



**Verified Carbon
Standard**

VERIFICATION REPORT

WASTE TO ENERGY PROJECTS BY MAHINDRA WASTE TO ENERGY SOLUTIONS LIMITED



South Asia

Document Prepared By
TÜV SÜD South Asia Pvt Ltd

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Summary:

TÜV SÜD South Asia Pvt. Ltd. has performed the first verification of the VCS project activity. The verification is based on the currently valid documentation of VCS. The main purpose of this project activity is to reduce GHG emission by avoiding anaerobic decomposition of MSW (Municipal Solid Waste) in a solid disposal site that would have occurred in the absence of the project activity and anaerobic decomposition of organic matter through bio methanation process and generate biogas. Mahindra (hereafter referred as “project proponent”) is installing Bio-gas Plants (hereafter referred as “proposed project activity”) at various locations across India as a grouped project activity. Mahindra is looking forward to earn carbon credits under VCS mechanism for these Bio-gas projects.

All the project instances i.e., Biogas plants to be included in this grouped project will be from within India only. Hence the location and geographical boundary of the grouped project can be defined as India.

The Verification has been conducted for the monitoring period 01-01-2021 to 31-December-2021 (start and end dates included).

The verification process includes three phases:

- Desk review of documents.
- On-site audit and follow-up interviews with the relevant personnel.

- Resolution of outstanding issues and the issuance of final verification report and opinion.

The main purpose of the project is to incorporate competent biogas technology and implementation to support in the country by setting up to field scale biogas plant; to be located based on the continuous availability of raw materials. Anaerobic digestion is the prominent technology used for degradation of biodegradable organic waste. The details of Project capacity and location details for all the project instances are as follows:

Sl. No.	Project Instance No.	Plant location	Capacity (TPD)	Usage	Commissioning Date
1	Mahindra Waste to Energy Solutions Ltd.	Aurangabad - Maharashtra	30	CNG Sale	01/05/2019
2		Tirupati – AP	40	CNG Sale	01/09/2019
3		Piduguralla – AP	20	CNG Sale	01/06/2019
4		Adoni - AP	20	CNG Sale	01/03/2019

During the Current Monitoring Period from 01/01/2021 to 31/12/2021 (First and last date included) the project activity has contributed 15,900 tCO₂e GHG reductions.

The implementation status of the plant has been cross verified with the commissioning certificates.

03 Clarification Requests (CLs) and 02 Corrective Action Request (CAR) have been raised during verification process and have been successfully closed. No Forward Action Request (FAR) was raised.

VVB confirms that the project is implemented in accordance with the registered VCS-PD. The monitoring plan complies with the applied methodologies ACM0022. version 2.0, and the monitoring has been carried out in accordance with the monitoring plan in the registered PDD. The monitoring system is in place and the emission reductions are calculated without material misstatements. The level of assurance of the verification is reasonable.

Our opinion relates to the projects GHG emissions, and the resulting GHG emission reductions reported and related to the valid and registered project baseline and monitoring and its associated documents. Based on the information reviewed and evaluated, VVB confirms that the

implementation of the project has resulted in 15,900 tCO₂e emission reductions during period 01/01/2021 to 31/12/2021, start and end dates included.

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1 INTRODUCTION

1.1 Objective

TÜV SÜD has been commissioned by the client to perform an independent verification assessment.

The objective of the verification work is to comply with the requirements of Verified Carbon Standards requirements. According to this assessment, TÜV SÜD shall:

- ✓ Ensure that the project activity has been implemented and operated as per the registered PD, and that all physical features (technology, project equipment, monitoring and metering equipment) of the project are in place,
- ✓ Ensure that the published MR and other supporting documents provided are complete, verifiable and in accordance with applicable VCS and CDM VVS requirements,
- ✓ Ensure that the actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved methodology,
- ✓ Evaluate the data recorded and stored as per the applicable requirements.
- ✓ Assess the sustainability monitoring parameters as per the VCS requirements.

1.2 Scope and Criteria

The scope of any assessment is defined by the underlying legislation, regulation and guidance given by relevant entities or authorities. In the case of VCS project activities, the scope is set by:

- ✓ VCS Standard v4.4 requirements.
- ✓ Clean Development Mechanism Validation and Verification Standard (VVS) for Project Activities v3.0.
- ✓ Baselines and monitoring methodologies (including GHG inventories).
- ✓ Environmental issues relevant to the applicable sectoral scope 13: Waste handling and disposal.
- ✓ Current technical and operational knowledge of the specific sectoral scope and information on best practice.
- ✓ Stakeholder consultation and feedback.

The verification process is not meant to provide any form of consulting for the Project Participant (PP). However, stated requests for clarifications, corrective actions, and/or forward actions may provide input for the improvement of the project design.

1.3 Level of Assurance

The verification has been carried out through the review of the monitoring report, PD documents, the supporting documents, and other relevant documents provided to the verification team; please refer to Appendix 1. Based on the mentioned documents and the site visits, the verification team has concluded that the level of assurance is reasonable. The errors identified in the project are below the threshold limit of materiality and hence not material. Therefore, the GHG emission reductions are calculated without material misstatements.

The VVB confirms that a reasonable level of assurance has been achieved during the verification process.

1.4 Summary Description of the Project

The project activity involves the establishment of biogas plants in various cities of India, municipal corporations to generate energy out of waste, thereby solving two major issues for the country. The biogas generated shall be used for various thermal applications such as use in vehicles or bottled for use. The project activity is expected to generate approximately 662,537 NM³ of Biogas for supply in Domestic market of the country. In the absence of the project activity, the accordant amount of CNG (fossil Fuel based) would have been delivered through the current supply mix of the country, leading to carbon dioxide emissions. The project is located in India.

During the Current Monitoring Period from 01/01/2021 to 31/12/2021 (First and last date included) the project activity has contributed 15,900 tCO₂e GHG reductions.

The project activity adopts renewable crediting period of 7 years which can be renewed for maximum 2 times.

Project Technology Details –

Project activity Instances being included in this grouped project activity are given in table below:

Sl. No.	Project Instance No.	Plant location	Technology	Capacity (TPD)	Usage	Commissioning Date
1	Mahindra Waste to Energy Solutions Ltd.	Aurangabad - Maharashtra	Bio Methanation	30	CNG Sale	01/05/2019
2		Tirupati – AP	Bio Methanation	40	CNG Sale	01/09/2019
3		Piduguralla – AP	Bio Methanation	20	CNG Sale	01/06/2019

4		Adoni - AP	Bio Methanation	20	CNG Sale	01/03/2019
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2 VERIFICATION PROCESS

2.1 Method and Criteria

The information provided by the project participants is assessed by applying the means of verification specified in the VCS Standard v4.4, VCS Validation and Verification Manual Version 3.2, Toolkit and the VVS.

A competent assessment team is selected prior to the start of the verification. The team is selected to cover the technical area(s), sectoral scope(s) and relevant host country experience for evaluating the VCS project activity. Additionally, a competent Technical Reviewer or Technical Reviewer Team is appointed to conduct checks on quality and completeness.

