VALIDATION ASSESSMENT REPORT

Integrated waste recycling and composting for methane reduction in Ghana

AENOR INTERNACIONAL S.A.U.
Génova, 6. 28004 Madrid – Spain
www.aenor.com

Mitigation Activity Name	Integrated waste recycling and composting for methane reduction in Ghana
Client	United Nations Development Programme (UNDP)
Name, position, and signature of the approver of the validation report	Jose Luis Fuentes Climate Change Manager jfuentes@aenor.com
Version number	2.0
Date of issue	04-January-2023
Estimated Emission Reduction	1,132,164 tCO_2e over the crediting period
Crediting period	1st January 2023 – 31st December 2030

SECTION A. Executive summary

AENOR has carried out the validation of the Mitigation Activity (MA): *Integrated waste recycling and composting for methane reduction in Ghana, ITMO* project activity, under the Article 6.2 of the Paris Agreement (PA) for Internationally Transferred Mitigation Outcomes (ITMO). The proposed NDC mitigation action (project activity) promotes an alternative to the existing waste value chain by diverting the collected waste away from disposal sites and unsustainable recycling practices. The spatial extent of the programme boundary are the sites where waste is treated: the Goaso site, Sunyani site, Ho site and Dambai site. It includes the facilities for processing the waste. Organic waste will be treated in the composting facilities to reduce methane and nitrous oxide emissions from food and garden waste. Through safe disposal and sustainable treatment of organic waste, major environmental health hazards related to the uncontrolled waste disposal will be avoided.

The project start date is 1 January 2023 and the MA aims to achieve total GHG emissions reductions of 1,132,164 tCO_2e over the period 1st January 2023 to 31st December 2030 by diverting the collected waste away from disposal sites and unsustainable recycling practices to composting facilities to reduce methane and nitrous oxide emissions.

The purpose of the validation was to determine the conformance of the MA programme with respect to the principles and criteria set by Article 6.2 of the Paris Agreement /1/, the Cooperation Agreement between the Swiss Confederation and the Republic of Ghana towards the implementation of the Paris Agreement /2/, Ghana's Nationally Determined Contribution (NDC) /17/, and the GHG calculation methodology: *AMS-III.F small-scale methodology: Avoidance of methane emissions through composting was applied, version 12.0* /3/.

During the validation, 11 corrective action requests (CARs) and 11 clarification requests (CLs) and 2 forward action requests (FARs) were raised. All these issues were closed through corrections, except those included the FARs, clearer explanations and provision of additional supporting evidence. Once all issued detected were resolved, AENOR carried out this final validation report with an objective opinion of the level to which the ITMO project activity meets all the validation criteria.

AENOR assessed as positive with the information available, the audit team concludes that the ITMO project activity complies with all the principles set by Article 6.2 of the Paris Agreement. The cumulative estimated ex-ante net GHG emissions reductions or removals of 1,132,164 tCO_2e over the crediting period (01-January 2023 to 31-December-2030). The GHGs have been quantified in accordance with the CDM methodology *AMS-III.F small-scale methodology: Avoidance of methane emissions through composting was applied, version 12.0,* based on the assumptions used by project proponent (PP) and validation team confirms that are accurate and free of material error.

SECTION B. Validation method and criteria

B.1. Scope and criteria of the validation

The purpose of the validation audit activity was to conduct an independent assessment of the ITMO project activity in order to determine whether it complies with the validation criteria as set out in the guidance documents listed below, including the monitoring procedures, and that the GHG emission reductions estimated ex-ante in the Mitigation Activity Design Document (MADD) are materially accurate for the approaches applied.

The scope of the validation audit was to validate the design and emissions reductions of the proposed MA in Vanuatu against the principles of Article 6.2 of the PA, the identified methodology and associated tools.

The scope was defined as follows:

- Project activity.
- Project boundaries.
- Additionality.
- Baseline scenario.

- Ex-ante estimation of GHG emission reductions.
- Double counting.
- Monitoring plan.
- Sustainable development contributions.

The validation was performed against the criteria set by the following documents:

- Article 6.2 of the Paris Agreement /1/.
- Cooperation Agreement between the Swiss Confederation and the Republic of Ghana towards the implementation of the Paris Agreement /2/.
- CDM methodology AMS-III.F small-scale methodology: Avoidance of methane emissions through composting was applied, Version 12.0 /3/.
- Methodological tool: Emissions from solid waste disposal sites, Version 08.0, /4/.
- Methodological tool: Project and leakage emissions from composting, Version 02.0 /5/.
- Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, Version 03.0 /6/.
- Methodological tool: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion Version 03.0 /7/.
- Ghana's Framework for Cooperative Approach under Article 6.2 of the Paris Agreement /16/.
- Ghana's Updated Nationally Determined Contribution under the Paris Agreement (2020-2030), November 2021 /17/.

B.2. Validation process

The validation was performed through a combination of document review and interviews with relevant personnel. At all times, the ITMO project activity was assessed for conformance to the criteria described in section B.1 of this report. Findings were issued to ensure that it was in full conformance to all requirements.

A detailed review of all ITMO project activity documentation was conducted to ensure consistency with and identify any deviation from the validation criteria, including the methodology (CDM AMS-III.F, version 12.0). For a list of all documents received from the client and assessed for this validation, see Appendix 1.

AENOR carried out a deep and meticulous review of the MADD /8//9/ and spreadsheet /10/ in order to verify the correct application of the methodology (formulae, equations) and checked that data required calculating the GHG reductions were appropriately provided in the MADD and/or spreadsheet. Based on the assessment carried out, AENOR confirms with a reasonable level of assurance that the claimed ex-ante emission reductions are free from material errors, omissions, or misstatements for the approaches considered.

AENOR confirms that due to the initial stage in the design of the project activity, the data used to the ex-ante estimated net anthropogenic GHG emission reductions have been obtained from estimation of the PP based on its experience and data from similar projects. The electricity consumption, diesel consumption and the quantity of wasted composted do not come from a comprehensive study, these are based on the experience of the project developer operating composting facilities. Then, these parameters must be reassessed during the verification as specified in FAR 1. Also, the claim that using of *Tarpaulin* to cover the compost piles avoids the emission due to methane and nitrous oxide were not supported by evidence; therefore, this will be assessed during the verification (FAR 2).

The audit team was able to crosscheck that the information provided is consistent with other supporting evidence provided by PP, except for those indicated in forwards actions requests (FAR 1 and FAR 2).

Revied documents includes:

- CDM methodology: AMS-III.F small-scale methodology: Avoidance of methane emissions through composting /3/.
- CDM Methodological tool: Emissions from solid waste disposal sites /4/.

- CDM Methodological tool: Project and leakage emissions from composting /5/.
- CMD Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation /6/.
- CDM Methodological tool: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion /7/.
- Environmental impact assessment (EIA): Integrated recycling and compost plant (IRECOP) Goaso proposed construction and installation of composting, sorting and material recovery facility /11/.
- Environmental impact assessment (EIA): Integrated recycling and compost plant (IRECOP) Sunyani proposed construction and installation of composting, sorting and material recovery facility /12/.
- Environmental and social impact assessment (ESIA): Integrated recycling and compost plant (IRECOP) Dambai proposed construction and installation of composting, sorting and material recovery facility/13/.
- Environmental and social impact assessment (ESIA): Integrated recycling and compost plant (IRECOP) Ho proposed construction and installation of composting, sorting and material recovery facility/14/.
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2, Energy /18/.

