# PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

**Title:** 24 MW RDF based Electricity Generation Power Plant at Jawahar Nagar, Hyderabad

Version 1.2

Date 21/09/2024

First CoU Issuance Period: 02 years, 10 months, 12 Days

Date: 20/08/2020 to 30/06/2023

Project Concept Note (PCN)
CARBON OFFSET UNIT (CoU) PROJECT

## BASIC INFORMATION

| | |
|---|---|
| Title of the project activity | 24 MW RDF based Electricity Generation Power Plant at Jawahar Nagar, Hyderabad. |
| Scale of the project activity | Large Scale |
| Completion date of the PCN | 21/09/2024 |
| Project participants | M/s Hyderabad MSW Energy Solutions Private Limited. |
| Host Party | INDIA |
| Applied methodologies and standardized baselines | Applied Baseline Methodology: ACM0022" Alternative waste treatment processes" Version 3.0. |
| Sectoral scopes | 01 Energy industries (Renewable/Non-Renewable Sources)<br>13 Waste handling and disposal |
| Estimated amount of total GHG emission reductions | 93,618 CoUs (93,618 $tCO_2eq$) per annum |

## SECTION A. Description of project activity

A.1. Purpose and general description of Carbon offset Unit (CoU) project activity >>

The project, RDF based Power Generation Plant is located in Jawahar Nagar Village, Medchal-Malkajgiri District, State Telangana, Country INDIA.

The details of the project are as follows:

**Purpose of the project activity:**

Municipal Solid Waste (MSW) to Electricity Generation is one of the major waste-to-energy technologies that allows MSW to be directly combusted into waste-to-energy facilities as a fuel with minimal processing (known as Mass Burn). Alternatively, the technology also allows combustion of Refuse Derived Fuel (RDF) that is produced after the MSW undergoes moderate to extensive processing. This technology presents the opportunity for both electricity production as well as an alternative to land filling or composting of MSW.

The 24 MW Municipal Solid Waste to electricity generation project essentially undertakes the generation of electricity from the Refuse Derived Fuel produced from the municipal solid waste of the city of Hyderabad.

The production of electricity from processed municipal solid waste i.e., RDF and synchronizing with grid was done at the project site located at Jawahar Nagar village, Medchal-Malkajgiri District, Telangana. The technology provides yet another source of renewable energy similar to that of wind energy and solar energy for power generation best suited for energy intensive Indian cities. The input fuel (RDF) is a coal substitute, further unlike coal, RDF has no shellac and has less ash content.

This project activity was therefore considered for execution and commissioning with following motives:

1.Creating a continuous demand for the RDF, thus creating a market for MSW projects based on RDF technology leading to reduction in development of new dumping sites for disposal of municipal solid waste, thus avoiding greenhouse gas emissions.
2. Reduction in generation of anthropogenic emissions from generation of electricity from a renewable source of energy thereby developing it as a potential UCR project.
3. Employment generation and improving the standard of living of rag pickers by converting them into skilled workers and securing their future as permanent employees to the company.
4. Proving the new technology thereby leading way for successful implementation of replication of similar projects across the country and other tropical regions across the globe.

The project is commissioned on 20/08/2020 and signed power purchase agreement on 19/02/2020 with TSSPDCL (Telangana State Southern Power Distribution Company Limited)

**Contribution to sustainable development:**

The project activity is a renewable electricity generation project. The generated electricity is exported to the Telangana state grid which is a part of the Indian grid, connected to the national grid of India which is largely fossil fuel dominated, thus emissions to atmosphere are reduced.

## A.2 Do no harm or Impact test of the project activity>>

There was no harm identified from the project and hence no mitigations measures are applicable.

The project has received environmental clearance from State level Environment Impact Assessment Authority, Andhra Pradesh (SEIAA). This project is covered under category B as per EIA, for which state level Environment Impact Assessment Authority is empowered to appraise the project for grant of Environmental clearance. There are social, environmental, economic and technological benefits which contribute to sustainable development.

