculated, then project participants may choose between the following two options to calculate $\varphi_y$:

*Option 1: Use a default value*

Use a default value: $\varphi_y = \varphi_{default}$. Default values for different applications and climatic conditions are provided in the section "*Data and parameters not monitored*" below.

*Option 2: Determine $\varphi_y$ based on specific situation of the project activity*

Undertake an uncertainty analysis for the specific situation of the proposed CPA. The overall uncertainty of the determination of methane generation in year *y* ($v_y$) is calculated as follows:

$$v_y = \sqrt{a^2 + b^2 + c^2 + d^2 + e^2 + g^2} \qquad \text{Equation 8}$$

The factors a, b, c, d, e and g quantify the effect of the uncertainty of different parameters (listed in the second column of Table 6), used in the FOD model, on the overall uncertainty of the methane generation in year *y*. Project participants shall select for each factor a value within the range provided in Table 6[20], following the instructions in the table, and justify their selection.

**Table 6:** *Instructions for the selection of values for the factors a, b, c, d, e and g.*

| Factor | Parameter | Lower value | Higher value | Instructions for selecting the factor |
|---|---|---|---|---|
| a | W | 2% | 10% | Use the lower value if solid waste is weighed using accurate weighbridges. Use the higher value if the amount of waste is estimated, such as from the depth and surface area of an existing SWDS. |
| b | $DOC_j$ | 5% | 10% | Use the lower value if the $DOC_j$ is measured. Use the higher value if default values are used. |
| c | $DOC_f$ | 5% | 15% | Use the lower value if more than 50% of the waste is rapidly degradable organic material or if the |

[20] These uncertainty values are estimated based on the 68% confidence level.

| | | | | |
|---|---|---|---|---|
| | | | | SWDS is located in a tropical climate. Otherwise use the higher value. |
| d | F | 0% | 5% | Use the lower value if more than 50% of the waste is rapidly degradable organic material. |
| e | $MCF_y$ | 0% | 50% | Use the lower value for managed SWDS. For unmanaged SWDS, use the higher value or determine the factor as 2/d, where d is the depth of the SWDS (in meters). |
| g | $e^{-k_j \times (y-x)} \times (1 - e^{-k_j})$ | 5% | 20% | The uncertainty values provided express the uncertainty for the exponential term as a whole. Use the lower uncertainty value in the following cases: (i) Application B: if residual waste is disposed at the SWDS and if the value of *k* is larger than 0.2 y-1); and (ii) Application A: if the SWDS compartments where the project is implemented were closed less than 3 years ago. In all other cases, use the higher value. |

$\varphi_y$ is then calculated as follows:

$$\varphi_y = \frac{1}{(1+v_y)} \qquad \text{Equation 9}$$

For the case that the monthly FOD model is being used, then $\varphi_y$ refers to the year *y* to which the month *m* belongs.

[Option 1 *or* Option 2] is applied for this CPA.

[*If option 2 is chosen,* Values from Table 6 selected for this CPA are given in the table below:

| Factor | Parameter | Value selected | Justification |
|---|---|---|---|
| a | W | 2% | [*justification*] |
| b | $DOC_j$ | 5% | [*justification*] |
| c | $DOC_f$ | 5% | [*justification*] |
| d | F | 0% | [*justification*] |
| e | $MCF_y$ | 0% | [*justification*] |
| g | $e^{-k_j \times (y-x)} \times (1 - e^{-k_j})$ | 5% | [*justification*] |

]

*Determining the amounts of waste types j disposed in the SWDS ($A_{j,x}$ or $A_{j,i}$)*

Where different waste types *j* are disposed or prevented from disposal in the SWDS (for example, in the case of MSW), it is necessary to determine the amount of different waste types ($A_{j,x}$ or $A_{j,i}$). In the case that only one type of waste is disposed (for example, in the case of a residual waste), then $A_{j,x} = A_x$ and $A_{j,i} = A_i$ and the following procedures do not need to be applied (e.g. waste sampling is not required).

**Application B**

Determine the amount of different waste types through sampling and calculate the mean from the samples either using equation 5 of the tool to determine the value of $A_{j,x}$ for the yearly model or using equation 6 of the tool to determine the value of $A_{j,i}$ for the monthly model, as follows:

$$A_{j,x} = A_x \times p_{j,x} \qquad \text{Equation 10}$$

$A_{j,x}$ Amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the year *x* (t)

$A_x$ Total amount of solid waste disposed or prevented from disposal in the SWDS in year *x* (t)
$p_{j,x}$ Average fraction of the waste type *j* in the waste in year *x* (weight fraction)
*j* Types of solid waste
*x* Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (*x* = 1) to year *y* (*x* = *y*)

$$A_{j,i} = A_i \times p_{j,i} \qquad \text{Equation 11}$$

$A_{j,x}$ Amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the month *i* (t)
$A_i$ Total amount of solid waste disposed or prevented from disposal in the SWDS in month *i* (t)
$p_{j,i}$ Average fraction of the waste type *j* in the waste in month *i* (weight fraction)
*j* Types of solid waste
*i* Months in the time period for which waste is disposed at the SWDS, extending from the first month in the time period (*i* = 1) to year *m* (*i* = *m*)

The fractions of the waste type *j* in the waste for the year *x* or month *i* are calculated according to equation 12 or 13 as follows:

$$p_{j,x} = \frac{\sum_{n=1}^{z_x} p_{n,j,x}}{z_x} \qquad \text{Equation 12}$$

Where:
$p_{j,x}$ Average fraction of the waste type *j* in the waste in year *x* (weight fraction)
$p_{n,j,x}$ Fraction of the waste type *j* in the sample *n* collected during the year *x* (weight fraction)
$z_x$ Number of samples collected during the year *x*
n Samples collected in year *x*
*j* Types of solid waste
*x* Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (*x* = *1*) to year *y* (*x* = *y*)

$$p_{j,i} = \frac{\sum_{n=1}^{3} p_{n,j,i}}{3} \qquad \text{Equation 13}$$

Where:
$p_{j,i}$ Average fraction of the waste type *j* in the waste in month *i* (weight fraction)
$p_{n,j,i}$ Fraction of the waste type *j* in the sample *n* collected during or recent to month *i* (weight fraction)
n The three most recent samples collected during or previous to month *i*
*j* Types of solid waste
*i* Months in the time period in which waste is disposed at the SWDS, extending from the first month in the time period (*i* = 1) to month m (*i* = m)

The value of $A_{j,x}$ for the [yearly *or* monthly] model is determined with the equation above for this CPA.

*Determining the fraction of DOC that decomposes in the SWDS ($DOC_{f,y}$)*

***Application B***
In the case that the tool is applied to MSW, then project participants may choose to either apply a default value ($DOC_{f,y} = DOC_{f,default}$) or to determine $DOC_{f,y}$ or $DOC_{f,m}$ based on measurements of the biochemical methane potential of the MSW ($BMP_{MSW}$)), as follows:

$$DOC_{f,y} = 0.7 \times \frac{12}{16} \times \frac{BMP_{MSW}}{F \times \sum_j (p_{j,y} \times DOC_j)} \qquad \text{Equation 14}$$

Where:

| | |
|---|---|
| $DOC_{f,y}$ | Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year *y* (weight fraction) |
| $BMP_j$ | Biochemical methane potential for the MSW disposed or prevented from disposal (t $CH_4$/ t waste) |
| F | Fraction of methane in the SWDS gas (volume fraction) |
| $DOC_j$ | Fraction of degradable organic carbon in the waste type *j* (weight fraction) |
| $p_{j,y}$ | Average fraction of the waste type j in the waste in year *y* (weight fraction) |
| j | Types of solid waste in the MSW |
| y | Year of the crediting period for which methane emissions are calculated (*y* is a consecutive period of 12 months) |

[*Case 1:* A default value is applied for this CPA therefore $DOC_{f,y} = DOC_{f,default}$

*or*

*Case 2:* ($DOC_{f,y}$ *or* $DOC_{f,m}$) is determined based on measurements of the biochemical methane potential of the MSW ($BMP_{MSW}$))]

*Procedure to determine the methane correction factor ($MCF_y$)*

In case of a water table above the bottom of the SWDS (for example, due to using waste to fill inland water bodies, such as ponds, rivers or wetlands), the MCF should be determined as follows:

$$MCF_y = MAX\left\{\left(1 - \frac{2}{d_y}\right), \frac{h_{w,y}}{d_y}\right\} \qquad \text{Equation 15}$$

Where:

| | |
|---|---|
| $MCF_y$ | Methane correction factor for year *y* |
| $h_{w,y}$ | Height of water table measured from the base of the SWDS (m) |
| $d_y$ | Depth of SWDS (m) |

In other situation, the MCF should be selected as a default value ($MCF_y = MCF_{default}$).

[*Case 1*: A default value for $MCF_y$ is applied for this CPA therefore $MCF_y = MCF_{default}$

*or*

*Case 2:* $MCF_y$ is determined using equation 15.]

Table below summarizes how the parameters required in this tool are determined in the context of the proposed CPA.

**Table 7:** *Selected options to determine parameters in the context of the proposed PoA for baseline emissions.*

| Parameter | Proposed CPA (Application B) |
|---|---|
| $\varphi_y$ | Baseline emissions: [default value *or* project specific value estimated yearly] |
| OX | Default value |
| F | Default value |
| $DOC_f$ | [Default value *or* ($DOC_{f,y}$ *or* $DOC_{f,m}$)Estimated once] |

| | |
|---|---|
| $MCF_y$ | [Monitored for SWDS with a water table above the bottom of the SWDS *or* Default values (based on SWDS type) for SWDS without a water table above the bottom of the SWD] |
| $k_j$ | Default values (based on waste type) |
| $A_{j,x}$ or $A_{j,i}$ | Calculated based on monitored data |
| $DOC_j$ | Default values or waste specific value estimated once |
| $f_y$ | Monitored |

*Baseline emissions from generation of energy displaced by the project activity* ($BE_{EN,y}$)

Energy generation from MSW is not included in the scope of the proposed CPA therefore, **$BE_{EN,y} = 0$**.

**Project Emissions**

The project emissions in year *y* are:

$$PE_y = PE_{elec,y} + PE_{fuel,\ on\text{-}site,y} + PE_{c,y} + PE_{a,y} + PE_{g,y} + PE_{r,y} + PE_{i,y} + PE_{w,y} + PE_{co\text{-}firing,y} \quad \text{Equation 16}$$

Where:

| | |
|---|---|
| $PE_y$ | Is the project emissions during the year *y* ($tCO_2e$) |
| $PE_{elec,y}$ | Is the emissions from electricity consumption on-site due to the project activity in year *y* ($tCO_2e$) |
| $PE_{fuel,\ on\text{-}site,y}$ | Is the emissions on-site due to fuel consumption on-site in year *y* ($tCO_2e$) |
| $PE_{c,y}$ | Is the emissions from composting in year *y* ($tCO_2e$) |
| $PE_{a,y}$ | Is the emissions from the anaerobic digestion process in year *y* ($tCO_2e$) |
| $PE_{g,y}$ | Is the emissions from the gasification process in year *y* ($tCO_2e$) |
| $PE_{r,y}$ | Is the emissions from the combustion of RDF/stabilized biomass in year *y* ($tCO_2e$) |
| $PE_{i,y}$ | Is the emissions from waste incineration in year *y* ($tCO_2e$) |
| $PE_{w,y}$ | Is the emissions from wastewater treatment in year *y* ($tCO_2e$) |
| $PE_{co\text{-}firing,y}$ | Is the emissions from thermal energy generation/electricity generation from on-site fossil fuel consumption during co-firing in year *y* ($tCO_2e$) |

***Emissions from electricity use on-site*** ($PE_{elec,y}$)

Where the project activity involves electricity consumption, $CO_2$ emissions are calculated as follows:

$$PE_{elec,y} = EG_{PJ,FF,y} * CEF_{elec} \quad \text{Equation 17}$$

Where:

| | |
|---|---|
| $EG_{PJ,FF,y}$ | Is the amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid as a result of the project activity, measured using an electricity meter (MWh) |
| $CEF_{elec}$ | Is the carbon emissions factor for electricity generation in the project activity ($tCO_2/MWh$) |

In cases where electricity is generated in an on-site fossil fuel fired power plant, project participants should use, as $CEF_{elec}$, the default emission factor for a diesel generator with a capacity of more than 200 kW for small-scale project activities (0.8 $tCO_2/MWh$, see AMS-I.F, Table I.F.1 in the simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories).

In cases where electricity is purchased from the grid, the emission factor $CEF_{elec}$ should be calculated according to the "*Tool to calculate the emission factor for an electricity system*".

Furthermore, electricity consumption for composting should not be included in $EG_{PJ,FF,y}$, as this emission source is accounted for in the parameter $PE_{c,y}$.

The only electricity consumption source included in the boundary of this CPA is composting process. The resulting project emissions are accounted for in parameter $PE_{c,y}$.