In this sense, there is a clear audit trail that contains the evidence and records that validate the stated figure in this validation report since:

- Sufficient evidence available: the PP has provided supporting evidence for data used in the calculations, except for those indicated in FAR 1 and FAR 2, to achieve the final estimated amount of GHG emission reductions.
- Nature of evidence: The electricity consumption, diesel consumption; the quantity of wasted composted and parameters included in the FAR 1 do not come from a comprehensive study, these are based on the experience of the project developer operating composting facilities. They are detailed the spreadsheet of emission reduction calculation: *"Ghana_composting ITMO project"*/10/. For project midsession due to CH_4 and N_2O, PP stated that they *will use Tarpaulin to cover the compost piles* to avoid this emission. This fact must be reassessed during the verification to confirm the implementation and provide supporting evidence that the use of the use of this material prevents such emissions (FAR 2).
- Cross-checked evidence: AENOR cross-checked the collected information through interviews reproducing calculations and against other public and reliable sources available.

Hence, AENOR confirms that the stated figures in the MADD are correct and confirms that is able to certify the ex-ante net anthropogenic GHG reductions based on the assumptions considered by the project proponent.

Several validation findings were raised in the form of CLs and CARs and submitted to the PP, which addressed them either by providing to the audit team with the requested information or by making the appropriate corrections or clarifications. Updated versions of the documentation were submitted by the PP and the audit team reassessed them against the validation criteria. This process was repeated iteratively until all findings were fully closed. Specifically, 11 CARs and 11 CLs and 2 FARs were raised. All findings issued during the validation process and the inputs for their closure are described in Appendix 2 of this report.

B.3. Internal quality control

Following the completion of the assessment process by the validation team, all documentation underwent an internal quality control through a technical review before submission to the client. The technical reviewer is a qualified member of AENOR, independent from the team that carried out the validation of the ITMO project activity. The technical reviewer appointed for the technical review is qualified in the technical area and sectoral scope of the Mitigation Activity (MA).

B.4. Validation team members

No.	Role	Last name	First name	Desk/document review	Interviews	Validation findings
1.	Lead Auditor	Gonzáles Toledo	Richard Daniel	X	X	X
2.	Auditor	Arroyo Bovea	Marina	X	X	X
2.	Trainee auditor	Arranz Arbex	Asis	X		X

B.5. Technical reviewer and approver of the validation and certification report

No.	Role	Last name	First name
1.	Technical reviewer	Arribas Alonso	Luis Javier
2.	Approver	Fuentes Perez	Jose Luis

B.6. Interviews

No.	Interviewee		
	Last name	First name	Affiliation
1	Soezer	Alexandra	Carbon Technical Advisor, UNDP
2	Kansuk	Stephen	Team Leader & Environment and Climate Change Specialist, UNDP Ghana
3	Fernández	Luz	Project Coordinator, UNDP
4	Tutu	Daniel	Deputy Director, Ghana Environmental Protection Agency

SECTION C. Validation findings

C.1. Mitigation activity details

The MA *"Integrated waste recycling and composting for methane reduction in Ghana"* promotes an alternative to the existing waste value chain by diverting the collected waste away from disposal sites and unsustainable recycling practices. Organic waste will be treated in three composting facilities to reduce methane and nitrous oxide emissions from food and garden waste. Through safe disposal and sustainable treatment of organic waste, major environmental health hazards related to the uncontrolled waste disposal will be avoided. The ITMO programme will improve air quality, municipal waste management and water quality.

The ITMO programme is aligned with Ghana's Nationally Determined Contributions and sectoral plans, policies and strategies, such as the National Solid Waste Management Strategy for Ghana and the Environmental Sanitation Policy.

IRECOP (Integrated Recycling and Compost Plant) is the owner of the mitigation activity under the Jospong Group of Companies (JGC), which is the major Ghanaian waste management company. It has been operating countrywide and, in some neighbouring countries, accumulating experience in waste management. The Activity is sponsored by the Ministry of Environment, Science, Technology and Innovation (MESTI), which will be responsible for coordinating the integrated waste ITMO programme in Ghana and ITMOs reporting to UNFCCC.

It is expected that the project activity start date is 1 January 2023 /15/. The crediting period is from 1 January 2023 to 31 December 2030, 8 years. The cumulative estimated ex-ante net GHG emissions reductions or removals of 1,132,164 tCO_2e over the crediting period.

C.2. Compliance of the mitigation activity with the methodology

The ITMO project activity applies the CDM small-scale methodology: AMS-III.F small-scale methodology: Avoidance of methane emissions through composting was applied, version 12.0 /3/.

No	AMS-III.F. Applicability Criteria	Assessment
1	This methodology is applicable to the composting of the organic fraction of municipal solid waste.	The project targets organic fraction of municipal solid waste.
2	This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility. For project activities that increase capacity utilization at existing facilities, project participant(s) shall demonstrate that special efforts are made to increase the capacity utilization, that the existing facility meets all applicable laws and regulations, and that the existing facility is not included in a separate CDM project activity. The special efforts should be identified and described.	IRECOP is constructing new treatment facilities. It was validated against EIA /11//12/ and ESIA /13//14/.
3	This methodology is also applicable for co-composting wastewater and solid biomass waste, where wastewater would otherwise have been treated in an anaerobic wastewater treatment system without biogas recovery. The wastewater in the project scenario is used as a source of moisture and/or nutrients to the biological treatment process e.g. composting of empty fruit bunches (EFB), a residue from palm oil production, with the addition of palm oil mill effluent (POME) which is the wastewater co-produced from palm oil production.	Not applicable. Comporting wastewater is not in the considered in the project boundary.
4	In case of co-composting, if it cannot be demonstrated that the organic matter would otherwise been left to decay anaerobically, Baseline emissions related to such organic matter shall be accounted for as zero, whereas project emissions shall be calculated according to the procedures presented in this methodology for all co-composted substrates.	Not applicable. Co-comporting is not in the considered in the project boundary.
5	The location and characteristics of the disposal site of the biomass, animal manure and co-composting wastewater in the baseline condition shall be known, in such a way as to allow the	The biomass would be left to decay in nearby landfills and stockpiles. The project does not involve manure management and wastewater

No	AMS-III.F. Applicability Criteria	Assessment
	estimation of its methane emissions, using the provisions of AMS-III.G, AMS III.E (concerning stockpile), AMS-III.D "Methane recovery in animal manure management systems" or AMS-III.H respectively.	treatment. It was validated against EIA /11//12/ and ESIA /13//14/.
6	Blending materials may be added in the project scenario to increase the efficiency of the composting process (e.g. to achieve a desirable C/N ratio or free air space value), however, only monitored quantity of solid waste or manure or wastewater diverted from the baseline treatment system is used for emission reduction calculation. Project activities for composting of animal manure shall also meet the requirements under paragraphs 3 and 4(c) of the latest version of AMS-III.D.	Not applicable. Blending material was not included in the project scenario. It was validated against EIA /11//12/ and ESIA /13//14/.
7	For solid wastes diverted from a solid waste disposal site, the following requirement shall be checked ex ante at the beginning of each crediting period: a. Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or b. Establish that it is common practice in the region to dispose of the waste in solid waste disposal site (landfill)/stockpile(s).	The landfills would receive the waste in the absence of the project as it is common practice in Ghana. Both conditions were validated against EIA /11//12/ and ESIA /13//14/.
8	The project participants shall clearly define the geographical boundary of the region referred in paragraph 11(b), and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the source of the waste i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. Once defined, the region should not be changed during the crediting period(s).	The geographical boundary can be clearly defined. It is established in the environmental impact assessment /11//12/ and environmental and social impact assessment /13//14/.
9	In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.	IRECOP ensures through its standard operations that proper conditions and procedures that do not result in methane emissions are fulfilled. It was validated against EIA /11//12/ and ESIA /13//14/.
10	In case produced compost is treated thermally/mechanically, the provisions in AMS-	Not applicable.