The verification team performs first a desk review, followed by a site visit, which results in the formation of a draft report and a list of findings. The next step involves the evaluation of the findings through direct communication with the PPs and then finally the preparation of the verification report. This verification report and other supporting documents then undergo an internal quality control by the CB "Environment and energy" before submission to the VCS.

2.2 Document Review

Documents provided by the PP including the monitoring plan, monitoring report, project design document, monitoring methodology, and the supporting documents have been reviewed to verify the materiality and suitability of the project. The documents referred to during this verification period are provided in Appendix 1.

2.3 Interviews

The VVB has conducted on-site inspection for this current monitoring period between 18th July to 01st August 2022. The objective of the interview process was to solicit important information from personnel related to project and relevant to the verification process. The VVB has conducted interviews with the site manager to understand and confirm the general aspects of the project, the personnel and their assigned responsibilities, monitoring method and equipment applied within the project boundary, animal manure collection and treatment system as well as the biogas and electricity generation. The site manager also

provided information on the QA/QC procedures and emergency preparedness of the facility. The key personnel interviewed are summarized in the table below.

The main topics covered during the interview are as follows:

- ✓ General Aspects of the project
- ✓ Project Implementation
- ✓ Equipment and operation
- ✓ Staff Training procedures
- ✓ Calibration procedures
- ✓ Monitoring & Measuring System
- ✓ Data collection, recording and archiving procedure
- ✓ QA/QC procedures
- ✓ VCS documentation
- ✓ Emission reduction calculations

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1	K	Basha	Site charge In Tirupati	25/07/2022	Plant technology and monitoring, general aspects of the project, data collection procedure. Monitoring of the lab operations, technologies, measurement / sampling procedures.	Shailendra Kewat
2	Chandra	Suresh	Operator	25/07/2022	Monitoring of the lab operations, technologies, measurement / sampling procedures.	Shailendra Kewat
3	Muthu	Kartik	Local villager	25/07/2022	knowledge about project and the concern if any	Shailendra Kewat
4	-	Sylesh	Site charge, In Aurangabad	18/07/2022	Plant technology and monitoring, general aspects of the project, data collection procedure. Monitoring of the lab operations, technologies, measurement / sampling procedures.	Eswar Murty
5	Patil	Deepak	Local villager	18/07/2022	knowledge about project and the concern if any	Eswar Murty
6	Shinde	Madhuri	Local villager	18/07/2022	knowledge about project and the concern if any	Eswar Murty
7	Prasad	Muralidh ara	Site charge, In Adoni	27/07/2022	Plant technology and monitoring, general aspects of the project, data collection procedure. Monitoring of the lab operations, technologies, measurement / sampling procedures.	Shailendra Kewat

8	Kumari	Padma	Local villager	27/07/2022	knowledge about project and the concern if any	Shailendra Kewat
9	Shekharan	Raj	Local villager	27/07/2022	knowledge about project and the concern if any	Shailendra Kewat
10	Prakash	Prem	Site In charge, Piduguralla	01/08/2022	Plant technology and monitoring, general aspects of the project, data collection procedure. Monitoring of the lab operations, technologies, measurement / sampling procedures.	Shailendra Kewat
11	Aiyangar	Ram	Local villager	01/08/2022	knowledge about project and the concern if any	Shailendra Kewat
12	Sankaran	Krishna	Local villager	01/08/2022	knowledge about project and the concern if any	Shailendra Kewat

2.4 Site Visits

Please refer sec 2.3

The site visits for the current monitoring period were conducted between 18th July to 01st August 2022. During these site visits, VVB has checked the monitoring data to date supplied by the PP, application of methodologies, appropriateness of monitoring plan. In addition, as mentioned in Section 4, all the monitoring parameters furnished by the PP have been cross-checked with the electronic records and operational logbooks for the entire monitoring period. Section 3.3.1.1 of the VCS Validation and Verification Manual v.3.2 classifies the types of evidence in order of decreasing reliability as physical, documentary and testimonial¹. Accordingly, VVB has ensured a reasonable level of assurance through examination of documentary evidence and testimonials from responsible personnel throughout the monitoring period. Thus, VVB has concluded that a reasonable level of assurance was provided for the current monitoring period.

2.5 Resolution of Findings

¹ https://verra.org/wp-content/uploads/2018/03/VCS_Validation_Verification_Manual_v3.2.pdf (Accessed on 30/01/2023)

As an outcome of the verification process, the team can raise different types of findings. Where a non-conformance arises the assessment team shall raise a Corrective Action Request (CAR).

A CAR is issued, where:

- a) Non-compliance with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;
- b) Modifications to the implementation, operation and monitoring of the project activity has not been sufficiently documented by the project participants;
- c) Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions;
- d) Issues identified in a FAR during validation to be verified during verification or previous verification(s) have not been resolved by the project participants.

The assessment team shall raise a Clarification Request (CL) if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met. All CARs and CLs raised during verification shall be resolved prior to submitting a request for issuance.

There are 03 CLs and 02 CARs raised during the verification process. Please see Appendix-2 for the details.

2.5.1 Forward Action Requests

No FAR has been raised

2.6 Eligibility for Validation Activities

Project is not a validation activity.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The VVB confirms that the project is registered only under VCS and not registered in any other GHG program, such as CDM, JI, the Climate Action Reserve, Biocarbon Registry, International Carbon Registry, Gold Standard for Global Goals (GS4GG), and Global Carbon Council (GCC).

3.2 Methodology Deviations

No deviation has been sought from the methodology during current monitoring period.

3.3 Project Description Deviations

PP has taken following deviations in the project description

Deviation 1:

Typo error for the data unit of the parameter $EF_{FC, default}$ 'Default emission factor for fossil fuel consumed by the Bio-methantion activity per tonne of waste composted (wet basis)' (fixed at the time of validation) has been corrected to "tCO₂/t"².

Deviation 2:

The registered PD of the project activity available at project's webpage³, shows in section 4.2 of the PD, Tool-14, Project and leakage emissions from anaerobic digesters (version-2.0) has been used for project emissions calculation. Whereas, Tool-13, Project and leakage emissions from composting (version-2.0) is mentioned in section 3.1 of the registered PD.

VVB has cross verified the revised MR and found 'Tool-13' is corrected with 'Tool-14' with weblink. The deviation neither impact on additionality and nor on design change of the project.

Deviation 3:

The value of the ex-ante parameter GWPCH₄ 'Global Warming Potential of methane' was taken as 25 during the registration of the project activity which is not in line with the guideline provided in section 3.14 of VCS standard_V-4.1.

"Projects that complete validation on or before 31 July 2021 may use GWP values from AR4 for ex-ante emission reduction estimates, though such projects shall use GWP values from AR5 for ex-post calculations", the GWPCH₄ value of 28 is used in all calculations for GHG emission reductions conducted during the period from January 1, 2021, to April 30, 2026. This value is associated with the crediting period of the project activity.

Deviation 4:

The value of the monitoring parameter $DOC_{f,y}$ 'default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS' was taken as 0.9 in the registered PD, which was not in line with the methodology.

PP has corrected the value of $DOC_{f,y}$ as 0.5 which is a default value present in the tool04 'Emissions from solid waste disposal sites'. The change in the value lead to the change in estimated ERs but did not lead to scale change, design change and also not impacting additionality.

