# WASTE TO ENERGY PROJECTS BY MAHINDRA WASTE TO ENERGY SOLUTIONS LIMITED

Document Prepared by (LGAI Technological Center S.A. (Applus+ Certification)

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| **Project Title** | Waste to Energy Projects by Mahindra Waste to Energy Solutions Limited |
| **Report Title** | Joint Validation and verification report of Waste to Energy Projects by Mahindra Waste to Energy Solutions Limited |
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## Summary:

**Validation purpose:** 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 details of Project capacity and location details for all the project instances are as follows:

| Project Instances No. | Project Investor | Plant Location | Technology | Capacity (TPD) | Usage | Commissioning Date |
|---|---|---|---|---|---|---|
| 1 | Mahindra Waste to Energy Solutions Ltd. | Aurangabad – M.H | 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 | 01/03/2020 |

During the 7 years of first crediting period i.e., 01/05/2019 to 30/04/2026, the project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 47,359 tCO2e per year, thereon total GHG emission reductions for the chosen 7-year crediting period will be 331,510 tonnes of $CO_2e$.

The objective of this validation activity is to have an independent third party for the assessment of the project design, estimated ER sheet and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- The project's monitoring plan is assessed against "ACM0022, ver. 2.0.
- The projects compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline and standard version 4.0
- CDM Validation and Verification Standard for project activities version 02.0
- CDM Project Standard for project activities version 02.0

- CDM project cycle procedure for project activities version 02.0
- VCS standard v4.1
- VCS guideline v4.0

Validation is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of estimated verified emission reductions (VERs).

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A risk-based approach has been followed to perform this validation and verification activity. In the course of Validation, 08 Corrective Action requests (CARs) and 00 Clarification Requests (CLs),0 Forward action request (FARs) were raised and successfully closed (for validation). The review of the project description and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and project owners have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence to verify the fulfilment of the stated criteria of VCS

Verification purpose:

The proposed grouped project activity will assist development of biogas plants based on bio- methanation technology in India and 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.

The proposed grouped project is a voluntary action being undertaken by the project owner (Mahindra Waste to Energy Solutions Ltd.) of the project activity Infinite Solutions is acting as the other party for this project activity.

During the Current Monitoring Period from 01/05/2019 to 31/12/2020 (including first and last dates) the project activity contributed to the GHG reductions 12,833 $tCO_2e$.

The project activity involves processing of fresh municipal solid waste by anaerobic treatment of municipal solid waste to produce biogas through bio methanation process. The compost produced will be sold in the market. The CNG produced will be sold to the market which would be used for end use outside the project boundary. The project thus avoids $CH_4$ emissions from anaerobic decay of municipal waste. The Project Proponent plans to avail the VCS benefits for the project.

During the current monitoring period, project activity undergoes continued operation since their commissioning and no major breakdown had taken place.

The objective of this verification activity is to have an independent third party for the assessment of the project design, Actual ER sheet and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- The project's baseline is assessed against “ACM0022, ver. 2.0
- The project’s monitoring plan is assessed against “ACM0022, ver. 2.0
- The projects compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline version 4.0 and standard version 4.1

- CDM Validation and Verification Standard for project activities version 02.0
- CDM Project Standard for project activities version 02.0
- CDM project cycle procedure for project activities version 02.0
- VCS standard v4.1[1]
- VCS guideline v4.0

A risk-based approach has been followed to perform this joint validation and verification activity. In the course of validation + verification, 08 Corrective Action requests (CARs) and 00 Clarification Requests (CLs), 00 Forward action request (FARs) were raised and successfully closed. The review of the Monitoring report and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and project owners have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence to verify the fulfillment of the stated criteria of VCS.

[1] https://verra.org/project/vcs-program/rules-and-requirements/

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# 1 INTRODUCTION

## 1.1 Objective

LGAI Technological Center S.A. (Hereinafter referred as Applus+ Certification) has been appointed by "**Mahindra Waste to Energy Solutions Ltd**" to perform the validation and verification of the project entitled "Waste to Energy Projects by **"Mahindra Waste to Energy Solutions Limited**" under VCS standard version 4.1 and guideline version 4.0. The objective of this joint validation & verification activity is to have an independent third party for the assessment of the project design, ER sheet and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- The project's baseline is assessed against "ACM0022, ver. 2.0
- The project's monitoring plan is assessed against "ACM0022, ver. 2.0
- The projects compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS standard version 4.1 and guideline version 4.0.
- CDM Validation and Verification Standard for project activities version 02.0
- CDM Project Standard for project activities version 02.0
- CDM project cycle procedure for project activities version 02.0
- VCS standard v4.1
- VCS guideline v4.0

Validation& verification is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of estimated verified emission reductions (VERs).

## 1.2 Scope and Criteria

The scope of the Joint validation and verification is the independent and objective review of the Joint Project Description & Monitoring Report. The Joint VCS PD & MR are reviewed against the relevant criteria (see 1.1) and decisions by the CDM Executive Board and VCS executive board, including the approved baseline and monitoring methodology. The validation and verification were based on the guidance given in the CDM Project Standard for project activities version 02.0, CDM Project Cycle Procedure for project activities version 02.0, VCS guideline version 4.0 and standard version 4.1.

The assessment team has employed a risk-based approach to assess the completeness and accuracy of the claims and conservativeness of the assumptions in the Joint VCS PD & MR. The main focus of the assessment team is to identify the significant risks for the project implementation and the generation of VERs. The validation and verification are not meant to provide any consulting towards the project participants. However, stated requests for

clarifications and/or corrective actions may have provided input for improvement of the project design and monitoring report combined.

The only purpose of the validation and verification is its usage during the registration /issuance process as part of the VCS project cycle. Therefore, LGAI Technological Center S.A. (Applus+ Certification) can't be held liable by any party for decisions made or not made based on the validation/verification opinion, which will go beyond that purpose.

## 1.3 Level of Assurance

The verification and validation have been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS.

## 1.4 Summary Description of the Project

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. The project activity is a grouped project activity in which several project instances would be added from time to time.

During the 7 years of first crediting period i.e., 01/05/2019 to 30/04/2026, the project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 47,359 $tCO_2e$ per year, thereon total GHG emission reductions for the chosen 7-year crediting period will be 331,510 tonnes of CO2e.

The details of the project and their location of installation are mentioned in the table below:

| Sl No. | Location | Capacity | Plant Location | Latitude and Longitude |
|---|---|---|---|---|
| 1 | Aurangabad | 30 | Aurangabad Industrial Area | 19° 54' 3.7"N<br>75° 21' 8.9" E |
| 2 | Tirupati | 40 | Temple city, Tirupati | 13°37'23" N<br>79°29'14" E |
| 3 | Piduguralla | 20 | Piduguralla town, Guntur District | 16° 29′ 50" N<br>79° 53′ 21" E |
| 4 | Adoni | 20 | Adoni town, Kurnool District | 15° 37′ 18" N<br>77°16′ 51" E |

During the Current Monitoring Period from 01/05/2019 to 31/12/2020 (First and last date included) the project activity has contributed 12,833 $tCO_2e$ GHG reductions.

**Project Technology Details –**

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

| Project Instance No. | Project Owner | Plant Location | Technology | Capacity (TPD) |
|---|---|---|---|---|
| 1 | Mahindra Waste to Energy Solutions Ltd. | Aurangabad – MH | Bio Methanation | 30 |
| 2 | | Tirupati – AP | Bio Methanation | 40 |
| 3 | | Piduguralla – AP | Bio Methanation | 20 |

| | | | | |
|---|---|---|---|---|
| 4 | | Adoni – AP | Bio Methanation | 20 |

Detail's information of technology and equipment installation is given in Section 3.0 of this report.

# 2 VALIDATION AND VERIFICATION PROCESS

## 2.1 Method and Criteria

**Validation and Verification Scope:** The scope is defined as an independent and objective review of the Joint project design document and Monitoring report. The Joint VCS PD and MR is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board and VCS standard version 4.1 and guideline version 4.0, including the approved baseline and monitoring methodology ACM0022- Version 2.0. The validation and verification were based on the requirements in the Validation and Verification Standard for project activities version 02.0, project standard for project activities version 02.0, project cycle procedure for project activities version 02.0 and VCS guideline version 4.0 and standard version 4.1.

The validation and verification are not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the combined project document and the Monitoring report.

**Validation and Verification Process:** The project assessment is based on the Clean Development Mechanism Validation and Verification Standard for project activities version 02.0 and VCS standard version 4.1 and guideline version 4.0 and is conducted using standard auditing techniques to assess the correctness of the information provided by the project participants. Before the assessment begins, members of the team covering the technical scope(s), sectoral scope(s), and relevant host country experience for evaluating the VCS project activity are appointed.

Once the project is received by the assessment team, the members of the assessment team carried out:

- A desk review of the Joint project design documentation and monitoring report;
- Follow-up interviews with project stakeholders;
- The resolution of outstanding issues and the issuance of the final Joint –VAL &report and opinion.

In order to ensure transparency, assumptions must be clear and stated explicitly and background material must also be referenced. LGAI TECHNOLOGICAL CENTER S.A. (APPLUS+ CERTIFICATION) has developed a specific checklist customized for the project. The checklist demonstrates, in a transparent manner, the project criteria (requirements), discussion on each criterion by the assessment team, and the results from validating/verifying the identified criteria.

**Appointment of the assessment team: -**

According to the sectoral scope / technical area and experience in the sectoral or national business environment, LGAI Technological Center S.A. (Applus+ Certification) has composed a project assessment team in accordance with the appointment rules in the internal Quality Management System of LGAI Technological Center S.A. (Applus+ Certification).

The composition of audit team shall be approved by the LGAI Technological Center S.A. (Applus+ Certification) ensuring that the required skills are covered by the team.

The four qualification levels for team members that are assigned by formal appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A) / Auditor in Training (AiT).
- Technical Expert (TE).
- Technical Reviewer (TR).

The sectoral scope / technical area knowledge linked to the applied methodology/ies shall be covered by the assessment team.

| Name | Role | SS Coverage | TA Coverage | Financial aspect | Host country experience |
|---|---|---|---|---|---|
| Mr. Pankaj Kumar | LA/TE | YES | YES | YES | YES |
| Mr. Simon Shen | TR | YES | YES | YES | NA |

The complete list of CVs is included as Appendix 3 of this report.

**Document Review: -**

The Joint VCS PD & MR submitted by the Client was reviewed against the approved methodology and other relevant criteria to verify the correctness, credibility, and interpretation of the presented information. Furthermore, a cross-check between information provided and information from other sources has been done. A complete list of all documents and evidence material reviewed is included in this report below in appendix 1.

**Follow -up Interviews: -**

A site visit is conducted by LGAI Technological Center S.A. (Applus+ Certification) who performed interviews, telephone conferences, and physical site inspection with project stakeholders to confirm selected information and to resolve issues identified in the document review. The detail is provided in this report in the below sections.

**Resolution of Clarification and Correction Action Request: -**

The objective of this phase of the joint validation and verification was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for LGAI Technological Center S.A. (Applus+ Certification) positive conclusion on the project design and Monitoring report. The Corrective Action Requests and Clarification Requests raised by LGAI Technological Center S.A. (Applus+ Certification) were resolved during communications between the Client and Applus+ Certifications to guarantee the transparency of the validation process, the concerns raised and responses given are summarized below in the appendix 2.

The Joint VCS PD & MR Version 03 submitted by project owners on 28/04/2021 serves as the basis for the final assessment presented. Additional changes to the project during the joint validation and verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

**Internal quality Control: -**

As final step of a joint validation and verification of the final documentation including the final Joint validation and verification report and the checklist have to undergo an internal quality control by the technical review committee, i.e., each report has to be finally approved either by the head of the technical review committee or the deputy. In case one of these two persons is part of the assessment team approval can only be given by the other one to avoid any conflict of Interest.

After confirmation of the project owners, the positive validation/verification opinion and relevant documents are submitted to the VCS secretariat through the VCS web-platform.

## 2.2 Document Review

The details of the document observed during the joint validation and verification process are listed below in appendix 1 of this report.

## 2.3 Interviews

A remote audit was conducted for the project activity on 14/01/2021. Remote audit was conducted due to ongoing COVID-19 pandemic situation in the entire state of India. Taking into account the rules of relevant national and local authorities (local to the DOE offices as well as to locality of the site visits), World Health Organization (WHO) recommendations, policies of the DOE and other relevant travel restrictions and guidance (for example, a requirement to self-isolate upon return). Moreover, The VCS Program does not explicitly mandate site visits as part of the validation and verification process, only that VVBs must achieve a reasonable level of assurance on all validations and verifications (per Section 4.1.2 of the VCS Standard, v4.1.

The VVB has taken alternative measures to reach reasonable level of assurance and conducted remote audit through Skype/Telephone with site personal & consultant (refer section 2.3) with the PP representative. This is also in line with the COVID-19 travel guidance for projects of VERRA.

Technical details & metering/monitoring arrangement verified through onsite photographs/name plates and calibration certificates shared by PP. All the documents were cross checked to ensure conservative estimation of emission reduction.

During the remote audit, the PP representatives were questioned about the implementation of the project activity. Several topics like the verification of commissioning date of meters, the generation, recording, and monitoring of the data and the error accountability were discussed. To cross check the information provided by PP, various documents like technical specifications, commissioning certificates, PPA, JMR sheets, invoice, calibration certificates, etc. were also verified. The names of the persons interviewed during remote audit through skype & telephonic interview is given below;

.

| Sr. No. | Name of Persons | Role/Designation |
|---|---|---|
| **Aurangabad Plant** | | |
| 1) | Mr. Sylesh | Site In-charge |

| | | |
|---|---|---|
| **Tirupati Plant** | | |
| 1) | Mr. Basha | Site In-charge |
| **Adoni Plant** | | |
| 1) | Mr Muralidhara | Site In-charge |
| **Piduguralla Plant** | | |
| 1) | Mr. Prem Prakash | Site In-charge |

## 2.4 Site Inspections

| **Duration of remote audit:** 14/01/2021 | | | | |
|---|---|---|---|---|
| **No.** | **Activity performed on-site** | **Site location** | **Date** | **Team** |
| 1. | Assessment team checked the implementation of the project, Baseline emission, Emission reduction calculation, technical description of the project and Monitoring. | 1) Aurangabad (M.H)<br>2) Tirupati (A.P)<br>3) Adoni (A.P)<br>4) Piduguralla (A.P) | 14/01/2021 | Pankaj Kumar |

## 2.5 Resolution of Findings

The objective of this phase of the joint validation and verification was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for LGAI Technological Center S.A. (Applus+ Certification)'s positive conclusion on the project design and Monitoring report. The Corrective Action Requests and Clarification Requests raised by LGAI Technological Center S.A. (Applus+ Certification) were resolved during communications between the Client and LGAI Technological Center S.A. (Applus+ Certification) to guarantee the transparency of the validation process, the concerns raised and responses given are summarized below in the Appendix 2.

The final Joint VCS PD & MR Version 03 submitted by project owners on 28/04/2021 serves as the basis for the final assessment presented. Additional changes to the project during the validation and verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

| **Areas of validation and verification findings** | **No. of CL** | **No. of CAR** | **No. of FAR** |
|---|---|---|---|
| Project design document and Monitoring report | 00 | 01 | 00 |
| Description of project activity | 00 | 01 | 00 |
| Application of selected baseline and monitoring methodology and selected standardized baseline | | | |
| - Applicability of methodology and standardized baseline | 00 | 01 | 00 |
| - Deviation from methodology | 00 | 00 | 00 |

| | | | |
|---|---|---|---|
| - Clarification on applicability of methodology, tool and/or standardized baseline | 00 | 00 | 00 |
| - Demonstration of additionality | 00 | 01 | 00 |
| - Emission reductions | 00 | 01 | 00 |
| - Monitoring plan | 00 | 00 | 00 |
| -Stakeholder's consultation process | 00 | 01 | 00 |
| - Public comments | 00 | 00 | 00 |
| Others (please specify)-Matter related to double counting- **for validation** | 00 | 00 | 00 |
| Others (please specify)-Matter related to Emission reduction calculation- **for verification** | 00 | 01 | 00 |
| ER achieved – Actual ER achieved calculations,<br>Compliance of the registered monitoring plan with the methodologies including applicable tools and standardized baselines<br>Compliance of monitoring activities with the registered monitoring plan<br>Compliance with the calibration frequency requirements for measuring instruments<br>Assessment of data and calculation of emission reductions or net removals<br>Assessment of reported sustainable development co-benefits | | 01 | |
| **Total** | 00 | **Validation+ Verification: 08** | 00 |

The list of findings and their resolution is presented in Appendix 2 of this report.