No	AMS-III.F. Applicability Criteria	Assessment
	III.E related to thermal/mechanical treatment shall be applied.	Produced compost is not treated thermally/mechanically. It was validated against EIA /11//12/ and ESIA /13//14/.
11	In case produced compost is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual organic content shall be taken into account and calculated as per the latest version of the methodological tool "Emissions from solid waste disposal sites".	Produced compost has been taken into account in the emission reduction calculations. It was validated against EIA /11//12/ and ESIA /13//14/.

AENOR, based on provided evidence /11//12//13//14/, validated the applicability conditions of the methodology. The audit team deems that the PP has selected the most appropriate existing methodology.

The system boundary of the proposed mitigation activity covering the sourcing MSW (municipal solid waste), production of compost and other recoverable, sales and their use will occur within Ghana, including:

Goaso Site: The project site is 12 km away from Asunafo South, 5.2 km from Asunafo North, 37km away from Asutifi North and 22 km from Asutifi South. Goaso is a town and it's the capital of the newly created Ahafo Region of Ghana. It is located between three major towns: Mim, Kukuom and Hwidiem. Other surrounding towns include Ayumso, Akrodie, Fawohoyeden and Nkaseim. is expected to treat about 400 tons per day of mixed municipal solid waste.

***Sunyani Site*:** The Project site is about 6 km from the Wawasua township, within an industrial zone earmark for such development activities in the Sunyani Municpal Assembly of the Bono Region of Ghana. The Project site for the treatment facility is barely six (6) km radius from major settlements and other structures. The project site is currently located near farmlands and some winning activities ongoing around the enclave. The facility is expected to treat about 400tons per day of mixed municipal solid waste.

Ho Site: The IRECOP project will be located in the Ho Municipal area in Volta Region. The facility will serve other towns aside from the Ho municipal, such as Kpetoe, Ziope, kpedze, Sokode, Abutia, and Mafi-Kumase. The project site is located at Akrofu in the Ho West District, about 5 kilometres from Sky Plus Hotel. Akrofu is predominantly a farming community in the Ho West District of Volta Region, Ghana. It is noted for rice production, okro, cassava and gari.

Dambai Site: The site is located at Dambai in the Krachi East Municipal Assembly in the Oti Region of Ghana. The plant is 5 km away from the Yariga community and 10 km away from the Yabram Senior High School.

As per applied methodology, the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter (including manure where applicable) are left to decay within the project boundary and methane is emitted to the atmosphere.

Therefore, as per methodology, the project boundary is the physical, geographical site: where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity. Then, AENOR deems that the project boundary is correctly defined and in compliance with the applicable methodology.

C.3. Baseline scenario

As per the methodology, *CDM methodology AMS-III.F small-scale methodology: Avoidance of methane emissions through composting was applied, version 12.0,* the baseline scenario *is the situation where, in the absence of the project activity, biomass and other organic matter (including manure where applicable) are left to decay within the project boundary and methane is emitted to the atmosphere.*

In this sense, the PP has considered as the baseline scenario is the continuation of the current urban solid waste management practice and the effects associated with that.

Based on the evidence provided, the audit team considers that landfills would receive the waste in the absence of the project as it is common practice in Ghana. Thus, the baseline scenario identified complies with CDM methodology AMS-III.F, version 12.

C.4. Additionality

According to the Ghana's framework for cooperative approach under article 6.2 of the Paris Agreement /16/ includes a pre-selected list of technologies that are considered additional to the NDC. Under this framework, waste handling, including composting of organic waste, is deemed automatically approved. The pre-selected list signals that composting organic waste is outside national measures to achieve its unconditional measures during 2021-2030.

The audit team reviewed Ghana's NDC and verified that the sectoral scope of the programme is not included. The additionality consideration is in accordance with *Ghana's Framework for Cooperative Approach under Article 6.2 of the Paris Agreement* /16/. Thus, AENOR deems that the additionality of the ITMO project activity is appropriately justified and in accordance with the validation criteria.

C.5. Quantification of GHG emission reductions and removals

Procedures for quantifying the GHG emission reductions generated by the project activity are stablished as per the methodology, CDM methodology AMS-III.F small-scale methodology: Avoidance of methane emissions through composting was applied, version 12.0.

The validation team performed an intensive review of all input data, parameters, formulas, calculations, conversions, statistics and resulting output data to ensure consistency with the validation criteria.

Furthermore, the validation revied provided evidence, except for those indicated in forward actions requests (FAR 1 and FAR 2) and reproduced 100% of the calculations to ensure accuracy of the results. Conversion factors, formulas, and calculations were provided by the PP in spreadsheet format to ensure all formulas were accessible for review.

The PP estimated the ex-ante emission reductions using approaches considered in the CDM methodology AMS-III.F small-scale methodology: Avoidance of methane emissions through composting was applied, version 12.0.

1. <u>Baseline emissions</u>

For the calculation of baseline emissions, the *CDM methodology AMS-III.F small-scale methodology: Avoidance of methane emissions through composting* was applied. The baseline emissions for the project activity are calculates as:

$$\boldsymbol{BE_y = BE_{CH4,SWDS,y} + BE_{ww,y} + BE_{CH4,manure,y} - MD_{y,reg} \times GWP_{CH4}}$$

Where:

BE_y	Baseline emissions in year y (tCO_2)
$BE_{CH4,SWDS,y}$	Yearly methane generation potential of the solid waste composted by the project activity during the years x from the beginning of the project activity (x=1) up to the year y estimated as per the latest version of the methodological tool "Emissions from solid waste disposal sites" (tCO_2e). The tool may be used with the factor "f=0.1" taking into account the methane oxidation effect by the upper layer of the landfill. With the definition of year x as 'the year

since the project activity started diverting wastes from landfill disposal, x runs from the first year of crediting period (x=1) to the year for which emissions are calculated (x=y)'

$BE_{ww,y}$	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne)
$BE_{CH4,manure,y}$	Where applicable, baseline emissions from manure composted by the project activities, as per the procedures in AMS-III.D (tCO_2e)
$MD_{y,reg}$	Where applicable, baseline emissions from the wastewater co-composted, calculated as per the procedures in AMS-III.H (tCO_2e)
GWP_{CH4}	Global Warming Potential for CH_4 applicable to the crediting period (t CO_2e/t CH_4)

The parameters: $BE_{ww,y}$, $BE_{CH4,manure,y}$, $MD_{y,reg}$ are not included in the baseline emissions since they are outside the project scope, i.e., that methane capture is prevailing based on regulations and the project does not involve manure management and wastewater treatment.

The methane emissions occurring in the baseline in the solid waste disposal side ($BE_{CH4,SWDS,y}$) is calculated as per Methodological tool: *Emissions from solid waste disposal sites, version 08.0*, using the yearly model, as follow:

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

Where:

$BE_{CH4,SWDS,y}$	Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in 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 year y (x = y)
y	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
$W_{j,x}$	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
φ_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 of methane
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized 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 year y
DOC_j	Fraction of degradable organic carbon in the waste type j (weight fraction)

k	Decay rate for the waste type j (1 / yr)
j	Type of residual waste or types of waste in the MSW

PP has prepared a spreadsheet /10/ with the equations described in the methodology and the values indicated above. The assumptions used by the PP for the estimation of the baseline emissions were assessed by the validation an considers appropriated to the ITMO project activity. Following is summarized the baseline calculation.

year	By (tCO_2e)
2023	32,990
2024	65,255
2025	96,864
2026	127,883
2027	158,374
2028	187,288
2029	217,635
2030	247,280
Total	**1,133,569**

2. Project emissions

According to the applied methodology (AMS III.F.) the project emissions from composting process (PE_y) shall be determined as per the latest version of the methodological tool "*Project and leakage emissions from composting*". PE_y is equivalent to parameter $PE_{COMP,y}$ in the tool. Then, Project emission is calculated as follow:

$$\boldsymbol{PE_{COMP,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{N2O,y} + PE_{RO,y}}$$

Where:

$PE_{COMP,y}$	Project emissions associated with composting in year y (tCO_2e/yr)
$PE_{EC,y}$	Project emissions from electricity consumption associated with composting in year y (tCO_2/yr)
$PE_{FC,y}$	Project emissions from fossil fuel consumption associated with composting in year y (tCO_2/yr)
$PE_{CH4,y}$	Project emissions of methane from the composting process in year y (tCO_2e/yr)
$PE_{N2O,y}$	Project emissions of nitrous oxide from the composting process in year y (tCO_2e/yr)
$PE_{RO,y}$	Project emissions of methane from run-off wastewater associated with co-composting in year y (tCO_2e/yr)

2.1. Project emissions from electricity consumption associated with composting ($PE_{EC,y}$)

According to the tool "*Project and leakage emissions from composting*" 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 methodological tool "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*".