***Emissions from fuel use on-site*** ($PE_{fuel,\ on\text{-}site,y}$)

Project participants shall account for $CO_2$ emissions from any on-site fuel combustion (other than electricity generation, e.g. vehicles used on-site). Emissions are calculated from the quantity of fuel used and the specific $CO_2$-emission factor of the fuel, as follows:

$$PE_{fuel,\ on\text{-}site,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel} \qquad \text{Equation 18}$$

Where:

| | | |
|---|---|---|
| $PE_{fuel,\ on\text{-}site,y}$ | = | Is the $CO_2$ emissions due to on-site fuel combustion in year *y* ($tCO_2$) |
| $F_{cons,y}$ | = | Is the fuel consumption on site in year *y* (l or kg) |
| $NCV_{fuel}$ | = | Is the net caloric value of the fuel (MJ/l or MJ/kg) |
| $EF_{fuel}$ | = | Is the $CO_2$ emissions factor of the fuel ($tCO_2$/MJ) |

Local values should be preferred as default values for the net calorific values and $CO_2$ emission factors. If local values are not available, project participants will use IPCC default values for the net calorific values and $CO_2$ emission factors.

Note that fuel consumption for the purpose of composting should not be included in $F_{cons,y}$, as this emission sources is accounted for in the parameter $PE_{c,y}$.

No fossil fuel consumption other than for the purpose of the composting process [and electricity generation *if applicable*] is expected in the CPA. Therefore, $PE_{fuel,\ on\text{-}site,y}$ =0.

***Emissions from composting*** ($PE_{c,y}$)

Project emissions associated with composting ($PE_{c,y}$) are calculated according to the methodological tool to estimate "*Project and leakage emissions from composting*". $PE_{c,y}$ is equivalent to parameter $PE_{COMP,y}$ in the tool.

The project emissions from composting ($PE_{COMP,y}$) are determined as follows:

$$PE_{COMP,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{N2O,y} + PE_{RO,y} \qquad \text{Equation 19}$$

Where:

| | |
|---|---|
| $PE_{COMP,y}$ | Project emissions associated with composting in year *y* (t $CO_2$e/yr) |
| $PE_{EC,y}$ | Project emissions from electricity consumption associated with composting in year *y* (t $CO_2$/yr) |
| $PE_{FC,y}$ | Project emissions from fossil fuel consumption associated with composting in year *y* (t $CO_2$/yr) |
| $PE_{CH4,y}$ | Project emissions of methane from the composting process in year *y* (t $CO_2$e/yr) |
| $PE_{N2O,y}$ | Project emissions of nitrous oxide from the composting process in year y (t $CO_2$e/yr) |
| $PE_{RO,y}$ | Project emissions of methane from run-off wastewater associated with co-composting in year *y* (t $CO_2$e/yr) |

***Determination of the quantity of waste composted ($Q_y$)***

The quantity of waste composted is a parameter required in the determination of emissions associated with each source of project emissions. There are two options to determine the quantity of waste composted in year *y* ($Q_y$).

**Option 1: Procedure using a weighing device**

Monitor the weight of waste delivered to the composting installation using an on-site weighbridge or any other applicable and calibrated weighing device (e.g. belt-scales).

**Option 2: Procedure without using a weighing device**

This procedure shall only be applied in the case that there is no weighbridge or any other applicable and calibrated weighing device available on site. Under this procedure, $Q_y$ is calculated based on the carrying capacity of each truck delivering waste to the composting installation in year *y* ($CT_y$), as follows:

$$Q_y = \sum_t CT_{t,y} \qquad \text{Equation 20}$$

Where:

| | |
|---|---|
| $Q_y$ | Quantity of waste composted in year *y* (t / yr) |
| $CT_{t,y}$ | Carrying capacity of truck *t* used in year *y* to deliver waste to the composting installation (t) |
| t | Waste deliveries in trucks to the composting installation in year *y* |

[Option 1 *or* Option 2] is selected for the CPA.

***Determination of project emissions from electricity consumption ($PE_{EC,y}$)***

Where the composting activity involves electricity consumption from the grid or from a fossil fuel fired on-site power plant, $PE_{EC,y}$ shall be calculated using the latest approved version of the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*", where the project emissionsource *j* referred to in the tool is composting.

When applying this tool, if monitored data for electricity consumption is not available, then electricity consumption from composting ($EC_{PJ,comp,y}$) may be determined based on a default value for the specific quantity of electricity consumed per tonne of waste composted ($SEC_{comp,default}$), according to equation 21. Note that the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" also provides options to calculate emission based on non-monitored parameters, including a default emission factor for the emissions per MWh of electricity consumed and an option to estimate electricity consumption based on the rated capacity of the captive power plant (if applicable).

$$EC_{PJ,comp,y} = Q_y \text{ x } SEC_{comp,default} \qquad \text{Equation 21}$$

Where:

| | |
|---|---|
| $EC_{PJ,comp,y}$ | Quantity of electricity consumed for composting in year *y* (MWh/yr) |
| $Q_y$ | Quantity of waste composted in year *y* (t/yr) |
| $SEC_{comp,default}$ | Default value for the specific quantity of electricity consumed per tonne of waste composted (MWh/t) |

The latest approved version of the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" is applied:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \qquad \text{Equation 22}$$

Where:

| | |
|---|---|
| $PE_{EC,y}$ | project emissions from electricity consumption by the project activity during the year *y* ($tCO_2$/yr) |

| | |
|---|---|
| $EC_{PJ,j,y}$ | quantity of electricity consumed by the project activity during the year *y* (MWh) |
| $EF_{EL,j,y} = EF_{grid,y}$ | emission factor of the grid ($tCO_2/MWh$), calculated as using the procedures in the latest approved version of the *Tool to calculate the emission factor for an electricity system* |
| $TDL_{j,y}$ | average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site |
| j | sources of electricity consumption in the project |

In the CPA, [*Case A:* monitored data for electricity consumption is available *or Case B*: monitored data for electricity consumption is not available thus the default value for the specific quantity of electricity consumed per tonne of waste composted ($SEC_{comp,default}$) is applied according to equation 21: $EC_{PJ,j,y} = EC_{PJ,comp,y} = Q_y \times SEC_{comp,default}$].

[*Case 1:* The project activity will only consume electricity from the national grid (Scenario A). Option A1 is applied. Therefore $EF_{EL,j,y} = EF_{grid,CM,y}$ and $TDL_{j,y}$ is determined annually.

*or*

*Case 2*: The project activity will consume electricity mainly from grid (Scenario A) but may use a fossil fuel generator as a back-up (scenario B). In this case Option A1 is applied for electricity consumed from the grid ($EF_{EL,j,y} = EF_{grid,y}$ and $TDL_{j,y}$ is determined annually and Option B2 is applied to calculate project emissions resulting from the specific use of a back-up generator, applying the conservative default value of 1.3 $tCO_2/MWh$ for $EF_{EL,j,y}$ (and $TDL_{j,y} = 0$).

*or*

*Case 3*: The project activity will consume electricity from a fossil fuel generator (scenario B). Option B2 is applied to calculate project emissions resulting from the specific use of a the generator, applying the conservative default value of 1.3 $tCO_2/MWh$ for $EF_{EL,j,y}$ (and $TDL_{j,y}=0$).]

**Determination of project emissions from fossil fuel consumption ($PE_{FC,y}$)**

Where the composting activity involves fossil fuel consumption, project participants may choose between the following two options to calculate $PE_{FC,y}$:

**Option 1: Procedure using monitored data**

$PE_{FC,y}$ shall be calculated using the latest approved version of the "*Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion*", where the project emission source *j* referred to in the tool is composting.

$CO_2$ emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} * COEF_{i,y} \qquad \text{Equation 23}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process *j* during the year *y* ($tCO_2/yr$) |
| $FC_{i,j,y}$ | Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr) |
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type *i* in year *y* ($tCO_2$/mass or volume unit) |
| *i* | Are the fuel types combusted in process *j* during the year *y* |

The $CO_2$ emission coefficient $COEF_{i,y}$ can be calculated using one of the following two options, depending on the availability of data on the fossil fuel type *i*, as follows:

**Option 1A:** The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type i, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = W_{C,i,y} * 44/12$ Equation 24

If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{i,y} = W_{C,i,y} * \rho_{i,y} * 44/12$ Equation 25

Where:

$COEF_{i,y}$ Is the $CO_2$ emission coefficient of fuel type *i* ($tCO_2$/mass or volume unit);
$W_{C,i,y}$ Is the weighted average mass fraction of carbon in fuel type *i* in year *y* (tC/mass unit of the fuel)
$\rho_{i,y}$ Is the weighted average density of fuel type *i* in year *y* (mass unit/volume unit of the fuel)
*i* Are the fuel types combusted in process *j* during the year *y*

**Option 1B:** The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type *i*, as follows:

$COEF_{i,y} = NCV_{i,y} * EF_{CO_2,i,y}$ Equation 26

Where:

$COEF_{i,y}$ Is the $CO_2$ emission coefficient of fuel type *i* in year *y* ($tCO_2$/mass or volume unit)
$NCV_{i,y}$ Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO_2,i,y}$ Is the weighted average $CO_2$ emission factor of fuel type *i* in year *y* ($tCO_2$/GJ)
*i* Are the fuel types combusted in process *j* during the year *y*

Option A should be the preferred approach, if the necessary data is available.

**Option 2: Procedure using a default value**

Project emissions from fossil fuel consumption associated with composting are calculated as follows:

$PE_{FC,y} = Q_y \times EF_{FC,default}$ Equation 27

Where:

$PE_{FC,y}$ Project emissions from fossil fuel consumption associated with composting in year *y* ($tCO_2$/yr)
Qy Quantity of waste composted in year *y* (t/yr)
$EF_{FC,default}$ Default emission factor for fossil fuels consumed by the composting activity per tonne of waste ($tCO_2$/t)

[Case 1: Option 1B is selected for the CPA given the unavailability of data on the chemical composition of fossil fuel required for option 1A.

*or*

Case 2: Option 2 is selected for the CPA.]

**Determination of project emissions of methane ($PE_{CH4,y}$)**

Project emissions of methane from composting ($PE_{CH4,y}$) are determined as follows:

$PE_{CH4,y} = Q_y \times EF_{CH4,y} \times GWP_{CH4}$ Equation 28

Where:

| | |
|---|---|
| $PE_{CH4,y}$ | Project emissions of methane from the composting process in year *y* ($tCO_2e/yr$) |
| Qy | Quantity of waste composted in year *y* (t/yr) |
| $EF_{CH4,y}$ | Emission factor of methane per tonne of waste composted valid for year *y*($tCH_4/t$) |
| $GWP_{CH4}$ | Global Warming Potential of $CH_4$ ($tCO_2e/tCH_4$) |

There are two options which project participants may choose for determining $EF_{CH4,y}$:

**Option 1: Procedure using monitored data**

$EF_{CH4,y}$ is determined based on measurements of the methane emissions during a composting cycle ($ECC_{CH4,c}$), as follows:

$$EF_{CH4,y} = \frac{\sum_{c=1}^{x} ECC_{CH4,c}/Q_c}{x} \qquad \text{Equation 29}$$

Where:

| | |
|---|---|
| $EF_{CH4,y}$ | Emission factor of methane per tonne of waste composted valid for year *y* ($tCH_4/t$) |
| $ECC_{CH4,c}$ | Methane emissions from composting during the composting cycle *c* ($tCH_4$) |
| $Q_c$ | Quantity of waste composted in composting cycle *c* (t) |
| c | Composting cycles for which measurements were undertaken |
| x | Number of composting cycles *c* for which emissions were measured in year *y* (at least three) |

**Option 2: Procedure using default values**

A default value is used: $EF_{CH4,y} = EF_{CH4,default}$. The default value is provided in the "*Data and parameters not monitored*" section of this PoA-DD.

[Option 1 *or* Option 2] is selected for the CPA.

***Determination of project emissions of nitrous oxide ($PE_{N2O,y}$)***

Project emissions of nitrous oxide from composting ($PE_{N2O,y}$) are determined as follows:

$$PE_{N2O,y} = Q_y \times EF_{N2O,y} \times GWP_{N2O} \qquad \text{Equation 30}$$

Where:

| | |
|---|---|
| $PE_{N2O,y}$ | Project emissions of nitrous oxide from composting in year *y* ($tCO_2e/yr$) |
| Qy | Quantity of waste composted in year *y* (t/yr) |
| $EF_{N2O,y}$ | Emission factor of nitrous oxide per tonne of waste composted valid for year *y* ($tN_2O/t$) |
| $GWP_{N2O}$ | Global Warming Potential of $N_2O$ ($tCO_2e/tN_2O$) |

There are two options which project participants may choose for determining $EF_{N2O,y}$:

**Option 1: Procedure using monitored data**

$EF_{N2O,y}$ is determined based on measurements of the emissions during a composting cycle ($ECC_{N2O,c}$), as follows:

$$EF_{N2O,y} = \frac{\sum_{c=1}^{x} ECC_{N2O,c}/Q_c}{x} \qquad \text{Equation 31}$$

Where:

| | |
|---|---|
| $EF_{N2O,y}$ | Emission factor of nitrous oxide per tonne of waste composted valid for year *y* ($tN_2O/t$) |
| $ECC_{N2O,c}$ | Nitrous oxide emissions from composting during the composting cycle *c* ($tN_2O$) |
| Qc | Quantity of waste composted in composting cycle *c* (t) |
| *c* | Composting cycles for which measurements were undertaken |
| *x* | Number of composting cycles c for which emissions were measured in year *y* (at least three) |

**Option 2: Procedure using default values**

A default value is used: $EF_{N2O,y} = EF_{N2O,default}$ Equation 32

The default value is provided in the "*Data and parameters not monitored*" section of this PoA-DD.