The deviation and change in $DOC_{f,y}$ & DOC_j values does not impact the conservativeness of the quantification of GHG emission reductions or removals. The nature of deviation is permanent.

The comparison in both the values are mentioned below:

Parameters	Value	Estimated Emissions Reductions (tCO ₂ e/year)	Actual Emissions Reductions (tCO ₂ e)

² <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-14-v2.pdf>

³ [Verra Search Page](#)

Estimated value as per Approved PD	$DOC_{f,y}$	0.9	47,359	28,790
As per deviation requested	$DOC_{f,y}$	0.5	25,440	15,900

The verification team confirms that the above deviation is appropriately described and justified in the Monitoring report and the project remains in compliance with the VCS rules and hence the deviation is deemed valid and acceptable.

3.4 Grouped Project

The project is not a grouped project.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The project activity involves the establishment of biogas plants in various cities of India, municipal corporations to generate energy out of waste, thereby solving two major issues for the country. The biogas generated shall be used for various thermal applications such as use in vehicles or bottled for use. The project activity is expected to generate approximately 662,537 NM³ of Biogas for supply in Domestic market of the country. In the absence of the project activity, the accordant amount of CNG (fossil Fuel based) would have been delivered through the current supply mix of the country, leading to carbon dioxide emissions. The project is located in India.

The project activity adopts renewable crediting period of 7 years which can be renewed for maximum 2 times.

Project Technology Details –

Project activity Instances being included in this grouped project activity are given in table below:

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2	Energy Solutions Ltd.	Tirupati – AP	Bio Methanation	40	CNG Sale	01/09/2019
3		Piduguralla – AP	Bio Methanation	20	CNG Sale	01/06/2019
4		Adoni - AP	Bio Methanation	20	CNG Sale	01/03/2019

The VVB confirms that the project implementation involves the installation of waste reception area; weighbridge; waste preparation and mixing tanks; digestion reactors, final fermentation reactor and biogas storage.

The technical description and flow chart of the project activity was confirmed via checking the MR and interviews with the project authorities. It is confirmed that the monitoring plan describing the implemented monitoring system is suitable to the requirements of the monitoring methodology. The interviews and the site inspections reveal that the required monitoring procedures has been set in place for the relevant monitoring parameters and data.

During the Current Monitoring Period from 01/01/2021 to 31/12/2021 (First and last date included) the project activity has contributed 15,900 tCO₂e GHG reductions.

The audit team has checked the commissioning certificates to confirm the location and the implementation status of the project.

Parameters Available at Validation and Data Fixed Ex-ante:

Data/parameter	Unit	Value applied	Assessment
ϕ_y	-	0.85	Model correction factor to account for model uncertainties (default): Value used is applicable for tropical humid/wet climate conditions as per the Tool “Emissions from solid waste disposal site” for Application B. VVB confirmed humidity and wet climate condition at the project location on the basis of the data available from the Indian Metrological Department.
DOC _{i,y}	Weight fraction	0.5	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS. VVB has cross verified it with the IPCC 2006 Guidelines for National Greenhouse Gas Inventories

OX	-	0.1	Value used is 0.1, default value as per the Tool “Emissions from solid waste disposal site”
F	-	0.5	Default value is used, as per the applicable Methodology Tool “Emissions from solid waste disposal site”
MCF _y		1	Value applied is 1 as applicable for managed solid waste disposal sites, controlled placement of waste and mechanical compacting and leveling, as per the Tool “Emissions from solid waste disposal sites”.
k _j		0.4	As applicable for wet (MAP>1000 mm) tropical conditions (MAT1>20°C) as per the methodological Tool, the decay rate (k _j) has been selected in accordance with the IPCC 2006 Guidelines. The climate where the project is located has been confirmed from data from Indian meteorological department; VVB confirms that the project location falls under wet tropical conditions with MAP> 1000 and MAT> 20°C)
GWP _{CH4}	t CO ₂ e/t CH ₄	28	Global warming potential of methane (GWPC _{H4}) in accordance with methodological tool, valid for the second commitment period. The values are sourced from the IPCC <i>fifth</i> assessment report- Direct global warming potentials.
f _y	tCO ₂ e/t CH ₄	0%	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 (f _y), default value as per the CDM methodological tool 04, version 8.0.
EF _{EF,j,y}	tCO ₂ /MWh	0.83	Weighted average emission factor, taken from the CO ₂ Baseline Database for the Indian Power Sector, Version 15.0.
EF _{FC, default}	t CO ₂₄ / t	0.0207	Default emission factor for fossil fuel consumed by the composting activity per tonne of waste composted (wet basis) default value as per CDM methodological tool 14, ver. 2.0
f _{CH4,default}	m ³ CH ₄ / m ³	0.6	Value for the fraction of methane in the biogas, default value was derived based on reported values from registered projects and

			research papers (Davidsson, 2007) and CDM Tool 14, ver. 2.0
ϕ_{CH4}	m ³ CH ₄ / m ³ CH ₄	0.00067	Density of methane at normal conditions, default value taken from CDM Tool, ver. 2.0
EF _{CH₄,default}	T CH ₄ leaked / t CH ₄ produced	0.028	Emission factor for the fraction of CH ₄ produced that leaks from the anaerobic digester, default value taken from IPCC (2006)
NCV _{Diesel,y}	TJ/Gg	43	Net calorific value of diesel, default value taken from IPCC guidelines for National GHG inventories, 2006.
EF _{CO₂, diesel, y}	tCO ₂ /TJ	74.10	Weighted avg. Carbon dioxide emission factor of diesel, default value taken from India's National communication to UNFCCC IPCC 2006 default values
DOC _j		0.15	Tool 04, Emissions from solid waste disposal site, Version 08.0, EB 94, Annex 7. VVB has cross verified the Tool04 and value is found in line.

The VVB has checked that all ex-ante parameters were fixed in accordance with the VCS Standard 4.4 and the applied methodology and the registered PD. The consistency of the ex-ante values throughout the ER was also checked and confirmed.

Monitoring Parameters:

Means of verification	Referring to VCS Standard v4.4 and p.360, p.361, p.363, and p.364 of CDM VVS PA, v3.0, the below tables provide a summary on the verification of each monitoring parameter listed in the registered monitoring report	
	Data / Parameter:	W _x ;
	Data unit:	T/yr
	Description:	Total amount of solid prevented from disposal in the landfill in the year x
	Source of data used:	Quantity of waste composted is measured using electronic weighbridge regularly and records are kept on paper and electronically.
Means of verification/Comments:	Weigh bridge records has been cross verified Value applied – 21,607	

	Cross-check	Annual calibration details of weigh bridge has been cross verified
Conclusion	The monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD. All parameters were monitored and determined as per the registered monitoring plan. Referring to p.360, p.361, p.363 and p.364 of CDM VVS PA, v3.0, VVB confirms through video calls and telephonic interviews and from the document review, that the actual monitoring system complies with the registered monitoring plan. Based on the review of the source and nature of available evidence and records, the verification team confirms the quality of evidence for emission reduction provided is sufficient as per CDM VVS PA, v3.0.	