The project activity includes the electricity consumption from the grid and from fossil fuel fired on-site. These emission sources are detailed following.

2.1.1. Project emission due electricity consumption from the grid

$$\boldsymbol{PE_{EC,y} = \sum EC_{PJ,jy} \times EF_{EF,j,y} \times \left(1 + TDL_{j,y}\right)}$$

Where:

$PE_{EC,y}$	Project emissions from electricity consumption in year y (tCO_2/yr)
$EC_{PJ,jy}$	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)
$EF_{EF,j,y}$	Emission factor for electricity generation for source j in year y (tCO_2/MWh)
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source j in year y

2.1.2. Project emission due to fossil fuel fired on-site power plant (generator):

The determination of the emission factors for electricity generation $EF_{EL,j/k/l,y}$ in the project scenario depends on which scenario (A, B or C) as described in the tool "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*". For the project activity due to none of the captive power plants is a cogeneration plant nor heat generation, the emission factor of the captive power plant is calculated as follows:

$$EF_{EL,j/k/l,y} = \frac{\sum_n \sum_i FC_{n,i,t} \times NCV_{i,t} \times EF_{CO2,i,t}}{\sum_n EG_{n,t}}$$

Where:

$EF_{EL,j/k/l,y}$	Emission factor for electricity generation for source j, k or l in year y (tCO_2/MWh)
$FC_{n,i,t}$	Quantity of fossil fuel type i fired in the captive power plant n in the time period t (mass or volume unit)
$NCV_{i,t}$	Average net calorific value of fossil fuel type i used in the period t (GJ /mass or volume unit)
$EF_{CO2,i,t}$	Average CO_2 emission factor of fossil fuel type i used in the period t (tCO_2 / GJ)
$EG_{n,t}$	Quantity of electricity generated in captive power plant n in the time period t (MWh)
i	are the fossil fuel types fired in captive power plant n in the time period t
j	Sources of electricity consumption in the project
k	Sources of electricity consumption in the baseline
l	Leakage sources of electricity consumption
n	Fossil fuel fired captive power plants installed at the site of the electricity consumption source j, k or l
t	Time period for which the emission factor for electricity generation is determined

Then, project emissions from electricity consumption associated with composting is summarized following:

year	Project emission due to electricity consumption from grid	emission due to fossil fuel fired on-site power plant (generator) (tCO_2e)	$PE_{EC,y}$ (tCO_2e)
2023	4.6	112.4	117
2024	4.6	112.4	117
2025	4.6	112.4	117
2026	4.7	112.4	117
2027	4.8	112.4	117
2028	4.9	112.4	117
2029	5.0	112.4	117
2030	5.1	112.4	118

2.2. Project emissions from fossil fuel consumption associated with composting ($PE_{FC,y}$)

Project activity involves the fuel consumption in vehicles. Then, according to the tool *"Project and leakage emissions from composting"*, Project emissions from fossil fuel consumption associated with composting ($PE_{FC,y}$) was estimated using option 1 of the tool, based on monitored data, using the latest approved version of the "*Tool to calculate projector leakage CO_2 emissions from fossil fuel combustion*", as follow:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \, x \, COEF_{i,y}$$

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

Then, project emissions from fossil fuel consumption associated with composting is summarized following:

year	$PE_{FC,j,y}$(tCO_2e)
2023	58
2024	58
2025	58
2026	58
2027	58
2028	58
2029	58
2030	58

2.3. Project emissions of methane ($PE_{CH4,y}$) and nitrous oxide ($PE_{N2O,y}$) from the composting process

According to the applied tool: "*Project and leakage emissions from composting*" Project emissions of methane ($PE_{CH4,y}$) and nitrous oxide ($PE_{N2O,y}$) is calculated as follow:

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

$$PE_{N2O,y} = Q_y \times EF_{N2O,y} \times GWP_{N2O,y}$$

Where:

$PE_{CH4,y}$	Project emissions of methane from the composting process in year y (tCO_2e/yr)
Q_y	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)
$PE_{N2O,y}$	Project emissions of nitrous oxide from the composting process in year y (tCO_2e/yr)
Q_y	Quantity of waste composted in year y (t/yr)
EF_{N2Oy}	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)

The quantity of waste will be determined based on the Tool "*Project and leakage emissions from composting*", Option 1: Procedure, using a weighing device. The weight of waste delivered to the composting installation will be monitored, using an on-site calibrated weighbridge.

The emission due to methane and nitrous oxide are considered zero for ex-ante calculation. This fact must be reassessed as per FAR 2.

year	$PE_{CH4,y}$ (tCO_2e)	$PE_{N2O,y}$ (tCO2e)
2023	0	0
2024	0	0
2025	0	0
2026	0	0
2027	0	0
2028	0	0
2029	0	0
2030	0	0

Finally, project emissions of methane from run-off wastewater ($PE_{RO,y}$) are not considered as wastewater treatment is not part of the ITMO project. Therefore, the project emission for each source is summarized following:

year	$PE_{EC,y}$ (tCO_2e)	$PE_{FC,y}$ (tCO_2e)	$PE_{CH4,y}$ (tCO_2e)	$PE_{N2O,y}$ (tCO_2e)	$PE_{RO,y}$ (tCO_2e)	PE_y) (tCO_2e)
2023	117	175	175	175	175	175
2024	117	175	175	175	175	175
2025	117	175	175	175	175	175
2026	117	176	176	176	176	176

year	$PE_{EC,y}$ (tCO_2e)	$PE_{FC,y}$ (tCO_2e)	$PE_{CH4,y}$ (tCO_2e)	$PE_{N2O,y}$ (tCO_2e)	$PE_{RO,y}$ (tCO_2e)	PE_y) (tCO_2e)
2027	117	176	176	176	176	176
2028	117	176	176	176	176	176
2029	117	176	176	176	176	176
2030	118	176	176	176	176	176
					Total	**1,405**

3. Leakage

Due to compost is not subject to anaerobic storage or disposed, as per established in the methodology (AMS III.F) leakage is not considered.

$$\boldsymbol{LEy = 0}$$

4. Emission reduction

According to the applied methodology (AMS III.F), the estimated ex-ante net GHG emission reduction to be achieved by the ITMO project activity, during the crediting period, was estimated using the following equation:

$$ER_y = BE_y - (PE_y + LE_y)$$

ER_y Emission reductions in year y (tCO_2e)

BE_y Baseline emissions in year y (tCO_2e)

PE_y Project emissions in year y (tCO_2e)

LE_y Leakage emissions in year y (tCO_2e)

The result achieved by the PP are summarized in the following table:

Year	Estimated baseline emissions (tCO_2e)	Estimated project emissions (tCO_2e)	Estimated project leakage (tCO_2e)	Estimated net GHG emission reductions (tCO_2e)
2023	32,990	175	0	32,815
2024	65,255	175	0	65,080
2025	96,864	175	0	96,689
2026	127,883	176	0	127,707
2027	158,374	176	0	158,198
2028	187,288	176	0	187,112
2029	217,635	176	0	217,459
2030	247,280	176	0	247,104
Total	**1,133,569**	**1,405**	**0**	**1,132,164**

AENOR reproduced calculations in the spreadsheets /10/ to achieve the same results and deems they are depicted clearly and correctly in the provided sheets. Formulae used are in compliance with the methodology.