### 2.5.1 Forward Action Requests

No FAR was raised during this joint validation and verification process. Please refer Appendix 2 for details.

# 3 VALIDATION FINDINGS

## 3.1 Project Details

The main purpose of this project activity is to reduce GHG emission by avoiding anaerobic decomposition of organic matter through bio methanation process and generate biogas (40 TPD, 30 TPD, 20 TPD and 15 TPD each) at four different locations.

**Baseline Scenario for bio-methanation project: -**

In the absence of the Bio-methanation project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. The baseline is to methane emissions avoidance through anaerobic decomposition of MSW in a landfill site in a windrow composting process, which is the same as the baseline scenario.

Hence, pre-project scenario and baseline scenario are the same.

Estimated Average GHG emission reductions from the project activity will be 47,359 tonnes of CO2e per year and total GHG emission reductions for the chosen 7-year crediting period will be 331,510 tonnes of CO2e.

This is a grouped project activity and geographical boundary of the project activity is Fixed as India only. Hence, all the project instances shall be located within the India only.

The grouped projects are located across the country. The geological coordinates are as follows;

| Sl No. | Location | Technology | Capacity | Plant Location | Latitude and Longitude |
|---|---|---|---|---|---|
| 1 | Aurangabad | Bio Methanation | 30 | Aurangabad Industrial | 19° 54' 3.7"N 75° 21' 8.9" E |
| 2 | Tirupati | Bio Methanation | 40 | Temple city, Tirupati | 13°37'23" N 79°29'14" E |
| 3 | Piduguralla | Bio Methanation | 20 | Piduguralla town, Guntur District | 16° 29′ 50" N 79° 53′ 21" E |
| 4 | Adoni | Bio Methanation | 20 | Adoni town, Kurnool District | 15° 37′ 18" N 77°16′ 51" E |

During the Current Monitoring Period from 01/05/2019 to 31/12/2020 (First and last date included) the project activity has contributed 12,833 $tCO_2e$ GHG reductions.

**Project Technology details: -**

The project includes installation of anaerobic decomposition of organic matter through bio methanation process and generate biogas (40 TPD, 30 TPD, 20 TPD and 20 TPD each) at four different locations.

Anaerobic digestion is a complex, natural, multi-stage process of degradation of organic compounds through a variety of intermediates into methane and carbon dioxide, by the action of a consortium of microorganisms. The interdependence of the bacteria is a key factor in the anaerobic digestion process. Instability during both the start-up and operation of the anaerobic degradation process can be problematic due to the low specific growth rate of the methanogenic microorganisms involved. The amount of one type of organic waste generated at a particular site at a certain time may not be sufficient to make anaerobic digestion cost-effective all year round. Co-digestion then becomes an interesting alternative as it is a well-established concept. Raw Material for biogas production:

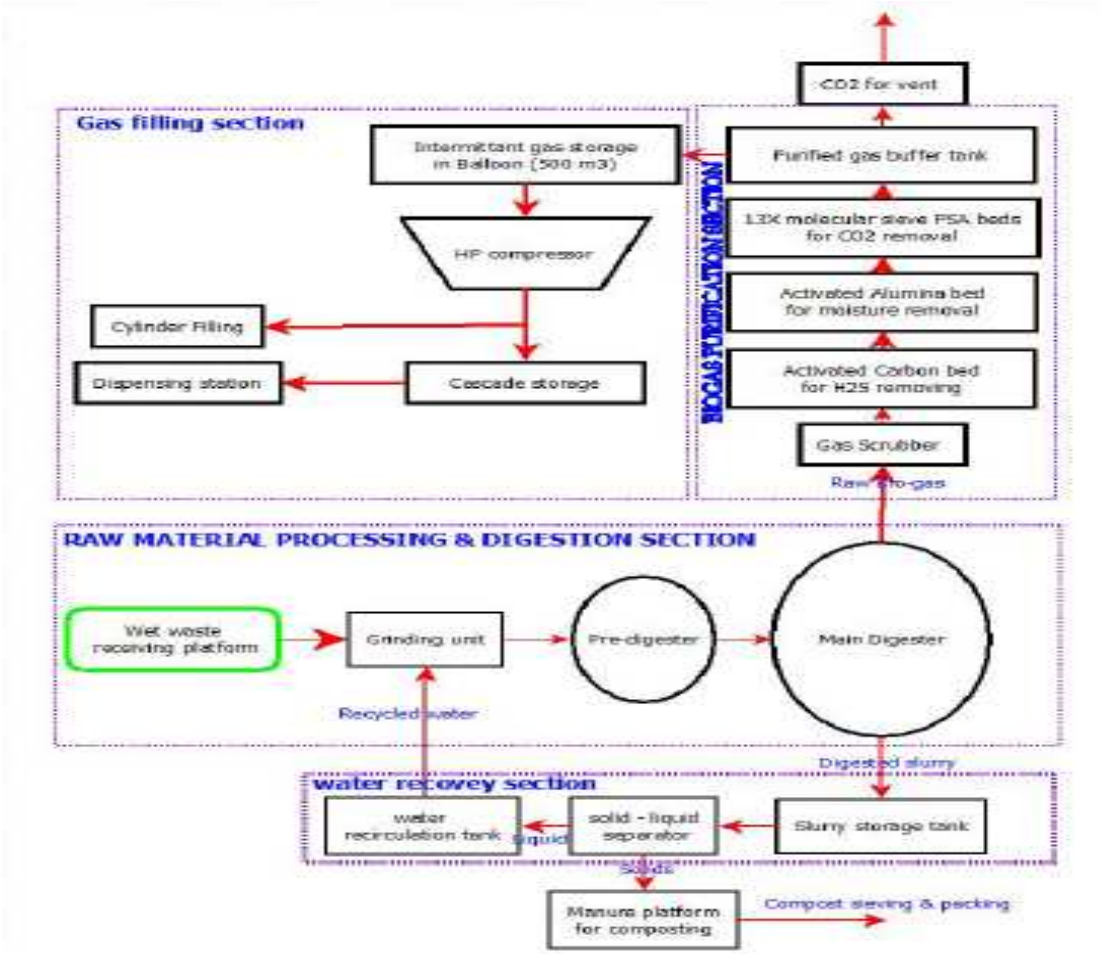
- Agricultural residue
- Energy crops
- Diary manure and biomass
- Food, fruit and vegetable waste
- Animal waste

- Municipal waste

There are mainly two products will produced from the plant. They are
1. Organic/ Bio manure
2. Biogas

Biogas plant slurry is an organic matter and it has rich nutrition content. Thus, the slurry can be de-watered or it can be mixed with garden waste to produce Organic manure/fertilizer for cultivation/horticulture. Manure is an excellent fertilizer containing nitrogen, phosphorus, potassium and other nutrients. It also adds organic matter to the soil which may improve soil structure, aeration, soil moisture-holding capacity, and water infiltration. Ever since agriculture has evolved, animal waste has been treated as a fertilizing element for the soil. The first step towards civilization was plantation and as time progressed, human beings developed new techniques of plantations and looked forward to improvise on the previous ones. It was a simple observation that the primitive man made, that led him to treat animal waste as manure.

Biogas generated can be converted into bio methane with the help of two steps; a cleaning process to remove the trace components and an upgrading process to adjust the calorific value. Upgrading is generally performed in order to meet the standards for use as vehicle fuel or for injection in the natural gas grid. A number of techniques are available for the up gradation of biogas. These techniques include chemical absorption method, high pressure water scrubbing, pressure swing adsorption, cryogenic separation and membrane separation method.




List of main equipment installed at Bio-Methanation Plant at all sites is tabulated below:

| List of equipment for Bio – methanation plant | | |
|---|---|---|
| **Sl. No** | **Description** | **Qty/size** |
| 1 | Feeding platform with shed for raw material feeding | 1 No |
| 2 | Screw/ Feed conveyor for material handling. | 2 Nos. each 3 ton/hr |
| 3 | Raw material grinder for grinding 20 tons/day | 3 Nos, each 3 tons/hr |
| 4 | Water storage tank RCC | 1 Nos |
| 5 | Aerobic Feeding tank with agitators RCC | 1 Nos |
| 6 | Raw material feeding pump/ inlet system | 1 Nos |
| 7 | Anaerobic digester of RCC , with agitators and water sealing technology and FRP dome/balloon. | 1 No |
| 8 | Water recirculation tank of RCC | 1 Nos |
| 9 | Slurry collection tank of RCC | 1 Nos |
| 10 | Slurry de watering system | 1 No |
| 11 | Biogas balloon | 1 Nos |
| 12 | Biogas Purification system | 1 Unit |
| 13 | Biogas Recovery system | 1 Unit |

| | | |
|---|---|---|
| 14 | Earth Mover | 1 Nos |
| 15 | Shredder machine | 1 Nos, 1 |
| 16 | Compost Sieving machine | 1 Nos, 2 |
| 17 | Biogas flow meter | 1 Nos |
| 18 | Online monitoring system – digester PH, Tempera- ture, gas $CH_4$, $CO_2$, $H_2S$, Moisture | 1 No each |
| 19 | Genset for back up | 1 Nos, 125 |
| 20 | Office room with toilet | 1 Nos |
| 21 | Control room | 1 Nos |
| 22 | Platform and Shed for purification system | 1 Nos |
| 23 | Manure storage yard | 1 No |
| 24 | Compost platform | 2 Nos |
| 25 | Diesel -Genet (Optional) 200KVA | 1 No |
| **Additional equipment required for Bottling Plant along with equipments specified in Table 2.** | | |
| 26 | HP Compressor | 1 No, |
| 27 | Cascade cylinders | 2100 kg storage |
| 28 | Area for bottling plant | 1 No |

The operational life of the Bio-methanation project activity is 20 years based upon the standard operational and maintenance practices followed at site.

The technical specifications, locations and other details are was checked during site visit.

Assessment team checked onsite and confirms that the details of the project proponent areas below:

| | |
|---|---|
| **Organization name** | MAHINDRA WASTE TO ENERGY SOLUTIONS LTD. |
| **Contact person** | Mr. B. Gowdhaman |
| **Title** | Plant In charge |
| **Address** | Mahindra Towers, Dr. GM Bhosale Marg, Worli, Mumbai – 400 018 |
| **Telephone** | - |
| **Email** | info@mahindra.com |

**Project start Date: -**

Project Start Date: 01/05/2019;

The project activity at Aurangabad site was commissioned and started operation on 01/05/2019. Hence the project start date is defined as the earliest commissioning date within all the units.

Assessment team checked the commission details from the commissioning certificate provided by the project proponent.

**Project crediting period: -**

Assessment team confirms that the crediting period dates for the project is as below:-

Project crediting period: Renewal crediting period

Start date of Crediting period: 01/05/2019

End date of crediting period: 30/04/2026

Total number of years: 7

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

**Project scale & estimated GHG Emissions Reductions or Removals: -**

Assessment team confirms that the project involves setting up with bio methanation projects of capacity 40, 30, 20 and 20 TPD respectively.

As per the section 3.9.1 of VCS standard version 4.1, the projects are classified as follows:

1) Projects: Less than or equal to 300,000 tonnes of CO2e per year

2) Large Projects: Greater than 300,000 tonnes of CO2e per year

The grouped project activity instances being included currently have less than 300,000 tCO2e Emission reductions, hence these project activity instances are classified as "Projects"

Similarly, the estimated GHG Emission Reductions will depend upon the Quantity of Bio-CNG and Manure Production by individual project activity instances. The tentative Emission Reduction for the project activity instances being included in the grouped project activity are as follows:

| Current Project activity instances | Estimated annual Emission Reductions over a year period ($tCO_2e$) |
|---|---|
| Aurangabad – MH | 13,141 |
| Tirupati – AP | 17,169 |
| Piduguralla – AP | 8,727 |
| Adoni – AP | 8,322 |
| **Total** | **47,359** |

| Project Scale | |
|---|---|
| Project | ✓ |
| Large project | |

| Year | Estimated GHG emission reductions or removals ($tCO_2e$) |
|---|---|
| Year 1 | 14,741 |
| Year 2 | 36,017 |
| Year 3 | 46,254 |
| Year 4 | 53,116 |
| Year 5 | 57,716 |
| Year 6 | 60,800 |
| Year 7 | 62,867 |
| **Total estimated ERs** | 331,510 |
| **Total number of crediting years** | 7 |
| **Average annual ERs** | 47,359 |

However, emission reductions achieved as part of grouped project activity will increase as per addition of new project activity instances in the future.

**Conditions prior to project initiation: -**

Assessment team during the desk review and onsite visit confirms that the project is a bio methanation by Mahindra Waste to Energy Solutions Ltd. and does not involve generation of GHG emissions for the purpose of their subsequent reduction, removal or destruction. The baseline as described in section 3.4.4 of this report will continue to be the baseline in the absence of project activity.

**Project compliance with applicable laws, statues and other regulatory framework: -**

Assessment team checked the Commissioning certificates, consents/ approvals from state board, Bio methanation plant of capacities 40 TPD, 30 TPD and 20 TPD respectively in the name of PP issued by Municipal corporation to confirm the project capacity and its relevant statutory requirements as per the host country regulations.

The Project has received consent to establish and operate from MPCB for 30 TPD Bio methanation dated 11/01/2019 for Aurangabad project site and from APPCB for 40 TPD, 20 TPD and 20 TPD capacity dated 05/03/2019, 07/05/2019 and 05/03/2019 respectively. Applus checked copies of consents and found these correct and in compliance with the local laws and regulations.

Assessment team noted that the project fulfils the norms put down by Central Pollution Control Board norms. As per Central Pollution Control Board (Ministry of Environment & Forests, Govt. of India), final document on revised classification of Industrial Sectors under Red, Orange, Green and White Categories (29/02/2016).

The relevant national laws and regulations pertaining to generation of energy in India are:

- Electricity Act 2003
- National Electricity Policy 2005
- Tariff Policy 2006
- Solid waste management Rules,2016

**The Project activity conforms to all the applicable laws and regulations in India:**

1. Generation of Bio CNG from waste is not a legal requirement or a mandatory option.

2. There are state and sectoral policies, framed primarily to encourage waste to Energy projects. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments.
3. The Indian Electricity Act, 2003 (May 2007 Amendment) does not influence the choice of fuel used for power generation.
4. There is no legal requirement on the choice of a particular technology for power generation.

Thus, assessment team confirms that the project activity follows the National and local law and regulation of the host country.

**Project ownership: -**

**Mahindra Waste to Energy Solutions Ltd.** is project proponent (PP) of project activity and they have the legal right to control and operate the project activities.

The project ownership has been checked by the Assessment Team and demonstrated through below supporting documents:

- Consent to Operate

- Commissioning certificate
- Consent to Establish

Further, individual compliance aspects will be provided for each of the project activity instance to be included in the grouped project activity based on the clearances/approval/certificates received for implementation of project instance.

**Emission Trading programs & other binding limits: -**

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. Audit team checked the REC Mechanism database of India and found that the project activity is not accredited[2]/ registered[3] under REC mechanism. Further, Declaration in effect of the same has been submitted by project proponent to audit team and found to be correct. Thus, it is concluded that the project activity not involved on other Emissions trading programs and other binding limits.