[Option 1 *or* Option 2] is selected for the CPA.

**Determination of project emissions from run-off wastewater ($PE_{RO,y}$)**

Project emissions of methane from run-off wastewater ($PE_{RO,y}$) are calculated only for the case of co-composting.

There is no co-composting activities under the CPA. Therefore **$PE_{RO,y} = 0$.**

***Emissions from anaerobic digestion*** ($PE_{a,y}$)

MSW treatment through anaerobic digestion process is not a technical option included in the scope of the proposed CPA, therefore **$PE_{a,y} = 0$**.

***Emissions from gasification*** ($PE_{g,y}$) ***or combustion of RDF/Stabilized Biomass*** ($PE_{r,y}$) ***or waste incineration*** ($PE_{i,y}$)

MSW treatment through gasification, combustion or incineration are not technical options included in the scope of the proposed CPA, therefore

**$PE_{g,y} = 0$**
**$PE_{r,y} = 0$**
**$PE_{i,y} = 0$**

***Emissions from wastewater treatment*** ($PE_{w,y}$)

If the CPA includes wastewater release, methane emissions shall be estimated. If the wastewater is treated using aerobic treatment process, the $CH_4$ emissions from wastewater treatment are assumed to be zero.

If wastewater is treated anaerobically or released untreated, $CH_4$ emissions are estimated as follows:

$PE_{CH4,w,y} = Q_{COD,y} \times P_{COD,y} \times B_0 \times MCF_p$ Equation 33

Where:

| | |
|---|---|
| $PE_{CH4,w,y}$ | Methane emissions from the wastewater treatment in year y ($tCH_4/y$) |
| $Q_{COD,y}$ | Amount of wastewaster treated anaerobically or released untreated from the project activity in year y ($m^3/yr$), which shall be measured monthly and aggregately annually |
| $P_{COD,y}$ | Chemical Oxygen Demand (COD) of wastewaster ($tCOD/m^3$), which will be measured monthly and averaged annually |
| $B_0$ | Maximum methane producing capacity ($tCH_4/tCOD$) |
| $MCF_p$ | Methane conversion factor (fraction), preferably local specific value should be used. In absence of local values, $MCF_p$ default values can be obtained from table 6.3, chapter 6, volume 4 from IPCC 2006 guidelines |

IPCC 2006 guidelines specifies the value for $B_0$ as 0.25 kg $CH_4$/kg COD. Taking into account the uncertainty of this estimate, project participants should use a value of 0.265 kg $CH_4$/kg COD as a conservative assumption for $B_0$.

In case of all the $CH_4$ are emitted into air directly, then:

$$PE_{w,y} = PE_{CH4,w,y} \times GWP_{CH4} \qquad \text{Equation 34}$$

If flaring occurs, the "*Tool to determine project emissions from flaring gases containing methane*" should be used to estimate methane emissions. In this case, $PE_{CH4,w,y}$ will be calculated ex-ante as per equation 33, and then monitored during the crediting period.

[Case 1:"The CPA does not include wastewater release, therefore the $CH_4$ emissions from wastewater treatment are assumed to be zero".

*Or*

Case 2: "The CPA includes wastewater release which is treated using aerobic treatment process therefore the $CH_4$ emissions from wastewater treatment are assumed to be zero".

*Or*

Case 3: "The CPA includes wastewater release; the wastewater is (treated anaerobically *or* released untreated) therefore $CH_4$ emissions are estimated using equation 33.

> Case 3a: All of the $CH_4$ are emitted into air directly. Therefore $PE_{w,y}$ is estimated using equation 34.
>
> *Or*
>
> Case 3b: Biogas from anaerobic wastewater treatment is flared. Therefore the "*Tool to determine project emissions from flaring gases containing methane*" is used to estimate methane emissions. $PE_{CH4,w,y}$ is calculated ex-ante as per equation 33, and then monitored during the crediting period.
>
> *Or*
>
> Case 3c: If the recovered biogas from anaerobic wastewater treatment is used for thermal or mechanical, electrical energy generation directly that component of the project activity can use a corresponding methodology under Type I.]

***Emissions from thermal energy generation/electricity generation (from on-site fossil fuel consumption during co-firing) ($PE_{co\text{-}firing,y}$)***

Project participants shall account for $CO_2$ emissions associated to thermal energy generation/electricity if any from any on-site fossil fuel combustion during co-firing with waste (other than electricity use as mentioned above ($PE_{elec,y}$) and from fuel use on-site ($PE_{fuel,\ on\text{-}site,y}$) and is calculated from the quantity of fossil fuel used for thermal energy generation/electricity generation and the specific $CO_2$ emission factor of the fossil fuel.

Thermal energy generation/electricity generation activities from MSW are not included in the scope of the proposed CPA therefore $\mathbf{PE_{co\text{-}firing,y} = 0}$.

**Leakage**

The sources of leakage considered in the methodology are $CH_4$ emissions from the residual waste from the anaerobic digestion, gasification processes and processing/combustion of RDF. Positive leakages that may occur through the replacement of fossil-fuel based fertilizers with organic composts are not accounted for. If the project activity is exclusively composting, then $L_y = LE_{COMP,y}$.

Transport emissions are not accounted for because it is assumed that similar transportation activities would occur in the baseline.[21]

Leakage emissions from composting ($LE_{COMP,y}$) shall be accounted for if compost is subjected to anaerobic storage or disposed of in a SWDS[22]. $LE_{COMP,y}$ shall be estimated to account for methane emissions from the anaerobic decay of compost, using the methodological tool "*Emissions from solid waste disposal sites*".

Compost produced under this CPA will not be stored anaerobically or disposed of in SWDS. Therefore **$L_y = LE_{COMP,y} = 0$.**

If the sum of $PE_y$ and $L_y$ is smaller than 1% of $BE_y$ in the first full operation year of a crediting period, the project participants may assume a fixed percentage of 1% for $PE_y$ and $L_y$ combined for the remaining years of the crediting period.

In the case that overall negative emission reductions arise in a year, ERs are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the year concerned. (For example: if negative emission reductions of 30 $tCO_2e$ occur in the year t and positive emission reductions of 100 $tCO_2e$ occur in the year t+1, 0 CERs are issued for year t and only 70 CERs are issued for the year t+1.)

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

No changes in the procedure are expected. If there have been changes in the regulations with respect to waste disposal or industries practices, the adjustment factor AF in the baseline emissions shall be re-estimated. Note that adjustment will be needed at the time of renewal of the crediting period.

[21] For example, the waste that is transported to the composting installation in the project activity would in the baseline scenario be transported to an alternative treatment location (e.g. a SWDS). The compost that is transported to its place of application in the project activity, would replace the need to transport fertilizer to the same place of application.

[22] If compost is used as a cover for a SWDS, rather than disposed of in it, then this is not accounted for as a source of leakage emissions.

### B.6.2. Data and parameters that are to be reported ex-ante

All fixed parametric values, including the ex-ante grid emission factor, will be revised at each point of the renewal of the crediting period of the CPAs. CPAs that are included or that renew their crediting period shall always apply the fixed parameters of the latest version of the PoA-DD. Following parameters are fixed for all CPAs included during the first 7 years of the PoA crediting period and for the respective first 7 year crediting period of these CPAs.

[*Only in case waste water is generated:*

| Data / Parameter | $B_0$ |
|---|---|
| Unit | $tCH_4/tCOD$ |
| Description | Maximum methane producing capacity |
| Source of data | The source of data should be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain. |
| Value(s) applied | 0.265 |
| Choice of data or Measurement methods and procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comment | A default value of 0.265 $tCH_4/tCOD$ may be used.Applicable only in case waste water is generated. |

| Data / Parameter | $MCF_p$ |
|---|---|
| Unit | % |
| Description | Methane conversion factor (fraction) |
| Source of data | The source of data should be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain. |
| Value(s) applied | [*To be provided at CPA level.*] |
| Choice of data or Measurement methods and procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comment | Preferably local specific value should be used. In absence of local values, $MCF_p$ default values can be obtained from table 6.3, chapter 6, volume 4 from IPCC 2006 guidelines. Applicable only in case waste water is generated. |

]

*Parameters from Methodological Tool "Project and leakage emissions from composting" (Version 01.0.0)*

[*Applicable in case B of the step "Determination of project emissions from electricity consumption ($PE_{EC,y}$)":*

| Data / Parameter | $SEC_{comp,default}$ |
|---|---|
| Unit | MWh/t |
| Description | Default value for the specific quantity of electricity consumed per tonne of waste composted |
| Source of data | Based on a review of information from relevant validation reports of CDM projects |
| Value(s) applied | 0.01 |
| Choice of data or Measurement methods and procedures | Default value provided by the Methodological Tool "*Project and leakage emissions from composting*" (Version 01.0.0) |
| Purpose of data | Calculation of project emissions |
| Additional comment | Applicable to the step "*Determination of project emissions from electricity consumption* ($PE_{EC,y}$)" |

[Applicable in case *Option 1B is chosen to determine emissions from fuel use (accounted for in the parameter $PE_{c,y}$):*

| Data / Parameter | $D_{fuel}$ |
|---|---|
| Unit | kg/L |
| Description | Density of diesel |
| Source of data | The source of data should be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain. |
| Value(s) applied | 0.88 |
| Choice of data or Measurement methods and procedures | - |
| Purpose of data | Calculation of project emissions. |
| Additional comments | Not necessary if $NCV_{fuel}$ is demonstrated on a per liter basis. |

]

[Applicable in case *Option 2 is chosen to determine emissions from fuel use (accounted for in the parameter $PE_{c,y}$):*

| Data / Parameter | $EF_{FC,default}$ |
|---|---|
| Unit | $tCO_2/t$ |
| Description | Default emission factor for fossil fuel consumed by the composting activity per tonne of waste composted (wet basis) |
| Source of data | Based on a review of fossil fuel consumption per tonne of waste composed in relevant validation reports of CDM projects and using a conservative default emission factor for diesel (from the 2006 IPCC Guidelines) |
| Value(s) applied | 0.0207 |
| Choice of data or Measurement methods and procedures | Default value provided by the Methodological Tool "*Project and leakage emissions from composting*" (Version 01.0.0) |
| Purpose of data | Calculation of project emissions |
| Additional comment | Applicable to Option 2 in the step "*Determination of project emissions from fossil fuel consumption ($PE_{FC,y}$)*" |

]

[*In case Option 2 in the step "Determination of methane and nitrous oxide emissions from the composting process" is applied:*

| Data / Parameter | $EF_{CH4,default}$ |
|---|---|
| Unit | $tCH_4/t$ |
| Description | Default emission factor of methane per tonne of waste composted (wet basis) |
| Source of data | The emission factor was selected based on studying published results of emission measurements from composting facilities, literature reviews on the subject and published emission factors. Data from recent, high quality sources was analyzed and a value conservatively selected from the higher end of the range in results. |
| Value(s) applied | 0.002 |
| Choice of data or Measurement methods and procedures | Default value provided by the Methodological Tool "*Project and leakage emissions from composting*" (Version 01.0.0) |
| Purpose of data | Calculation of project emissions |
| Additional comment | Applicable to Option 2 in the step "*Determination of methane and nitrous oxide emissions from the composting process*" |

| | |
|---|---|
| **Data / Parameter** | **$EF_{N2O,default}$** |
| **Unit** | $tN_2O/t$ |
| **Description** | Default emission factor of nitrous oxide per tonne of waste composted (wet basis) |
| **Source of data** | The emission factor was selected based on studying published results of emission measurements from composting facilities, literature reviews on the subject and published emission factors. Data from recent, high quality sources was analyzed and a value conservatively selected from the higher end of the range in results |
| **Value(s) applied** | 0.0002 |
| **Choice of data or Measurement methods and procedures** | Default value provided by the Methodological Tool "*Project and leakage emissions from composting*" (Version 01.0.0) |
| **Purpose of data** | Calculation of project emissions |
| **Additional comment** | Applicable to Option 2 in the step "*Determination of methane and nitrous oxide emissions from the composting process*" |