Based on the information reviewed, it can also be confirmed that the sources used are obtained from the methodology applied or from estimations of the PP which shall be verified after the implementation of the project

to assess that the estimations are consistent with the monitored values. All assumptions and data indicated in the MADD and all relevant sources were checked and are listed in this validation report.

In essence, the methodology was correctly applied following the requirements. All values in the MADD are considered reasonable in the context of the proposed ITMO project activity. Hence, the calculation of baseline and project emission and the estimated net GHG emission reductions are considered correct.

C.6. Double counting

According to the PP, double counting is avoided through the commitment of the Ghana Government to apply a corresponding adjustment to all ITMO programmes and projects implemented under the bilateral agreement with Switzerland. The corresponding adjustment ensures that the MO are not claimed twice.

Specifically, the eligibility criteria under Ghana's Framework for Cooperative Approach under Article 6.2 of the Paris Agreement /1/ include provisions to prevent the registration of MA under more than one national or international carbon crediting scheme, whether voluntary or otherwise, to avoid double counting. In addition, MA shall demonstrate at verification that there is no double counting nor double claiming.

The audit teams deems that this is aligned with the Cooperation Agreement between the Swiss Confederation and the Republic of Ghana towards the Implementation of the Paris Agreement /2/. AENOR did not found any evidence of potential double counting during the validation.

C.7. Monitoring plan

The audit team checked all parameters presented in the monitoring plan within the MADD against the requirements of the methodologies: *AMS-III.F: Small-scale methodology: Avoidance of methane emissions through composting, Version 12.0.*

Fixed parameters are:

Parameter	Description	Source of data	Value
φ_y	Model correction factor to account for model uncertainties for year y	Default value, according to the table 1 of the Methodological tool Emissions from solid waste disposal sites, Version 08.0 /4/	0.75
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)	Default value, according to the table 2 of the Methodological tool Emissions from solid waste disposal sites, Version 08.0 /4/	0.1
F	Fraction of methane in the SWDS gas (volume fraction)	Default value, according to the table 3 of the Methodological tool Emissions from solid waste disposal sites, Version 08.0 /4/	0.5
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)	Default value, according to the table 4 of the Methodological tool Emissions from solid waste disposal sites, Version 08.0 /4/	0.5
MCF_y	Methane correction factor for year y	Default value, according to the table 5 of the Methodological	0.8

Parameter	Description	Source of data	Value	
		tool Emissions from solid waste disposal sites, Version 08.0 /4/ For unmanaged solid waste disposal sites – deep (case c).		
DOC_j	Fraction of degradable organic carbon in the waste type j (weight fraction)	Default value, according to the table 6 of the Methodological tool Emissions from solid waste disposal sites, Version 08.0 /4/.	0.43	Wood and wood products:
			0.40	Pulp, paper and cardboard (other than sludge):
			0.15	Food, food waste, beverages and tobacco (other than sludge):
			0.24	Textiles:
			0.20	Garden, yard and park waste:
			0.00	Glass, plastic, metal, other inert waste:
k_j	Decay rate for the waste type j (1/yr)	Default value, according to the table 7 of the Methodological tool Emissions from solid waste disposal sites, Version 08.0 /4/. Values for Tropical (MAT>20°C) and Dry (MAP< 1000m m)	0.025	Wood and wood products:
			0.045	Pulp, paper and cardboard (other than sludge):
			0.085	Food, food waste, beverages and tobacco (other than sludge):
			0.045	Textiles:
			0.065	Garden, yard and park waste:
			0.000	Glass, plastic, metal, other inert waste:
GWP_{CH4}	Global Warming Potential of methane	According to Ghana's NDC /17/: *"Ghana will continue to use 100-year global warming potential from the AR4"*	25	
GWP_{N2O}	Global Warming Potential	According to Ghana's NDC /17/: *"Ghana will continue to use 100-year global warming potential from the AR4"*	298	
$EF_{EF,j,y}$	Emission factor for electricity generation for source j in year y (tCO_2/MWh)	Ghana´s grid emission factor/19/	0.4	

Parameter	Description	Source of data	Value
$NCV_{i,t}$	Net calorific value of fossil fuel type i used in the period t (GJ/t) (Diesel)	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 /18/	43.3
$EF_{CO2,i,t}$	CO_2 emission factor of fossil fuel type I used in the period t (tCO_2/GJ) (Diesel)	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 /18/	0.0748

The monitored parameters are:

Parameter	Description	Monitoring	Value (ex-ante)	
Q_y	Quantity of waste composted in year y (t/yr)	Will be measured continually, using a weighbridge or any other applicable and calibrated weighing device, e.g., belt-scales. (Refer to FAR 1)	2023	478,400
			2024	492,752
			2025	507,535
			2026	522,761
			2027	538,443
			2028	554,597
			2029	571,235
			2030	588,372

Parameter	Description	Monitoring	Value (ex-ante)	
$EC_{PJ,jy}$ (MWh)	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)	It will be Measurement with electricity meters. (Refer to FAR 1)	2023	11.46
			2024	11.51
			2025	11.57
			2026	11.80
			2027	12.04
			2028	12.28
			2029	12.53
			2030	12.78
$EF_{EL,j/k/l,y}$	Emission factor for electricity generation for source j, k or l in year y (tCO_2/MWh)	Calculated based on IPCC default values and fuel consumptions	45.51	
$FC_{n,i,t}(t/y)$	Quantity of fossil fuel type i fired in the captive power plant n in the time period t (mass or volume unit)	Measured For ex-ante values refer to FAR 1	34.68	
$EG_{n,t}$	Quantity of electricity generated in captive power plant n in the time period t (MWh)	Measured For ex-ante values refer to FAR 1	2.47	
$FC_{i,j,y}$	The quantity of fuel type i combusted in process j during the year y (t)	Measured For ex-ante values refer to FAR 1	17.87	
$COEF_{i,y}$	Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)	Based on IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Tables 1.2 and 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories /18/	3.24	
$EF_{CH4,y}$	Emission factor of methane per tonne of waste composted valid for year y (tCH_4/t)	As per stated by PP (refer to FAR 2)	0	
EF_{N2Oy}	Emission factor of nitrous oxide per tonne of waste composted valid for year y (tN_2O/t)	As per stated by PP (refer to FAR 2)	0	

In opinion of AENOR, all necessary parameters required by the selected methodology are contained in the monitoring plan. The means of monitoring described in the plan comply with the requirements of the methodology.

In essence the monitoring plan presented in the MADD under the section 9 of the MADD (*Determination, monitoring and reporting of mitigation outcomes*) comply with the requirement of the methodology. The audit

team deems that the ITMO associated with the implementation of project activity are planned to be monitored through a transparent structure.

After the review of evidence provided by the PP the interview, and communications with PP, AENOR confirms that monitoring arrangements described in the monitoring plan are feasible within the project activity and that the means considered for the implementation, including data management, quality and assurance control procedures, are sufficient to ensure that the GHG net anthropogenic reductions achieved resulting from the proposed MA can be reported ex post and verified. Therefore, in opinion AENOR, the PP will be able to implement the monitoring plan.