**Environmental benefits:**

The project activity consumes RDF, which is a renewable source for energy and is derived by processing Municipal Solid Waste. Hence the project activity leads to reduction in municipal solid waste dumping in landfills. The project activity also leads to conservation of water, through reduction of water consumption at the power plant by introducing an air-cooled condenser unit instead of the standard water-cooled condenser unit. Even the rain water is drained out through dedicated drains, it is not mixed with the waste water generated within the project activity. The waste water (leachate) generated in the project activity is treated in leachate treatment plant, which is a closed unit in the site. There is no chance of rain water mixing with this waste water and drained out. The treated water is used within the facility for other operations. The landfills that are operated to accommodate the rejects/inerts, also has separate drains and is well managed and waste water is collected and treated with no harmful disposal outside the project. Thus there is no harm to any water bodies.

**Social benefits:**

The project activity has been essentially conceptualised to provide electricity to the national grid. The generated electricity is being fed into the local grid sub-station for leading to strengthening of the grid both in terms of frequency as well availability of electricity.

**Economical Benefits:**

The project activity has generated employment for the local community as well as for rag pickers leading to their economic wellbeing.

**Technological Benefits:**

Successful implementation of the project activity would lead to further diffusion of technology for treatment of waste generated in India.

## A.3. Location of project activity >>

Country: INDIA.
District: Medchal-Malkajgiri
Village: Jawahar Nagar
State: Telangana
Pin Code: 500087

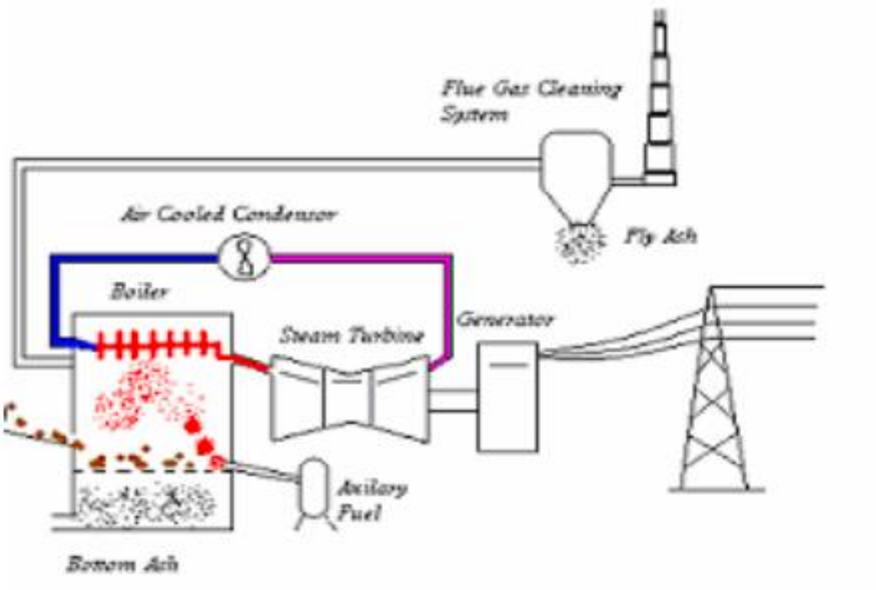

The project location is situated in village Jawahar Nagar of Medchal-Malkajgiri district in the state of Telangana. The nearest railway station to the project site is at Secundrabad. The project location can be approached by road with a distance of 3 Kms from Jawahar Nagar. Nearest Airport is Rajeev Gandhi International Airport.

The geographic co-ordinate of the project locations is 17°31’04.3” N and 78° 35’12.42” E

## A.4. Technologies/measures >>

The project activity is 24 MW (gross) capacity grid connected RDF based renewable energy project

Typical process flow diagram: -




Technical details of the major equipment

| Equipment | Make | Details | Quantity |
|---|---|---|---|
| Boiler | WUXI HUAYUN POWER ENGINEERING CO., LTD. | Fuel: - 600 TPD<br>Steam Flow: 65 TPH<br>Steam Temp: - 410+/-5 DEG c | 2 |
| Turbine | HTC | inlet Steam: -130 TPH<br>Pressure: -45 Kg/Cm$^2$ | 1 |
| compressor | KOBELCO OIL-FLOODED SCREW COMPRESSOR | Air capacity: -10 m$^3$/hr | 4 |
| Generator | TDPS | Capacity: - 24 Mw<br>Full load current: -1574 amp | 1 |
| Cooling Tower | Paharpur | 500 m$^3$/h (1w+1S)<br>type: -Counter flow with FRP construction | 2 |
| DCS | SUPCON | 10000 I/O<br>5 controllers ECS 700 with standby | 1 |
| FGCS Bag filter | Wuxi Huaxing Electric Power | Flue gas flow: -146339 Nm3/hr<br>No of bags: - 105 / compartment<br>No. of compartments: - 16 | 2 |
| ACC | HTC | No of fans: - 8<br>exhaust steam quantity: - 121500 Kg/hr<br>Temp: - 57.2 Deg c | 1 |