Means of verification	Referring to VCS Standard v4.4 and p.360, p.361, p.363, and p.364 of CDM VVS PA, v3.0, the below tables provide a summary on the verification of each monitoring parameter listed in the registered monitoring report	
	Data / Parameter:	RATEcompliance,t,y
	Data unit:	Fraction
	Description:	State level compliance rate of the MSW Management Rules in that year y
	Source of data used:	Preferably from secondary sources and alternatively from the Central Pollution Control Boards (CPCBs).
	Means of verification/Comments:	The Union Ministry of Environment, Forests and Climate Change (MoEF&CC) notified the Solid Waste Management Rules (SWM), 2016 which only advised the processing of bio-degradable waste. In accordance with the Provision of the Solid Wastes Management Rules, 2016, the Central Pollution Control Board (CPCB) is required to prepare a Consolidated Annual Report (CAR) and forward to the Central Government. There as per the subsequent reports, the ratio of total waste treated to the total waste generated is being considered as the RATE compliance and for current monitoring period, compliance rate calculated as 0% as checked by VVB and found the rate of compliance considered is appropriate. Value applied – 36.67%
	Cross-check	
Conclusion	Based on the review of the source and nature of available evidence and records, the verification team confirms the quality of evidence for emission reduction provided is sufficient as per CDM VVS PA, v3.0.	

Means of verification	Referring to VCS Standard v4.4 and p.360, p.361, p.363, and p.364 of CDM VVS PA, v3.0, the below tables provide a summary on the verification of each monitoring parameter listed in the registered monitoring report	
	Data / Parameter:	EC _{PJ,j,y}
	Data unit:	MWh
	Description:	Amount of electricity consumed from the grid as a result of the project activity
	Source of data used:	Electricity meter reading from electricity meter bill by the State Electricity Board or any Private Supplier.
	Means of verification/Comments:	The value will be continuously monitored using the electricity meters installed by the state electricity board. Calibration frequency will be once in five years. Electricity meter with accuracy class 0.2S & 0.5S installed within the project boundary of biomethanation plant to measure electricity consumed in bio methanation process and measured continuously by state utility and meter is under control of state utility. Value applied- 678.015
Cross-check		
Conclusion	The verification team confirms that the monitoring methods applied for this parameter is in line with the registered MR and quality of evidence for emission reduction provided is sufficient as per CDM VVS PA, v3.0.	

Means of verification	Referring to VCS Standard v4.4 and p.360, p.361, p.363, and p.364 of CDM VVS PA, v3.0, the below tables provide a summary on the verification of each monitoring parameter listed in the registered monitoring report	
	Data / Parameter:	Q _y
	Data unit:	T/yr
	Description:	Quantity of waste composted in year y (wet basis)
	Source of data used:	Plant Records/logbook
	Means of verification/Comments:	Quantity of waste composted in year y (wet basis). This will be weighed through weighbridge. Value applied – 3,796

	Cross-check	Values are cross-checked with the recordings of the weighbridge readings and found conservative.	
Conclusion	VVB cross-checked net capacity readings of the weighbridge recordings, the VVB confirmed the validity of this value. The verification team confirms that the monitoring methods applied for this parameter is in line with the registered MR and quality of evidence for emission reduction provided is sufficient as per CDM VVS PA, v3.0.		

Means of verification	Referring to VCS Standard v4.4 and p.360, p.361, p.363, and p.364 of CDM VVS PA, v3.0, the below tables provide a summary on the verification of each monitoring parameter listed in the registered monitoring report		
	Data / Parameter:	Q _{biogas,y}	
	Data unit:	Nm ³ biogas	
	Description:	Amount of biogas collected at the digester outlet in year y	
	Source of data used:	Plant records/logbooks	
	Means of verification/Comments:	The values is obtained from Log book data maintained by the plant personnel. Value applied - 662,537	
	Cross-check	VVB has cross verified the log book records of the plant and values are found consistent.	
Conclusion	The verification team confirms that the monitoring methods applied for this parameter is in line with the registered MR and quality of evidence for emission reduction provided is sufficient as per CDM VVS PA, v3.0.		

Means of verification	Referring to VCS Standard v4.4 and p.360, p.361, p.363, and p.364 of CDM VVS PA, v3.0, the below tables provide a summary on the verification of each monitoring parameter listed in the registered monitoring report		
	Data / Parameter:	FC _{diesel,Bio-methanation,y}	
	Data unit:	volume (m ³ /yr)	
	Description:	Quantity of diesel combusted in Bio-methanation process during the year y	
	Source of data used:	Onsite Logbook	
	Means of verification/Comments:	Store department maintain record of total fuel consumed in DG set as confirmed during site visit.	

		Value applied - 0	
	Cross-check		
Conclusion	The verification team confirms that the monitoring methods applied for this parameter is in line with the registered MR and quality of evidence for emission reduction provided is sufficient as per CDM VVS PA, v3.0.		

Emissions trading programs and other binding limits:

The assessment team confirms that the Net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits. Further, the declaration in the effect of the same has been submitted by the project proponent to the audit team and found to be correct.

The project has not been registered under any other GHG and/or Renewable/Green Energy programs. Also, the Project is not rejected by other GHG programs. A declaration for the same is checked and found correct by the assessment team. Also, the assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

1. <http://cdm.unfccc.int/>
2. <http://www.goldstandard.org/>
3. <https://verra.org/>
4. <https://www.globalcarboncouncil.com>
5. <https://www.irecstandard.org>
6. <https://biocarbonregistry.com/en/>
7. <https://ji.unfccc.int/index.html>
8. <https://carbonregistry.com/>

The Project has no intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

Thus, it is concluded that the project activity not involved on other Emissions trading programs and other binding limits.

Sustainable Development:

The contributions of the project to SDG has been checked and it was verified that the project implemented the SDG's that are described in the MR. The SDG's and how they are monitored are briefly described in the following:

- SDG 1.1.1 Proportion of population below the international poverty line

The VVB has verified that the project contributes to SDG 1.1 by providing a total of 65 jobs and bringing them above the international poverty line.

- SDG 3.3.3 Malaria incidence per 1,000 population

The project Lowered the malaria incidence per 1,000 from 157 to 98. This was verified upon checking the project's personal affairs' official records, together with the company's official social security and workshop records.

- SDG 13 Climate Action,

The project contributes to this goal by generating GHG emission reductions, which is in total 15,900 tCO₂eq during this monitoring period. It was ensured that the applied Meth is followed accurately in the ER calculation. The VVB finds the reasoning valid.

- SDG 6.1 Proportion of the rural population who have easy access to a safe water supply.

The project completed construction of 4 additional improved wells to provide potable water to 230 people and provided with at least 10 liters of potable water per day to 1,200 people, a 40% increase in the catchment area, over the project lifetime by constructing improved wells, PP records have been cross-checked to verify this goal.

Conclusion: In view of the assessment of MR and supporting documents as listed in Appendix 1 of this report, the validation team is able to confirm that the project implementation status provided in the MR, provides the reader with a clear understanding of the precise nature of the project activity and the technical aspects of its implementation. Consequently, the assessment team confirms that the project implementation status provided in the MR to be complete and satisfactory. The MR complies with the relevant forms and guidance for completing the VCS MR.