]

| | |
|---|---|
| **Data / Parameter** | **$GWP_{CH4}$** |
| **Unit** | $tCO_2e/tCH_4$ |
| **Description** | Global Warming Potential of $CH_4$ |
| **Source of data** | IPCC |
| **Value(s) applied** | 21 for the first commitment period. Shall be updated for future commitment periods according to any future COP/MOP decisions. |
| **Choice of data or Measurement methods and procedures** | - |
| **Purpose of data** | Calculation of project emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | **$GWP_{N2O}$** |
| **Unit** | $tCO_2e/tN_2O$ |
| **Description** | Global Warming Potential of $N_2O$ |
| **Source of data** | IPCC |
| **Value(s) applied** | 310 for the first commitment period. Shall be updated for future commitment periods according to any future COP/MOP decisions. |
| **Choice of data or Measurement methods and procedures** | - |
| **Purpose of data** | Calculation of project emissions |
| **Additional comment** | - |

*Parameters from Baseline "Emissions from solid waste disposal sites"*

[*In case Option 1 in the procedure "Determining the model correction factor ($\varphi_y$)" is applied:*

| Data / Parameter | $\varphi_{default}$ |
|---|---|
| Unit | - |
| Description | Default value for the model correction factor to account for model uncertainties |
| Source of data | - |
| Value(s) applied | [*To be provided at CPA level.*] |
| Choice of data or Measurement methods and procedures | Default value provided by the Methodological Tool "*Emissions from solid waste disposal sites*"<br><br>For baseline emissions: refer to Table 8 to identify the appropriate factor based on the application of the tool (application B for this PoA) and the climate where the SWDS is located.<br><br>**Table 8:** *Default values for the model correction factor*<br>[table below]<br><br>Average temperature is [mean temperature in °C] and average rainfall is [mean rainfall in mm] (source: [source of information used]) |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Table 8 is applicable to Option 1 in the procedure "*Determining the model correction factor* ($\varphi_y$)" |

| | Humid/wet conditions | Dry conditions |
|---|---|---|
| Application B | 0.85 | 0.80 |

]

| Data / Parameter | OX |
|---|---|
| Unit | - |
| Description | Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste) |
| Source of data | Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories |
| Value(s) applied | 0.1 |
| Choice of data or Measurement methods and procedures | Default value provided by the *Methodological Tool "Emissions from solid waste disposal sites"*. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | When methane passes through the top-layer, part of it is oxidized by methanotrophic bacteria to produce $CO_2$. The oxidation factor represents the proportion of methane that is oxidized to $CO_2$.This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWD. |

| Data / Parameter | F |
|---|---|
| Unit | - |
| Description | Fraction of methane in the SWDS gas (volume fraction) |
| Source of data | IPCC 2006 Guidelines for National Greenhouse Gas Inventories |
| Value(s) applied | 0.5 |
| Choice of data or Measurement methods and procedures | Default value provided by the Methodological Tool "*Emissions from solid waste disposal sites*" |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide |

| Data / Parameter | $DOC_{f,default}$ |
|---|---|
| Unit | Weight fraction |
| Description | Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS. |
| Source of data | IPCC 2006 Guidelines for National Greenhouse Gas Inventories |
| Value(s) applied | 0.5 |
| Choice of data or Measurement methods and procedures | Default value provided by the Methodological Tool "*Emissions from solid waste disposal sites*". |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS. This default value can be used for Application B if the tool is applied to MSW.<br>An alternative to using the default factor is to estimate $DOC_{f,y}$ or $DOC_{f,m}$ using Equation 14. |

[*In the absence of a water table above the bottom of the SWDS:*

| Data / Parameter | $MCF_{default}$ |
|---|---|
| Unit | - |
| Description | Methane correction factor |
| Source of data | IPCC 2006 Guidelines for National Greenhouse Gas Inventories |
| Value(s) applied | [*To be provided at CPA level.*] |
| Choice of data or Measurement methods and procedures | Default value provided by the Methodological Tool "*Emissions from solid waste disposal sites*" (Version 06.0.1) can be applied.<br><br>In case that the SWDS does not have a water table above the bottom of the SWDS, then select the applicable value from the following:<br>• 1.0 for **anaerobic managed solid waste disposal sites**. These must have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste;<br>• 0.5 for **semi-aerobic managed solid waste disposal sites**. These must have controlled placement of waste and will include all of the following structures for introducing air to the waste layers: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system;<br>• 0.8 for **unmanaged solid waste disposal sites - deep**. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters;<br>• 0.4 for **unmanaged-shallow solid waste disposal sites or stockpiles that are considered SWDS**. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 meters. This includes stockpiles of solid waste that are considered SWDS (according to the definition given for a SWDS). |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | MCF accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.<br>In case of a water table above the bottom of the SWDS, a larger proportion of the SWDS is anaerobic and MCF shall be estimated according to Equation 12. |

<table>
<tr><td>Data / Parameter</td><td>$DOC_j$</td></tr>
<tr><td>Unit</td><td>-</td></tr>
<tr><td>Description</td><td>Fraction of degradable organic carbon in the waste type j (weight fraction)</td></tr>
<tr><td>Source of data</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)</td></tr>
<tr><td>Value(s) applied</td><td>For MSW, the following values for the different waste types j should be applied:<br>Table 9: Default values for $DOC_j$
<table>
<tr><th>Waste type j</th><th>$DOC_j$ (% wet waste)</th></tr>
<tr><td>Wood and wood products</td><td>43</td></tr>
<tr><td>Pulp, paper and cardboard (other than sludge)</td><td>40</td></tr>
<tr><td>Food, food waste, beverages and tobacco (other than sludge)</td><td>15</td></tr>
<tr><td>Textiles</td><td>24</td></tr>
<tr><td>Garden, yard and park waste</td><td>20</td></tr>
<tr><td>Glass, plastic, metal, other inert waste</td><td>0</td></tr>
</table>
For the following residual waste types, project participants may use or derive default values, as follows:<br>
• For empty fruit brunches (EFB), as their characteristics are similar to garden waste, the value for garden, yard and park waste in Table 9 may be used as a default.<br>
• For industrial sludge, either a value of 9% (% wet sludge) may be used as a default, assuming an organic dry matter content of 35 percent, or alternatively, if the percentage of organic dry matter content is known, then the DOC value may be calculated as follows: $DOC_j$ (% wet sludge) = 9 * (% organic dry matter content/35).<br>
• For domestic sludge, either a value of 5% (% wet sludge) may be used as a default, assuming an organic dry matter content of 10 percent, or alternatively, if the percentage of organic dry matter content is known, then the DOC value may be calculated as follows: $DOC_j$ (% wet sludge) = 5 * (% organic dry matter content/10).<br><br>
If a waste type is not comparable to MSW and cannot clearly be described as a combination of waste types in the table above or if a default value is not available or if the project participants wish to measure $DOC_j$, then project participants should measure $DOC_j$ in an ignition loss test according to the procedure in EN 15169 or similar national or international standards. This measurement is only required once for each waste type j and the value determined for $DOC_j$ remains valid during the crediting period.</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
</table>

| | |
|---|---|
| **Additional comment** | The procedure for the ignition loss test is described in BS EN 15169:2007 Characterization of waste. Determination of loss on ignition in waste, sludge and sediments.<br>The percentages listed in Table 9 are based on a wet waste basis which are concentrations in the waste as it is delivered to the SWDS. The IPCC Guidelines also specify DOC values on a dry waste basis, which are the concentrations after complete removal of all moist from the waste, which is not believed practical for this situation. |

| | |
|---|---|
| **Data / Parameter** | $k_j$ |
| **Unit** | l/yr |
| **Description** | Decay rate for the waste type *j* |
| **Source of data** | IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) |
| **Value(s) applied** | [*To be provided at CPA level.*]<br>Apply the following default values for the different waste types *j*<br><br>**Table 10:** *Default values for the decay rate ($k_j$)* |

| Waste type j | | Boreal and Temperate (MAT<20°C) | | Tropical (MAT>20°C) | |
|---|---|---|---|---|---|
| | | **Dry (MAP/ PET<1)** | **Wet (MAP/ PET>1)** | **Dry (MAP <1,000mm)** | **Wet (MAP >1,000mm)** |
| **Slowly degrading** | **Pulp, paper and 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 |
| **Rapidly degrading** | **Other (no-food) organic putrescible garden and park waste** | 0.05 | 0.10 | 0.065 | 0.17 |
| | **Food, food waste, sewage sludge, beverages and tobacco** | 0.06 | 0.185 | 0.085 | 0.40 |

NB: MAT - mean annual temperature, MAP - Mean annual precipitation, PET - potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration

If a waste type disposed in a SWDS cannot clearly be attributed to one of the waste types in the table above, project participants should choose, among the waste types that have similar characteristics, the waste type where the values of $DOC_j$ and $k_j$ result in a conservative estimate (lowest emissions), or request a revision of/deviation from this methodology

In the case of EFB, as their characteristics are similar to garden waste, the parameter values correspondent of garden waste shall be used. In case of sludge from pulp and paper industry, a conservative value of 0.03 shall be used for all precipitation and temperature combination

| | |
|---|---|
| **Choice of data or Measurement methods and procedures** | Average temperature is [mean temperature in °C] and average rainfall is [mean rainfall in mm] (source: [source of information used] ) |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | Document in the -CPA-DD the climatic conditions at the SWDS site (temperature, precipitation and, where applicable, evapotranspiration). Use long term averages based on statistical data, where available. Provide references |

[*case 1 or case 2: Parameters from Grid Emission Factor calculation*

| Data / Parameter | $FC_{i,m,y}$ |
|---|---|
| Unit | Mass or volume unit |
| Description | Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y* |
| Source of data | Government records / official sources |
| Value(s) applied | See detailed tables in Appendix 4 of the PoA-DD |
| Choice of data or Measurement methods and procedures | • Simple OM: once for each crediting period using the most recent three historical years for which data is available at the time of submission of the PoA-DD to the DOE for validation (*ex ante* option);<br>• BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period. |
| Purpose of data | Calculation of project emissions |
| Additional comment | Data vintage available at validation: 2008 - 2010 |

| Data / Parameter | $NCV_{i,y}$ |
|---|---|
| Unit | GJ/mass or volume unit |
| Description | Net calorific value (energy content) of fossil fuel type *i* in year *y* |
| Source of data | Government records / official sources |
| Value(s) applied | See detailed tables in Appendix 4 of the PoA-DD |
| Choice of data or Measurement methods and procedures | • Simple OM: once for each crediting period using the most recent three historical years for which data is available at the time of submission of the PoA-DD to the DOE for validation (*ex ante* option);<br>• BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period. |
| Purpose of data | Calculation of project emissions |
| Additional comment | - |

| Data / Parameter | $EF_{CO2,i,y}$ |
|---|---|
| Unit | $tCO_2/GJ$ |
| Description | $CO_2$ emission factor of fossil fuel type *i* in year *y* |
| Source of data | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories, as neither local nor national values are available. |
| Value(s) applied | See detailed tables in Appendix 4 of the PoA-DD |
| Choice of data or Measurement methods and procedures | • Simple OM: once for each crediting period using the most recent three historical years for which data is available at the time of submission of the PoA-DD to the DOE for validation (*ex ante* option);<br>• BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period. |
| Purpose of data | Calculation of project emissions |
| Additional comment | - |

| Data / Parameter | $EG_{m,y}$ |
|---|---|
| Unit | MWh |
| Description | Net electricity generated by power plant/unit *m* in year *y* |

| | |
|---|---|
| **Source of data** | Government records / official sources |
| **Value(s) applied** | See detailed tables in Appendix 4 of the PoA-DD |
| **Choice of data or Measurement methods and procedures** | • Simple OM: once for each crediting period using the most recent three historical years for which data is available at the time of submission of the PoA-DD to the DOE for validation (*ex ante* option);<br>• BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period. |
| **Purpose of data** | Calculation of project emissions |
| **Additional comment** | Data vintage available at validation: 2008 - 2010 |

| | |
|---|---|
| **Data / Parameter** | **$CEF_{elec}$** |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission factor for the production of electricity in the project activity |
| **Source of data** | Official utility documents for $CEF_{elec,GRID}$<br>Emission factor for diesel generator according to AMS.I.F, Table I.F.1. |
| **Value(s) applied** | $CEF_{elec,GRID}$ = 0.4732<br>$CEF_{elec,GEN}$ = [*To be provided at CPA level.*] |
| **Measurement methods and procedures** | $CEF_{elec,GRID}$ is calculated according to the *"Tool to calculate the emission factor for an electricity system"* based on available grid electricity generation data for 2008, 2009 and 2010 from the Energy Commission of Ghana. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comments** | The former Table I.D.1 "*Emission Factors for diesel generator systems*" from AMS-I.D was moved to AMS-I.F Version 01. |