**Additional Information Relevant to the project: -**

**Eligibility criteria for the grouped project: -**

This is a grouped project, the eligibility criteria for inclusion of new instances of each project activity has been defined below:

| S. no. | Eligibility Criteria | Project Activity instances eligibility |
|---|---|---|
| 1 | Applicability Conditions: The project activity instances shall meet applicability conditions for applicable methodology as defined in section 2.2 | The current instances described are in line with the methodology |
| 2 | Geographical Area: The project activity instances to be included in the grouped project activity will be activities involving waste to Energy projects in India | All the instances are located within the boundary of the country, India. |
| 3 | Baseline scenario: All Project Activity Instances shall meet the baseline definition as defined in respective valid methodology and as explained in section 2.4 | The baseline for each instance is inline with the methodology requirements. |

[2] https://www.recregistryindia.nic.in/index.php/publics/accredited_regens

[3] https://www.recregistryindia.nic.in/index.php/publics/accredited_regens

| | | |
|---|---|---|
| 4 | Start Date: The start date of each project activity instance under the grouped project should not be prior to the start date of the grouped project. The start date of each project activity instance will be determined through documentary evidence. | The data of the first commissioning is 01/05/2019. All other instances shall be subsequent to this date. The commissioning certificate shall act as the evidence to determine the same |
| 5 | Conditions that avoid double counting of emission reductions like unique identifications of project and claiming emission reduction only under one GHG program for any given monitoring period. | The initial project activity instances – has not applied in any other mechanism.<br><br>Declaration needs to be provided that for any given monitoring period, the carbon credits would be issued in only one mechanism. |
| 6 | The Grouped Project specific requirements stipulated by the Entity responsible for coordinating and managing grouped project for conducting local stakeholder consultations. | Local stakeholder consultation has been conducted at the project site for initial project activity instances.<br><br>Details are mentioned in subsequent section of this document. Hence, this condition is fulfilled. |

In View of above discussion, the assessment team able to confirm that the project instances meet all the eligibility criteria.

**Leakage Management for AFOLU project: -**

Not applicable to the project activity.

**Commercially Sensitive Information: -**

No commercially sensitive information has been excluded from the public version of the project description. The details are presented transparently to the assessment team for analysis which lead to positive conclusion for this validation and verification.

**Sustainable Development: -**

The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment, Forest and Climate Change (MoEFCC), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India. Thus, the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

**Social well being**

The project activity will provide job opportunity to local people during erection, commissioning and maintenance of the project. This directly and indirectly positively effects the economy of nearby populace.

**Environmental well being**

Bio CNG generation is one of the cleanest renewable energy powers and does not involve any fossil fuel. There are no GHG emissions. The impact on land, water, air and soil is negligible. Thus, the project activity contributes to environmental well-being without causing any negative impact on the surrounding environment.

Further the project leads to generation of energy from waste thus solving a major environmental concern for waste management.

**Economic well being**

The project activity generates permanent and temporary employment opportunity within the --- vicinity of the project.

**Technological well being**

The Project will also contribute towards achieving sustainable waste management in the city. The design and operation of this project, in conjunction with the avoidance of methane emissions and production of compost as a soil amendment, will serve as an example to many other urban areas in the country that are facing similar waste management challenges.

## 3.2 Participation under Other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program. Audit team checked the REC Mechanism database of India and found that the project activity is not accredited / registered under REC mechanism. Further, declaration for the same is checked and found correct by the assessment team. Also, assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

1. https://www.recregistryindia.nic.in/
2. http://cdm.unfccc.int/
3. http://www.goldstandard.org/

**Rejection by other GHG program: -**

The Project is not rejected by other GHG programs. A declaration for the same is checked and found correct by the assessment team. Also, assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

1. https://www.recregistryindia.nic.in/
2. http://cdm.unfccc.int/
3. http://www.goldstandard.org/
4. www.v-c-s.org

The Project does not intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

Renewable energy certificates are available for trading in the host country However, the same is not availed by the project participant. The undertaking regarding the same is submitted by PP which is acceptable to the assessment team and assessment team also checked the REC web site (https://recregistryindia.nic.in/) and found the declaration to be correct

## 3.3 Safeguards

### 3.3.1 No Net Harm

As project is a methane avoidance project, hence there is no negative environmental and socio impact effect and the same can be summarized in the below table: -

| S.No. | Indicator | Assessment team opinion |
|---|---|---|
| 1 | Air quality | Bio-methanation can have some local environmental impact, mainly odour emissions. Odour reduction techniques are applied by the use of inoculants. The fresh stacks of material are sprayed within inoculums/ sanitizer via sprayer to reduce odour and repel vectors. The inoculums also reduce the problems of flies and bird menace.<br><br>Adequate measures were taken to mitigate the envisaged impacts like spraying water on the road side to reduce dust level, etc. This was confirmed by the local stakeholders. Therefore, it is validated that mitigation measures were robustly implemented on ground for air quality issues project will have a positive impact on air quality. |
| 2 | Water quality and quantity | The project has no effect on water quality and quantity because it neither generates any waste does not consume any water. It was validated during remote assessment that there was no requirement of water for operations of Bio-Methanation and the only usage of water was for drinking and sanitation purpose. The consumption of freshwater during construction was also pretty much limited as confirmed by the local stakeholders.<br>Hence the parameter is indicated as neutral and the same is acceptable to the DOE. |

| | | |
|---|---|---|
| 3 | Soil condition | There are negligible impacts envisaged during operation of the project activity.<br>For mitigating the impacts during construction, various mitigation measures were taken which is validated from the plant records of PP and the interview with local villagers.<br>The top soil excavated during construction, was stockpiled and used for compaction. The roads were not paved and soling was done with excavated earth & rock material, so land disturbance could be minimized.<br>The air born litter is controlled by providing a green belt around the plant. The compost produced in the plants will act as a soil conditioner and will enrich the organic content of soil. This will reduce soil erosion and chemical imbalance in soil associated with excessive use of chemical fertilizers<br>It was also confirmed that, the vegetation done at site helps for soil erosion. The same is confirmed during the stakeholder meetings during onsite visit. Therefore, it can be concluded that the project has no effect on soil conditions during its operation because it has no waste coming out. |
| 4 | Biodiversity | During the remote audit it was confirmed that the condition of ground vegetation will be gradually improved; No rare species has been found in the around area. The project site is not on the migration route of migratory bird.<br>With the implementation of Project, the greening water will be increased significantly; the biodiversity in the vicinity will be improved with the vegetation improvement.<br>NO negative impact envisaged. |
| 5 | Employment Generation | The project activity employed local population as skilled workers as well as security guards which were envisaged during the validation site visit. The personnel employed by the project activity are also provided trainings and exposed to various awareness programs therefore a positive indicator has been accepted. |
| 6 | Livelihood of the poor | The project is associated with infrastructure development like roads in the nearby areas and promoting economic activities like grants to local school and communities' temples etc.<br>Positive impact envisaged. |

### 3.3.2 Local Stakeholder Consultation

As per the VCS requirements, it is necessary to invite the relevant stakeholders, prior of the validation process. Moreover, the stakeholder meeting took place prior to the start date of the project activity which fulfill the requirement of project standard for project activities version 02. The DOE checked the relevance of the dates during the validation site visit. The detail of the invitation date and stakeholder meeting date is as below:

| Project Instance No | Project proponent | Plant | Invitation Notice Dates | LSHM Meetings Dates |
|---|---|---|---|---|
| 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) | 14/06/2019 | 08/07/2019 |

The stake holder meeting was conducted at the project site itself as below:

The local stakeholders' consultation meeting was attended by local persons including local villagers, local vendors and technology suppliers.

The stakeholders identified by the project participant were local people/ NGOs who are the major population of the particular area, local communities and gram panchayat (Village head), technology supplier, project proponent representatives, O&M Team and other people involved in the project. Validation team verified the list of participants who attended the stakeholder meeting and feedback questionnaire and confirms the stakeholders identified are relevant. Validation team verified the list of participants who attended the stakeholder meeting and feedback questionnaire and confirms the stakeholders identified are relevant. The validation team also verified the minutes of meeting to note that no negative comments were received and the same was cross checked with the information obtained during follow up interviews with the stakeholders. Moreover, assessment team during the validation site visit also noted that a grievance register is also put onsite for the stakeholder to comment on any grievances during the operation lifetime of the project activity, the grievances from the stakeholder if found suitable will be addressed immediately by the top management and thus the approach is found appropriate for the project activity

The interactions with some of the stakeholders during the site visit are presented below:

| Name of the stakeholder | Mr. Shahji More |
|---|---|
| DOE questions: Did the project generate local people employment at the project site?<br>Answer: Yes. Employment given to locals in O&M activities for technically educated youths and unskilled men & womens as labours in construction activity. | |

| Name of the stakeholder | Mr. Suresh |
|---|---|
| DOE questions: What kind of safety equipment installed in plants?<br>Answer: Fire Safety equipment, cautionary signage and other safety accessories would be provided to the workers in the plant. | |

Thus, Validation team is of the opinion that the stakeholder meeting was adequate an appropriate.

### 3.3.3 Environmental Impact

**Bio-Methanation project: -**

The project activity has obtained consents to establish and operate from Maharashtra & Andhra Pradesh Pollution Control Board. Overall evaluation of the project activity brings into light only positive aspects to the environment. Odour and water contamination mitigation measures are in place and Applus believes the environmental impacts of the project activity is positive.

### 3.3.4 Public Comments

Assessment team noted that this project was open for public comment from 24/02/2020 to 23/02/2020. No comments were received.

The details were checked by the assessment team in the following web platform

https://registry.verra.org/app/projectDetail/VCS/2093

### 3.3.5 AFOLU-Specific Safeguards

The grouped project is not AFOLU project; Hence this section is not required.

## 3.4 Application of Methodology

### 3.4.1 Title and Reference

Assessment team checked that following methodology and tools are applicable for the grouped project activity. The details are as below:

**For Bio-methanation project: -**

**Methodology:**

Methodology : ACM0022

Project Type : Type-I

Sectoral scopes: 01 and 13

Title : Alternative waste treatment processes [4],

Version Number: 2.0

[4] https://cdm.unfccc.int/methodologies/DB/YINQ0W7SUYO02S6GU8E5DYVP2ZC2N3

The methodology refers to following CDM tools:

- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion[5], Version 3.0, EB 96, Annex 4
- Emissions from solid waste disposal sites, Version 08.0, EB 94, Annex 7
- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation[6], Version 03.0, EB 96, Annex 5
- Project and leakage emissions from composting, Version 2.0, EB 96, Annex 6

### 3.4.2 Applicability

The applied baseline methodology is justified as it has been demonstrated that the proposed project activity is:

**For ACM0022 Ver 2.0 (For Bio-methanation projects)**

**Applicability 1: -**

a) This project activity is construction of anaerobic digestion of the organic fraction of municipal solid waste and biomass waste collected from door-to-door waste collecting vehicles.
b) Not applicable as the project activity involves composting and anaerobic digestion.
c) Neither the organic fresh waste nor the product and by-product from the waste treatment plant are stored on-site under anaerobic conditions.
d) Run-off wastewater is not treated within the project site but a separate wastewater treatment plant, the system is itself designed as zero discharge system.
e) The project does not reduce the amount of waste that would be recycled in the absence of the project activity.

Hence the project activity meets the given applicability criterion.

**Applicability 2: -**

a) The disposal of fresh waste in a SWDS is without an LFG capture system.
b) This is not a co-composting project activity.
c) These project activity does not generate electricity.
d) Project activities doesn't generate electricity.

**Applicability 3: -**

[5] https://cdm.unfccc.int/methodologies/DB/YINQ0W7SUYOO2S6GU8E5DYVP2ZC2N3

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

The emission reductions are claimed only for the baseline scenarios, the project activity doesn't claim emission reductions from the use of product or by-products.

**Applicability 4: -**

Not applicable for the project activity.

**Applicability 5: -**

The Union Ministry of Environment, Forests and Climate Change (MoEF & CC) notified the new Solid Waste Management Rules (SWM), 2016 which only advised the processing of bio-degradable waste. The various technological construction are solely initiatives by respective Municipal Corporation.

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. LGAI Technological Center S.A. (Applus+ Certification) confirms that the application of the baseline methodology is transparent and conservative and confirms that the chosen baseline and monitoring methodology i.e., ACM0022- Version 2.0 is applicable to the bio methanation projects of 40 TPD, 30 TPD, 20 TPD respectively.

### 3.4.3 Project Boundary

Project boundary for Bio methanation process has been ascertained and confirmed during the site visit using ACM0022, Ver. 2.0 –the spatial extent of the project boundary includes dumping ground for waste collected from respective municipal area, processing facility, finishing section and storage facility for bio gas and manure for soil application.

The sources and GHG gases involved for proposed Project activity are as below:

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Emissions from heat generation | $CO_2$ | Yes | Major emission source if heat generation is included in the project activity and displaces more carbon intensive heat generation in the baseline |
| | | $CH_4$ | No | Excluded for simplification. This is conservative |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small |
| | Emissions from | $CH_4$ | Yes | The major source of emissions in the baseline |

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | decomposition of waste at the SWDS | $N_2O$ | No | $N_2O$ emissions are small compared to CH4 emissions from landfills. Exclusion of this gas is conservative |
| | | $CO_2$ | No | $CO_2$ emissions from the decomposition of fresh waste are not accounted for |
| | Emissions from anaerobic lagoons or sludge pits | $CO_2$ | No | $CO_2$ emissions from biomass source are considered GHG neutral |
| | | $CH_4$ | Yes | Methane emission from anaerobic process |
| | | $N_2O$ | No | Not significant. Excluded for simplification and conservativeness |
| Project | Emissions from use of natural gas | $CO_2$ | No | Excluded for simplification. This is conservative |
| | | $CH_4$ | No | Major emission source if supply of upgraded biogas through a natural gas distribution network is included in the project activity |
| | | $N_2O$ | No | Excluded for simplification. This is conservative |
| | Emissions from on-site fossil fuel consumption due to the project activity other than for electricity generation | $CO_2$ | Yes | May be an important emission source. Includes heat generation for mechanical/thermal treatment process, start up of the gasifier, auxiliary fossil fuels needed to be added into incinerator, etc. It does not include transport |
| | | $CH_4$ | No | Excluded for simplification. This is conservative |
| | | $N_2O$ | No | Excluded for simplification. This is conservative |

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | Emissions from on-site electricity use | $CO_2$ | Yes | May be an important emission source |
| | | $CH_4$ | No | Excluded for simplification. This emission source is assumed to be very small |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small |
| | Emissions from wastewater treatment | $N_2O$ | Yes | $N_2O$ may be emitted from composting, incineration, syngas produced and RDF/SB combustion |
| | | $N_2O$ | Yes | $N_2O$ may be emitted from composting, incineration, syngas produced and RDF/SB combustion |
| | | $CO_2$ | Yes | $CO_2$ emissions from incineration, gasification or combustion of fossil-based waste shall be included. $CO_2$ emissions from the decomposition or combustion of fresh waste are not accounted |
| | | $CH_4$ | Yes | $CH_4$ leakage from the anaerobic digester and incomplete combustion in the flaring process are potential sources of project emissions. $CH_4$ may be emitted from incineration, gasification, composting and RDF/SB combustion |
| | Emissions from wastewater treatment | $CO_2$ | No | $CO_2$ emissions from the decomposition of fresh waste are not accounted |
| | | $CH_4$ | Yes | $CH_4$ emissions from anaerobic treatment of wastewater are accounted for. Aerobic treatment of wastewater shall not result in $CH_4$ emissions |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small |

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | Greenfield Solar Power Project Activity. | $CO_2$ | No | No $CO_2$ emissions are emitted from the project |
| | | $CH_4$ | No | Project activity does not emit $CH_4$ |
| | | $N_2O$ | No | Project activity does not emit $N_2O$ |
| | | Other | No | Project activity does not emit other forms of GHG emissions |

### 3.4.4 Baseline Scenario

**Bio-methanation Plant:**

According to ACM0022 Version 2.0, the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere.

The baseline is to methane emissions avoidance through anaerobic decomposition and anaerobic digestion of MSW in a landfill site. No landfill gas capture system is installed in the Landfill site and there is no legal or regulatory mandate on the project proponent to recover the landfill gas.

As per the consolidated methodology ACM0022 Version 2.0, two approaches are available to the project participants to select the most plausible baseline scenarios and to demonstrate additionality.

Approach 1 is used to the "Combined tool to identify the baseline scenario and demonstrate additionality".

Approach 2 broadly refers to the project located in the LDC country and auto additionality of the project, which is not the case of the proposed project activity.