4.2 Safeguards

4.2.1 No Net Harm

As project is a methane avoidance project, hence there is no negative environmental and socio impact effect, hence no measure has been taken during the monitoring period.

4.2.2 Local Stakeholder Consultation

The Local Stakeholder Meetings were organized at the project sites.

Project Instance No.	Project Proponent	Plant	Invitation Notice Dates	LSHM Meetings Date
1	Mahindra Waste to Energy Solutions Ltd.	Bio Methanation -30 TPD (Aurangabad)	02/10/2018	25/10/2018
2		Bio Methanation -40 TPD (Tirupati)	26/10/2018	14/11/2018
3		Bio Methanation -20 TPD (Piduguralla)	29/11/2018	19/12/2018
4		Bio Methanation -20 TPD (Adoni)	14/06/2018	08/07/2018

After explaining the importance of the continuous input and grievance mechanism to the audience and clearly stating that their voices would always be heard at every single phase of the project via this mechanism. VVB has also cross verified the grievance register and found no comments are received during the current monitoring period.

4.3 AFOLU-Specific Safeguards

Not applicable since the project is not an AFOLU project.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means verification	of	<p>The assessment of data and the calculation of baseline emission reduction in the MR and the ER excel sheet have been verified as per the following set of supporting documents:</p> <ol style="list-style-type: none"> 1. Logbook records 2. Latest photographs & videos 3. VER spreadsheets 4. Sales Invoices 5. Weigh bridge records
Conclusion		<p>Upon checking the supporting documents and the submitted MR, the verification team confirms that;</p> <ul style="list-style-type: none"> - PP has provided all required data for the calculations. - The cross-check data is provided for respective parameters so that the verification of calculations is enabled.

	<ul style="list-style-type: none"> - Applied formulae and method for calculation of baseline emission are in accordance with the registered monitoring plan and are in line with the requirements of the applied methodology. - Reference and default values used for baseline GHG emission calculations were correctly applied. - The calculations related to baseline GHG emissions were reproducible and correct.
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Calculation of project GHG emissions or actual net anthropogenic GHG removals by sinks

Means of verification	<p>The verification team assessed whether the data and calculations of GHG emission reductions achieved resulting from the project activity. The following documents were taken into consideration for the verification of project GHG emissions;</p> <ol style="list-style-type: none"> 1. Logbook records 2. Bills raised for fuel and electricity consumption 3. VER spreadsheets 4. Sales Invoices
Conclusion	<p>Upon checking the supporting documents and the submitted MR, the verification team confirms that;</p> <ul style="list-style-type: none"> - PP has provided all required data for the calculations. - The cross-check data is provided for respective parameters so that the verification of calculations is enabled. - The official records such as bills and invoices supports the data used in GHG calculations. - Applied formulae and method for calculation of project emission are in accordance with the registered monitoring plan and are in line with the requirements of the applied methodology. - Reference and default values used for baseline GHG emission calculations were correctly applied. - The calculations related to project GHG emissions were reproducible and correct.

Calculation of leakage GHG emissions

Leakage emissions are 0 as per the applied tool “Project and leakage emissions from anaerobic digesters”, Version 02.0; and “Project and leakage emissions from composting”

The Bio-methanation project doesn’t include direct composting, gasification, no association of RDF/SB and incineration at the project site. Therefore, $PE_{COMP,y}$, $PE_{GAS,y}$, $PE_{RDF,SB,y}$ and $PE_{INC,y}$ are considered as zero.

Based on the document review, site inspections, and interviews, VVB confirms that project has been implemented as described in the registered project description document and there is no leakage during the current monitoring period.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

Baseline Emissions

Calculation of Baseline Emissions as per ACM0022

As per ACM0022 equation 35, para 107, the emission reduction is calculated as;

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission Reduction in year y (tCO₂e)

BE_y = Baseline Emission in year y (tCO₂e)

PE_y = Project Emission in the year y (tCO₂e)

LE_y = Leakage Emission in Year y (tCO₂e)

and

$$BE_y = BE_{\text{Bio-methanation, } y}$$

$$PE_y = PE_{\text{Bio-methanation, } y}$$

$$LE_y = LE_{\text{Bio-methanation, } y}$$

BE_{Bio-Methanation, y} = Baseline Emissions in year y (tCO₂e) from Bio-methanation.

PE_{Bio-Methanation, y} = Project Emissions in the year y (tCO₂e) from Bio-Methanation.

LE_{Bio-Methanation, y} = Leakage Emissions in year y (tCO₂e) from Bio-Methanation

The amount of methane generated from the disposal of waste at the SWDS is calculated based on a first order decay (FOD) model. The model differentiates between the different types of waste *j* with respective constant decay rates (*k_j*) and fractions of degradable organic carbon (DOC_{*j*}). The model calculates the methane generation occurring in year *y* disposed in the SWDS over a specific time period *y*. There is no SWDS methane captured, flared and combusted or used in another manner that prevents emission of methane to the atmosphere at the project site.

According to ACM0022, Version-2.0, equation (1) para 41, the baseline emissions would be calculated as:

$$BE_{CH_4, SWDS, y} = \varphi_y \times (1 - f_y) \times GWP_{CH_4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f, y} \\ \times MCF_y \times \sum_{x=1}^y \sum_j (W_{j, i} \times DOC_j \times e^{(-k_j \times (y-x))} \times (1 - e^{-k_j}))$$

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* (t CO₂e/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)
$DOC_{t,y}$	=	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_{CH_4}	=	Global warming potential of methane
OX	=	Oxidation factor (reflecting the amount of methane from SWDS)
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/year)
j	=	Type of residual waste or types of waste in the MSW

The Table(s) below depicts the baseline emission calculations:

The fixed data values used in the calculation of baseline emissions

Parameter	Value	Unit
ϕ_y	0.85	-
f_y	0	tCO ₂ / tCH ₄
(1- f_y)	1	-
GWP_{CH_4}	28	tCO ₂ / tCH ₄
OX	0.1	-
(1-OX)	0.9	-
F	0.5	-
$DOC_{t,y}$	0.5	Weight Fraction
MCF_y	1.0	-
DOC_j	0.15	Weight Fraction
k_j	0.40	1/yr

The monitoring data values used in the calculation of baseline emissions of Aurangabad

S. No.	Month	Monthly Qty of Municipal Solid waste treated (In Ton)	Amount of Bio Gas collected (Nm ³)	Monthly Qty of Bio CNG (In T)	Monthly Qty of Compost (In Ton)	Monthly Electricity Consumption	Monthly Diesel Consumption (In Ltr.)
1	Jan-21	536	23,905	10	25	27,998	0
2	Feb-21	348	23,905	10	39	23,643	0
3	Mar-21	471	19,652	8	30	26,527	0
4	Apr-21	306	14,080	6	30	23,538	0
5	May-21	239	10,647	4	20	18,550	0
6	Jun-21	362	13,383	5	0	14,053	0
7	Jul-21	369	12,438	5	14	20,610	0
8	Aug-21	387	28,706	12	17	32,915	0
9	Sep-21	444	23,881	10	21	30,270	0
10	Oct-21	403	22,388	9	0	23,260	0
11	Nov-21	408	19,950	8	25	22,755	0
12	Dec-21	455	24,876	10	20	30,323	0
Total		4,728	237,811	96	241	294,442	0