]

### B.6.3. Ex-ante calculations of emission reductions

- **Baseline Emissions**

[There is a sorting process before the composting phase. The composition of MSW entering into the plant before sorting[23] is as follows:

**Table 11:** *Waste composition before sorting.*

| Waste type | Collected waste composition % |
|---|---|
| [*Waste type*] | [*value*] |
| [*Waste type*] | [*value*] |
| [*Waste type*] | [*value*] |
| [*Waste type*] | [*value*] |
| [*Waste type*] | [*value*] |
| [*Waste type*] | [*value*] |
| [*Waste type*] | [*value*] |
| Total | 100.00 |

| | |
|---|---|
| Sorting efficiency | [*value*]% |

[23] [*Source of data*]

| | |
|---|---|
| Waste categories to be composted | [*Waste type*] |
| | [*Waste type*] |
| | [*Waste type*] |

After sorting, plastics, glass and metals are recovered for recycling along with the paper, while remaining textiles and inert materials are disposed of at the residual landfill. The composition of the waste being directed to the compost unit is thus:]

**Table 12:** *Composition of waste entering into the composting plant (Pn,x), applicable $k_j$ and DOC.*

| Composted waste type j | Pn,x (%) | kj | kj / 12 | $DOC_j$ |
|---|---|---|---|---|
| Wood and wood products | | | | 0.43 |
| Pulp, paper and cardboard (other than sludge) | | | | 0.4 |
| Food, food waste, beverages and tobacco (other than sludge) | | | | 0.15 |
| Textiles | | | | 0.24 |
| Garden, yard and park waste | | | | 0.2 |
| Glass, plastic, metal, other inert waste | | 0 | 0 | 0 |
| TOTAL | | / | | / |

Based on the conservative assumptions of [*estimated value for number of collection days per year, shifts per day, quantity of collected waste per shift, load factor, etc*] the expected quantities of waste collected, treated and compost produced are:

**Table 13:** *Expected quantities of waste collected, treated and compost produced.*

| Year | Quantity of waste collected (tonnes) | Waste to compost (tonnes) | Quantity of compost generated (tonnes on a wet basis) |
|---|---|---|---|
| *Year 1* | | | |
| *Year 2* | | | |
| *Year 3* | | | |
| *Year 4* | | | |
| *Year 5* | | | |
| *Year 6* | | | |
| *Year 7* | | | |
| [*Year 8* | | | |
| *Year 9* | | | |
| *Year 10*] | | | |
| | | | |
| **TOTAL** | | | |
| **Annual average** | | | |

*From literature and experiments, a conservative compost mass reduction of* [*value %*] *is expected* [*Source*].

**Table 14:** *Annual quantity of waste entering into the composting plant (in tonnes)*

| *Year* | $A_{j,1}$ Wood and wood products | $A_{j,2}$ Pulp, paper and cardboard (other than sludge) | $A_{j,3}$ Food, food waste, beverages and tobacco (other than sludge) | $A_{j,4}$ Textiles | $A_{j,5}$ Garden, yard and park waste | $A_{j,6}$ Glass, plastic, metal, other inert waste |
|---|---|---|---|---|---|---|
| *Year 1* | | | | | | |
| *Year 2* | | | | | | |
| *Year 3* | | | | | | |
| *Year 4* | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Year 5* | | | | | | |
| *Year 6* | | | | | | |
| *Year 7* | | | | | | |
| [*Year 8* | | | | | | |
| *Year 9* | | | | | | |
| *Year 10*] | | | | | | |
| | | | | | | |

For emissions reduction calculation, the quantity of waste entering into the composting plant is taken into account, as it represents the amount of organic waste being composted thus diverted from disposal at a landfill.

| Parameter | Value |
|---|---|
| $\varphi_y$ | [Value] |
| $f_y$ | [Value] |
| GWP $_{CH4}$ | 21 |
| Ox | 0.1 |
| F | 0.5 |
| DOC,f | [Value] |
| MCF | [Value] |

**Table 15:** *$MD_{reg,y}$, $MB_y$ and AF.*

| | $MD_{reg,y}$ | $MB_y$ | AF |
|---|---|---|---|
| **Year** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** |
| *Year 1* | | | - |
| *Year 2* | | | - |
| *Year 3* | | | - |
| *Year 4* | | | - |
| *Year 5* | | | - |
| *Year 6* | | | - |
| *Year 7* | | | - |
| [*Year 8* | | | - |
| *Year 9* | | | - |
| *Year 10*] | | | - |
| **TOTAL** | | | - |
| **Annual average** | | | - |

**Table 16:** *$BE_y$, $MB_y$, $MD_{reg,y}$, and $BE_{EN,y}$.*

| | $BE_y$ | $MB_y$ | $MD_{reg,y}$ | $BE_{EN,y}$ |
|---|---|---|---|---|
| **Year** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** |
| *Year 1* | | | - | - |
| *Year 2* | | | - | - |
| *Year 3* | | | - | - |
| *Year 4* | | | - | - |
| *Year 5* | | | - | - |
| *Year 6* | | | - | - |
| *Year 7* | | | - | - |
| [*Year 8* | | | - | - |
| *Year 9* | | | - | - |
| *Year 10*] | | | - | - |
| **TOTAL** | | | - | - |
| **Annual average** | | | - | - |

**Table 17:** *$BE_{y,a}$, $BE_y$ and $RATE^{compliance}_{,y}$.*

| | $BE_{y,a}$ | $BE_y$ | $RATE^{compliance}_{,y}$ |
|---|---|---|---|
| **Year** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** |
| *Year 1* | | | - |
| *Year 2* | | | - |
| *Year 3* | | | - |
| *Year 4* | | | - |
| *Year 5* | | | - |
| *Year 6* | | | - |
| *Year 7* | | | - |
| [*Year 8* | | | - |
| *Year 9* | | | - |
| *Year 10*] | | | - |
| **TOTAL** | | | - |
| **Annual average** | | | - |

- **Project Emissions**

## Summary of Project Emissions

**Table 18:** *Summary of project emissions.*

| | $PE_y = PE_{elec,y} + PE_{fuel,on-site,y} + PE_{c,y} + PE_{a,y} + PE_{g,y} + PE_{r,y} + PE_{i,y} + PE_{w,y} + PE_{co-firing,y}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $PE_y$ | $PE_{elec,y}$ | $PE_{fuel,on-site,y}$ | $PE_{c,y}$ | $PE_{a,y}$ | $PE_{g,y}$ | $PE_{r,y}$ | $PE_{i,y}$ | $PE_{w,y}$ | $PE_{co-firing,y}$ |
| **Units** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** | **$tCO_2e$** |
| *Year 1* | | | - | | - | - | - | - | | - |
| *Year 2* | | | - | | - | - | - | - | | - |
| *Year 3* | | | - | | - | - | - | - | | - |
| *Year 4* | | | - | | - | - | - | - | | - |
| *Year 5* | | | - | | - | - | - | - | | - |
| *Year 6* | | | - | | - | - | - | - | | - |
| *Year 7* | | | - | | - | - | - | - | | - |
| [*Year 8* | | | - | | - | - | - | - | | - |
| *Year 9* | | | - | | - | - | - | - | | - |
| *Year 10*] | | | - | | - | - | - | - | | - |
| **TOTAL** | | | **0** | | **0** | **0** | **0** | **0** | | **0** |
| **Annual average** | | | **0** | | **0** | **0** | **0** | **0** | | **0** |

### *Emissions from electricity use on-site ($PE_{elec,y}$)*

Accounted for in parameter $PE_{c,y.}$

### *Emissions from fuel use on-site ($PE_{fuel,on-site,y}$)*

Accounted for in parameter $PE_{c,y.}$

### *Emissions from composting ($PE_{c,y}$)*

**Table 19:** *Summary of project emissions from composting.*

| | $PE_{c,y} = PE_{COMP,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{N2O,y} + PE_{RO,y}$ | | | | | |
|---|---|---|---|---|---|---|
| | $PE_{c,y}$ | $PE_{EC,y}$ | $PE_{FC,y}$ | $PE_{CH4,y}$ | $PE_{N2O,y}$ | $PE_{RO,y}$ |
| **Year** | $tCO_2e$ | $tCO_2$ | $tCO_2$ | $tCO_2e$ | $tCO_2e$ | $tCO_2e$ |
| *Year 1* | | | | | | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Year 2* | | | | | | - |
| *Year 3* | | | | | | - |
| *Year 4* | | | | | | - |
| *Year 5* | | | | | | - |
| *Year 6* | | | | | | - |
| *Year 7* | | | | | | - |
| [*Year 8* | | | | | | - |
| *Year 9* | | | | | | - |
| *Year 10*] | | | | | | - |
| **TOTAL** | | | | | | - |
| **Annual average** | | | | | | |

***Project emissions from electricity consumption ($PE_{EC,y}$)***

**Table 20:** *Project emissions from electricity consumption.*

| | $PE_{EC,y} = Q_y \times SEC_{comp,default} \times EF_{EL,j,y} \times (1+TDL_{j,y})$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $PE_{EC,y}$ | $EC_{PJ,comp,y}$ | Share of electricity consumption from the grid | Share of electricity consumption from the gen set | $Q_y$ | $SEC_{comp,default}$ | $EF_{grid,y}$ | $EF_{EL,Fossil\ fuel,y}$ | $TDL_{j,y}$ |
| **Year** | $tCO_2$ | MWh | % | % | t/yr | MWh/t | $tCO_2$/MWh | $tCO_2$/MWh | % |
| *Year 1* | | | | | | | 0.4732 | 1.3 | |
| *Year 2* | | | | | | | 0.47320 | 1.3 | |
| *Year 3* | | | | | | | 0.47320 | 1.3 | |
| *Year 4* | | | | | | | 0.47320 | 1.3 | |
| *Year 5* | | | | | | | 0.47320 | 1.3 | |
| *Year 6* | | | | | | | 0.47320 | 1.3 | |
| *Year 7* | | | | | | | 0.47320 | 1.3 | |
| [*Year 8* | | | | | | | 0.47320 | 1.3 | |
| *Year 9* | | | | | | | 0.47320 | 1.3 | |
| *Year 10*] | | | | | | | 0.47320 | 1.3 | |
| **TOTAL** | | | | | | | 0.47320 | 1.3 | |
| **Annual average** | | | | | | | 0.47320 | 1.3 | |

***Project emissions from fossil fuel consumption ($PE_{FC,y}$)***

**Table 21:** *Project emissions from fossil fuel consumption.*

| | $PE_{FC,y} = Qy \times EF_{FC,default}$ | | |
|---|---|---|---|
| | $PE_{FC,y}$ | $Q_y$ | $EF_{FC,default}$ |
| **Year** | $tCO_2$ | t/yr | $tCO_2$/t |
| *Year 1* | | | 0.0207 |
| *Year 2* | | | 0.0207 |
| *Year 3* | | | 0.0207 |
| *Year 4* | | | 0.0207 |
| *Year 5* | | | 0.0207 |
| *Year 6* | | | 0.0207 |
| *Year 7* | | | 0.0207 |
| [*Year 8* | | | 0.0207 |
| *Year 9* | | | 0.0207 |
| *Year 10*] | | | 0.0207 |
| **TOTAL** | | | 0.0207 |
| **Annual average** | | | |

### *Project emissions of methane ($PE_{CH4y}$)*

**Table 22:** *Project emissions of methane during composting.*

| | $PE_{CH4,y} = Qy \times EF_{CH4,y} \times GWP_{CH4}$ | | | |
|---|---|---|---|---|
| | $PE_{CH4,y}$ | $Q_y$ | $EF_{CH4,y}$ | $GWP_{CH4}$ |
| **Year** | $tCO_2e$ | t/yr | $tCH_4/t$ | $tCO_2e/tCH_4$ |
| *Year 1* | | | 0.002 | 21 |
| *Year 2* | | | 0.002 | 21 |
| *Year 3* | | | 0.002 | 21 |
| *Year 4* | | | 0.002 | 21 |
| *Year 5* | | | 0.002 | 21 |
| *Year 6* | | | 0.002 | 21 |
| *Year 7* | | | 0.002 | 21 |
| [*Year 8* | | | 0.002 | 21 |
| *Year 9* | | | 0.002 | 21 |
| *Year 10*] | | | 0.002 | 21 |
| **TOTAL** | | | 0.002 | 21 |
| **Annual average** | | | 0.002 | 21 |