C.8. Sustainable development

Section 8 of the MADD describes the expected impact of the project in promoting sustainable development. Specifically, it is expected to contribute to 9 UN's Sustainable Development Goals (SDGs):

- SDG 3: he ITMO Programme will improve health conditions for the general public through a significant reduction of uncontrolled, informal disposal of waste.
- SDG 5: The ITMO Programme will create opportunities for new income-generating activities for women in the waste value chain.
- SDG 8: The ITMO Programme will foster productivity, increase production efficiency, enable added-value activities and encourage new income-generating activities, enhancing economic growth and providing the means to alleviate poverty.
- SDG 9: The ITMO Programme will increase access to composting technologies, integrating new small-scale enterprises into value chains and markets.
- SDG 11: The ITMO Programme will increase recycling and composting, thereby improving air quality, and municipal waste management.
- SDG 12: The ITMO Programme will improve consumption and production patterns by improving waste management and reducing waste that is left for decay.
- SDG 13: The ITMO Programme is a mitigation action, and the technical interventions will lead to emission reduction, thus contributing to positive climate action.
- SDG 16: The ITMO Programme will directly contribute to the NDC objectives and targets by supporting the creation of a Public-Private Partnership on sustainable urban solid waste management and strengthen public institutions managing waste programmes.
- SDG 17: The ITMO Programme finance elaborates international carbon finance through results-based payments.

The following 3 SDG targets will be monitored during implementation. These benefits are assuming the project reaches full scale. Else the numbers are proportional to the share of ITMOs actually generated

- SDG5: The ITMO Programme will create 100 new income-generating activities for women in the waste value chain.
- SDG11: The ITMO Programme will compost 400,000 tonnes of organic waste per year, thereby improving air quality and municipal waste management.
- SDG16: The ITMO Programme will directly contribute to the NDC objectives and targets by supporting the creation of 1 fully operational Public-Private Partnership on sustainable urban solid waste management.

The audit team traced the identification of the project impacts on sustainable development through the information provided in the MADD by the PP and assessed their rationale based on the defined conditions prior to the project activity start (sustainable development baseline), on the nature of the ITMO project activity and their goals. AENOR is able to confirm that the impacts have been comprehensible identified and that the expected contribution to SDG is appropriately attributed.

SECTION D. Validation conclusions

AENOR has validated that the Mitigation project *activity "Integrated waste recycling and composting for methane reduction in Ghana"* is in compliance with the principles of the Article 6.2 of the Paris Agreement.

AENOR has performed the validation of this ITMO project activity in Ghana on the basis of the validation criteria set by Article 6.2 of the Paris Agreement, the Cooperation Agreement between the Swiss Confederation and the Republic of Ghana towards the implementation of the Paris Agreement, Ghana's NDC, and the GHG calculation methodology. The conclusions of this report showed that the programme, as it was described in the Mitigation Activity Design Document, is in line with all criteria applicable for the validation.

The validation consisted of the following three phases: i) a desk review of the ITMO project design; ii) follow-up interviews with project activity staff; iii) the resolution of outstanding issues and the issuance of the final Validation Report and opinion. During the validation process, corrective actions and clarifications were raised. All have been successfully closed as explained in the validation protocol annexed to this report (Appendix 2).

The CDM *AMS-III.F. Small-scale methodology: Avoidance of methane emissions through composting,* version 12.0 was applied to determine the GHG net anthropogenic reductions. The GHG net anthropogenic reductions attributable to the project activity is additional to any that would occur in the absence of the mitigation activity.

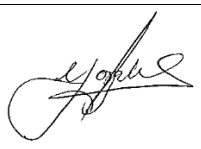
The review of the Mitigation Activity Design Document and additional documents related to baseline and monitoring methodology, and the subsequent background investigation, follow-up interviews and review of comments by parties have provided AENOR evidence to validate the stated criteria.

In detail, the conclusions can be summarized as follows:

- The project is in line with validation criteria.
- The project additionality is sufficiently justified.
- The monitoring plan is transparent and adequate.
- The analysis of the baseline emission, project emissions and leakage has been carried out in accordance with the options and approaches of the applied methodology.
- The ITMO project activity start date is 01−January−2023 and the crediting period goes from 1st January 2023 to 31st December 2030 (8 years). During this period, the reduction of 1,132,164 tCO_2e is expected through the implementation of project activity, accounting for an annual average of 141,521 tCO_2e/year.
- The project has demonstrated that all claims related to its expected contribution to the SDGs are credible and achievable.

AENOR confirms with a reasonable level of certainty that the Mitigation Activity Design Document and the claimed emission reductions are free from material errors, omissions, or inaccuracies.

Madrid, 4 January 2023.

 Richard Daniel Gonzales Toledo Lead auditor	 Approved by Jose Luis Fuente Perez Climate Change Unit Manager

Appendix 1. Documents reviewed or referenced

No.	Title	Date of reception/ retrieval/version
1	Article 6.2 of the Paris Agreement	-
2	Cooperation Agreement between the Swiss Confederation and the Republic of Ghana towards the Implementation of the Paris Agreement	17/03/2022
3	CDM methodology: AMS-III.F small-scale methodology: Avoidance of methane emissions through composting	version 12.0
4	CDM Methodological tool: Emissions from solid waste disposal sites	Version 08.0
5	CDM Methodological tool: Project and leakage emissions from composting	Version 02.0
6	CMD Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation,	Version 03.0
7	CDM Methodological tool: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion	Version 03.0
8	MADD - Initial version. Version 1	05/05/2022
9	MADD – Final version. Version 2	03/01/2023
10	Emission reduction calculation spreadsheet: "*Ghana_composting ITMO project_16December2022*"	December 2022
11	Environmental impact assessment (EIA): *Integrated recycling and compost plant (IRECOP) Goaso proposed construction and installation of composting, sorting and material recovery facility*	July 2021
12	Environmental impact assessment (EIA): *Integrated recycling and compost plant (IRECOP) Sunyani proposed construction and installation of composting, sorting and material recovery facility*	July 2021
13	Environmental and social impact assessment (ESIA): *Integrated recycling and compost plant (IRECOP) Dambai proposed construction and installation of composting, sorting and material recovery facility*	July 2021
14	Environmental and social impact assessment (ESIA): *Integrated recycling and compost plant (IRECOP) Ho proposed construction and installation of composting, sorting and material recovery facility*	July 2021

No.	Title	Date of reception/ retrieval/version
15	Resolution of the board of directors of the Jospong Group of companies limited on the establishment of integrated recycling plant and carbon credit trading	21/12/2021
16	Ghana's Framework for Cooperative Approach under Article 6.2 of the Paris Agreement	17/03/2022
17	Updated Nationally Determined Contribution under the Paris Agreement (2020 - 2030)	November 2021
18	2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2, Energy	2006
19	Environmental protection agency (EPA) written confirmation of Ghana´s grid emission factor	19/12/2022

Appendix 2. Findings

Corrective Action Requests (CARs)

CAR ID	01	Date: 22/07/2022
Description of CAR		
"Programme start date" on the first page states "1st July 2022", whereas page 16 states "The expected start date is Q4 of 2022".		
Project Proponent response		**Date: 10/10/2022**
The programme start date has been updated to reflect the Q4 start date of the programme.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 19/10/2022**
PP has updated the MADD. **Then, CAR 1 is closed.**		

CAR ID	02	Date: 22/07/2022
Description of CAR		
"Total number of ITMOs for transfer" on the first page does not match value in excel.		
Project Proponent response		**Date: 10/10/2022**
The total number of ITMOs has been revised as per the revised Excel.		
Documentation provided by the Project Proponent		
-		
VVB Assessment		**Date: 19/10/2022**
MADD has been updated accordingly. **Then, CAR 2 is closed.**		

CAR ID	03	Date: 22/07/2022
Description of CAR		

Section 7.1 states that “There are no existing or planned policies related to this Activity.” However, the NDC states “Adopt alternative urban solid waste management” as a Nationally determined contribution policy actions.