The monitoring data values used in the calculation of baseline emissions of Adoni

S. No.	Month	Monthly Qty of Municipal Solid waste treated (In Ton)	Amount of Bio Gas collected (Nm ³)	Monthly Qty of Bio CNG (In T)	Monthly Qty of Compost (In Ton)	Monthly Electricity Consumption	Monthly Diesel Consumption (In Ltr.)
1	Jan-21	557	622	0.25	123	4,185	0
2	Feb-21	357	1,741	0.70	121	3,568	0
3	Mar-21	389	1,244	0.50	120	4,412	0
4	Apr-21	377	1,741	0.70	127	3,488	0
5	May-21	379	1,493	0.60	129	4,153	0
6	Jun-21	373	1,741	0.70	135	4,089	0
7	Jul-21	364	1,990	0.80	113	3,416	0
8	Aug-21	367	1,741	0.70	120	4,277	0
9	Sep-21	311	1,119	0.45	125	4,258	0
10	Oct-21	398	1,368	0.550	95	3,879	0

11	Nov-21	386	1,468	0.590	120	4,917	0
12	Dec-21	370	1,493	0.600	110	3,782	0
Total		4,628	17,761	7	1,438	48,424	0

The monitoring data values used in the calculation of baseline emissions of Tirupati

S. No.	Month	Monthly Qty of Municipal Solid waste treated (In Ton)	Amount of Bio Gas collected (Nm ³)	Monthly Qty of Bio CNG (In T)	Monthly Qty of Compost (In Ton)	Monthly Electricity Consumption	Monthly Diesel Consumption (In Ltr.)
1	Jan-21	909	28,607	12	77	20,154	0
2	Feb-21	543	30,410	12	100	19,516	0
3	Mar-21	796	33,085	13	90	23,556	0
4	Apr-21	679	31,604	13	40	18,574	0
5	May-21	523	21,953	9	70	19,254	0
6	Jun-21	387	24,876	10	65	16,424	0
7	Jul-21	707	33,582	14	35	27,578	0
8	Aug-21	421	22,388	9	20	17,828	0
9	Sep-21	507	22,388	9	40	18,712	0
10	Oct-21	403	27,114	11	20	27,906	0
11	Nov-21	741	29,851	12	20	18,746	0
12	Dec-21	680	28,109	11	10	24,228	0
Total		7,296	333,968	134	587	252,476	0

The monitoring data values used in the calculation of baseline emissions of Piduguralla

S. No.	Month	Monthly Qty of Municipal Solid waste treated (In Ton)	Amount of Bio Gas collected (Nm ³)	Monthly Qty of Bio CNG (In T)	Monthly Qty of Compost (In Ton)	Monthly Electricity Consumption	Monthly Diesel Consumption (In Ltr.)
1	Jan-21	445	4,975	2	120	7,230	0
2	Feb-21	410	5,597	2	121	7,171	0
3	Mar-21	473	7,201	3	125	9,829	0
4	Apr-21	495	9,950	4	127	7,165	0
5	May-21	328	6,219	3	175	5,207	0

6	Jun-21	317	6,219	3	128	5,009	0
7	Jul-21	517	3,731	2	130	5,194	0
8	Aug-21	411	6,219	3	131	8,091	0
9	Sep-21	400	4,975	2	135	6,317	0
10	Oct-21	393	4,975	2	91	10,176	0
11	Nov-21	425	7,463	3	132	5,387	0
12	Dec-21	342	5,473	2	115	5,897	0
Total		4,956	72,998	29	1,531	82,673	0

Accordingly, the PP determined the total baseline emissions including both the AMS-III.D. and AMS-I.D. components as follows:

Project Activity	Using the default and monitored values $BE_{Composting,y}$
$BE_{Aurangabad}$	3,451
BE_{Adoni}	3,445
$BE_{Tirupati}$	5,334
$BE_{Piduguralla}$	3,671
Total Baseline Emission BE_y	16,111 tCO ₂ e

Project Emissions

As per consolidated methodology ACM0022 para 65, equation 18, the project emissions from Bio-Methanation ($PE_{Bio-Methanation}$) are determined as follows:

$$PE_{Bio-methanation,y} = PE_{COMP,y} + PE_{AD,y} + PE_{GAS,y} + PE_{RDF_SB,y} + PE_{INC,y}$$

Where,

- $PE_{Bio-methanation}$ = Project emissions in year y (t CO₂e) from Bio-Methanation
- $PE_{COMP,y}$ = Project emissions from composting or co-composting in year y (t CO₂e)
- $PE_{AD,y}$ = Project emissions from anaerobic digestion and biogas combustion in year y (t CO₂e)
- $PE_{GAS,y}$ = Project emissions from gasification in year y (t CO₂e)
- $PE_{RDF_SB,y}$ = Project emissions associated with RDF/SB in year y (t CO₂e)

- $PE_{INC,y}$ = Project emissions from incineration in year y (t CO₂e)
 $PE_{EC,y}$ = Project emissions from electricity consumption associated with anaerobic digester in year y (t CO₂e /yr)
 $PE_{FC,y}$ = = Project emissions from fossil fuel anaerobic digester associated with composting in year y (t CO₂e /yr)

This project doesn't include direct composting, gasification, no association of RDF/SB and incineration at the project site. Therefore, $PE_{COMP,y}$, $PE_{GAS,y}$, $PE_{RDF,SB,y}$ and $PE_{INC,y}$ are considered as zero by PP. VVB found it appropriate.

As per tool "Project and leakage emission from anaerobic digesters" para 13, equation (1), $PE_{AD,y}$ are considered as zero.

$$PE_{AD,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH_4,y} + PE_{flare,y}$$

Where:-

- $PE_{AD,y}$ = Project emissions associated with anaerobic digester in year y (t CO₂e)
 $PE_{EC,y}$ = Project emissions from electricity consumption associated with anaerobic digester in year y (t CO₂e /yr)
 $PE_{FC,y}$ = Project emissions from fossil fuel anaerobic digester associated with composting in year y (t CO₂e /yr)
 $PE_{CH_4,y}$ = Project emissions of methane from the anaerobic digester process in year y
 $PE_{flare,y}$ = Project emissions from flaring of biogas in year y (CO₂e/ yr)

Since the capacity of each bio-methanation plant is small, and the project emission from biogas flaring is negligible (less than 0.5% of the baseline emissions) therefore PP has considered $PE_{flare,y}$ as zero. Also, as per the methodological tool 06 Project emissions from flaring, project activity flaring is not from the biogenic sources like landfill gas or biogas from wastewater treatment or coal mine methane.

$$PE_{EC,y} = Q_{CH_4,y} \times F_{EC,default} \times EF_{EL}$$

Where:

- $PE_{EC,y}$ = Project emissions from electricity consumption associated with anaerobic digester in year y (t CO₂e)
 $Q_{CH_4,y}$ = Quantity of methane produced in the anaerobic digester in year y (tCH₄)
 $F_{EC,default}$ = Default factor for the electricity consumption associated with the anaerobic digester per ton of methane generated (MWh/tCH₄)
 EF_{EL} = Default emission factor for the electricity consumed in year y (t CO₂/ MWh)

$$Q_{CH_4,y} = Q_{biogas,y} \times f_{CH_4,default} \times \varphi_{CH_4}$$

Where:

- $Q_{CH_4,y}$ = Quantity of methane produced in the digester in year y (tCH₄)
- $Q_{biogas,y}$ = Amount of biogas collected at the digester outlet in year y (Nm³ biogas)
- $f_{CH_4,default}$ = Default emission factor for the fraction of methane in the biogas
- φ_{CH_4} = Density of methane at normal conditions (t CH₄/ Nm³ CH₄)

As per the methodological tool 03, Version 03.0, Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion, the PE_{FC,y} for diesel consumption at site is calculated as follows:

$$PE_{FC,diesel,y} = \sum_i FC_{diesel,Bio-methnation,y} \times COEF_{diesel,y}$$

Where:

- PE_{FC,diesel,y} = CO₂ emissions from fossil fuel combustion in Bio-methanation during the year y (tCO₂/ yr)
- FC_{diesel,Bio-methnation,y} = The quantity of diesel combusted in Bio-methanation process during the year y (mass or volume unit/yr)
- COEF_{diesel,y} = The CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit)

The COEF_{diesel,y} is calculated as follows:

$$COEF_{diesel,y} = NCV_{diesel,y} \times EF_{CO_2,i,y}$$

Where:

- COEF_{diesel,y} = The CO₂ emission coefficient of diesel in year y (tCO₂/mass or volume unit)
- NCV_{diesel,y} = The weighted average net calorific value of the diesel in year y (GJ/mass or volume unit)
- EF_{CO₂,diesel,y} = The weighted average CO₂ emission factor of diesel in year y (tCO₂/GJ)

$$PE_{CH_4,y} = Q_{CH_4,y} \times EF_{CH_4,default} \times GWP_{CH_4}$$

Where:

- $PE_{CH_4,y}$ = Project emissions of methane from the anaerobic digester in year y (t CO₂)
 $Q_{CH_4,y}$ = Quantity of methane produced in the anaerobic digester in year y (tCH₄/yr)
 $EF_{CH_4,default}$ = Default emission factor for the fraction of CH₄ produced that leaks from the anaerobic digester (fraction)
 GWP_{CH_4} = Global Warming Potential of CH₄ (t CO₂e / t CH₄)

The Table(s) below depicts the project emission calculations:

The fixed data values used in the calculation of project emissions

Parameter	Value	Unit
$EF_{EF,j,y}$	0.83	tCO ₂ /MWh
$EF_{FC,default}$	0.0207	tCO ₂ /t
$f_{CH_4,default}$	0.6	m ³ CH ₄ / m ³
ϕ_{CH_4}	0.00067	t CH ₄ / m ³ CH ₄
$EF_{CH_4,default}$	0.028	T CH ₄ leaked / t CH ₄ produced
$NCV_{Diesel,y}$	43	TJ/Gg
$EF_{CO_2,diesel,y}$	74.10	tCO ₂ /TJ

The calculation result of PE_y during reporting monitoring period

Project Activity	Using the default and monitored values BE _{Composting,y}
PE _{Aurangabad}	75
PE _{Adoni}	6
PE _{Tirupati}	106
PE _{Piduguralla}	24
Total Project Emission PE _y	211 tCO ₂ e

Leakage

No leakage is accounted for.

Net GHG Emission Reductions and Removals

The total emission reduction achieved in current monitoring period is

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$$BE_y = BE_{Bio-methanation,y}$$

$$PE_y = PE_{Bio-methanation,y}$$

$$LE_y = LE_{Bio-methanation,y}$$

Hence, total emission reductions for the project activity in current monitoring period are:

$$ER_y = 15,900 \text{ tCO}_2 \text{ (Rounded down)}$$

Year	Baseline emissions removals (tCO ₂ e)	or	Project emissions removals (tCO ₂ e)	or	Leakage emissions (tCO ₂ e)	Net emission reductions removals (tCO ₂ e)	GHG or
2021 (01-January-2021 -- 31-December-2021)	16,111		211		0	15,900	
Total	16,111		211		0	15,900	

PP's adaptation of the Meth's provision on quantification of the project's net ERRs regarding the comparison of actual and calculated CH₄ is found conservative and in line with the applied Method to calculate net emission reductions and verification team found it conservative.

The VVB verifies that net GHG ER calculations are on the conservative side and complies with the applied Methodology.

Means of verification	<p>The verification team has checked all the reported data, emission factors, and default values used for the net GHG emission reduction calculations and cross-checked where necessary as described in detail in Section 4.1 of this Verification Report. The verification team has also checked whether monitoring methods comply with the monitoring plan,</p> <p>No reporting risks have been identified for the data reported. Troubleshooting procedure, maintenance, and calibration of monitoring equipment, monitoring measurements and reporting, record handling and maintenance, reviewing monitored data are available at the plant. All the monitored data are archived electronically and in paper form. The data will be kept for the whole crediting period and five years after the last crediting period thereby meeting the requirement of the monitoring plan.</p>
Conclusion	<p>The formulae and the methods referred to in the MR and the emission reduction calculation spreadsheet comply with the methods described in the registered PDD.</p>

	<p>No lack of evidence and missing data were detected during this monitoring period. All values as per the monitoring plan were crosschecked by the verification team against basic monitored data and the GHG emission calculation is found to be correct and conservative.</p> <p>TUV SUD confirms that all assumptions, emission factors and default values have been correctly justified. All the emission factors and default values are explicitly mentioned in the monitoring report. Calculations applied formulae and method for calculation of GHG emission are in accordance with the registered monitoring plan and are in line with the requirements of VCS, the applied methodology and p. 372, p.373 of CDM VVS PA ver 3.0.</p>
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4.6 Non-Permanence Risk Analysis

There is no non-permanence risk rating determined by the project proponent.

5 VERIFICATION OPINION

Our verification approach was based on the requirements as defined under the applicable VCS standards and relevant UNFCCC requirements. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. The verification can confirm that:

- the project is implemented and operated as per the registered PD;
 - the monitoring plan in the registered PD is as per the applied Methodology;
 - the monitoring complies with the monitoring plan in the registered PD;
 - the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS and CDM requirements;
 - the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
 - the monitoring system is in place and generates GHG emission reductions data;
 - the GHG emission reductions are calculated without material misstatements.
-
- There is an audit trail that contains the evidence and records that validate the stated figures.

Based on the information we have seen and evaluated, we confirm that the Waste to Energy Projects by Mahindra Waste to Energy Solutions Limited activity achieved the verified number of reductions in anthropogenic emissions by sources of greenhouse gases that would not have occurred in the absence of the project activity.