### *Project emissions of nitrous oxyde ($PE_{N2O,y}$)*

**Table 23:** *Project emissions of nitrous oxyde during composting.*

| | $PE_{N2O,y} = Q_y \times EF_{N2O,y} \times GWP_{N2O}$ | | | |
|---|---|---|---|---|
| | $PE_{N2O,y}$ | $Q_y$ | $EF_{N2O,y}$ | $GWP_{N2O}$ |
| **Year** | $tCO_2e$ | t/yr | $tCH_4/t$ | $tCO_2e/tCH_4$ |
| *Year 1* | | | 0.0002 | 310 |
| *Year 2* | | | 0.0002 | 310 |
| *Year 3* | | | 0.0002 | 310 |
| *Year 4* | | | 0.0002 | 310 |
| *Year 5* | | | 0.0002 | 310 |
| *Year 6* | | | 0.0002 | 310 |
| *Year 7* | | | 0.0002 | 310 |
| [*Year 8* | | | 0.0002 | 310 |
| *Year 9* | | | 0.0002 | 310 |
| *Year 10*] | | | 0.0002 | 310 |
| **TOTAL** | | | 0.0002 | 310 |
| **Annual average** | | | 0.0002 | 310 |

### *Project emissions from wastewater treatment ($PE_{w,y}$)*

**Table 24:** *Project emissions from waste water.*

| | $PE_{w,y} = PE_{CH4,w,y} \times GWP_{CH4}$ | | |
|---|---|---|---|
| | $PE_{w,,y}$ | $PE_{CH4,w,,y}$ | $GWP_{CH4}$ |
| **Year** | $tCO_2e/y$ | $tCH_4/y$ | N/A |
| *Year 1* | | | 21 |
| *Year 2* | | | 21 |
| *Year 3* | | | 21 |
| *Year 4* | | | 21 |
| *Year 5* | | | 21 |
| *Year 6* | | | 21 |
| *Year 7* | | | 21 |
| [*Year 8* | | | 21 |
| *Year 9* | | | 21 |
| *Year 10*] | | | 21 |
| **TOTAL** | | | 21 |
| **Annual average** | | | 21 |

**Table 25:** *Methane emissions from waste water.*

| | $PE_{CH4,w,y} = Q_{COD,y} \times P_{COD,y} \times B_0 \times MCF_p$ | | | | |
|---|---|---|---|---|---|
| | $PE_{CH4,w,y}$ | $Q_{COD,y}$ | $P_{COD,y}$ | $B_0$ | $MCF_p$ |
| **Year** | $tCO_2e$ | $m^3/yr$ | $tCOD/m^3$ | $tCH_4/tCOD$ | N/A |
| *Year 1* | | | | | |
| *Year 2* | | | | | |
| *Year 3* | | | | | |
| *Year 4* | | | | | |
| *Year 5* | | | | | |
| *Year 6* | | | | | |
| *Year 7* | | | | | |
| *[Year 8* | | | | | |
| *Year 9* | | | | | |
| *Year 10]* | | | | | |
| **TOTAL** | | | | | |
| **Annual average** | | | | | |

- **Leakage Emissions**

No leakage emissions are expected.

**B.7. Application of the monitoring methodology and description of the monitoring plan**

**B.7.1. Data and parameters to be monitored by each generic CPA**

- **Baseline emissions parameters monitored:**

| **Data / Parameter** | **$MB_y$** |
|---|---|
| **Unit** | $tCO_2e$ |
| **Description** | Methane produced in the landfill in the absence of the project activity in year *y* |
| **Source of data** | Calculated as per the methodological tool *"Emissions from solid waste disposal sites"* |
| **Value(s) applied** | *[To be provided at CPA level.]* |
| **Measurement methods and procedures** | As per the methodological tool *"Emissions from solid waste disposal sites"* |
| **Monitoring frequency** | As per the methodological tool *"Emissions from solid waste disposal sites"* |
| **QA/QC procedures** | As per the methodological tool *"Emissions from solid waste disposal sites"* |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comments** | - |

| Data / Parameter | $RATE^{compliance,}_{y}$ |
|---|---|
| Unit | Number |
| Description | Rate of compliance |
| Source of data | Municipal bodies |
| Value(s) applied | *[To be provided at CPA level.]* |
| Measurement methods and procedures | The compliance rate is based on the annual reporting of the municipal bodies issuing these reports. The state-level aggregation involves all landfill sites in the country. If the rate exceeds 50%, no CERs can be claimed. |
| Monitoring frequency | Annual |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comments | - |

| Data / Parameter | $f_y$ |
|---|---|
| Unit | - |
| Description | Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y* |
| Source of data | Select the maximum value from the following: (a) contract or regulation requirements specifying the amount of methane that must be destroyed/used (if available) and (b) historic data on the amount captured. |
| Value(s) applied | *[To be provided at CPA level.]* |
| Measurement methods and procedures | - |
| Monitoring frequency | For application B: Annually |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comments | - |

| Data / Parameter | [$A_{j,x}$ *or* $A_{j,i}$] |
|---|---|
| Unit | T |
| Description | Amount of organic waste type *j* prevented from disposal in the landfill in the [year *x or* month *i*] (tonnes/year) |
| Source of data | Measurements by project participants |
| Value(s) applied | *[To be provided at CPA level.]* |
| Measurement methods and procedures | Measure on wet basis |
| Monitoring frequency | Annually |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comments | This is the value to be used for variable $W_{i,x}$ in the methodological tool "*emissions from solid waste disposal sites*". |

| | |
|---|---|
| **Data / Parameter** | [$p_{n,j,x}$ *or* $p_{n,j,i}$] |
| **Unit** | - |
| **Description** | Weight fraction of the waste type in the sample *n* collected during the [year *x* *or* month *i*] |
| **Source of data** | Sample measurements by project participants |
| **Value(s) applied** | [*To be provided at CPA level.*] |
| **Measurement methods and procedures** | Sample the waste composition, using the waste categories *j*, as provided in the table for $DOC_j$ and $k_j$, and weigh each waste fraction (measure on wet basis) |
| **Monitoring frequency** | Minimum of three samples every three months. |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comments** | This parameter only needs to be monitored for Application B and if the waste includes more than one waste type *j*. Sampling is not required if the waste comprises only one waste type. |

| | |
|---|---|
| **Data / Parameter** | $z_x$ |
| **Unit** | - |
| **Description** | Number of samples collected during the year *x* |
| **Source of data** | Project participant |
| **Value(s) applied** | [*To be provided at CPA level.*] |
| **Measurement methods and procedures** | Minimum of three samples every three months |
| **Monitoring frequency** | Continuously, aggregated annually |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comments** | This parameter only needs to be monitored for Application B and if the waste includes more than one waste category *j* |

[*In case of a water table above the bottom of the SWDS:*

| Data / Parameter | $d_y$ |
|---|---|
| Unit | m |
| Description | Depth of the SWDS |
| Source of data | Project participants |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | Monitoring well that is also used to measure the height of the water table ($h_{w,y}$) |
| Monitoring frequency | Monthly, average annual values to be used in the case of application of the yearly model (Equation 6) |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comments | This parameter needs to be monitored to identify whether the SWDS has a water table above the bottom of the SWDS, such as due to using waste to fill inland water bodies, such as ponds, rivers or wetlands. If the SWDS does have a water table above the bottom of the SWDS, then this parameter is used to determine the MCF. |

| Data / Parameter | $h_{w,y}$ |
|---|---|
| Unit | m |
| Description | Height of the water table in the SWDS |
| Source of data | Project participants |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | Monitoring well |
| Monitoring frequency | Monthly, average annual values to be used in the case of application of the yearly model (Equation 6) |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comments | This parameter needs to be monitored to identify whether the SWDS has a water table above the bottom of the SWDS, such as due to using waste to fill inland water bodies, such as ponds, rivers or wetlands. If the SWDS does have a water table above the bottom of the SWDS, then this parameter is used to determine the MCF. |

]

| | |
|---|---|
| **Data / Parameter** | **a, b, c, d, e, g** |
| **Unit** | % |
| **Description** | Effect of the uncertainty of different parameters |
| **Source of data** | Project participant |
| **Value(s) applied** | [*To be provided at CPA level.*] |
| **Measurement methods and procedures** | Using the instructions in Table 3 of the methodological tool "*emissions from solid waste disposal sites*". |
| **Monitoring frequency** | Annually if the conditions described in the "*Instructions for selecting the Factor*" in table 6have changed (e.g. a change in how the weight of the waste is measured). Once for the crediting period, if these conditions do not change. |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of baseline emissions. |
| **Additional comments** | Used in Option 2 for determining the model correction factor. |

| | |
|---|---|
| **Data / Parameter** | **AF** |
| **Unit** | % |
| **Description** | Methane destroyed due to regulatory or other requirements. |
| **Source of data** | Local and/or national authorities |
| **Value(s) applied** | [*To be provided at CPA level.*] |
| **Measurement methods and procedures** | - |
| **Monitoring frequency** | At renewal of crediting period |
| **QA/QC procedures** | Data are derived from or based upon local or national guidelines, so QA/QC-procedures for these data are not applicable |
| **Purpose of data** | Calculation of baseline emissions. |
| **Additional comments** | Changes in regulatory requirements, relating to the baseline landfill(s) need to be monitored in order to update the adjustment factor (AF), or directly $MD_{reg}$.<br>This is done at the beginning of each crediting period. |

- **Project emissions parameters monitored:**

*Parameters to determine emissions from electricity consumption:*

[*If monitored data for electricity consumption is available:*

| Data / Parameter | $EC_{PJ,comp,y}$ (equivalent to $EC_{PJ,j,y}$) |
|---|---|
| Unit | MWh |
| Description | Amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid as a result of the project activity |
| Source of data | Electricity meter |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | - |
| Monitoring frequency | Continuous |
| QA/QC procedures | Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company. |
| Purpose of data | Calculation of project emissions. |
| Additional comments | If monitored data for electricity consumption is not available, then electricity consumption from composting ($EC_{PJ,comp,y}$) may be determined based on a default value for the specific quantity of electricity consumed per tonne of waste composted ($SEC_{comp,default}$). |

]

| Data / Parameter | $TDL_{j,y}$ |
|---|---|
| Unit | % |
| Description | Average technical transmission and distribution losses for providing electricity to source *j* |
| Source of data | • Use recent, accurate and reliable data available within the host country;<br>• Use as default values of 20% for (a) project or leakage electricity consumption sources; |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | For a): $TDL_{j/k/l,y}$ should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed CDM project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial losses/theft). The distribution losses can either be calculated by the project participants or be based on references from utilities, network operators or other official documentation. |
| Monitoring frequency | Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years. |
| QA/QC procedures | - |
| Purpose of data | Calculation of project emissions. |
| Additional comments | - |

*Parameters to determine emissions from fuel use (accounted for in the parameter $PE_{c,y}$):*

[*Option 1B is applied:*

| Data / Parameter | $FC_{i,j,y}$ |
|---|---|
| Unit | Mass or volume unit per year (e.g. tonnes/yr or $m^3$/yr) |
| Description | Quantity of fuel type *i* combusted in process *j* during the year *y* |
| Source of data | Onsite measurements |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | • Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift);<br>• Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance;<br>• In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions. |
| Monitoring frequency | Continuously |
| QA/QC procedures | The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes.<br>Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records. |
| Purpose of data | Calculation of project emissions. |
| Additional comments | - |

| | |
|---|---|
| **Data / Parameter** | **$NCV_{i,y}$** |
| **Unit** | GJ per mass or volume unit (e.g. GJ/m³, GJ/tonne) |
| **Description** | Weighted average net calorific value of fuel type *i* in year *y* |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source if the carbon fraction of the fuel is not provided (Option A)<br>b) Measurements by the project participants — If a) is not available<br>c) Regional or national default values — If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) applied** | 43.3 MJ/Gg |
| **Measurement methods and procedures** | Option d) IPCC Guideline 2006 Vol. 2 Table 1.2 "Default Net Calorific Values and lower and upper limits of the 95% confidence intervals": **upper** default value has been chosen for conservative estimation (43.3MJ/t for gas-oil). |
| **Monitoring frequency** | For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comments** | Applicable where Option B is used |

| | |
|---|---|
| **Data / Parameter** | $EF_{CO2,i,j}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type *i* in year *y* |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the project participants — If a) is not available<br>c) Regional or national default values — If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) applied** | 74.8 |
| **Measurement methods and procedures** | IPCC Guideline 2006 Vol. 2 Table 2.2: "Default $CO_2$Emission Factors for combustion": **upper** default value has been chosen for conservative estimation (74,800 $tCO_2/MJ$ for gas-oil). |
| **Monitoring frequency** | Or d) Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comments** | Applicable where Option B is used |

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***Parameters to determine emissions from composting:***

**Monitoring procedures**

Monitoring involves an annual assessment of the amount of waste composted and, in case of co-composting, also the amount of run-off wastewater. For all other monitored parameters there are also options to use default values.

| **Data / Parameter** | $Q_y$ |
|---|---|
| **Unit** | t/yr |
| **Description** | Quantity of waste composted in year y (wet basis) |
| **Source of data** | Project participants |
| **Value(s) applied** | [*To be provided at CPA level.*] |
| **Measurement methods and procedures** | Use a weighbridge or any other applicable and calibrated weighing device, e.g. belt-scales. |
| **Monitoring frequency** | Continuously |
| **QA/QC procedures** | Weighbridge or any other applicable weighing device is subject to periodic calibration (in accordance with stipulation of the weighing device supplier) |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comments** | Applicable to Option 1 in the step "*Determination of the quantity of waste Composted*". The parameter corresponds to the quantity of solid waste delivered to the composting installation, weighed on a wet basis. In the case of co-composting, the weight of liquid wastes is neglected. |