Project Proponent response	**Date: 10/10/2022**
All waste related measures referred to in the NDC are conditional upon financial support and cannot happen without external support. This has also been pointed out in the MADD.	
Documentation provided by the Project Proponent	
VVB Assessment	**Date: 20/10/2022**
MADD has been updated accordingly. **Then, CAR 3 is closed.**	

CAR ID	**04**	**Date: 22/07/2022**
Description of CAR		
Table 2 does not correctly identify SDG 12, 4, 16.		
Project Proponent response		**Date: 10/10/2022**
The SDGs have been revised and corrected in the MADD.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 20/10/2022**
MADD has been updated accordingly. **Then, CAR 4 is closed.**		

CAR ID	**05**	**Date: 22/07/2022**
Description of CAR		
Project emissions have not been calculated in accordance with tool “Project and leakage emissions from composting”, as calculations do not include project emissions from electricity consumption, project emissions from fossil fuel consumption nor Project emissions of methane from run-off wastewater.		
Project Proponent response		**Date: 10/10/2022**

The project does not involve activities related to wastewater management and therefore, methane emissions from run-off wastewater are not considered. Project emissions related to the use of electricity from the grid have been included in the ex-ante calculations of emission reductions. The Government approved grid emission factor of 0.4 tCO_2 per MWh has been applied.
Documentation provided by the Project Proponent
-

VVB Assessment	**Date: 19/12/2022**
Project emission calculation was updated and is according to the applied methodology (AMS III.F). **Then, CAR 5 is closed.**	

CAR ID	**06**	**Date: 22/07/2022**
Description of CAR		
According to Ghana's NDC: "Ghana will continue to use 100-year global warming potential from the AR4 or consider using the latest metric that the CMA may agree upon for estimating anthropogenic emissions and removals." CH4 does not consider the GWP AR4 value.		
Project Proponent response		**Date: 10/10/2022**
The GWP of methane of 25 has been used in the revised calculation and will be updated once the EPA updates the GWP for methane in their UNFCCC reporting.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 20/10/2022**
ERs has been updated accordingly. **Then, CAR 6 is closed.**		

CAR ID	**07**	**Date: 22/07/2022**
Description of CAR		
Number of jobs created by the ITMO programme stated on the first page does not match the numbers stated on the excel tab SDG.		
Project Proponent response		**Date: 10/10/2022**

The numbers have been corrected and aligned.
Documentation provided by the Project Proponent
VVB Assessment | **Date: 20/10/2022**
ERs has been updated accordingly. **Then, CAR 7 is closed.**

CAR ID	**08**	**Date: 22/07/2022**
Description of CAR		
Sections 7.2 and 9 of the MADD do not include sufficient information to allow the reader to reproduce the calculation of emissions as only generic equations are provided. Additionally, units and values are not provided in equations and tables across the MADD.		
Project Proponent response		**Date: 10/10/2022**
In section 7 of the MADD, the applicable tool used for the ex-ante calculated emission reductions was added and the formulas and default value application detailed.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 20/10/2022**
PP has not provided formulae, including complete description, used to determine baseline, project and leakage emission. PP is requested to include **all equations used to calculated emission reductions**, as per applied methodology and referred tools, in order to allow the reader, reproduce the calculation. According to the applied methodology AMS-III.F. Baseline emission is determined using equation 1, which was deleted. Also, it was not included a complete description of each parameter ($BE_{ww,y}$, $BE_{CH4,manure,y}$, $MD_{y,re}$) to determine the baseline emissions in the MADD (justifying that those parameters are zero). AMS-III.F. states (paragraphs 26) that project emission shall be determined as per the latest version of the methodological tool "Project and leakage emissions from composting". However, all parameters of equation 1 are not included in the MADD, neither is justified whether they are applicable or zero. The tool *Project and leakage emissions from composting* refers to the tool "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"* and *"Project and leakage emissions from composting".* However, the MADD does not include the sequence of calculation including chosen option from the tools. The MADD does not include the emission reduction calculation formulas established in the AMS-III.F, equation 3 an equation 4 if applicable.		

Therefore, PP shall update the MADD including the complete applicable formulas used to determine the baseline emission, project emission and leakage, from methodology and tools, providing references of applied values and supporting evidence.	
Project Proponent response	**Date: 24/10/2022**
Baseline emission formulas have been included again, additional formulas and justifications, including options have been included as well.	
Documentation provided by the Project Proponent	
VVB Assessment	**Date: 19/12/2022**
PP has updated the MADD and spreadsheet of emission reduction calculation as per applied methodology. **Then, CAR 8 is closed.**	

CAR ID	**09**	**Date: 22/07/2022**
Description of CAR		
The MADD does not provide a list of data and parameters fixed ex ante and data and parameters to be monitored, including measurement procedures, QA/QC procedures, etc. as per section 6 of CDM methodology AMS-III.F v12.0 and section V of CDM tool "Project and leakage emissions from composting".		
Project Proponent response		**Date: 10/10/2022**
In the monitoring and reporting section of the MADD, all data/parameters fixed ex-ante and monitored ex-post have been included (based on the applied methodology and the methodological tools).		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 19/12/2022**
ERs has been updated accordingly. **Then, CAR 9 is closed.**		

CAR ID	**10**	**Date: 22/07/2022**
Description of CAR		
Equations from CDM tool 04 have been used in calculations, but not included nor referenced on the MADD.		
Project Proponent response		**Date: 10/10/2022**

For the baseline calculation, formulas from CDM tool 04 have been included.	
Documentation provided by the Project Proponent	
VVB Assessment	**Date: 19/12/2022**
ERs has been updated accordingly. **Then, CAR 10 is closed.**	

CAR ID	**11**	**Date: 22/07/2022**
Description of CAR		
Excel calculations consider a full year of quantity of waste for 2022, when according to the MADD the project start date is Q4.		
Project Proponent response		**Date: 10/10/2022**
The Excel has been revised to reflect the start date.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 20/10/2022**
PP has updated ERs as requested. **Then, CAR 11 is closed.**		

Clarification Requests (CLs)

CL ID	01	Date: 22/07/2022
Description of CL		
Provide the ITMO activity start date and crediting period, including star date and end date (DD/MM/YYYY), and evidence of the start date and the lifetime of the project.		
Project Proponent response		**Date: 10/10/2022**
The project proponent has provided a written confirmation confirming the start date of the ITMO activity.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 19/12/2022**
PP has provided requested evidence. **Then, CL 1 is closed.**		

CL ID	02	Date: 22/07/2022
Description of CL		
Provide evidence of the following: • Production of 62,521.22 tonnes per year of grade A high-quality organic fertiliser • Creation of 3500 direct jobs and several thousand indirect jobs • 49,400 households are in the coverage area of IRECOP • IRECOP is the owner of the mitigation activity under the JSC • Recycling rate of below 10 per cent and a waste collection coverage rate of 80 per cent • Creation of three new income-generating activities for women in the waste value chain • Compost 400,000 tonnes of organic waste per year • Compost is not subjected to anaerobic storage or disposed of in SWDS • Data used in financial calculations • Estimations of yearly quantity of waste		
Project Proponent response		**Date: 10/10/2022**
The project proponent has provided written confirmation of the values related to waste volume, job creation, household covered in target areas, data in financial calculations. EPA has confirmed the recycling rate of 10% in Ghana as mentioned in the MADD.		
Documentation provided by the Project Proponent		

VVB Assessment	Date: 20/10/2022
PP has provided the requested evidence and they are considered adequate. **Then. CL 2 is closed.**	

CL ID	03	Date: 22/07/2022
Description of CL		
According to AMS-III.F. v12 applicability conditions: *"For solid wastes diverted from a solid waste disposal site, the following requirement shall be checked ex ante at the beginning of each crediting period:* *(a) Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or* *(b) Establish that it is common practice in the region to dispose of the waste in solid waste disposal site (landfill)/stockpile(s)."* Provide evidence of this for each site.		
Project Proponent response		**Date: 10/10/2022**
The project proponent confirmed in writing that above conditions apply.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 19/12/2020**
Applicability condition was detailed the updated MADD. **Then, CL 3 is closed.**		