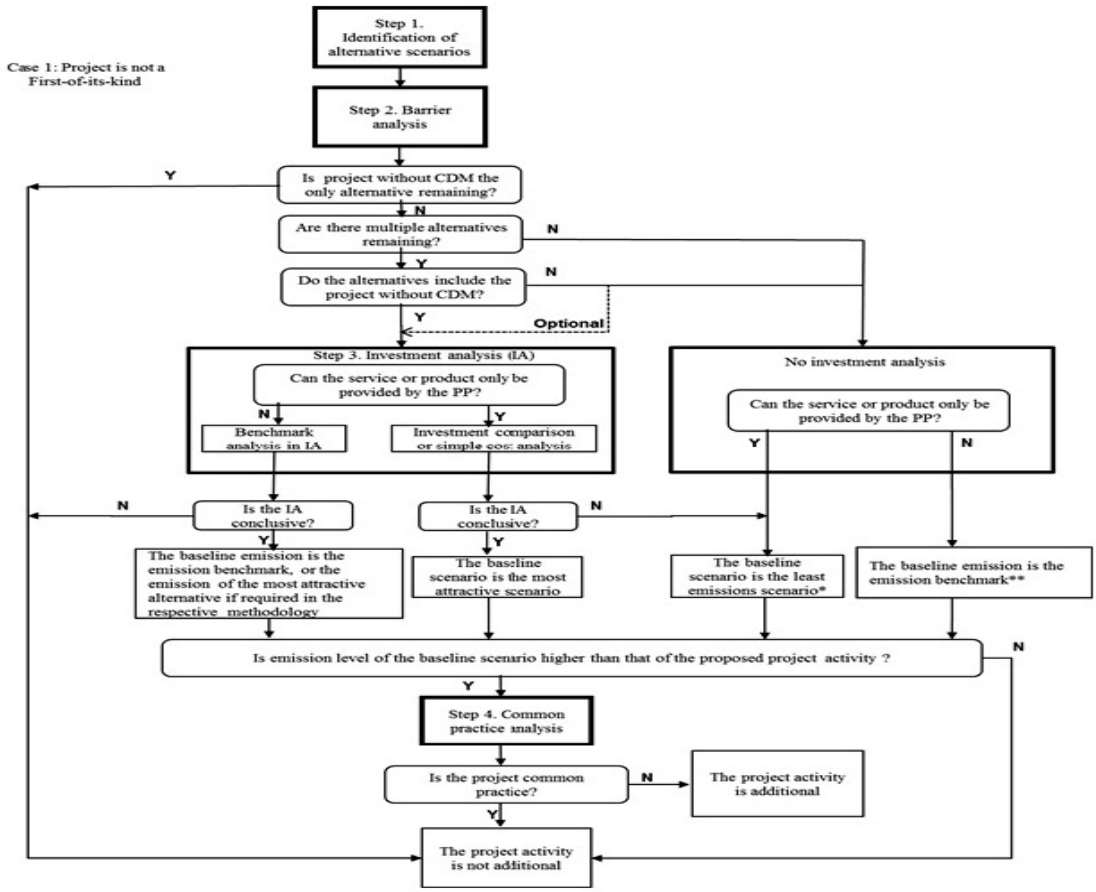
Therefore approach 1 is selected for the procedures.

The "Combined tool to identify the baseline scenario and demonstrate additionality" version 07.0.0, has been used for baseline identification and demonstration of additionality.

***Step 0:*** *Demonstration whether the proposed project activity is the first-of-its-kind*

The proposed project activity is not the first-of-its-kind.

**Figure 1. Flowchart of the step-wise approach (Case 1: Project is not a first-of-its-kind)**




* In case of only one alternative remaining, the baseline scenario is the remaining alternative;
** If not required otherwise in the respective methodology

***Step 1:*** *Identification of alternatives Scenario*

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

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

As per the consolidated methodology ACM0022 V2.0, "In identifying baseline alternatives for the treatment of fresh waste the following alternatives or combination of these alternatives shall, inter alia, be considered:"

| Representation | Parameters | Plausible Scenarios | Reason with Justification |
|---|---|---|---|
| M1 | The project activity without being registered as a CDM project activity (i.e., | Yes | This alternative involves processing of waste in a Bio-methanation plant. This option is in compliance with all the |

| | | | |
|---|---|---|---|
| | any (combination) of the waste treatment options listed in Table 2 of the methodology); | | mandatory laws and regulations. This option has been considered as a baseline alternative. |
| M2 | Disposal of the fresh waste in a SWDS with a partial capture of the LFG and flaring of the captured LFG; | No | The common practice in towns was to dump the MSW generated in the designated open landfill[7] which does not have a provision for landfill gas capture. Hence, this option has not been considered as a baseline alternative. |
| M3 | Disposal of the fresh waste in a SWDS without a LFG capture system; | Yes | This is the 'Business As Usual' Scenario. All waste is collected and transported to the designated landfill sites. This alternative does not have any landfill gas capture and flaring system, since it does not require any capital investment or operation and maintenance cost or any other associated cost. Therefore, this alternative is a real and plausible baseline alternative. |
| M4 | Part of the fresh fraction of the solid waste is recycled and not disposed in the SWDS; | No | The common practice in towns was to dump the MSW generated in the designated open landfill. No part of waste is recycled therefore not considered as a baseline alternative. |
| M5 | Part of the fresh fraction of the solid waste is treated aerobically and not disposed in the SWDS; | No | M5 cannot be considered a baseline alternative to the project activity since it aims only at introducing a waste treatment system and there is no possibility to generate biogas when treating the solid waste aerobically. Thus, M5 is discarded for further consideration |

[7] Every state in India has open dumping as current practice.

https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2018-19.pdf, pg 13-14

| | | | |
|---|---|---|---|
| M6 | Part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS; | No | Incineration of solid wastes (in part or full) was not recommended by CPCB[8]. Hence this alternative has not been considered as an alternative to the project activity. |
| M7 | Part of the organic fraction of the solid waste is gasified and not disposed in the SWDS; | No | Gasification of solid wastes (in part or full) was not recommended by CPCB[9]. Hence this alternative has not been considered as an alternative to the project activity. |
| M8 | Part of the organic fraction of the solid waste is treated in an anaerobic digester and not disposed in the SWDS; | No | The project activity involves aerobic treatment through Bio-methanation for treatment of MS. Thus, M8 is a part of the project activity under consideration and therefore not considered as a baseline alternative |
| M9 | Part of the organic fraction of the solid waste is mechanically or thermally treated to produce RDF/SB and not disposed in the SWDS. | No | The project alternative does not include mechanical treatment of solid waste (RDF manufacturing) for treatment of MSW in the project activity. Hence, this option is not considered as a baseline alternative. |

**Outcome of step 1a and step 1b:**

Following alternatives amongst the ones listed above are in compliance with all the mandatory legal and regulatory requirements:

| | |
|---|---|
| M1 | The project activity without being registered as a CDM project activity (i.e., any (combination) of the waste treatment options listed in Table 2 of the methodology); |
| M3 | Disposal of the fresh waste in a SWDS without an LFG capture system |

**Step 2: Barrier analysis**

Project proponent (PP) is to determine whether the Project activity faces barriers that:
(a) Prevent the implementation of this type of proposed project activity; and

[8] https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2018-19.pdf ; refer page 13-14

[9] https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2018-19.pdf ; refer page 13-14

(b) Do not prevent the implementation of at least one of the alternatives; using the following sub-steps:

**Step 2a: Identify barriers that would prevent the implementation of alternative scenario**

**Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers**

As per the "Combined tool to identify the baseline scenario and demonstrate additionality", version 07, project participant is required to "establish a complete list of realistic and credible barriers that may prevent alternative scenarios to occur. Such realistic and credible barriers may include:" (a) Investment Barriers, (b) Technological Barriers and (c) Other barrier, preferably specified in the underlying methodology approved consolidated baseline and monitoring methodology ACM0022 – "Alternative waste treatment processes", version 2.0 as examples

Outcome of Step 2(a) and 2(b): The following alternatives faces investment barrier –

| | | | |
|---|---|---|---|
| M1 | The project activity without being registered as a CDM project activity (i.e., any (combination) of the waste treatment options listed in Table 2 of the methodology); | Investment barrier | The project activity without revenue from VER requires investment and from project proponent and generates revenue through sale of CNG. However, the return from the investment is not sustainable.<br><br>The alternative does not face any barrier other than insufficient financial return which is elaborated in step 3 – Investment Analysis in accordance with combined tool. |
| M3 | Disposal of the fresh waste in a SWDS without a LFG capture system. | No Barrier | This alternative does not face any barrier. This alternative neither requires any investment from the project developer nor does it generate any revenue. |

As per the above analysis, there are two alternatives i.e. M1 and M3

Scenario M1 is unlikely due to the strong investment barrier for its implementation. This is demonstrated as per the Investment Analysis included in Step 3.

.

**Step 3: Investment Analysis**

**Step 4: Common Practice Analysis**

Step 3 and step 4 are being conducted as part of section 3.5 of the VCS Joint PD & MR. Please refer the same.

### 3.4.5 Additionality

As per para 29 of "Tool for the demonstration and assessment of additionality" (version 07.0.0), for financial analysis of the project, the following three options are available:

Option I: Simple Cost Analysis

Option II: Investment Comparison Analysis

Option III: Benchmark Analysis

The project will generate revenues from sale of Bio-CNG, therefore Option I is not applicable. Option II also does not apply since there is no comparable investment alternative available to the project participant. In line with the para 32 of the Tool the most appropriate financial analysis method is therefore option III: the benchmark analysis, where the returns on investment in the project activity are compared to benchmark returns that are available to any investors in the country.

Project Participants have considered Post-Tax Equity IRR for investment analysis at the time of decision-making. As Project Participants is only interested in the returns project is generating on the portion of investment costs, which is financed by them in the form of equity.

As per Para 15 of EB105, Annex 06 states that Required/expected returns on equity are appropriate benchmarks for an equity IRR. Therefore, the Expected return on equity is considered appropriate benchmark.

Accordingly, the post-tax Equity IRR has been considered as the relevant financial indicator for Investment Analysis.

**Default Value Benchmark:**

The Required return on equity (benchmark) was computed in the following manner:

Nominal Benchmark = {(1+Real Benchmark) *(1+Inflation rate)}-1

Where:

(a) Default value for Real Benchmark is the default value of expected return on equity in real terms for Energy Industries (Group 1) in India as provided in the Appendix.

(b) Inflation Rate forecast for India as per IMF website.

**Benchmark estimation**

Default Value as per latest version of Investment Analysis Tool version 10:
Table under EB 105 annex 06 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = 10.24%

Inflation Forecast for India as per RBI website[10] and corresponding benchmark values:

[10] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=18113

| Project Instance No. | Project Owner | Plant Location | Inflation Forecast (10 Years) | Benchmark |
|---|---|---|---|---|
| 1 | Mahindra Waste to Energy Solutions Ltd. | Aurangabad – MH | 4.50% | 15.20% |
| 2 | | Tirupati – AP | 4.50% | 15.20% |
| 3 | | Piduguralla – AP | 4.50% | 15.20% |
| 4 | | Adoni – AP | 4.50% | 15.20% |

The equity IRR for (**Bio-Methanation Plant)** has been computed based on the following input assumptions:

| Parameters | Project Instance - 1 | Project Instance - 2 | Project Instance - 3 | Project Instance - 4 | Basis |
|---|---|---|---|---|---|
| Location | Aurangabad, MH | Tirupati, AP | Piduguralla, AP | Adoni, AP | DPR |
| Capacity of Bio-Methanation Plant | 30 | 40 | 20 | 20 | DPR |
| Cost of Project (Rs. million) | 128.10 | 77.76 | 61.10 | 64.10 | DPR |
| Financing Pattern – Equity Loan (Rs. Million) | 32.03 | 19.44 | 15.28 | 16.03 | DPR |
| Financing Pattern – Term Loan (Rs. Million) | 96.08 | 58.32 | 45.83 | 48.08 | DPR |
| Rate of Interest | 8% | 8% | 8% | 8% | DPR |
| Selling Price of CNG (Rs./Kg) | 46 | 46 | 46 | 46 | DPR |
| O&M Cost (including Manpower and compliances) | 7.4 | 6.8 | 6.8 | 6.8 | DPR |
| Income Tax- MAT | 21.55% | 21.55% | 21.55% | 21.55% | Income Tax Act |

| | | | | | |
|---|---|---|---|---|---|
| Income Tax | 29.12% | 29.12% | 29.12% | 29.12% | Income Tax Act |

Based on above the equity IRR works out to:

| Project Instance No. | Project Owner | Plant Location | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Mahindra Waste to Energy Solutions Ltd. | Aurangabad – MH | **3.56%** | **15.20%** |
| 2 | | Tirupati – AP | **3.98%** | **15.20%** |
| 3 | | Piduguralla – AP | **6.28%** | **15.20%** |
| 4 | | Adoni – AP | **6.29%** | **15.20%** |

As evident the IRR is lower than the benchmark rate. The additionality of the project is thus evident.

a) **Parameters and assumptions used:**

DPR has been submitted to validation team. The DPR were available during decision making and financial profitability of the project was decided based on this DPR. Validation team checked the DPR of the project activity and found that consideration of the project cost in revised Joint VCS PD& MR Version 02 is correct and it is in line with Appendix of Methodological tool "Investment Analysis" Version 09 as well as in compliance to CDM Validation and Verification Standard for project activities version 4. Hence, the project cost consideration is justified. Assessment team checked the actual project cost and found still the project do not breach the benchmark. The sensitivity analysis below confirms the same. Since the actual cost is considered for commissioned projects, hence there is no way the cost can go up and thus the same is assessed to be correct.

In India, infrastructure projects are generally entitled to a debt equity ratio of 70:30. However, depending on the relationship of the client with the bank, its credit rating and collaterals offered, banks consider higher debt equity ratio also. The debt equity ratio for the project is 70:30. Assessment team checked the order for the respective state regarding ratio of debt and equity which was available at the time of investment decision and found that the ratio of Debt to equity was considered correctly for the present validation condition.

The profitability of the project, which forms the basis for IRR calculation is based on installed capacity, yield, project cost, O&M cost, depreciation and taxation.

b) **Assessment of O& M cost:**

The DPR has been used in the financial calculation as same was available during decision making and hence applicable. According to Appendix of Methodological tool "Investment Analysis" Version 09, the cost should be based on the input parameters available at the time of decision making and the PP has submitted offer letter supporting this consideration. Therefore, considering the above assessment, validation team concluded that the O&M cost considered from respective DPR in the computation of financial indicator is in conformity with guidance Appendix of Methodological tool "Investment Analysis" Version 09.

c) **Assessment of Tax computation:**

The project developer has adopted book depreciation rates as per Schedule XIV of the Companies Act, 1956 for computing book profit and Income Tax Act 1961 stipulated for income tax calculation, which are in conformity with the accepted accounting principles adopted by the company and income tax laws in the host country. The block of assets has been computed for depreciation purpose as per the accepted accounting principles. Tax liability has been calculated as per the income tax rules and the rulings given. In computing the income tax liability, the project developers have considered Tax holiday (u/s 80IA of the Income Tax Act, 1961). Accelerated depreciation on plant and machinery is also sourced from IT act. The tax rates assumed corresponds to the tax rate prevailing at the time of taking decision (conformity to Appendix of EB85, Annex 12). Hence, these assumptions are appropriate during decision making context.

d) **Cross checking parameters:**

<table>
<tr><th>Name of the parameter</th><th>DOE Assessment</th></tr>
<tr><td>Project Cost</td><td>The Project cost has been considered from DPR, and was available at the time decision made for the project activity.<br><br>IRR value as per the assumptions from the DPR is as below:
<table>
<tr><th>Project Instance No.</th><th>Plant Location</th><th>Project Cost (In Million)</th><th>Equity IRR</th><th>Benchmark</th></tr>
<tr><td>1</td><td>Aurangabad – MH</td><td>128.10</td><td>3.56%</td><td>15.20%</td></tr>
<tr><td>2</td><td>Tirupati – AP</td><td>77.76</td><td>3.98%</td><td>15.20%</td></tr>
<tr><td>3</td><td>Piduguralla – AP</td><td>61.10</td><td>6.28%</td><td>15.20%</td></tr>
<tr><td>4</td><td>Adoni – AP</td><td>64.10</td><td>6.29%</td><td>15.20%</td></tr>
</table></td></tr>
</table>

The DOE has also checked the cost of each project instance from the DPR and also cross checked with the actual project cost certificate provided by CA and found that, the project cost is within the range of sensitivity analysis. The project activity is additional with the project cost as per DPR.