| Equipment | Make | Details | Quantity |
|---|---|---|---|
| Generator Transformer | QRE | Rating: -28/35 MVA<br>Rated Voltage: - 132 KV HV<br><br>11 KV LV<br>Rated Current: 122.47/153.09 AMP HV<br><br>1469.62/1837.02 AMP LV | 1 |

The project uses renewable fuel like RDF. Thus, RDF based projects have practical availability of fuels for running of plant and thus use of coal (GHG emission) is not required for running of plant.

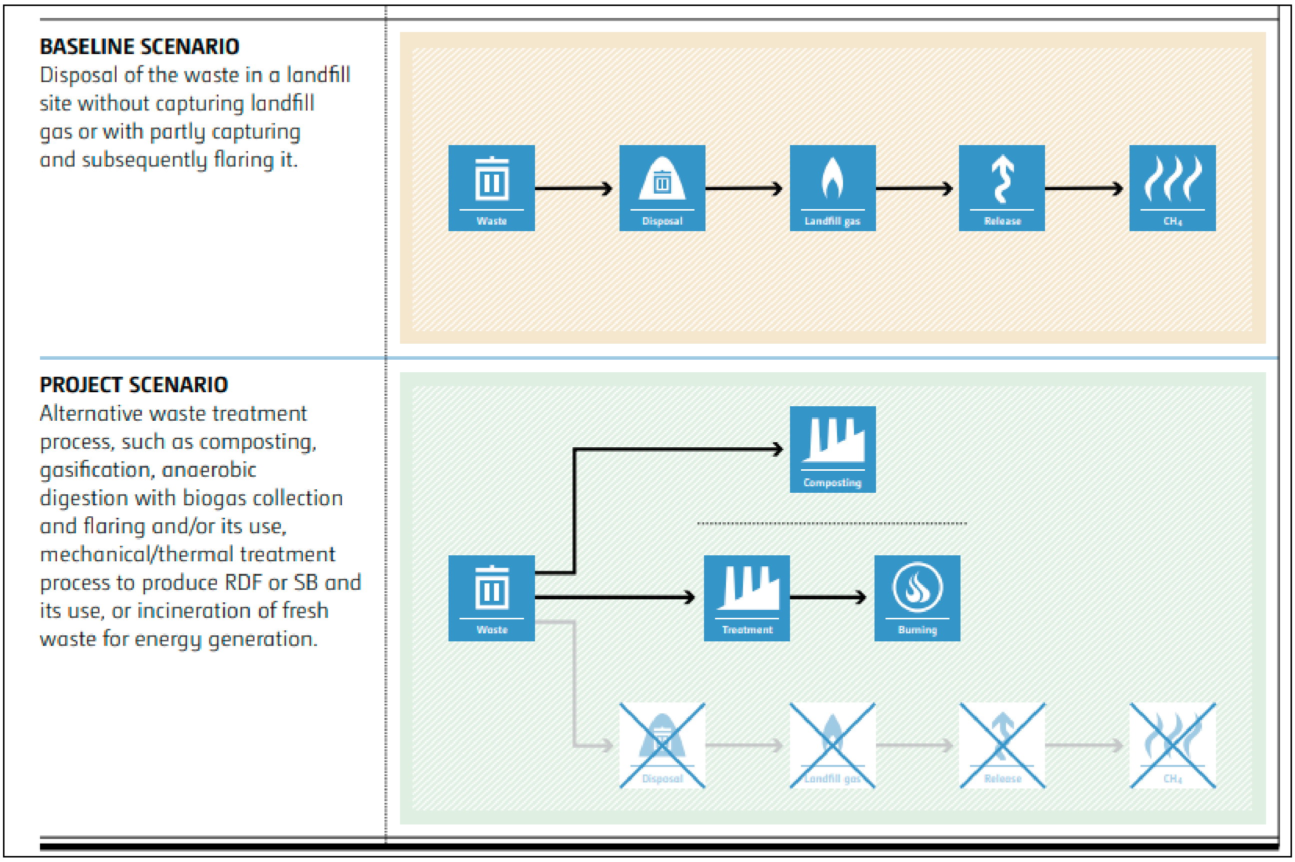
The power plant has a condensing steam turbo generator with travelling grate boiler capable of firing fuels, resulting in efficient burning of RDF