CL ID	04	Date: 22/07/2022
Description of CL		
According to AMS-III.F. v12 applicability conditions: *"In defining the geographical boundary of the region, project participants should take into account the source of the waste i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. Once defined, the region should not be changed during the crediting period(s)."* Clarify how this has been considered for all sites.		
Project Proponent response		**Date: 10/10/2022**

The company has provided a written confirmation that the waste collection radius from waste collection hubs is less than 50 km.
Documentation provided by the Project Proponent

VVB Assessment	**Date: 19/12/2020**
Applicability condition was detailed the updated MADD. **Then, CL 4 is closed.**	

CL ID	**05**	**Date: 22/07/2022**
Description of CL		
According to AMS-III.F. v12 applicability conditions: *"This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility. For project activities that increase capacity utilization at existing facilities, project participant(s) shall demonstrate that special efforts are made to increase the capacity utilization, that the existing facility meets all applicable laws and regulations and that the existing facility is not included in a separate CDM project activity. The special efforts should be identified and described".* Clarify how this has been considered for all sites.		
Project Proponent response		**Date: 10/10/2022**
The project proponent confirmed in writing that the new facilities meet all applicable laws and the composting plants are not registered under the CDM as carbon project.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 19/12/2020**
Applicability condition was detailed the updated MADD. **Then, CL 5 is closed.**		

CL ID	**06**	**Date: 22/07/2022**
Description of CL		

According to AMS-III.F. v12 applicability conditions: *"In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.* *In case produced compost is treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.* *In case produced compost is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual organic content shall be taken into account and calculated as per the latest version of the methodological tool "Emissions from solid waste disposal sites".* Clarify how produced compost is going to be treated.

Project Proponent response	**Date: 10/10/2022**
The project proponent confirmed in writing that compost is handled aerobically under conditions and procedures that don't result in methane emissions and submitted to soil application.	
Documentation provided by the Project Proponent	
VVB Assessment	**Date: 19/12/2022**
Applicability condition was detailed the updated MADD. **Then, CL 5 is closed.**	

CL ID	**07**	**Date: 22/07/2022**
Description of CL		
Provide information on avoidance of double claiming of MO.		
Project Proponent response		**Date: 10/10/2022**
The project will be registered at the Ghana Registry and for each tCO_2e generated and transferred a Corresponding Adjustment will be applied to avoid double claiming. The issued and transferred ITMOs and their serial numbers will be made public and will be transparently trackable.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 20/10/2022**
PP provided requested clarification. **Then, CL 7 is closed.**		

CL ID	**08**	**Date: 22/07/2022**

Description of CL	
In section 7.2 of the MADD, it is stated: "The ITMO programme full crediting period will be 9 years from 2022 to 2030". Ghana's Framework for Cooperative Approach under Article 6.2 of the Paris Agreement, Unedited v1, states in section 2.17: "Limiting crediting period – for high impact MO activities, Ghana will limit the MO crediting period to between 5 to 7 years non-renewable over the NDC implementation period to guarantee a year for the same MO activities to generate MO to retire on Ghana's NDC target". Provide clarification whether the ITMO programme qualifies as an activity.	
Project Proponent response	**Date: 10/10/2022**
The financial viability based on the confirmed price per tCO_2e requires the generation of credits over a period of 9 years and therefore the ITMO programme will be eligible to apply a crediting period of 9 years.	
Documentation provided by the Project Proponent	
VVB Assessment	**Date: 20/12/2022**
According to EPA (environmental protection agency of Ghana), the authorization for ITMOs is granted to the period, covering Ghana´s NDC implementation, i.e.: from 30th November 2021 to 31st December 2030. PP updated the crediting period as per NDC implementation period. Therefore, ITMO programme qualifies as an activity. **Then, CL 8 is closed.**	

CL ID	09	Date: 22/07/2022
Description of CL		
Ghana's Framework for Cooperative Approach under Article 6.2 of the Paris Agreement, Unedited v1, requires in section 3.1.1: "MO activities acquire or demonstrate that it has obtained an environmental permit under the Environmental Impact Assessment Legislation (LI, 1652, 1999) to meet the sustainable development criteria". Clarify the state of the environmental permit of the ITMO programme.		
Project Proponent response		**Date: 10/10/2022**
The project proponent provided evidence that all mandatory environmental permits are obtained.		
Documentation provided by the Project Proponent		
-		
VVB Assessment		**Date: 20/10/2022**

PP has provided approved environmental impact assessment for all facilities. **Then, CL 9 is closed.**

CL ID	**10**	**Date: 22/07/2022**
Description of CL		
Clarify the following values from the excel: • φ_y = 1 for project • $W_{j,x}$ = 2500 for baseline and 0 for project • f_y = 0 • OX = 0.1 • Q_y = 2500 • $EF_{N2O,y}$ = 0 for project • Revenues US$ 13 • Food waste 90% garden waste 10%		
Project Proponent response		**Date: 10/10/2022**
Default values as per the CDM Tool 04. The carbon revenues per tCO_2e have been pre-agreed between the buyer and the seller and considered in the business model.		
Documentation provided by the Project Proponent		
VVB Assessment		**Date: 20/12/2022**
PP has provided supporting evidence; default values are taken from applied tools. **Then, CL 10 is closed.**		

CL ID	**11**	**Date: 22/07/2022**
Description of CL		
Clarify why MDy,reg ; BECH4,$manure,y$ and $BEww,y$ have not been accounted in baseline emission calculations.		
Project Proponent response		**Date: 10/10/2022**
The above parameters have not been accounted for because: Methane capturing and combustion is not prevailing practice and not regulated. The programme does not involve manure management and wastewater treatment.		

Documentation provided by the Project Proponent	
VVB Assessment	**Date: 20/10/2022**
PP has updated the MADD and emission reduction calculation, following the procedure stated in the applied methodology. **Then, CL 11 is closed**.	

Forward Action Requests (FARs)

FAR ID	**1**	**Date: 19/12/2022**
Description of CL		
The following parameters, values and monitoring, must be reassessed during de verification due to values used for ex-ante emission reduction calculation do not come from a comprehensive study. The values reported by IRECOP are based on previous project experience. Q_y Quantity of waste composted in year y (t/yr) $W_{j,x}$ Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t) $EC_{PJ,jy}$ Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr) $FC_{n,i,t}$ Quantity of fossil fuel type i fired in the captive power plant n in the time period t (mass or volume unit) $EG_{n,t}$ Quantity of electricity generated in captive power plant n in the time period t (MWh) $FC_{i,j,y}$ The quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)		
Project Proponent response		**Date: DD/MM/YYYY**
To be assessed during the verification		
Documentation provided by the Project Proponent		
To be assessed during the verification		
VVB Assessment		**Date: DD/MM/YYYY**
To be assessed during the verification		

FAR ID	**2**	**Date: 19/12/2022**

Description of CL	
The project emissions due to Methane (CH_4) and nitrous oxide (N_2O) calculation must be reassessed during the verification. The claims that using of Tarpaulin to cover the compost piles avoids the emission due to methane and nitrous oxide were not supported by evidence. Therefore, the emission factors of methane and nitrous oxide will be reassessed. $EF_{CH4,y}$ Emission factor of methane per tonne of waste composted valid for year y (tCH_4/t) $PE_{N2O,y}$ Project emissions of nitrous oxide from the composting process in year y ($t\ CO_2e/yr$)	
Project Proponent response	**Date: DD/MM/YYYY**
To be assessed during the verification	
Documentation provided by the Project Proponent	
To be assessed during the verification	
VVB Assessment	**Date: DD/MM/YYYY**
To be assessed during the verification	