Based on sectoral scope expert and local knowledge, the project cost considered as per DPR for the proposed project activity is found to be appropriate for bio methanation projects. Also, since the actual cost is available to DOE and IRR is still within benchmark, thus the same is acceptable.

| Project Instance No. | Plant Location | Actual Project Cost (In Million) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 128.10 | 3.56% | 15.20% |
| 2 | Tirupati – AP | 72.99 | 6.24% | 15.20% |
| 3 | Piduguralla – AP | 56.187 | 8.17% | 15.20% |
| 4 | Adoni – AP | 61.86 | 7.14% | 15.20% |

Since the comparison is done, the increase of the same in future is not possible. Thus, assessment team is of the opinion that project is still additional with the consideration of actual project cost for the project activity.

**Selling Price of CNG**

The Selling Price of CNG has been considered from DPR which was available at the time decision made for the project activity.

IRR value as per the assumptions from the DPR is as below:

| Project Instance No. | Plant Location | CNG Price (Rs./kg) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 46.00 | **3.56%** | **15.20%** |
| 2 | Tirupati – AP | 46.00 | **3.98%** | **15.20%** |
| 3 | Piduguralla – AP | 46.00 | **6.28%** | **15.20%** |
| 4 | Adoni – AP | 46.00 | **6.29%** | **15.20%** |

DOE has cross checked Selling Price of CNG from Actual Bills, found there are no changes in CNG Price

DOE found there are no changes in Selling Price of CNG and the project activity is additional with actual Selling Price of CNG.

| Project Instance No. | Plant Location | Actual CNG Price (Rs./kg) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 46.00 | **3.56%** | **15.20%** |
| 2 | Tirupati – AP | 46.00 | **3.98%** | **15.20%** |
| 3 | Piduguralla – AP | 46.00 | **6.28%** | **15.20%** |
| 4 | Adoni – AP | 46.00 | **6.29%** | **15.20%** |

**Selling Price of Organic Manure**

The Selling Price of Organic Manure has been considered from DPR which was available at the time decision made for the project activity.

IRR value as per the assumptions from the DPR is as below:

| Project Instance No. | Plant Location | Organic Manure Price (Rs./kg) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 3.5 | **3.56%** | **15.20%** |
| 2 | Tirupati – AP | 3.5 | **3.98%** | **15.20%** |
| 3 | Piduguralla – AP | 3.5 | **6.28%** | **15.20%** |
| 4 | Adoni – AP | 3.5 | **6.29%** | **15.20%** |

DOE has cross checked Selling Price of Organic Manure from Actual Bills, found there are no changes in Organic Manure Price

DOE found there are no changes in Selling Price of Organic Manure and the project activity is additional with actual Selling Price of Organic Manure.

| Project Instance No. | Plant Location | Actual Organic Manure Price (Rs./kg) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 3.5 | **3.56%** | **15.20%** |
| 2 | Tirupati – AP | 3.5 | **3.98%** | **15.20%** |
| 3 | Piduguralla – AP | 3.5 | **6.28%** | **15.20%** |
| 4 | Adoni – AP | 3.5 | **6.29%** | **15.20%** |

**Biogas CNG Production**

The Biogas CNG Production has been taken from the DPR which and acceptable to the assessment team.

Validation team assessed the DPR and found that DPR Value of Biogas CNG Production has been used in the financials and the emission reduction calculation. Biogas CNG Production value has been checked and found that Biogas CNG Production considered for the project activity in within the range of sensitivity analysis and found to be appropriate.

IRR value as per the assumptions from the DPR is as below:

| Project Instance No. | Plant Location | Biogas CNG Production Capacity (kg/Day) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 1,200.00 | 3.56% | 15.20% |
| 2 | Tirupati – AP | 1,680.00 | 3.98% | 15.20% |
| 3 | Piduguralla – AP | 800.00 | 6.28% | 15.20% |
| 4 | Adoni – AP | 800.00 | 6.29% | 15.20% |

Validation team assessed the sensitivity of Biogas CNG Production Values for the Project activity and found that IRR values is within threshold limit. Thus, the project activity is still additional.

Based on sectoral scope expert and local knowledge, the Biogas CNG Production Values considered as per DPR for the proposed project activity is found to be appropriate for the projects.

Since Project instances are commissioned so actual production data has been cross checked and found IRR is still within benchmark, thus the same is acceptable.

| Project Instance No. | Plant Location | Actual Biogas CNG Production Capacity in 1st year (kg/Day) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 225 | 2.89% | 15.20% |
| 2 | Tirupati – AP | 91 | 2.13% | 15.20% |
| 3 | Piduguralla – AP | 59 | 5.23% | 15.20% |

| | | | | | |
|---|---|---|---|---|---|
| | 4 | Adoni – AP | 4 | **4.37%** | **15.20%** |

**Organic Manure Production**

The Organic Manure Production has been taken from the DPR which and acceptable to the assessment team.

Validation team assessed the DPR and found that Organic Manure Production value as per report has been used in the financials and the emission reduction calculation. Organic Manure Production value has been checked and found that Organic Manure Productionconsidered for the project activity in within the range of sensitivity analysis and found to be appropriate.

IRR value as per the assumptions from the DPR is as below:

| Project Instance No. | Plant Location | Organic Manure Production Capacity (kg/Day) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 3,500.00 | **3.56%** | **15.20%** |
| 2 | Tirupati – AP | 3,500.00 | **3.98%** | **15.20%** |

| | | | | | |
|---|---|---|---|---|---|
| | 3 | Piduguralla – AP | 3,500.00 | **6.28%** | **15.20%** |
| | 4 | Adoni – AP | 3,500.00 | **6.29%** | **15.20%** |

Validation team assessed the sensitivity of Organic Manure Production Values for the Project activity and found that IRR values is within threshold limit. Thus, the project activity is still additional.

Based on sectoral scope expert and local knowledge, the Organic Manure Production Values considered as per DPR for the proposed project activity is found to be appropriate for the projects.

Since Project instances are commissioned so actual production data has been cross checked and found IRR is still within benchmark, thus the same is acceptable.

| Project Instance No. | Plant Location | Actual Organic Manure Production in 1st year Capacity (kg/Day) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 457 | 3.41% | **15.20%** |
| 2 | Tirupati – AP | 2,214 | 3.67% | **15.20%** |
| 3 | Piduguralla – AP | 2,782 | 5.91% | **15.20%** |
| 4 | Adoni – AP | 1,909 | 5.61% | **15.20%** |

**O&M cost**

The details of the proposed project activity are given below.

The O&M cost has been considered from DPR and was available at the time of decision making for the project activity.

The assessment team also checked the O&M cost as per the DPR for each site. Thus, the project activity is additional with as per the O&M cost from the respective DPR.

| Project Instance No. | Plant Location | O&M cost (in Million) | Equity IRR | Benchmark |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 7.4 | **3.56%** | **15.20%** |
| 2 | Tirupati – AP | 15.3 | **3.98%** | **15.20%** |
| 3 | Piduguralla – AP | 6.8 | **6.28%** | **15.20%** |
| 4 | Adoni – AP | 6.8 | **6.29%** | **15.20%** |

Validation team assessed the sensitivity of O&M Cost Values for the Project activity and found that IRR values is within threshold limit. Thus, the project activity is still additional.

| Project Instance No. | Plant Location | O&M cost (in Million) | Breaching Value (in Million) | % change |
|---|---|---|---|---|
| 1 | Aurangabad – MH | 7.4 | 0.24 | -96.68% |
| 2 | Tirupati – AP | 15.3 | 12.78 | -16.26% |
| 3 | Piduguralla – AP | 6.8 | 4.45 | -34.21% |
| 4 | Adoni – AP | 6.8 | 4.59 | -32.17% |

Based on sectoral scope expert and local knowledge, the O&M Cost Values considered as per DPR for the proposed project activity is found to be appropriate for the projects.

Since the actual O&M Cost is not available to the DOE, DOE has cross checked O&M Cost with the VCS Registered Project activity VCSID 1941: SUSTAINABLE CITY PROJECTS AT INDIA'S CLEANEST CITY- INDORE

| Project Instance No. | Plant Location | TPD | Actual O&M cost on prorata basis (in Million) | Equity IRR | Benchmark |
|---|---|---|---|---|---|
| 1 | Aurangabad – MH | 30 | 15.3 | 0.00% | **15.20%** |
| 2 | Tirupati – AP | 40 | 21 | 0.00% | **15.20%** |
| 3 | Piduguralla – AP | 20 | 10.5 | 0.00% | **15.20%** |
| 4 | Adoni – AP | 20 | 10.5 | 0.00% | **15.20%** |

So, the DOE has also checked the O&M Cost using Values of VCS Registered Project VCSID 1941 and found that IRR values is within threshold limit. Thus, the project activity is still additional.

**Tax Rates**

| Parameters | Project Instance - 1 | Project Instance - 2 | Project Instance - 3 | Project Instance - 4 | Basis |
|---|---|---|---|---|---|
| Location | Aurangabad, MH | Tirupati, AP | Piduguralla, AP | Adoni, AP | DPR |
| Capacity | 30 | 40 | 20 | 20 | DPR |
| Income Tax- MAT | 21.55% | 21.55% | 21.55% | 21.55% | Income Tax Act |
| Income Tax | 29.12% | 29.12% | 29.12% | 29.12% | Income Tax Act |

The above table shows the tax rate considered for individual projects and the same is found suitable.

Assessment team noted that the project developer has adopted book depreciation rates as per Schedule XIV of the Companies Act, 1956 for computing book profit and Income Tax Act 1961 stipulated for income tax calculation, which are in conformity with the accepted accounting principles adopted by the company and income tax laws in the host country.

i.e., INDIA. Tax liability has been calculated as per the income tax rules and the rulings given. In computing the income tax liability, the project developers have considered Tax holiday (u/s 80IA of the Income Tax Act, 1961). Accelerated depreciation on plant and machinery is also sourced from IT act. The tax rates assumed corresponds to the tax rate prevailing at the time of taking decision. Hence, these assumptions are appropriate during decision making context and thus acceptable to the assessment team.

No further assessment is required as the Values are directly procured from Income Tax Act, 1961 which is standard guideline for Tax value in India.

**Sensitivity Analysis**

Guidance on investment analysis requires the project developer to subject critical assumptions to reasonable variation to ascertain the robustness of the conclusion drawn, that is, the project is additional. As required a sensitivity analysis has been conducted to measure the impact, of changes in the chosen parameters. The rationale of sensitivity is, "The ultimate objective of the sensitivity analysis is to determine the likelihood of the occurrence of a scenario other than the scenario presented, in order to provide a cross-check on the suitability of the assumptions used in the development of the investment analysis."

The results of the sensitivity analysis are as given below:

**Sensitivity Analysis for Aurangabad – MH Plant (30 TPD):**

| Variation % | -10% | Normal | 10% | Variation required to reach benchmark |
|---|---|---|---|---|
| Biogas CNG Production | 0.89% | 3.56% | 6.09% | 51.09% |
| Organic Manure Production | 2.97% | 3.56% | 4.14% | 230.23% |
| O&M | 5.10% | 3.56% | 1.89% | -96.68% |
| Project Cost | 5.34% | 3.56% | 2.11% | -42.44% |
| Selling Price of CNG | 0.89% | 3.56% | 6.09% | 51.09% |
| Selling Price of Organic Manure | 2.97% | 3.56% | 4.14% | 230.23% |

Sensitivity Analysis for Tirupati – AP Plant (40 TPD):

| Variation % | -10% | Normal | 10% | Variation required to reach benchmark |
|---|---|---|---|---|
| Biogas CNG Production | Undetermined | 3.98% | 13.31% | 12.56% |
| Organic Manure Production | 1.63% | 3.98% | 5.85% | 79.22% |
| O&M | 11.75% | 3.98% | Undetermined | -16.26% |
| Project Cost | 7.84% | 3.98% | 0.74% | -24.55% |
| Selling Price of CNG | Undetermined | 3.98% | 13.31% | 12.56% |
| Selling Price of Organic Manure | 1.63% | 3.98% | 5.85% | 79.22% |

Sensitivity Analysis for Piduguralla – AP Plant (20 TPD):

| Variation % | -10% | Normal | 10% | Variation required to reach benchmark |
|---|---|---|---|---|
| Biogas CNG Production | 1.76% | 6.28% | 10.13% | 24.85% |
| Organic Manure Production | 4.84% | 6.28% | 7.62% | 74.65% |
| O&M | 9.31% | 6.28% | 2.48% | -34.21% |
| Project Cost | 8.69% | 6.28% | 4.28% | -28.92% |

| | | | | |
|---|---|---|---|---|
| Selling Price of CNG | 1.76% | 6.28% | 10.13% | 24.85% |
| Selling Price of Organic Manure | 4.84% | 6.28% | 7.62% | 74.65% |

Sensitivity Analysis for Adoni – AP Plant (20 TPD):

| Variation % | -10% | Normal | 10% | Variation required to reach benchmark |
|---|---|---|---|---|
| Biogas CNG Production | 1.76% | 6.29% | 10.38% | 23.10% |
| Organic Manure Production | 4.86% | 6.29% | 7.71% | 69.40% |
| O&M | 9.46% | 6.29% | 2.54% | -32.17% |
| Project Cost | 8.91% | 6.29% | 4.26% | -27.32% |
| Selling Price of CNG | 1.76% | 6.29% | 10.38% | 23.10% |
| Selling Price of Organic Manure | 4.86% | 6.29% | 7.71% | 69.40% |

The sensitivity analysis reveals that even with significant changes in various parameters, the Equity IRR does not cross benchmark rate. Therefore, the project is additional and is not a business – as – usual scenario.

The results of sensitivity analysis show that even with a variation of +10% & -10% in project cost, O&M cost, capacity and Equity IRR is significantly lower than the benchmark. DoE concludes that based on above sensitivity analysis, the project remains additional even under the most favorable conditions

Barrier analysis

Barrier analysis has not been used.

Common practice analysis

For the concerned project, the Common Practice Analysis has been carried out. Stepwise approach for common practice analysis has been carried out as per Methodological tool "Common Practice", version 03.1 EB84, Annex 7:

Step (1): Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

| | Aurangabad – MH | Tirupati – AP | Piduguralla – AP | Adoni – AP | |
|---|---|---|---|---|---|
| Range | Capacity | | | | UNIT |
| +50% | 45 | 60 | 30 | 30 | TPD |
| Capacity of the proposed project activity | 30 | 40 | 20 | 20 | TPD |
| -50% | 15 | 20 | 10 | 10 | TPD |

Bio-methanation facilities with capacity +/- 50% of the capacity of the project activity has been considered i.e., bio-methanation plants within project boundary of capacity in the range mentioned in the above table has only been considered further analysis.

Based upon the annual report on implementation of Solid waste management rules 2018-19[11] Bio-methanation project are identified.

**Step (2):** Identify similar projects (CDM/VCS/GS projects and non CDM/VCS/GS projects) which fulfil all of the following conditions:

a. The projects are located in the applicable geographical area;

b. The projects apply the same measure as the proposed project activity;

c. The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

d. The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

e. The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

f. The projects started commercial operation before the project design document (CDMPDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

[11] https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2017-18.pdf

Identification of the similar projects (CDM/VCS/GS projects and non CDM/VCS/GS projects) is carried out as per sub-steps of Step (2) as follows:

a. As the projects is located in Project Instance 1 in Maharashtra and Project Instances 2, 3, 4 in Andhra Pradesh therefore the projects located in the geographical area of Maharashtra for Project Instance 1 and Andhra Pradesh for Project Instance 2,3,4 have been chosen for analysis. The project activity involves treatment of municipal solid waste. The project activity is located in the Maharashtra state and Andhra Pradesh state of India and the policy applicable for the handling Municipal Solid waste handling is regulated by respective state and zonal Municipal Corporation. The policies/regulation for each state is regulated by respective state and zonal Municipal Corporations and they differ for respective states.

b. The project uses municipal generated solid waste for the processing, therefore projects using municipal solid waste for treatment is considered for analysis.

c. The project produces CNG gas (generated from the municipal waste), therefore those projects producing CNG gas is considered for the analysis.

d. The capacity range of the projects is within the applicable capacity range from the table mentioned in step (1).

e. The start date of the large-scale project activity is the board decision date. Therefore, projects before state date have been considered for analysis.