## A.5. Parties and project participants >>

| Party (Host) | Participants |
|---|---|
| INDIA | **M/s Hyderabad MSW Energy Solutions Private Limited.**<br>Address: Survey no: 173, Jawahar nagar village, Kapra Mandal, Medchal-Malkajgiri District, Hyderabad, Telangana, 500087 |

## A.6. Baseline Emissions>>

The baseline emissions is calculated as detailed below in section B.5.
The project involves avoidance of GHG emission as $CH_4$ emissions due to anaerobic decay of organic waste are avoided by alternative waste treatment processes. MSW land filling without capture of landfill gas is identified as the baseline scenario, which involve emission from MSW land filling (open dumping on land) without capture of land fill gas, adjusted for the compliance rate.
Further the project involves use of organic waste (RDF) as renewable energy source. For electricity generation, electricity generation in existing and/or new grid-connected electricity plants is identified as the baseline scenario. Baseline emissions from electricity generation is calculated as the net kWh produced by the renewable generating unit multiplied by an emission factor (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner.




## A.7. Debundling>>

This Grid Connected RDF based power generation plant at Jawahar Nagar, Hyderabad project is not a debundled component of a project activity.

## SECTION B. Application of methodologies and standardized baselines

### B.1. References to methodologies and standardized baselines >>

SECTORAL SCOPE – 01, Energy industries (Renewable/Non-renewable sources)
SECTORAL SCOPE – 13 Waste handling and disposal

The applied CDM methodologies - ACM0022: Alternative Waste Treatment Process, Version 03, EB 111, Annex 7

### B.2. Applicability of methodologies and standardized baselines >>

The project activity meets the applicability guidelines they are:
.
Title: ACM0022: Alternative Waste Treatment Process, Version 03, EB 111, Annex 7

1. Tool 3: Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion version 03, EB 96, Annex 4.
2. Tool 4: Tool Emissions from solid waste disposal sites; version 08.1, EB 94, Annex 7.
3. Tool 5: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation; version 3.0, EB 96, Annex 5

*Table 1: Applicability of Methodology ACM0022,version 03.0*

| Applicability of ACM0022 | Justification |
|---|---|
| This methodology covers project activities implementing and operating new plants for the treatment of fresh waste, that would otherwise be disposed in a solid waste disposal site (SWDs) | This project activity processes fresh pre-sorted municipal waste(RDF) for generation of electricity, as per the latest Consent to Operate granted by AP Pollution Control Board, dated 10.03.2022 Project proponent will ensure that processing of Incineration of fresh waste alone is considered for claiming GHG emission reduction. Hence the project activity conforms to this criteria. |
| This methodology applies to project activities that install and operate new plants for the treatment of fresh waste through any combination of the following processes<br>(a) Composting process under aerobic conditions<br>(b) Anerobic digestion with biogas recovery and flaring and/or its use<br>(c) Co-composting of wastewater in combination with solid waste<br>(d) Anaerobic co-treatment of wastewater in combination with solid waste<br>(e) Mechanical/thermal treatment process to produce refuse- | This project uses Incineration of fresh waste/RDF to produce electricity, hence the criteria is applicable. |