[Applicable to Option 2 in the step "*Determination of the quantity of waste composted*"

| **Data / Parameter** | $CT_{t,y}$ |
|---|---|
| **Unit** | t |
| **Description** | Carrying capacity of each truck delivering waste to the composting installation in year |
| **Source of data** | Project participants |
| **Value(s) applied** | [*To be provided at CPA level.*] |
| **Measurement methods and procedures** | The maximum carrying capacity as stated on the truck's nameplate is registered by personnel at the entrance gate of the composting installation. |
| **Monitoring frequency** | Register maximum carrying capacity of every truck delivery for the year *y* |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comments** | Applicable to Option 2 in the step "*Determination of the quantity of waste composted*" |

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[*Applicable if option 1 is selected for "Project emissions of methane from composting ($PE_{CH4,y}$)":*

| Data / Parameter | $Q_c$ |
|---|---|
| Unit | t |
| Description | Quantity of waste composted in composting cycle c (wet basis) |
| Source of data | Project participants |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | Weighed using weighbridge or any other applicable and calibrated weighing device, e.g. belt-scale |
| Monitoring frequency | Measure the weight of waste for every truck delivery and aggregate for the same composting cycle for which $ECC_{CH4,c}$ or $ECC_{N2O,c}$ is being estimated |
| QA/QC procedures | Weighbridge or any other applicable weighing device is subject to periodic calibration (in accordance with stipulation of the weighing device supplier). |
| Purpose of data | Calculation of project emissions. |
| Additional comments | This is the specific amount of waste treated for the composting cycle *c* that emission measurements are made for ($ECC_{CH4,c}$, $ECC_{N2O,c}$)<br>Applicable to Option 1 in the step "*Determination of methane and nitrous oxide emissions from the composting process*" |

| Data / Parameter | $ECC_{CH4,c,}$ |
|---|---|
| Unit | $tCH_4$ |
| Description | Methane emissions from the composting installation during the composting cycle c |
| Source of data | On site measurement |
| Value(s) applied | [To be provided at CPA level.] |
| Measurement methods and procedures | Measurement procedures are specified for closed composting installations and non-closed composting installations:<br>Closed composting installation. Choose between the following two options to measure emissions from a closed-composting system for composting cycle c:<br>• Option 1: Measure methane and/or nitrous oxide concentrations, gas velocity, temperature and pressure in the exhaust pipe using appropriate analytical equipment (e.g. FID, IR, FTIR).<br>• Option 2: Use the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*".<br>Non-closed composting installation (windrows). Measure emissions using a flux box. In a flux box measurement, the concentration increase of $CH_4$ in the box is measured over time and the emission flux from the surface covered by the box is calculated (kilogram $CH_4$ per square meter per hour). From the measurements made during the cycle, an overall emission flux value can be determined. Emissions during the composting cycle can then be calculated over the time of the composting cycle and the total surface area of the windrow (kg per windrow per hour). |
| Monitoring frequency | Measure at least one composting cycle per climatic season, and at least two cycles in one climatic season. This means there are at least three measurements of $ECC_{CH4,cc}$in each year in the case of two seasons. |
| QA/QC procedures | Closed composting installation:<br>• According to the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*";<br><br>Flux box measurement:<br>• Flux box equipment accuracies (as specified by the supplier of the flux box equipment) shall be 1 ppm or better for $CH_4$ . |
| Purpose of data | Calculation of project emissions. |
| Additional comments | Applicable to Option 1 in the step "*Determination of methane and nitrous oxide emissions from the composting process*"<br>More information on the measurement procedure is available in the Tool. |

| Data / Parameter | $ECC_{N2O,c}$ |
|---|---|
| Unit | $tN_2O$ |
| Description | Nitrous oxide emissions from the composting installation during the composting cycle *c* |
| Source of data | On site measurement |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | Measurement procedures are specified for closed composting installations and non-closed composting installations:<br>**Closed composting installation.** Choose between the following two options to measure emissions from a closed-composting system for composting cycle *c*:<br>• Option 1: Measure methane and/or nitrous oxide concentrations, gas velocity, temperature and pressure in the exhaust pipe using appropriate analytical equipment (e.g. FID, IR, FTIR).<br>• Option 2: Use the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*".<br>**Non-closed composting installation (windrows).** Measure emissions using a flux box. In a flux box measurement, the concentration increase of $N_2O$ in the box is measured over time and the emission flux from the surface covered by the box is calculated (kilogram $N_2O$ per square meter per hour). From the measurements made during the cycle, an overall emission flux value can be determined. Emissions during the composting cycle can then be calculated over the time of the composting cycle and the total surface area of the windrow (kg per windrow per hour). |
| Monitoring frequency | Measure at least one composting cycle per climatic season, and at least two cycles in one climatic season. This means there are at least three measurements of $ECC_{N2O,cc}$ in **each year in the case of two seasons.** |
| QA/QC procedures | Closed composting installation:<br>• According to the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*";<br><br>Flux box measurement:<br>• Flux box equipment accuracies (as specified by the supplier of the flux box equipment) shall be 100 ppb or better for $N_2O$. |
| Purpose of data | Calculation of project emissions. |
| Additional comments | Applicable to Option 1 in the step "*Determination of methane and nitrous oxide emissions from the composting process*"<br>More information on the measurement procedure is available in the Tool. |

[*In case wastewater is treated anaerobically:*

| Data / Parameter | $Q_{COD,y}$ |
|---|---|
| Unit | $m^3$/yr |
| Description | Amount of wastewaster treated anaerobically or released untreated from the project activity in year *y* |
| Source of data | Measured value by flow meter |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | |
| Monitoring frequency | Monthly aggregated annually |
| QA/QC procedures | The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy |
| Purpose of data | Calculation of project emissions. |
| Additional comments | If the wastewater is treated aerobically, emissions are assumed to be zero, and hence this parameter does not need to be monitored. |

| Data / Parameter | $P_{COD,y}$ |
|---|---|
| Unit | tCOD/$m^3$ |
| Description | Chemical Oxygen Demand (COD) of wastewaster |
| Source of data | Measured value by purity meter |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | - |
| Monitoring frequency | Monthly and averaged annually. |
| QA/QC procedures | The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy |
| Purpose of data | Calculation of project emissions. |
| Additional comments | If the wastewater is treated aerobically, emissions are assumed to be zero, and hence this parameter does not need to be monitored. |

| Data / Parameter | $M_{compost,y}$ |
|---|---|
| Unit | Tonnes |
| Description | Total Quantity of compost produced in year y |
| Source of data | Plant records |
| Value(s) applied | [*To be provided at CPA level.*] |
| Measurement methods and procedures | Sales invoices of the compost should be kept at the project site. They should contain customer contact details, physical location of delivery, type amount (in tonnes) and the use of compost. A list of customers and delivered SD amount should be kept at the project site |
| Monitoring frequency | Weekly |
| QA/QC procedures | Weighed on calibrated scale; also cross check with sales of compost. |
| Purpose of data | Calculation of project emissions. |
| Additional comments | The produced compost will be trucked off from site. All trucks leaving site will be weighed. Possible temporary storage of compost will be weighed as well or not taken into account for calculated carbon credit. |

]

**B.7.2. Description of the monitoring plan for a generic CPA**

Details of the monitoring plan will be described within each CPA due to the size, location and nature-specific characteristics of projects under this proposed PoA.

Each CPA monitoring plan will comply with the methodology AM0025 - Avoided emissions from organic waste through alternative waste treatment processes (Version 13.0.0) and the CDM Project Standard Version 02.0.

**Monitoring organization**

The CME will establish and maintain a database for each CPA. The CME will record CPA information detail delivered by CPA implementer, as follows:

- Name of the CPA,
- Name of CPA implementer,
- Contact details of CPA implementer,
- Capacity of the composting plant and other relevant technical specifications of each CPA,
- GPS coordinates of each CPA,
- Verification status (number of verification and associated monitoring period),
- Emission reductions monitored and issued each monitoring period.

The CME will be responsible for the management of records and data associated with each CPA. Data monitored and required for verification and issuance will be kept and archived electronically for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

The database will be updated using the data supplied by the CPA implementer. It will form the basis for the verification of CPA and be available for inspection by the DOE at any point in time.

For each CPA, all parameters included in section B.7.1 Part II will be monitored by the CPA implementer, recorded electronically, and provided to the CME.

**Data quality**

CPA implementer will have to implement a QA/QC procedure to ensure that data provided meet the requirements of the monitoring plan.

The data and reports provided by each CPA implementer to the CME will be checked internally to ensure the accuracy and completeness of data. In case of mistakes, corrective action will be applied to avoid future similar mistakes. If applicable, the CPA implementer will have to deliver equipment calibration certificates to the CME.

The CME will crosscheck, reconcile or consolidate data with multiple sources whenever possible. At minimum, data obtained from the electricity meters is to be crosschecked with the electricity sales receipts. This kind of reconciliation activity will be recorded properly as DOE may request for such information during the verification.

**Monitoring team and training**

Data collection, consolidation and results analysis will be undertaken by a dedicated team adequately trained, well aware of CDM requirements and supervised by the CME. This team will not have any hierarchical relationships or dependence links with all entities involved to measure emission reduction and to assure the correct operation and maintenance of the measuring equipment either within the CME and/or CPA implementers. This independence shall guarantee the integrity of the work that will be done.

The human resources dedicated to the monitoring tasks will consist of:

- A monitoring manager;
- A data manager;
- Operators;

- - - - -

**Appendix 1: Contact information on entity/individual responsible for the PoA**

| | |
|---|---|
| **Organization** | **Standard Bank Plc** |
| **Street/P.O.Box** | 20 Gresham Street |
| **Building** | |
| **City** | London |
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| **Postcode** | EC2V 7JE |
| **Country** | United Kingdom of Great Britain and Northern Ireland |
| **Telephone** | +44 20 31456890 |
| **Fax** | +44 20 3189 6930 |
| **E-mail** | co2@standardbank.com |
| **Website** | www.standardbank.com |
| **Contact person** | Geoff Sinclair |
| **Title** | Head of Carbon Sales & Trading |
| **Salutation** | Mr |
| **Last name** | Sinclair |
| **Middle name** | |
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| **Department** | Energy Trading and Marketing |
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ecosur afrique is not a project participant.

## Appendix 2: Affirmation regarding public funding

The PoA does not expect to involve any public funding according to the OECD definitions for Official Development Assistance (ODA).

## Appendix 3: Application of methodology(ies)

Not applicable.

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**Appendix 4: Further background information on ex ante calculation of emission reductions**

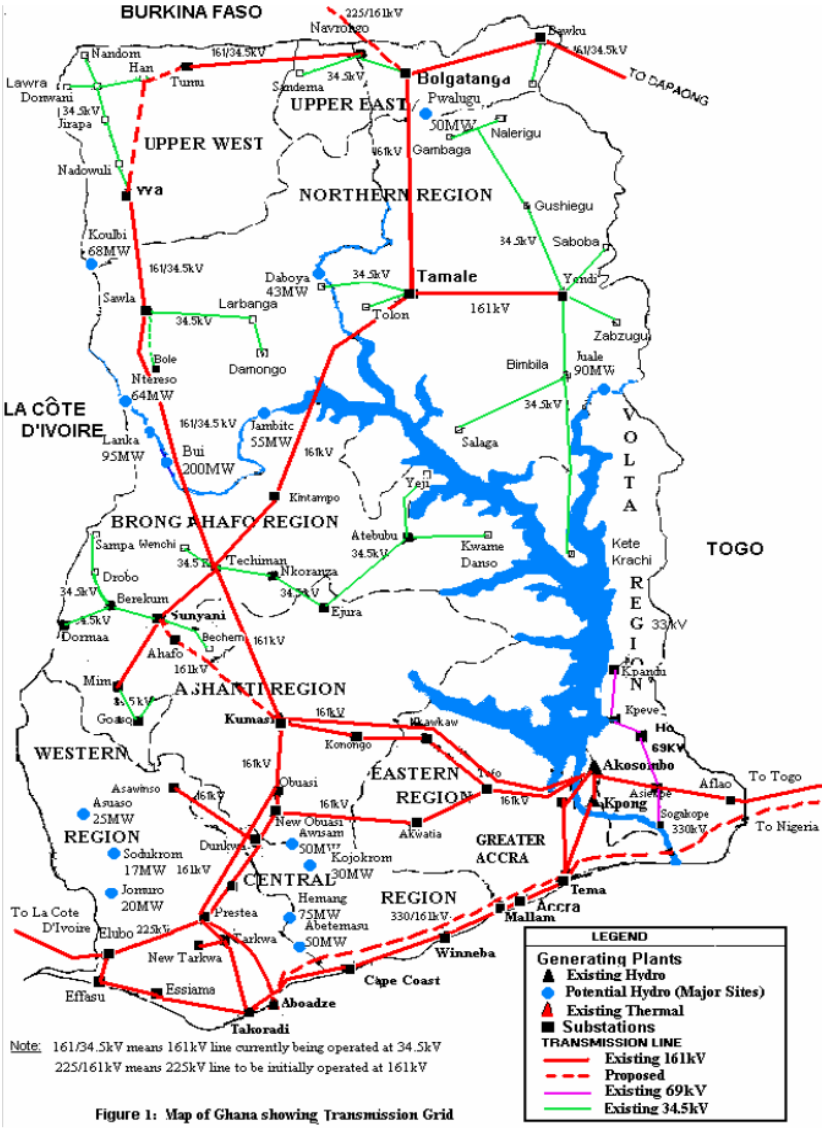
## GRID EMISSION FACTOR

*Calculation of $CEF_{elec,GRID}$*

According to the "*Tool to calculate the emission factor for an electricity system*" Version 02.2.1, the combined margin (CM) emission factor shall be calculated by applying the following seven steps:

**STEP 1. Identify the relevant electricity systems.**

The following map shows that electrical Ghana's electric power system has one national Grid the "National Interconnected Transmission System (NITS)" with transmission lines to Côte d`Ivoire, Togo/Benin and Burkina Faso.