The Numbers of Similar projects identified, which fulfil above-mentioned condition are

| Particulars | Aurangabad – MH | Tirupati – AP | Piduguralla – AP | Adoni – AP |
|---|---|---|---|---|
| Bio-methantion | 0 | 0 | 0 | 0 |

Step (3): Within the projects identified in Step 2, identify those that are neither registered as CDM/VCS and GS project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number **Nall.**

CDM project activities, which have got registered or are under validation, have been excluded in this step.

| Particulars | Aurangabad – MH | Tirupati – AP | Piduguralla – AP | Adoni – AP |
|---|---|---|---|---|
| Nall | 0 | 0 | 0 | 0 |

**Step (4):** Within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number $N_{diff}$.

As per the tool on Common Practice, the project activities have been separated from the different technologies on the basis two criteria:

3. Size of Installation – Since project activity is large scale project, small and micro scale projects are considered as different technology project. Based on this criteria, there are no any different technology project out of similar identified projects.

4. Investment climate on the date of the investment decision – For proposed project activity, there are no any different technology project considered out of similar identified projects.

Hence, projects where either of the conditions is satisfied those projects are counted for calculating $N_{diff}$ projects.

| Particulars | Aurangabad – MH | Tirupati – AP | Piduguralla – AP | Adoni – AP |
|---|---|---|---|---|
| Ndiff | 0 | 0 | 0 | 0 |

**Step (5):** Calculate factor F=1-Ndiff/Nall representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the propose project activity.

Calculate $F=1-N_{diff}/Nall$

$F = 1-(0/1) = 1$

As per methodological tool "common practice" version 03.1, the proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and Nall-Ndiff is greater than 3.

Thus if both conditions are fulfilled, then project activity will be a common practice otherwise, the project activity is treated as not a common practice.

**Outcome of Common Practice analysis:**

| Particulars | Aurangabad – MH | Tirupati – AP | Piduguralla – AP | Adoni – AP |
|---|---|---|---|---|
| F | Undefined | Undefined | Undefined | Undefined |
| Nall-Ndiff | 0 | 0 | 0 | 0 |

The project instances does not satisfy condition (i) and (ii), the proposed project instance is not a "common practice" within a sector in the applicable geographical area.

**Thus, the proposed project instance is not a "common practice" within a sector in the applicable geographical area.**

The above discussions show that Bio methanation plant development of such magnitude is not a common practice and the project activity is not financially attractive; hence the project activity is additional.

### 3.4.6 Quantification of GHG Emission Reductions and Removals

Assessment team checked the baseline, project and leakage calculation and confirm that the evaluation of baseline, project and leakage is as per the approved methodology and formula used to calculate the same is correct. The detail analysis is as below:

**Baseline Emissions: -**

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 ($tCO_2e$)

$BE_y$ = Baseline Emission in year y($tCO_2e$)

$PE_y$ = Project Emission in the year y ($tCO_2e$)

$LE_y$ = Leakage Emission in Year y ($tCO_2e$)

Also,

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

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

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

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

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

$LE_{Bio\text{-}Methanation,\ y}$ = 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, equation (1) para 41, the baseline emissions would be calculated as:

$$BE_{Bio-methanation,y} = \sum \left(BE_{CH4,t,y} + BE_{WW,y} + BE_{EN,t,y} + BE_{NG,t,y}\right) \times DF_{RATE,t,y}$$

Equation (2)

With:

$$DF_{RATE,t,y} = \begin{cases} 1 - RATE_{compliance,t,y}, & if\ RATE_{compliance,t,y} < 0.5 \\ 0, & if\ RATE_{compliance,t,y} \geq 0.5 \end{cases}$$

Equation (3)

Where,

$BE_{Bio\text{-}Methanation,\ y}$ = Baseline Emissions in year y ($tCO_2e$) from Bio-Methanation project activity.

$BE_{CH4,\ t,\ y}$ = Baseline emissions of methane from the SWDS in year y ($t\ CO_2e$)

$BE_{WW,y}$ = Baseline methane emissions from anaerobic treatment of the wastewater in open anaerobic lagoons or of sludge in sludge pits in the absence of the project activity in year y ($t\ CO_2e$)

$BE_{EN,t,y}$ = Baseline emissions associated with energy generation in year y ($tCO_2e$)

$BE_{NG,t,y}$ = Baseline emissions associated with natural gas use in year y ($t\ CO_2e$)

$DF_{RATE,t,y}$ = Discount factor to account for $RATE_{Compliance,t,y}$

$RATE_{Compliance,t,y}$ = Rate of compliance of a requirement that mandates the use of alternative waste treatment option t in year y

t = Type of alternative waste treatment option

Since the project does not involve any anaerobic treatment of the wastewater, energy generation, natural gas use, the $BE_{ww,y}$ , are considered zero.

Baseline emissions of methane from the SWDS ($BE_{CH4,y}$) is determined using the methodological tool "Emissions from solid waste disposal sites". Therefore, following the tool V8, para 17 Equation (1), the emission is calculated as:

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

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 $CO_2e$/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) |
| $\varphi_y$ | = | Model correction factor to account for model uncertainties for year y |
| $f_y$ | = | Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y |
| $GWP_{CH4}$ | = | Global Warming Potential 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

DOCj = 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

As per the methodology, Application B: The CDM project activity avoids or involves the disposal of waste at a SWDS best outfits the project case, therefore various default values are used as per the methodological tool which are listed in section 4.1

**Project Emissions: -**

The project emission calculation as per para 65 of of ACM0022 version 02,

**For Bio-methanation Project:**

As per consolidated methodology ACM0022 para 65, equation 18, the project emissions from Bio-Methanation ($PE_{Bio\text{-}Methanation}$) 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,

$PE_{Bio\text{-}methanation}$ = Project emissions in year *y* (t $CO_2e$) 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)

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.

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

$$PE_{AD,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{flare,y}$$

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)

$PE_{CH4,y}$ = Project emissions of methane from the anaerobic digester process in year , y

$PE_{flare,y}$ = Project emissions from flaring of biogas in year yCO2e/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 $PE_{flare,y}$ is considered 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.

$$PE_{EC,y} = Q_{CH4,y} \times F_{EC,default} \times EF_{EL,}$$

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption associated with anaerobic digester in year y (t CO2e)

$Q_{CH4,y}$ = 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 (tCO2/MWh)

$$Q_{CH4,y} = Q_{biogas,y} \times f_{CH4,default} \times \varphi_{CH4}$$

Where:

$Q_{CH4,y}$ = 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 ($Nm^3$biogas )

$f_{CH4,default}$ = Default emission factor for the fraction of methane in the biogas

$\varphi_{CH4}$ = Density of methane at normal conditions (t CH4 / Nm3CH4)

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:

$PE_{FC,diesel,y}$ = the CO2 emissions from fossil fuel combustion in Bio-methanation during the year y (tCO2/yr)

$FC_{diesel,Bio-methanation,y}$ = Is the quantity of diesel combusted in Bio-methanation process during the year y (mass or volume unit/yr)

$COEF_{diesel,y}$ = Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)

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

$$COEF_{diesel,y} = NCV_{diesel,y} \times EF_{CO2,i,y}$$

Where:

$COEF_{diesel,y}$ = Is the CO2 emission coefficient of diesel in year y ($tCO_2$/mass or volume unit)

$NCV_{diesel,y}$ = Is the weighted average net calorific value of the diesel in year y (GJ/mass or volume unit)

$EF_{CO2,diesel,y}$ = Is the weighted average $CO_2$ emission factor of diesel in year y (tCO2/GJ)

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

Where:

$PE_{CH4,y}$ = Project emissions of methane from the anaerobic digester in year y (tCO2)

$Q_{CH4,y}$ = Quantity of methane produced in the anaerobic digester in year y(tCH4/yr)

$EF_{CH4,default}$ = Default emission factor for the fraction of CH4 produced that leaks from the anaerobic digester (fraction)

$GWP_{CH4}$ = Global Warming Potential of CH4 (t CO2e/tCH4)

**Leakage Emissions: -**

As per Methodological tool 14 Version 2.0," Project and leakage emissions from anaerobic digesters", The leakage emissions associated with the anaerobic digester ($LE_{AD}$) is

$LE_{AD,y}$ = Leakage emissions associated with the anaerobic digester in year y (tCO2e)

$LE_{storage,y}$ = Leakage emissions associated with storage of digestate in year y(tCO2e)

$LE_{COMP,y}$ = Leakage emissions associated with composting digestate in year y (tCO2e)

In the Project case $LE_{Storage,y}$ is considered zero as the storage lagoon is not un-aerated. Also, $LE_c$, is calculated using the methodological tool "Project and leakage emissions from composting". The term $PE_{comp,y}$ + $LE_{comp,y}$ in the methodological tool "Project and leakage emissions from composting" provides the value for $LE_{comp,y}$ of this tool. Therefore, following equation (6) of this document is used to calculate the $LE_{comp,y}$.

The net emission reduction is calculated as

$$ER_y = BE_y - PE_y - LE_y$$

Where:

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

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

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

| Year | Estimated baseline emissions or removals ($tCO_2e$) | Estimated project emissions or removals ($tCO_2e$) | Estimated leakage emissions ($tCO_2e$) | Estimated net GHG emission reductions or removals ($tCO_2e$) |
|---|---|---|---|---|
| Year 1 | 16,212 | 1,472 | 0 | 14,741 |
| Year 2 | 38,056 | 2,039 | 0 | 36,017 |
| Year 3 | 48,293 | 2,039 | 0 | 46,254 |
| Year 4 | 55,155 | 2,039 | 0 | 53,116 |
| Year 5 | 59,755 | 2,039 | 0 | 57,716 |
| Year 6 | 62,839 | 2,039 | 0 | 60,800 |
| Year 7 | 64,906 | 2,039 | 0 | 62,867 |
| **Total** | **345,217** | **13,707** | **0** | **331,510** |
| **Average** | **49,317** | **1,958** | | **47,359** |

### 3.4.7 Methodology Deviations

Assessment team confirms that No methodology deviation is applicable for the present project activity.

### 3.4.8 Monitoring Plan

To calculate the emission reductions the following parameters are fixed ex-ante as per the approved consolidated baseline and monitoring methodology ACM0022 (Version 2), the Methodological Tool "Emission from solid waste disposal site" version 8.0.

**Parameters determined ex-ante: -**

- Model correction factor to account for model uncertainties (default): Value used is 0.85 which applicable for tropical humid/wet climate conditions as per the Tool "Emissions from solid waste disposal site" /53/ for Application B. Applus confirmed humidity and wet climate condition at the project location on the basis of the data available from the Indian Metrological Department.
- Oxidation factor (OX): Value used is 0.1, default value as per the Tool "Emissions from solid waste disposal site";
- Fraction of methane in the SWDS gas (F): Default value of 0.5, as per the applicable Methodology Tool "Emissions from solid waste disposal site".
- Methane correction factor ($MCF_{default}$): 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".
- Decay rate for waste type ($k_j$): 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; DoE confirms that the project location falls under wet tropical conditions with MAP> 1000 and MAT> 20°C)
- Global warming potential of nitrous oxide ($GWP_{CH4}$) as 25 in accordance with methodological tool, valid for the second commitment period. The values are sourced from the IPCC fourth assessment report- Direct global warming potentials.
- Emission factor for $CH_4$ emissions from the composting process ($EF_{CH4, default}$)- 0.002 $tCH_4$/tonnes of waste composted, default value as per the methodological tool "Project and leakage emissions from composting", Version 02.0.0
- 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.
- Weighted average emission factor, $CO_2$ Baseline Database for the Indian Power Sector, Version 15.0 ($EF_{EF_{j,y}}$) – 0.83 $tCO_2$/MWh
- Default emission factor for fossil fuel consumed by the composting activity per tonne of waste composted (wet basis), ($EF_{FC,default}$) – 0.0207 t $CH_4$ / t, default value as per CDM methodological tool 13, ver. 2.0
- Value for the fraction of methane in the biogas, ($f_{CH_4, default}$) – 0.6 $m^3CH_4$ / $m^{3,}$ default value was derived based on reported values from registered projects and research papers (Davidsson, 2007) and CDM Tool 14, ver. 2.0
- Density of methane at normal conditions ($\Phi_{CH4}$)- 0.00067 $m^3CH_4$ / $m^3CH_4$, default value taken from CDM Tool, ver. 2.0

- Emission factor for the fraction of CH4 produced that leaks from the anaerobic digester( $EF_{CH4,\ default}$) – 0.028 T $CH_4$leaked / t $CH_4$ produced, default value taken from IPCC (2006)
- Net calorific value of diesel ($NCV_{diesel,y}$)- 43 TJ/Gg, default taken from IPCC guidelines for National GHG inventories, 2006.
- Weighted avg. Carbon dioxide emission factor of diesel ($EF_{CO2,diesel,y}$) – 74.10 $tCO_2$/TJ, default value taken from India's National communication to UNFCCC IPCC 2006 default values

**Parameters determined ex-post: -**

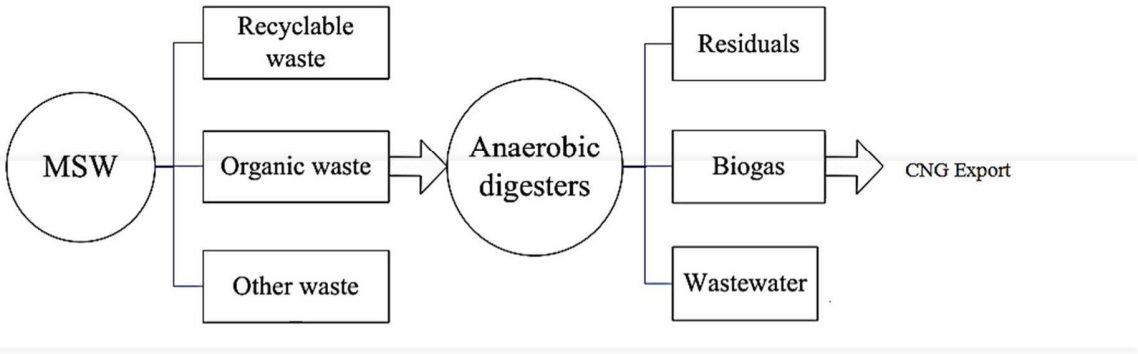
- **Amount of electricity consumed from the grid as a result of project activity ($EC_{,pj,y}$):** Grid electricity consumed by the project site. The value will be continuously monitored using the electricity meters installed by the state electricity board. Calibration frequency will be once in five 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.
- **Wx**; Total amount of solid prevented from disposal in the landfill in the year x. Monitoring frequency: Continuously, aggregated at least annually for year x. The weighbridge used for weighing shall be regularly calibrated in accordance with the manufacturer's specification. As confirmed during site visit and calibration records, calibration of electronic weighbridge will be done annually. Plant record for total solid waste reached at site maintained at site electronically as well as manually.
- **$Q_y$**; Quantity of waste composted in year y (wet basis). This will be weighed through weighbridge.
- **Amount of electricity consumed from the grid as a result of project activity ($EC_{,pj,y}$):** Grid electricity consumed by the project site. 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.
- **$FC_{i,j,y}$** : Mass or volume units of fuel consumed: Stores department maintain record of total fuel consumed in DG set as confirmed during site visit.
- **-$RATE_{Compliance,\ y}$**; Rate of compliance: Monitored ex-post based on the information (like annual report) to be provided by the municipal bodies.
  The $RATE_{complaiance}$ measurement procedures as per the methodology "Fraction is calculated as the number of instances of compliance divided by the number of instances of compliance plus non compliances". 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 Applus and found the rate of compliance considered is appropriate.

- $Q_{biogas,y}$ : Amount of bio gas collected in the digester outlet in year y. The values will be obtained from Log book data maintained by the plant personnels.
- **DOC content in % of wet waste ($DOC_j$):** The fraction of degradable organic carbon in the waste type (DOCj). The value will be obtained from the project participant declaration as there are doing monthly testing for waste.