| | |
|---|---|
| derived fuel (RDF) of stabilized biomass (SB) that is produced within the project boundary and its use<br>(f) Gasification process to produce syngas and its use<br>(g) Incineration of fresh waste for the generation of thermal/electric energy | |
| The project plant only treat fresh waste/wastewater for which emission reductions are claimed, except for cases involving compositing, co-composting and anaerobic digestion. | Project proponent will ensure that RDF from processing of fresh waste alone is considered for claiming GHG emission reduction under this project activity. |
| Neither the fresh waste nor the products from the project plant are stored on-site under anaerobic conditions | Project participants will ensure that only fresh waste is not stored in anaerobic conditions in the RDF manufacturing facility |
| Any wastewater discharge resulting from the project actiivty is treated in accordance with applicable regulations | Applicable, as waste water generated in the project activity is treated onsite and used within the operations. |
| The project activity does not reduce the amount of waste that would be recycled in the absence of the project activity. This shall be justified and documented in the clean development mechanism project design document (CDM-PDD) | The project activity will not reduce use of recyclable wastes as sorting and separation of recyclable from waste received is done at site prior to feeding waste to the boiler |
| When applicable regulations mandate any waste treatment process implemented under the project activity, the rate of compliance with such regulations for the treatment process is below 50 per cent | As per the "Annual Report 2020-21 on Implementation of Solid Waste Management Rules, 2016 " by CPCB, waste to energy plants using incineration is zero of combustible MSW generated for Telangana state.<br>As per reports available only 22-28 % of the waste collected is treated.<br>https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2020-21.pdf |
| Hazardus waste/wastewater are not eligible under this methodology | No hazardous waste/waste water is treated in the project activity and so not applicable |
| The methodology is only applicable if the baseline scenario is :<br>(a)The disposal of the fresh waste in a SWDs with or without a partial LFG capture system (M2 or M3) | As discussed in the baseline scenario is that fresh muncipal waste is disposed in the SWDS, where organic matter is broken down through uncontrolled anaerobic processes, releasing methane into the atmosphere.<br>Disposal of the fresh waste in a SWDs with or without a partial LFG capture system is the common practice followed in India as evident from the discussion in base line scenario. |
| b) In the case of co-composting or co-treatment of wastewater in an anaerobic digector, the treatment of organic waste in either an existing or new anaerobic lagoon or sludge pit | Not applicable |

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| without methane recovery (W1 ir W4) | |
| In the case of electricity generation, the electricity is generated in an existing/new captive fossil fuel fired power-only plant, captive cogeneration plant and/or the grid (P2, P4 or P6) | The project activity is a green field project which involve generation and export of electricity to the grid system by installing a new waste to energy plant. In the absence of the project activity the equivalent amount of electricity would have been met by the existing/new grid connected power plant and hence scenario is considered as the baseline alternative, as discussed in section B.5 . Therefore, the this applicability criterion is complied by the project activity |
| In the case of heat generation, the heat is generated in an existing/new fossil fuel fired cogeneration plant, boiler or air heater (H2 or H4) | Not applicable, as the project activity involves power generation facility without co-generation of steam |

### B.3. Applicability of double counting emission reductions >>

This project activity is not registered with any other GHG program for carbon credits prior to this monitoring period. Hence this project will not cause any double accounting of carbon credits. Further

- Project is uniquely identifiable based on its location coordinates,
- Project has dedicated commissioning certificate and connection point,
- Project is associated with energy meters which are dedicated to the consumption point of the user and grid.