*(as of 07/08/2010)*

No other electricity system is located within the country, thus no internal imports take place. Therefore, the relevant electric power system is the national grid.

The following power plants are connected to the National Interconnected Transmission System:

| Power plants | Type | Commissioning date | Capacity(MW) |
|---|---|---|---|
| TAPCO | *Thermal* | 1997/98 | 330 |
| TICO | *Thermal* | 2000/01 | 220 |
| Tema Diesel Reserve Plant* | *Thermal* | April 2007 | 50 |
| Emergency R. Power Plant | *Thermal* | May 2007 | 55.2 |
| AGGREKO* | *Thermal* | July 2007 | 25 |
| Kumasi Res. Power Plant* | *Thermal* | August 2007 | 20 |
| Mines Reserve Power Plant | *Thermal* | October 2007 | 80 |
| TT1PP - VRA | *Thermal* | 2009 | 110 |
| TT2PP 2010 | *Thermal* | 2010 | 21 |
| Akosombo | *Hydro* | 1966 | 1,020 |
| Kpong | *Hydro* | 1982 | 160 |

** Decommissioned as of 2009*

Ghana imported the following amount of electricity from other countries:

| Imports | GWh |
|---|---|
| **2008** | 274.8 |
| **2009** | 198.0 |
| **2010** | 106.3 |

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

The tool allows selecting one of the following two options to calculate the operating margin and build margin emission factor:

**Option 1:** Only grid power plants are included in the calculation.

**Option 2:** Both grid power plants and off-grid power plants are included in the calculation.

Because off-grid power plants are not considered, **Option 1** is selected for the calculation of both the operating and build margin emission factors.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

The hydro power plants of Akosombo and Kpong represent low cost/must run resources and constitute more than 50% of the total grid generation, based on the average of the five most recent years 2006 - 2010 (68.6%). Therefore method (a), simple OM, is not applicable.

The simple adjusted OM requires the detailed operation and hourly dispatch data of each power plant in the grid, which are not available to date for the Ghanaian grid. Therefore, method (b) is not applicable.

For identical reasons of data availability, method (c) dispatch data analysis OM is not applicable.

The method (d), average OM, will be used as low-cost/must run resources constitute more than 50% of the total amount of power generation on the grid.

According to the Energy Commission, the total electric power generation of the Ghanaian grid in 2010 is 10,126 GWh, in which fossil fuel based power generation is 3,135 GWh, accounting for 31 % and hydropower generation represents 6,991 GWh accounting for 69 %.

As the table below shows, hydropower represents all of the low-cost/must run resources with an average share over the past 5 years of 68.6%.

**Table 26:** *Net production and share of low cost/must run power plants.*

| | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Hydropower gross production (GWh) | 5,615 | 3,724 | 6,192 | 6,871 | 6,991 |
| **Share of hydropower [%]** | 66.6% | 52.9% | 74.3% | 76.9% | 69.0% |

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

According to the tool, the average OM emission factor ($EF_{OM,ave,y}$) is calculated as the average emission rate of all power plants serving the grid, using the guidance for the simple OM calculation, but also including the low-cost/must-run power plants in all equations.

Option A is applied:

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM\ simple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

| | | |
|---|---|---|
| $\mathbf{EF_{grid,OM\ simple,y}}$ | = | Simple operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$). |
| $\mathbf{EG_{m,y}}$ | = | Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh). |
| $\mathbf{EF_{EL,m,y}}$ | = | $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$) |
| **m** | = | All power units serving the grid in year y except low-cost/must-run power units. |
| **y** | = | The relevant year as per the data vintage chosen in **STEP 3**. |

Since data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows (**option A1** of the tool):

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

Where:

| | | |
|---|---|---|
| $\mathbf{EF_{EL,m,y}}$ | = | $CO_2$ emission factor of power unit *m* in year *y* ($tCO_2/MWh$) |
| $\mathbf{FC_{i,m,y}}$ | = | Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit) |
| $\mathbf{NCV_{i,y}}$ | = | Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit) |
| $\mathbf{EF_{CO2,i,y}}$ | = | $CO_2$ emission factor of fossil fuel type *i* in year *y* ($tCO_2/GJ$) |
| $\mathbf{EG_{m,y}}$ | | Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh) |
| ***m*** | = | All power units serving the grid in year *y* except low-cost/must-run power units |

| | | |
|---|---|---|
| ***i*** | = | All fossil fuel types combusted in power unit *m* in year *y* |
| ***y*** | = | The relevant year as per the data vintage chosen in Step 3. |

For the calculation of the OM emission factor, the consumption data for each fossil fuel used to power the different power plants are taken from the certified data provided by the Energy Commission. The Energy Commission holds data on annual fuel consumption, electricity generation by sources and electricity imports/exports.

The calculation of the OM is based on the years 2008, 2009 and 2010.

If available, local values of $NCV_i$ and $EF_{CO2,i}$ shall be used. If not, country-specific values are preferable to IPCC default values. In this PoA-DD:

- NCVi,y of all fossil fuels come from IPCC default value at the lower limit of the uncertainty at a 95% confidence interval as provided in table 2.2 of Chapter 2 Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
- $EF_{CO2,i}$ of all fossil fuels come from IPCC default value at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

Based on 2008, 2009 and 20010, the calculated Operating Margin is: **0.2015 $tCO_2$/MWh.**

**STEP 5. Calculate the build margin (BM) emission factor.**

Option 1: For the first crediting period, project participants calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of PoA-DD submission to the DOE for validation (year 2010). This option does not require monitoring the emission factor during the crediting period.

Capacity additions from retrofits of power plants are not included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin are determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$);

- The set of five power units that started to supply electricity to the grid most recently represents a net electricity production (in year 2010) **$AEG_{SET\text{-}5\text{-units}}$ = 763 GWh.**

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities ($AEG_{total}$). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of $AEG_{total}$ (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$);

- The set of power capacity additions in the electricity system that comprise 20% of the system generation (i.e. 2,205GWh in year 2010) and that started to supply electricity to the grid most recently corresponds to a total set of **$AEG_{SET\text{-}\geq 20\%}$ = 3,135 GWh.**

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation ($SET_{sample}$);

- The set of power units that comprises the larger annual generation is $\mathbf{SET_{sample} = SET_{\geq 20\%}}$.

Identify the date when the power units in $SET_{sample}$ started to supply electricity to the grid. If none of the power units in $SET_{sample}$ started to supply electricity to the grid more than 10 years ago, then use $SET_{sample}$ to calculate the build margin.

Otherwise (d), (e); which are irrelevant since there is no power units registered as CDM project activity in Ghana.

(f) The sample group of power units m used to calculate the build margin is the resulting set $\mathbf{SET_{sample\text{-}CDM\text{->}10yrs} = SET_{sample} = SET_{\geq 20\%}}$.

**Table 27:** *Set of power units under consideration.*

| Name of power plants included in the build margin (interconnected grid) | Date of operation | Fuel Type | Net power generation in 2010 (GWh) | Cumulated share (%) |
|---|---|---|---|---|
| TAPCO | 1997 | LCO/DO | 447 | **23.1%** |
| TICO | 2000 | LCO/DO | 1,034 | **18.1%** |
| Tema Reserve Power Plant | Apr-07 | Diesel | 0 | **6.5%** |
| Emergency R. Power Plant | May-07 | Diesel | 0 | **6.5%** |
| AGGREKO | Jul-07 | Diesel | 0 | **6.5%** |
| Kumasi Res. Power Plant | Aug-07 | Diesel | 0 | **6.5%** |
| Mines Reserve Plant | Oct-07 | Diesel | 16 | **6.5%** |
| TT1PP - VRA | 2009 | LCO/DO | 568 | **6.4%** |
| TT2PP | 2010 | DO | 21 | **1.57%** |
| Sunon Asogli | 2010 | NG | 138 | **1.36%** |

The build margin emissions factor is the generation weighted average emission factor ($tCO_2/MWh$) of all power units *m* during the most recent year y for which electricity generation data is available, calculated as follows:

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

Where:

| | | |
|---|---|---|
| $EF_{grid,BM,y}$ | = | Build margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$) |
| $EG_{m,y}$ | = | Net quantity of 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* ($tCO_2/MWh$) |
| ***m*** | = | Power units included in the build margin |
| ***y*** | = | Most recent historical year for which electricity generation data is available. |

As there is no specific guidance or data from the host country, the value[24] of the carbon emission factor of fossil fuel used for the calculations are:

- EF Light Crude Oil (LCO) = 71,100 $kgCO_2/TJ$ ;
- EF Distillate Oil (DO) = 71,100 $kgCO_2/TJ$;

[24] *IPCC 2006 Volume 2 - Chapter 1 – Table 1.2– Default $CO_2$ Emission Factors For Combustion. at the lower limits of the 95% confidence interval..*

- EF Diesel = 72,600 $kgCO_2/TJ$.

As there is no specific guidance or data from the host country, the Net Calorific Values[25] of fossil fuel used for the calculations are:

- NCV Light Crude Oil (LCO) = 40.1TJ/Gg;
- NCV Distillate Oil (DO) = 40.1 TJ/Gg;
- NCV Diesel = 41.4 TJ/Gg;
- NCV Natural Gas (NG) = 46.5 TJ/Gg.

**Table 28:** *Emissions of the set of power units included in the Build Margin.*

| Name of power plants included in the build margin (interconnected grid) | Fuel type | Net Power Generation | Emission factor of the power unit | $CO_2$ emissions |
|---|---|---|---|---|
| | | GWh | $tCO_2/MWh$ | $tCO_2$ |
| TAPCO | LCO/DO/NG | 1,213 | 0.6497 | 787,976 |
| TICO | LCO/DO | 1,034 | 0.8532 | 882,216 |
| Tema Reserve Power Plant | Diesel | 0 | 0.0000 | 0 |
| Emergency R. Power Plant | Diesel | 0 | 0.0000 | 0 |
| AGGREKO | Diesel | 0 | 0.0000 | 0 |
| Kumasi Res. Power Plant | Diesel | 0 | 0.0000 | 0 |
| Mines Reserve Plant | Diesel | 16 | 1.1310 | 18,096 |
| TT1PP - VRA | LCO/DO | 568 | 0.7863 | 446,630 |
| TT2PP | LCO/DO/NG | 21 | 0.6985 | 14,460 |
| Suno Asogli | NG | 138 | 0.5636 | 77,781 |
| Total | | 2,990 | **0.7450** | 2,227,160 |

From data provided in table 27, the Build Margin is calculated to be: **0.7450 $tCO_2/MWh$**.

**STEP 6. Calculate the combined margin (CM) emission factor**.

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on the following method:

(a) Weighted average CM;

$$\mathbf{EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}}$$

Where:

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

According to the tool, default values for other projects than wind and solar power generation project activities are: $w_{OM}$= 0. 5 and $w_{BM}$ = 0.5.

Based on 2008, 2009 and 2010, the combined margin emission factor $CEF_{elec,GRID}$ is **0.4732$tCO_2/MWh$**.

[25] IPCC 2006 Volume 2 - Chapter 2 – Table 2.2 – Default NCV at the lower limits of the 95% confidence interval.

## Appendix 5: Further background information on the monitoring plan

Not applicable

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**History of the document**

| Version | Date | Nature of revision(s) |
|---|---|---|
| 02.0 | EB 66<br>13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, Annex 12). |
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