Verification period: From (01-January-2021 -- 31-December-2021) (start and end dates included)

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions removals (tCO ₂ e)	or	Project emissions removals (tCO ₂ e)	or	Leakage emissions (tCO ₂ e)	Net emission reductions removals (tCO ₂ e)	GHG or
2021 (01-January-2021 -- 31-December-2021)	16,111		211		0	15,900	
Total	16,111		211		0	15,900	

PP has estimated ERs 25,440 tCO₂eq/y in the PD. The amount of emission reductions for this monitoring period would be 15,900 tCO₂e. TUV-SUD confirmed that the ER calculations are conservative and correct.

APPENDIX 1: DOCUMENTS REVIEWED

No	Author	Document Title	References to the Document
1	Project Proponent (PP)	VCS PD for “Waste to Energy Projects by Mahindra Waste to Energy Solutions Limited” version 02.0	28/04/2021
2	PP	Emission Reduction Calculation Sheets, “ER Calculation Sheet” Version 450	28/02/2024
3	PP	VCS Monitoring Report for “Waste to Energy Projects by Mahindra Waste to Energy Solutions Limited” version 05.0	28/02/2024
4	UNFCCC/CDM	ACM0022. “Alternative waste treatment processes”, Version 2.0	-
5	VERRA/VCS	VCS Standard, Version 4.4	30.01.2023
6	UNFCCC/CDM	Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion, version 03.0	-
7	UNFCCC/CDM	Project emissions from flaring, version 04.0	-
8	UNFCCC/CDM	Project and leakage emissions from anaerobic digesters, Version 02.0	-
9	UNFCCC/CDM	Project and leakage emissions from biomass, Version 05.0	-
10	UNFCCC/CDM	Project and leakage emissions from road transportation of freight, Version 1	-
11	UNFCCC/CDM	Validation and Verification standard for project activities, version 03.0 of	-
12	IPCC	2006 IPCC guidelines for National Greenhouse Gas inventories, Volume 2	2006
13	IPCC	2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4	2019
14	PP	Lab Log Book Records	2021
15	PP	Log Book Records on Weight Bridge	2021
16	Manufacturer	Calibration test certificates for weighbridge	2021
17	FARE labs private limited	Lab test report for the DOCj	2021

18	PP	Grievance register	2021
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APPENDIX 2: FINDINGS IN THIS VERIFICATION

CL from this verification

CL ID	01	Section no.	MR	Date: 28/07/2022
Description of CL				
Following documents are need to be submitted: <ol style="list-style-type: none"> 1. Evidence for each SDG indicator 2. Calibration details 3. Generation records 4. Maintenance records 5. ERPA 				
Project participant response				Date: 31/07/2022
Following documents has been submitted along with this submission.				
Documentation provided by project participant				
<ol style="list-style-type: none"> 1. MR_Version-2.0 2. Waste collection record / logbook 3. Calibration certificates 4. Break down details 5. ERPA 				
DOE assessment				Date: 25/02/2023
Requested documents received. CL is closed				

CL ID	02	Section no.	1.1	Date: 28/07/2022
Description of CL				
Tirupati plan capacity has been mention 40 TPD, whereas commissioning certificate and on-site inspection shows a different capacity.				
Project participant response				Date: 31/07/2022
The total capacity of Tirupati plant is 50 TPD, but only 40 TPD capacity is being utilized for bio methanation process and rest 10 TPD is being used for production of compost. Since technology of the project is Bio-methanation, hence 40 TPD capacity is only considered in project description.				
Documentation provided by project participant				
MR_Version-2.0 Commissioning Certificate				
DOE assessment				Date: 25/02/2023
Revised MR with justification received. CL is closed				

CL ID	03	Section no.	3.1	Date: 28/07/2022
Description of CL				
Section 3.1 states "The project is a grouped project activity of installation of 110 TPD" Please explain if it is a grouped project?				

Project participant response				Date: 31/07/2022
<p>The project is the installation of 110 TPD as a grouped project activity developed by Mahindra Group.</p> <p>As per section 3.5.8 of VCS Standard, “Grouped projects shall have one or more clearly defined geographic areas within which project activity instances may be developed. Such geographic areas shall be defined using geodetic polygons”.</p> <p>In the project activity, four locations (instances) are grouped with similar technology i.e., biogas technology by implementing the bio methanation plant. This project activity comprises of different locations located in below locations:</p>				
Project Instance No.	Location	Capacity	Plant Location	Latitude & Longitude
1	Aurangabad	30	Aurangabad Industrial Area	19° 54' 3.7"N 75° 21' 8.9" E
2	Tirupati	40	Temple city, Tirupati	13°37'23" N 79°29'14" E
3	Piduguralla	20	Piduguralla town, Guntur District	16° 29' 50" N 79° 53' 21" E
4	Adoni	20	Adoni town, Kurnool District	15° 37' 18" N 77°16' 51" E
Documentation provided by project participant				
MR_Version-2.0 Registered PDD				
DOE assessment				Date: 25/02/2023
Revised MR received. CL is closed				

CARs from this verification

CAR ID	01	Section no.	1.4	Date:	28/07/2022
Description of CAR					
<p>Parameter $DOC_{t,y}$ is an Ex-ante parameter. Also TOOL states that “if a default value is not available or if the project participants wish to measure $DOC_{t,y}$ then project participants should measure $DOC_{f,y}$ in an ignition loss test according to the procedure in EN 15169 or similar national or international standards”. PP has to clarify if these standards are followed and provide the evidence for the same.</p>					
Project participant response					Date: 31/07/2022

PP applied a deviation request and the reasons for the deviation is explained under section 2.1.2 of revised MR.

The value of the monitoring parameter of default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS ($DOC_{f,y}$) has been updated as default in line with the tool04 'Emissions from solid waste disposal sites' and monitoring parameter.

Further, fraction of degradable organic carbon in the waste type j (weight fraction) (DOCj) has also been added in the section 4 as per the methodological tool 04 i.e., 'Emissions from solid waste disposal sites', which was not mentioned earlier in the section "Parameters available at validation".

This deviation does not have any impact on applicability of the methodology, additionality or the appropriateness of the baseline scenario. The nature of deviation is permanent.

The Lab test report for DOCj has been submitted to the assessment team for verification.

Documentation provided by project participant

Lab Test Report
Revised ME version 2.0

DOE assessment

Date: 25/02/2023

Lab test report for the parameter is received. CAR is closed

CAR ID	02	Section no.	1.4	Date: 11/12/2023
Description of CAR				
Why the value for parameter $RATE_{compliance,t,y}$ has been changed to 36.67%				
Project participant response				Date: 18/12/2023
As per the registered PD, the parameter ' $RATE_{compliance,t,y}$ ' is a monitored parameter used in baseline emissions calculations. The said parameter is the ratio of Quantity of Solid waste generated (TPD) to quantity of Solid waste treated (TPD) in India during the year y and is sourced from the government official studies or Central Pollutions Control Borad's (CPCB) annual reports.				
During the reported monitoring period, the value of this parameter is obtained from the CPCB's latest available version of annual report. In ERs calculation value of ' $RATE_{compliance,t,y}$ ' is used as 36.67% and the typo error regarding same in MR is updated in the revised MR.				
Documentation provided by project participant				

- 1) MR_Version-4.0
- 2) ER_Version-4.0

DOE assessment	Date: 19/12/2023
Revised MR is received. CAR is closed	