**For Bio-Methanation Project: -**

The monitoring plan defines the standards and rules according to which the emission reductions of the project activity are monitored and verified in conformance with all relevant requirements of the VCS. The monitoring plan and procedures can be updated and adjusted to meet the operational requirements.




**Use of the Monitoring Plan (MP) by the Site Operator:**

This Monitoring Plan identifies key performance indicators of the project and sets out the procedures for metering, monitoring, calculating and verifying the ERs generated by the compost plant, annually. Adherence to the instructions in the Monitoring Plan will be issued to the operator to measure and track the impact of the project on the environment. The MP is thus the basis for the production of ERs and accreditation of the ERs within the VCS mechanism. The operation of the composting facilities will be documented in a quality control program, monitoring the conditions and procedures that ensure the aerobic condition of the waste during the composting process.

| AGENT | DELIVERABLE |
|---|---|
| | Overall responsible for completeness of data, reliability of data (calibration of meters, weighing machines measuring samples) and monthly report generation. Following shall be measured and recorded: |

| | |
|---|---|
| | *1)* Electricity consumption for equipment used on site. Data can be collected from electricity meter installed by state electricity board (a kWh-instrument).<br>*2)* Fuel consumption for equipment used on site. Data can be based upon the received invoices for fuel. Operator shall keep/file receipt of invoices.<br>✓ Produced compost that is trucked off of site.<br>✓ Quantity of waste supplied to the compost plant will be measured by weighing on a weighbridge as described in the Monitoring plan. This information is required for calculation of the ER's<br>✓ Measurement of the composition of the incoming waste in accordance with the procedure as indicated in the sampling plan.<br>✓ Number and detail of vehicles that bring in the waste and the vehicles that transport compost to the end user. |

**Training and maintenance procedures:**

Training of the staff on good practices of composting would also take place as and when found necessary. A document control system will be implemented by the plant manager in order to ensure proper storage of the monitored data and other relevant documents.

**Emergency Procedures for monitoring system:**

The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

## 3.5 Non-Permanence Risk Analysis

Not applicable for the present project activity.

# 4 VERIFICATION FINDINGS

## 4.1 Accuracy of GHG Emission Reduction and Removal Calculations

| | |
|---|---|
| **Means of verification** | The verification team assessed whether the data and calculations of GHG emission reductions achieved resulting from the Joint VCS PD & MR. The verification team has checked whether calculations of baseline GHG emissions, project GHG emissions and leakage GHG emissions have been carried out in accordance with the formulae and methods described in the monitoring plan of the Joint VCS PD & MR. |
| **Findings** | CL 00 & CAR 08 raised on this section and closed successfully. Please refer Appendix 2 for further details |

**Conclusion**

**Baseline Emissions: -**

$$BE_{CH4,SWDS,y} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \times \sum_{x=1}^{3} \sum (W_{j,i} \times DOC_j \times e^{(-k_j \times (y-x))} \times (1 - e^{-k_j}))$$

| Project Instance Sites | Using the default and monitored values ($BE_{Bio\text{-}methanation, y}$) |
|---|---|
| Aurangabad (30 TPD) | 4,419 |
| Adoni (20 TPD) | 2,530 |
| Piduguralla (20 TPD) | 1,898 |
| Tirupati (40 TPD) | 4,118 |
| Total | 12,963(Rounded Down) |

Since the project does not involve any anaerobic treatment of the wastewater, energy generation, natural gas use, the $BE_{WW,y}$ , $BE_{EN,t,y}$ , $BE_{NG,t,y}$ is considered zero.

**Project Emissions: -**

Project emission is calculated using equation (7):

$$PE_{Bio-methanation\ y} = PE_{COMP,y} + PE_{AD,y} + PE_{GAS,y} + PE_{RDF\_SB,y} + PE_{INC,y}$$

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.

Therefore, project emission due to anaerobic digestion is calculated as

$$PE_{AD,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{flare,y}$$

$$PE_{EC,y} = Q_{CH4,y} \times F_{EC,default} \times EF_{EL,}$$

$$Q_{CH4,y} = Q_{biogas,y} \times f_{CH4,default} \times \varphi_{CH4}$$

| Project Instance Sites | Using the default and monitored values $Q_{CH4, y}$ |
|---|---|
| Aurangabad (30 TPD) | 118 |
| Adoni (20 TPD) | 1 |
| Piduguralla (20 TPD) | 22 |
| Tirupati (40 TPD) | 37 |
| Total | 178 |

$PE_{EC,y}$ = 0

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

| Project Instance Sites | Using the default and monitored values $PE_{FC,diesel,y}$ |
|---|---|
| Aurangabad (30 TPD) | 0.61 |
| Adoni (20 TPD) | 0.35 |
| Piduguralla (20 TPD) | 0.61 |
| Tirupati (40 TPD) | 0.38 |
| Total | 1.95 |

| Project Instance Sites | Using the default and monitored values $PE_{Bio-methanation, y}$ |
|---|---|
| Aurangabad (30 TPD) | 85 |
| Adoni (20 TPD) | 1 |
| Piduguralla (20 TPD) | 17 |
| Tirupati (40 TPD) | 27 |
| Total | 130(Roundup) |

**For Bio-methanation Project:** As per Methodological tool 14 Version 2.0," Project and leakage emissions from anaerobic digesters", The leakage emissions associated with the anaerobic digester $LE_{AD,y}$ is



$$LE_{AD,y} = LE_{Storage,y} + LE_{Comp,y}$$

Where:

$LE_{AD,y}$= Leakage emissions associated with the anaerobic digester in year y (tCO2e)

$LE_{Storage,y}$ = Leakage emissions associated with storage of digestate in year y (tCO2e)

$LE_{Comp,y}$ = Leakage emissions associated with composting digestate in year y(tCO2e)

In the Project case $LE_{Storage,y}$ is considered zero as the storage lagoon is not un-aerated.

Also, $LE_c$, is calculated using the methodological tool "Project and leakage emissions from composting". The term $PE_{comp}$ + $LE_{comp}$, in the methodological tool "Project and leakage emissions from composting" provides the value for $LE_{Comp}$ ,of this tool. Therefore, following equation (6) of this document is used to calculate the $LE_{comp}$,. **As per section 3.3 and using Equation (6),** $LE_{comp,\ y}$

$$LE_{Comp,y}\ is\ PE_{COMP,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{N20,y} + PE_{RO,y}$$

The value for $LE_{Comp}$ is Negligible considered as zero.

| Project Instance Sites | Using the default and monitored values $LE_y$ |
|---|---|
| Aurangabad (30 TPD) | 0 |
| Adoni (20 TPD) | 0 |
| Piduguralla (20 TPD) | 0 |
| Tirupati (40 TPD) | 0 |
| Total | 0 |

The total emission reduction achieved in current monitoring period is

$ER_y=BE_y - PE_y - LE_y$

=12,833 tCO2e

Where,

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

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

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

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

= 12,833 $tCO_2$:

The verification team has checked the entire monthly plant records/ log book for the monitoring period as per the project activity applied for verifications and found all the parameters are monitored and recorded as per the monitoring plan in the Joint VCS PD & MR. The verification team has crosschecked the emission reduction sheet and monitoring report data with the plant records and invoice bills and found all the values are matching.

Applus checked the ER sheet and found the below summary of project wise emission reductions for each vintage, correct and in line with applied methodologies.

Further breakdown of credit generation from each plant:

| Bio Methanation (Aurangabad – 30 TPD) | | | | |
|---|---|---|---|---|
| **Monitoring Period** | **Baseline Emissions ($BE_y$)** | **Project Emissions ($PE_y$)** | **Leakage Emissions ($LE_y$)** | **Emission Reductions ($ER_y$)** |
| | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** |
| 2019(01/05/2019 to 31/12/2019) | 908 | 29 | 0 | 879 |
| 2020 (01/01/2020 to 31/12/2020) | 3511 | 56 | 0 | 3455 |
| **Total** | **4419** | **85** | **0** | **4,334** |

| Bio Methanation (Adoni – 20 TPD): | | | | |
|---|---|---|---|---|
| **Monitoring Period** | **Baseline Emissions ($BE_y$)** | **Project Emissions ($PE_y$)** | **Leakage Emissions ($LE_y$)** | **Emission Reductions ($ER_y$)** |
| | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** |
| 2019(01/05/2019 to 31/12/2019) | 0 | 0 | 0 | 0 |
| 2020 (01/01/2020 to 31/12/2020) | 2530 | 1 | 0 | 2529 |
| **Total** | **2530** | **1** | **0** | **2,529** |

| Bio Methanation (Tirupati - 40 TPD): | | | | | |
|---|---|---|---|---|---|
| **Monitoring Period** | | **Baseline Emissions ($BE_y$)** | **Project Emissions ($PE_y$)** | **Leakage Emissions ($LE_y$)** | **Emission Reductions ($ER_y$)** |
| | | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** |
| 2019(01/05/2019 to 31/12/2019) | | 327 | 4 | 0 | 323 |
| 2020 (01/01/2020 to 31/12/2020) | | 3790 | 23 | 0 | 3767 |
| **Total** | | **4118** | **27** | **0** | **4,091** |

| Bio Methanation (Pidugaralla – 20 TPD): | | | | | |
|---|---|---|---|---|---|
| **Monitoring Period** | | **Baseline Emissions ($BE_y$)** | **Project Emissions ($PE_y$)** | **Leakage Emissions ($LE_y$)** | **Emission Reductions ($ER_y$)** |
| | | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** | **($tCO_2e$)** |
| 2019(01/05/2019 to 31/12/2019) | | 572 | 2 | 0 | 570 |
| 2020 (01/01/2020 to 31/12/2020) | | 1326 | 15 | 0 | 1311 |
| **Total** | | **1898** | **17** | **0** | **1,881** |

## 4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

| | |
|---|---|
| **Means of verification** | The verification team checked the break down log for the monitoring period. During the verification site visit, the location of all relevant meters of the project is also checked. The Calibration details of the monitoring meters are also checked with calibration certificates. Calibration details of all relevant meters, weighbridge checked and found to be ok. Details of calibration provided in Annex. 5 of the report. |

| | |
|---|---|
| **Findings** | No CAR/CL raised on the section. |
| **Conclusion** | All parameters which need to be monitored for verification such as total waste received at site, amount of bio gas generated and other parameters sourced from plant records/ log book also cross checked with stores.<br>The meters installed at various plants are controlled by plant owner except energy which is under the control and supervision of state electricity board officials. Similarly, Site operator is responsible for monitoring of relevant parameters at different locations of bio methanation plants.<br>It is reported that the data will be kept for 2 years following the end of the crediting period or till the last issuance of VERs for the project activity whichever occurs later. The responsibilities and authorities of project management, data handling and recording, measurement methods and QA/QC procedure have been systematically established and formalized and the same was verified during the site visit.<br><br>During remote audit with O&M personnel also confirms that the operational and organizational chart as mentioned in Joint VCS PD & MR is as per the site practice and thus assessment team confirms that the details are correct. |

# 5 VALIDATION AND VERIFICATION CONCLUSION

Validation Conclusion: -
Applus+ Certification has been engaged by "**Mahindra Waste to Energy Solutions Ltd."** to perform the Joint validation and verification of the "**Waste to Energy Projects by Mahindra Waste to Energy Solutions Limited.**"

The management of the project participant/owner is responsible for the preparation of the GHG emissions data and the reported/estimated GHG emissions reductions on the basis set out within the project's Monitoring Plan in the Joint VCS PD & MR and the approved methodologies; ACM0022, Ver. 2.0

**Our Validation approach** was based on the requirements as defined under the Kyoto Protocol, Marrakesh accord, as well as those defined by the CDM Executive Board and VCS board. Our approach is risk-based, drawing on an understanding of the risks associated with estimated GHG emissions data and the controls in place to mitigate these. The validation can confirm that:

- The projects description compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline version 4.0 and standard version 4.1.

- The project's baseline and additionality are assessed against "ACM0022, Ver. 2.0.
- The project's monitoring plan is assessed against "ACM0022, Ver. 2.0.
- A risk-based approach has been followed to perform this validation activity. The review of the project description and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews with Project Owner have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence for positive validation opinion as per the requirement of VCS.

  The project is expected to generate 331,510 tCO2e during the length of entire crediting period (01/05/2019 to 30/04/2026).

  **Verification Conclusion: -**

  Our Verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakesh accord, as well as those defined by the CDM Executive Board. 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 operated as planned and described in the project document;
  - The monitoring plan is as per the applied methodology;
  - The monitoring process in Monitoring Report is as per the PD
  - The development and maintenance of records and reporting procedures are in accordance with the monitoring plan;
  - 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.
  - No limitation observed for the present verification

    Verification period: 01/05/2019 to 31/12/2020 (first and last date included) Verified GHG emission reductions and removals in the above verification period:

| Year | Baseline emissions or removals ($tCO_2e$) | Project emissions or removals ($tCO_2e$) | Leakage emissions ($tCO_2e$) | Net GHG emission reductions or removals ($tCO_2e$) |
|---|---|---|---|---|
| 2019(01/05/2019 to 31/12/2019) | 1,806 | 35 | - | 1,771 |

| | | | | |
|---|---|---|---|---|
| 2019(01/01/ 2020 to 31/12/2020) | 11,157 | 95 | - | 11,062 |
| **Total** | 12,963 | 130 | | 12,833 |

The ER estimated during the current monitoring period (611 days) is 79,278. The ER generated during the current monitoring period is 84 % less than the estimated values, which is conservative.

Applus+ Certification has checked the calculation in ER sheet and confirmed that estimated ER is calculated using the unitary method. The daily VERs generation is calculated using the ratio of annual average generation of the commissioned plant by the number of days in a year, then the calculated daily VERs generation is multiplied with the monitoring duration of the project.

# APPENDIX 1: <DOCUMENTS REVIEW UNDER VALIDATION & VERIFICATION>

| No. | Author | Title | References to the document | Provider |
|---|---|---|---|---|
| 1. | NA | Commissioning certificates | Commissioning certificates | Project participant |
| 2. | NA | Contract of the PP with the DOE | Contract of the PP with the DOE | Project participant |
| 3. | NA | Technical specifications | Technical specifications Of Bio methanation plant from manufacturers | Project participant |
| 4. | NA | Draft Joint VCS PD&MR Version 01<br>Revised Joint VCS PD&MR Version 02<br>Final Joint VCS PD & MR Version 03 | 06/02/2020<br><br>28/04/2021 | Project participant |
| 5. | NA | Emission Calculation sheet- version 01- Estimated ER<br>Emission Calculation sheet- Version 02- Estimated ER | 06/02/2020<br><br>19/04/2021 | Project participant |
| 6. | NA | Emission Calculation sheet- version 01– Actual ER<br><br>Emission Calculation sheet- Version 02– Actual ER | 10/01/2021<br><br>19/04/2019 | Project participant |
| 7. | NA | IRR calculation sheet Ver-01 | 19/04/2021 | |
| 8. | NA | The operational lifetime of the project activity from the manufacturer= (Technical specifications) | Manufacturer technical specifications | Project participant |

| | | | | |
|---|---|---|---|---|
| 9. | NA | Reference link is provided. | SERC order of the respective states<br>RBI: Reserve Bank of India<br>www.rbi.org.in<br>Ministry of Environment and forest:<br>www.envfor.nic.in<br>UNFCCC<br>www.cdm.unfccc.int<br>CEA: Central electricity authority<br>www.cea.nic.in<br>Income tax act 1961<br>http://law.incometaxindia.gov.in/DIT/<br>VCS: Verified Carbon Standard www.v-c-s.org | Independent Search |
| 10. | NA | Tools/ guidelines used in the project activity | UNFCCC CDM web site<br>• Tool to determine the remaining lifetime of the project activity in line with Annex 15 EB 50<br>• Tool to calculate the emission factor for an electricity system version 07<br>• UNFCCC Methodology: ACM0022, ver. 2.0<br>• Glossary of CDM terms version 07<br>• VCS joint validation and verification report template Version 3.1<br>Tool for the demonstration and assessment of additionality version 06 &07 | UNFCCC |
| 11. | NA | Calibration details of the project activity undergoing verifications | Please refer to Appendix 5 | Project participant |
| 12. | NA | DPR | DPR for Individual project owners | Project participant |
| 13. | NA | Plant records + log book | JMR records+ Invoices for the respective states | Project participant |
| 14. | NA | Consents from MPCB & APPCB | Consent to establish and operate from MPCB & APPCB | Project participant |

| | | | | |
|---|---|---|---|---|
| 15. | NA | VCS Declaration | Declaration from PP for Participation under Other GHG Programs | Project participant |
| 16 | NA | Declaration for DOCj | Declaration from PP for DOCj | Project participant |
| 17. | NA | CA Certificate | Actual project cost certificate | Project participant |
| 18. | NA | CPCB Annual reports | https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2017-18.pdf<br>https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2018-19.pdf | Project participant |