## B.4. Project boundary, sources and greenhouse gases (GHGs)>>

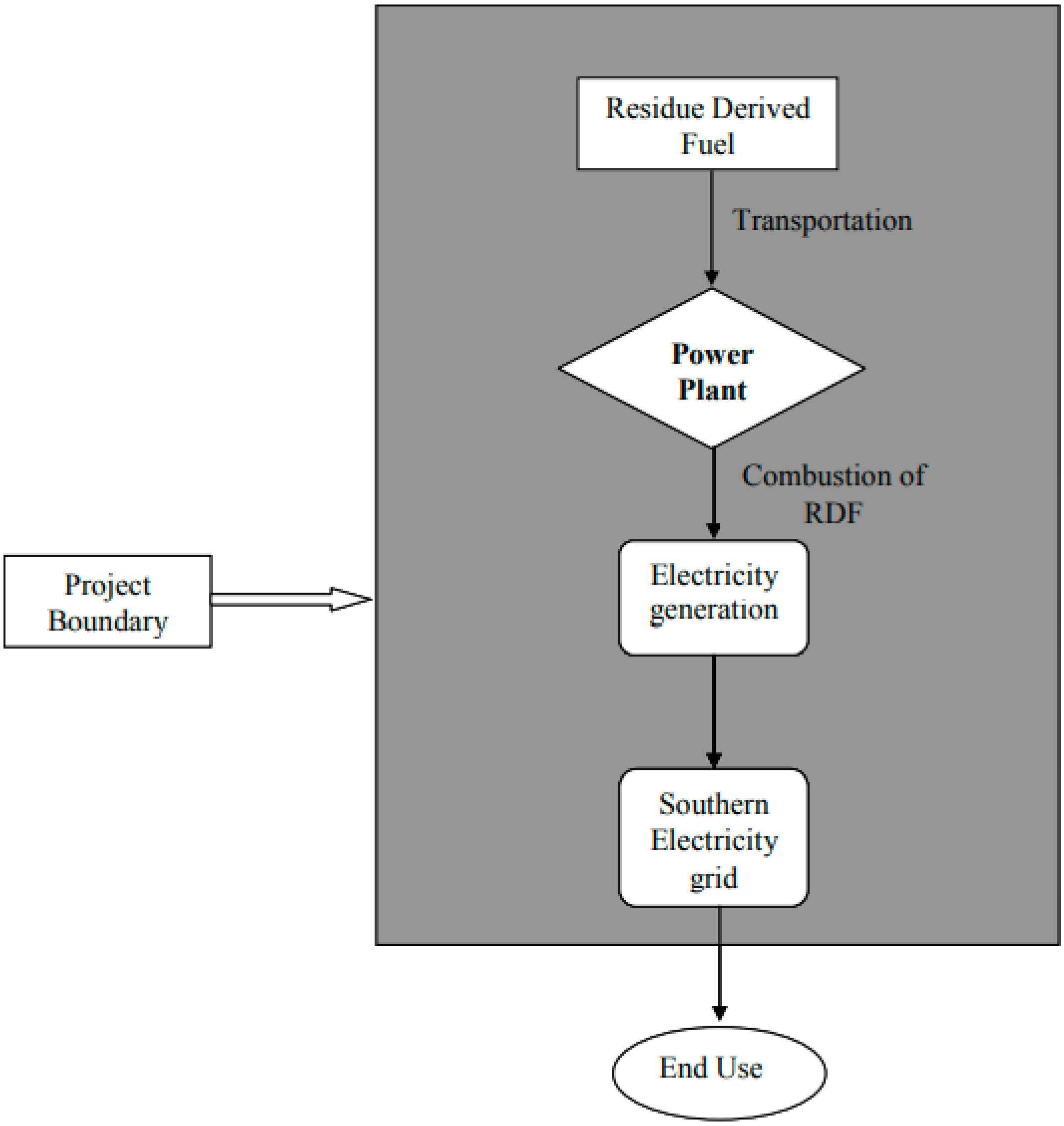
A pictorial representation of the project boundary is given below. The project boundary is limited to geographical boundary of the project sites; i.e., the site where all the facilities of the project are located. The following project activity and the emission sources are considered within the project boundary.

| Source | | GHG | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Emissions from heat generation | $CO_2$ | Excluded | The baseline scenario does not involve heat generation |
| | | $CH_4$ | Excluded | The baseline scenario does not involve heat generation |
| | | $N_2O$ | Excluded | The baseline scenario does not involve heat generation |
| | Emissions from decomposition of waste at SWDs | $CO_2$ | Excluded | $CO_2$ emissions from decomposition of fresh waste are not accounted as GHG emissions as per EB 20, annex 8 |
| | | $CH_4$ | Included | The main source of emission in the baseline |
| | | $N_2O$ | Excluded | $N_2O$ emissions are small compared to $CH_4$ emissions from landfills. Exclusion of this gas is conservative |
| | Emissions from anaerobic lagoons or sludge pits | $CO_2$ | Excluded | The baseline scenario does not include anaerobic lagoons |
| | | $CH_4$ | Excluded | The baseline scenario does not include anaerobic lagoons |
| | | $N_2O$ | Excluded | The baseline scenario does not include anaerobic lagoons |
| | Emissions from electricity generation | $CO_2$ | Included | Electricity is generated from incineration of pre-sorted MSW. |
| | | $CH_4$ | Excluded | Excluded for simplification and thereby conservative. |
| | | $N_2O$ | Excluded | Excluded for simplification and thereby conservative. |
| | Emissions form Natural gas | $CO_2$ | Excluded | The baseline scenario does not involve supply of natural gas |
| | | $CH_4$ | Excluded | The baseline scenario does not involve supply of natural gas |
| | | $N_2O$ | Excluded | The baseline scenario does not involve supply of natural gas |
| Project Activity | Emissions from on-site fossil fuel consumption due to the project activity other than for electricity generation | $CO_2$ | Included | On-site fossil fuel shall be used in the project activity for transportation of RDF-waste and products within the project site and hence, the emission due to on-site fossil fuel consumption shall be included |
| | | $CH_4$ | Excluded | Excluded for simplification. This emission source is assumed to be very small. |
| | | $N_2O$ | Excluded | Excluded for simplification. This emission source is assumed to be very small. |
| | Emissions from on-site electricity use | $CO_2$ | Included | $CO_2$ emissions from on-site electricity use are accounted. |
| | | $CH_4$ | Excluded | Excluded for simplification. This emission source is assumed to be |

| | | | | |
|---|---|---|---|---|
| | | | | very small and not related to project |
| | | $N_2O$ | Excluded | Excluded for simplification. This emission source is assumed to be very small and not related to project |
| | Emissions from the on-site waste treatment processes | $CO_2$ | Included | $CO_2$ emissions from RDF combustion is included. |
| | | $CH_4$ | Included | $CH_4$ may be emitted from RDF combustion. Inclusion of this gas is conservative. |
| | | $N_2O$ | Included | $N_2O$ may be emitted from RDF combustion. Inclusion of this gas is conservative |
| | Emissions from wastewater treatment | $CO_2$ | Excluded | $CO_2$ emissions from the decomposition of fresh waste are not accounted as GHG emissions as per EB 20, annex 8 |
| | | $CH_4$ | Excluded | No treatment of wastewater is employed in the project activity. |
| | | $N_2O$ | Excluded | Excluded for simplification. This emission source is assumed to be very small. |

The spatial extent of the project boundary is the SWDS where the waste is disposed of in the baseline, and the site of the alternative waste treatment process(es)(this project). The boundary also includes on-site electricity generation and supply to grid , on-site fuel use and the wastewater treatment plant used to treat the wastewater by-products of the alternative waste treatment process(es). The project boundary does not include facilities for waste collection and transport.

The project boundary is depicted in the figure below




## B.5. Establishment and description of baseline scenario >>

As per the guideline provided in applied approved methodology ACM0022, version03.0 the Step 1 of the latest version 07 of "Tool 02: Combined tool to identify the baseline scenario and demonstrate additionality" has been applied to identify the most plausible and realistic baseline scenario. The step wise description on identification of baseline scenario is given below:

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
For the treatment of the fresh waste, the following alternatives or combinations of these alternatives shall, inter alia, be considered

M 1: The project activity without being registered as a CDM project activity (i.e., any (combination) of the waste treatment processes listed in Table 2 (of the applied methodology ACM0022, version 03.0)

This project involves generation of electricity from RDF by burning the waste(RDF) in a boiler for steam generation and utilising the steam for power generation.

The project utilises dry waste having calorific value of above 1500 kcal/kg (like rubber, textiles etc) including non-biodegradable components. Hence the relevant treatment process of Table 2 is incineration. This option is in compliance with all the mandatory laws and regulations and has been considered as a baseline alternative.

M 2: Disposal of the fresh waste in a SWDs with a partial capture of the LFG and flaring of the captured LFG.
The common practice in Hyderabad is to dump the MSW generated in a designated open landfill which does not have a provision for landfill gas capture.
There are no mandatory rules or regulations which restrict or mandate the installation of an LFG capture system at the SWDS with flaring of the captured LFG. Hence, this option is considered as a baseline alternative.

M 3: Disposal of the fresh waste in a SWDS without an LFG capture system
Currently, all waste generated is collected, transported and disposed in the designated landfill sites in Hyderabad without landfill gas capture and flaring system, this is the 'business as usual' scenario and is considered as a baseline alternative

M 4: Part of the fresh fraction of the solid waste is recycled and not disposed in the SWDS
The project activity involves burning of RDF (that is prepared for fraction of solid waste) in boilers for steam generation and utilizing the steam for power generation. RDF is manufactured in the project boundary.. Hence, this alternative is not considered as a baseline alternative.

M 5: Part of the fresh fraction of the solid waste is treated aerobically and not disposed in the SWDS
The project activity involves no RDF manufacturing. Hence, this alternative is not considered as a baseline alternative for the project activity.