# APPENDIX 2: < CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS, FORWARD ACTION REQUESTS (CAR/CL/FAR) >

| CAR ID | 01 | Section no. | 1.1 | Date: 11/02/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| During the document review it was observed that<br>1. Joint PD-MR submitted is in template of VCS ver. 3.0. PP is requested to provide PD-MR in latest template of VCS 4.0<br>2. In table, PP shall confirm plant location, capacity and their commissioning status<br>3. In sec. 1.1, PP shall provide brief description of the scenario prior to the implementation of the project along with an estimate of annual average and total GHG ERs and GHG removal for the entire crediting period. The total GHG ERs generated in this monitoring period is also missing<br>Declaration from PP regarding participation in other trading / GHG programs, rejection under other GHG program etc. is missing. PP requested to submit the same. | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |
| 1. The Latest version of VCS-Joint PD – MR Version 4.0 is now being used and Hence Revised Joint PD-MR.<br>2. The plant location, capacity, and their commissioning date of projects is now updated in section 1.1.<br>3. The brief description of the prior implementation scenarios of the project along with the annual average and total GHR ER has been updated in the Revised monitoring report.<br>4. The Declaration has now been submitted to the assessment team mentioning that the participation in other trading / GHG programs, rejection under other GHG program. | | | | |
| **Documentation provided by project participant** | | | | |
| Revised VCS PD-MR Version 2.0<br>Declaration Letter | | | | |

| DOE assessment | Date: 23/04/2021 |
|---|---|
| 1. PP has submitted joint PDMR, ver. 02 dated 19/04/2021 in latest VCS ver. 4.0 template. **Comment closed.**<br>2. PP has now provided plant location, capacity and their commissioning status in sec. 1.1 of revised joint PDMR, ver. 02 dated 19/04/2021. However, capacity of the Tirupati plant is not consistent with the capacity mentioned on commissioning certificate issued by Tirupati Municipal Council. **Comment open**<br>3. PP has provided description of baseline scenario along with total estimated GHG reduction over entire crediting period and GHG reduction achieved in current monitoring period in sec. 1.1 of revised PDMR, ver. 02 dated 19/04/2021. **Comment closed**<br>4. PP has provided declaration dated 07/04/2021 regarding no double counting. VVB checked and found the same in line. **Comment closed.** | |

| CAR ID | 02 | Section no. | 1.5, 1.6, 1.7 | Date:11/02/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| 1. PP shall provide evidence for Project start date<br>2. PP shall update Project start date and duration of crediting period in sec. 1.6<br>3. PP shall provide rationale for categorizing Project activity under Project category in line with VCS Standard 4.0 | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |
| 1. The commissioning certificate of first commissioned Bio-methanation plant in the project activity has been provided which can be considered as start date of Project activity as per VCS Standard 4.0.<br>2. The Project start date and duration of crediting period has been updated in section 1.6 of the monitoring report.<br>3. The rationale for categorizing project activity under the project category in the monitoring report has been updated in line with VCS Standard 4.0 | | | | |
| **Documentation provided by project participant** | | | | |
| Commissioning Certificate<br><br>Revised Joint PD-MR Version 4.0 | | | | |
| **DOE assessment** | | | | **Date: 23/04/2021** |
| 1. Commissioning certificate provided by PP as evidence for Project start date. VVB confirms the same in line with guidelines of VCS, ver. 4.0. **Comment closed.** | | | | |

| |
|---|
| 2. PP has now corrected the Project start date and date of crediting period in the revised PDMR, ver. 02 dated 19/04/2021. **Comment closed**.<br>3. PP has now provided explanation regarding categorization of Project in revised PDMR, ver. 02 dated 19/04/2021. **Comment closed.** |

| **CAR ID** | 03 | **Section no.** | 3.1 | **Date:**11/02/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| PP requested to provide commissioning certificates and technical specifications of all bio methanation plant involved in the project activity. | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |
| The Commissioning certificates and technical specification of all bio-methanation plant in project activity is now provided to assessment team. | | | | |
| **Documentation provided by project participant** | | | | |
| Commissioning certificates<br><br>Technical specifications | | | | |
| **DOE assessment** | | | | **Date: 23/04/2021** |
| PP has provided commissioning certificates and DPRs which contain technical specification of the plants for all four locations. **Comment closed.** | | | | |

| **CAR ID** | 04 | **Section no.** | 2.4, 2.5 | **Date:**11/02/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| 1. PP shall demonstrate how most plausible baseline scenario identified in line with para 5.1 of applied methodology.<br>2. In sec. 2.5, PP shall explain how approach for selecting additionality demonstration selected in line with para 5.1 of applied methodology<br>3. Description provided in sec. 5.1 suggests that financial barrier chosen to prove additionality but detailed calculation and supporting spread sheet is missing. PP shall provide supporting documents for all input parameter/ assumptions considered for demonstration of additionality | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |

| |
|---|
| 1. *The baseline scenario in line with para 5.1 of applied methodology has been updated in the joint PD & MR.*<br>2. *Sec. 2.5 of the joint PD & MR has been revised in line with para 5.1 of applied methodology; including the approach followed for selecting additionality demonstration.*<br>3. *Detailed calculation and supporting spread sheet to prove additionality is being submitted along with this submission to the DOE.*<br>4. *Further all the supporting documents is being provided to the DOE along with this submission.* |
| **Documentation provided by project participant** |
| *IRR Sheet*<br><br>*DPR*<br><br>*Certificate of Establishment*<br><br>*Certificate to Operate* |

| **DOE assessment** | **Date: 23/04/2021** |
|---|---|
| 1. PP has identified most plausible baseline scenario in line with applied methodology in revised PDMR, ver. 02 dated 19/04/2021. **Comment closed**.<br>2. PP has made necessary correction in sec. 3.4 and 3.5 of revised PDMR, ver. 02 dated , 19/04/2021 to arrive on approach to be adopted for demonstration of additionality in line with applied methodology. **Comment closed.**<br>3. PP has provided IRR sheets for all the instances involved in the Project activity along with supporting documents used for investment analysis. **Comment closed.** | |

| **CAR ID** | 05 | **Section no.** | 3.1 & 3.3.6 | **Date:**11/10/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| PP shall provide ER spread sheet along with all supporting documents/ web links. | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |
| The ER sheet and along with all supporting documents/weblinks is now being provided to the assessment team. | | | | |
| **Documentation provided by project participant** | | | | |
| Revised ER Sheet Version 2.0 | | | | |
| **DOE assessment** | | | | **Date: 23/04/2021** |
| PP has provided ER sheets for calculation of estimated ER as well as actual ERs achieved for current monitoring period. **Comment closed.** | | | | |

| CAR ID | 06 | Section no. | 3,4,5,6 | Date:11/02/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| Sec. 3.0, 4.0, 5.0 and 6.0 are incomplete. PP shall update these sections in line with latest version of PD-MR template, ver. 4.0 | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |
| The Sec 3.0, 4.0, 5.0, 6.0 are updated in the monitoring report in line with the latest version of VCS PD – MR template version 4.0 | | | | |
| **Documentation provided by project participant** | | | | |
| Revised VCS PD -MR Version 2.0 | | | | |
| **DOE assessment** | | | | **Date: 23/04/2021** |
| PP has now updated all the sections in revised PDMR, Ver. 02 dated 19/04/2021 in line with latest template of VCS ,ver. 4.0. **Comment closed.** | | | | |

| CAR ID | 07 | Section no. | 5.3 | Date:11/02/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| PP is requested to provide supporting documentation for Local Stakeholders consultation conducted for all project activities (invitation/ public notice/ Summary of consultations/ agenda etc.). | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |
| The Supporting documents for local stakeholders consultation for all project activity is being provided to the assessment team. | | | | |
| **Documentation provided by project participant** | | | | |
| Local stakeholder consultation documents | | | | |
| **DOE assessment** | | | | **Date: 23/04/2021** |
| PP has provided supporting documents of LSC conducted at all 4 sites. **Comment closed** | | | | |

| CAR ID | 8 | Section no. | 5.2 | Date:11/02/2021 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| PP is requested to provide all relevant consents/ clearance needed from State pollution control Board and other statutory bodies. | | | | |
| **Project participant response** | | | | **Date: 19/04/2021** |
| The all relevant consents/clearance for all project sites is being provided to the assessment team. | | | | |
| **Documentation provided by project participant** | | | | |
| Consents letters for all project sites | | | | |
| **DOE assessment** | | | | **Date: 23/04/2021** |
| PP provided all applicable consents issued from State Pollution control Board for all the Project locations. **Comment closed.** | | | | |

# APPENDIX 3: < COMPETENCE OF TEAM MEMBER AND TECHNICAL REVIEWER>

Validation/Verification Team Member: -

| No. | Role | Type of resource | Last name | First name | Affiliation (e.g. name of central or other office of DOE or outsourced entity) | Involvement in | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Desk review | On-site inspection | Interview(s) | Validation/Verification findings |
| 1. | Lead Auditor/ Technical Expert | OR | Kumar | Pankaj | TQC-Outsourced entity | Yes | No | Yes | Yes |

Technical Reviewer and Approver of the Validation and Verification/Certification Report: -

| No. | Role | Type of resource | Last name | First name | Affiliation (e.g., name of central or other office of DOE or outsourced entity) |
|---|---|---|---|---|---|
| 1. | Technical reviewer (TR) | EI | Shen | Simon | LGAI Technological Center S.A. (Applus+ Certification) |
| 2. | Approver | IR | Calle de Miguel | Agustín | LGAI Technological Center S.A. (Applus+ Certification) |

Shorts CV of the Team: -

1. **Mr. Pankaj Kumar** worked as team leader – Bihar for South Asia Climate Proofing and Growth Development (CPGD) – Climate Change Innovation Programme (CCIP) supported by DFID that seeks to mainstream climate change resilience into planning and budgeting at the national and sub-national level in India, Pakistan, Nepal, and Afghanistan. Pankaj Kumar has worked previously with IL&FS Infrastructure Development Corporation and BUIDCO (Bihar Urban Infrastructure Development Corporation), Govt. Of Bihar as Environmental Specialist for WB & ADB funded projects. Prior to this, he worked with Carbon Check (UNFCCC accredited DoE), Johannesburg, RSA as Team Leader for validation, verification of around 100 GHG projects in Asia, Africa, USA, Asia Pacific &

Americas. Pankaj is accredited Lead Auditor, Validator, Verifier and Technical Expert for Sectoral Scope/Technical Area –1.1, 1.2, 3.1 & 13.1 by UNFCCC DoE (Designated Operational Entity), APPLUS, Spain. He is also member of task force on climate change & human health, Health

Department, GoB and on roster of UNICEF's WASH experts. He is an experienced, qualified and result oriented Environment Professional having more than 14 yrs. Of relevant experience in Climate Change (Mitigation &Adaptation), Environmental Due Diligence, Disaster Risk Reduction, Validation and Verification of GHG project under CDM, Verified Carbon Standard, Gold Standard & Social Carbon Standard, Brazil. He provides technical support for environmental investigative, consultative and remedial projects involving air, water and soil, Waste management, EIA, Environmental Compliance, ISO 14001, OHSAS 18001, GHG accounting (ISO 14064) and Carbon foot printing Pankaj Kumar is Masters in Environment Management from Forest Research Institute (University), I.C.F.R.E, Dehradun, which is Centre of Excellence in South East Asia for Forestry education & research and PGDEL from National Law School of India University, Bangalore (India).

2. **Mr. Simon Shen** (Master Degree in Thermal Energy Engineering, Bachelor Degree in Environmental Engineering) is a Lead Auditor appointed by Applus+ LGAI for the GHG project assessment. He is based in Shanghai. He has several years of work experience in environmental protection field. Before he joined Applus+ LGAI, he had been worked for TÜV SÜD as a GHG Validator/Assessment team and ISO 9001/14001 Lead Auditor for 5 years.

# APPENDIX 4: < ABBREVIATIONS>

| Abbreviations | Full texts |
|---|---|
| CAR | Corrective Action Request |
| CDM | Clean Development Mechanism |
| CER | Certified Emission Reduction(s) |
| CEA | Central Electricity Authority |
| CL | Clarification request |
| CERC | Central Electricity Regularity Commission |
| CMS | Central Monitoring system |
| CO2 | Carbon dioxide |
| CO2e | Carbon dioxide equivalent |
| DNA | Designated National Authority |
| DOE | Designated Operational Entity |
| DR | Document Review |
| EF | Emission Factor |
| EIA | Environmental Impact Assessment |
| ER | Emission Reductions |
| FAR | Forward Action Request |
| GHG | Greenhouse gas(es) |
| OM | Operating Margin |
| GWP | Global Warming potential |
| JMR | Joint Metering reading |
| RBI | Reserve Bank Of India |
| SEB | State Electricity Board |
| SERC | State Electricity Regularity Commission |

# APPENDIX 5: < CALIBRATION DETAILS>

Bio-Methanation Plants: -

Aurangabad Plant (30 TPD): -

Weighbridge Details: -

| | | | |
|---|---|---|---|
| S.NO | 1/1 (Rs.4000) | | |
| MAX Capacity | 40000 Kg | | |
| Make | Prime & Automation | | |
| Model | Class III | | |
| Minimum Capacity | 100 Kg | | |
| Minimum Value | 5 Kg | | |
| Calibration Date | 24/04/2019 | Validity | 23/04/2020 |
| Calibration Date | 28/08/2019 | Validity | 27/08/2020 |
| Calibration Date | 26/08/2020 | Validity | 25/08/2021 |

Electricity Meter Details: -

| | | | |
|---|---|---|---|
| S. No | X1082365 | | |
| Class | 0.5 Sec | | |
| Calibration Date | 22/02/2019 | Validity | 21/02/2024 |

Tirupati Plant (40 TPD): -

| | |
|---|---|
| S.NO | WB1321 (Rs.2500) |

| | | | |
|---|---|---|---|
| MAX Capacity | 50000 Kg | | |
| Make | Prime & Automation | | |
| Model | Class III | | |
| Minimum Capacity | 100 Kg | | |
| Minimum Value | 5 Kg | | |
| Calibration Date | 20/08/2019 | Validity | 19/08/2020 |
| Calibration Date | 08/06/2020 | Validity | 07/06/2021 |

Electricity Meter Details: -

| | | | |
|---|---|---|---|
| S. No | X0774356 | | |
| Class | 0.5 Sec | | |
| Calibration Date | 26/06/2019 | Validity | 25/06/2024 |

Piduguralla Plant (20 TPD): -

| | | | |
|---|---|---|---|
| S.NO | 130408 | | |
| MAX Capacity | 60000 Kg | | |
| Make | LOTUS | | |
| Model | Class III | | |
| Minimum Capacity | 200 Kg | | |
| Minimum Value | 5 Kg | | |
| Calibration Date | 25/05/2019 | Validity | 24/05/2020 |
| Calibration Date | 23/05/2020 | Validity | 22/05/2021 |

Electricity Meter Details: -

| | | | |
|---|---|---|---|
| S. No | 18259357 | | |
| Class | 0.2 Sec | | |
| Calibration Date | 04/09/2017 | Validity | 03/09/2022 |

Adoni Plant (20 TPD): -

| | | | |
|---|---|---|---|
| S.NO | 041 | | |
| MAX Capacity | 40000 Kg | | |
| Make | WEITRANS | | |
| Model | Class III | | |
| Minimum Capacity | 100 Kg | | |
| Minimum Value | 5 Kg | | |
| Calibration Date | 06/02/2020 | Validity | 05/02/2021 |

Electricity Meter Details: -

| | | | |
|---|---|---|---|
| S. No | X0773812 | | |
| Class | 0.2 Sec | | |
| Calibration Date | 09/09/2019 | Validity | 08/09/2024 |