M 6: Part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS
The project activity involves use of RDF manufactured from MSW by burning this RDF in boiler for steam generation and utilizing the steam for power generation. That is, this alternative is a part of the project activity under consideration and therefore not considered as a baseline alternative

M 7: Part of the organic fraction of the solid waste is gasified and not disposed in the SWDS
The project activity involves use of RDF manufactured from MSW by burning this RDF in boiler for steam generation and utilizing the steam for power generation. As the combustible fraction of pre-sorted waste used in the project activity is not suitable for gasification, this baseline alternative is considered as not feasible in the case of the project activity.
.
M 8: Part of the organic fraction of the solid waste is treated in an anaerobic digester and not disposed in the SWDS
The project activity involves use of RDF manufactured from MSW by burning this RDF in boiler for steam generation and utilizing the steam for power generation. As the combustible fraction of pre-sorted waste used in the project activity is not suitable for anerobic digestion, this baseline alternative is considered as not feasible in the case of the project activity.

M 9: Part of the organic fraction of the solid waste is mechanically or thermally treated to produce RDF/SB and not disposed in the SWDS.

The project activity doesn’t involve RDF manufacturing but RDF is bought and used for burning in boiler for steam generation and utilizing the steam for power generation. That is, this alternative is a part of the project activity under consideration and therefore 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 approved consolidated baseline and monitoring methodology, ACM0022 version 03.0- “alternative waste treatment processes”, version 03.0
M2: Disposal of the fresh waste in a SWDS with a partial capture of the LFG and flaring of the captured LFG
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
(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, the 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 03.0 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 1 of approved consolidated baseline and monitoring methodology ACM0022-“alternative waste treatment processes”, version 03.0
The project activity involves RDF burning in boilers for steam generation and utilization of steam for power generation. The project activity investment from project proponent and generates revenue through sale of electricity. However, without revenue from Carbon credits the return from the investment is not sustainable. The alternative does not face any barrier other than insufficient financial return.

M2: Disposal of the fresh waste in a SWDS with a partial capture of the LFG and flaring of the captured LFG.

This alternative is not economically viable since it involves infrastructural investment and no revenue accruing out of the activity. Moreover, it is not mandatory as per the MSW 2000 rules, to implement landfill gas capture and flaring. Thus, alternative M2 faces investment barriers and is not a realistic scenario.

M 3: Disposal of the fresh waste in a SWDS without an LFG capture system

Currently waste is disposed in the SWDS where organic matter is broken down through uncontrolled anaerobic processes, releasing methane into the atmosphere.
This is the common practice followed in India as evident from the MSW annual report by CPCB, giving “

Annual Report 2020-21 on Implementation of Solid Waste Management Rules, 2016". 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 only two alternatives which do not face any barrier, M1 and M3. M1 is the project activity under consideration without CDM revenue which does not have attractive financial return as explained step 3 – Investment Analysis. Thus, the only plausible baseline alternative is M3 –Disposal of the fresh waste in a SWDS without an LFG capture system. The same does not face any of the barriers as mentioned above. Thus, it is ascertained that continuation of the current scenario i.e., disposal of MSW on designated landfills without the destruction or capture of landfill gas is the baseline scenario

For electricity generation the following alternative or combinations of these alternatives, inter alia. Shall be considered

P 1: Electricity generated as an output of one of the waste treatment processes listed in table 1, not undertaken as a CDM project activity

The plant utilizes RDF for burning in boiler for generating steam and utilising steam for power generation. This is in compliance with all the mandatory laws and regulations and has been considered as a baseline alternative.

P 2: Use of an existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant

The project is waste to energy plant involving burning of RDF in boilers for steam generation and utilizing steam for power generation. There is no cogeneration of steam under the project activity. Hence, the alternative is not plausible scenario.

P 3: Existing or new construction of an on-site or offsite renewable based cogeneration plant

The project is waste to energy project involving burning of RDF in boilers for steam generation and the steam is utilised for power generation. There is no cogeneration of steam under the project activity. Hence, the alternative is not plausible scenario.

P 4: Existing or new construction of an on-site or off-site fossil fuel fired electricity plant

The project is waste to energy project and is implemented to generate power from MSW and export the electricity to grid. The project is an Independent Power Plant (IPP) and will not supply electricity to any facility/factory of the project participants. Since, there is no on-site demand for captive power (except for auxiliary equipment for MSW treatment power generation at project site), there is no requirement to setup on-site fossil fuel fired or renewable based captive power plant. Thus, P4 is not considered as realistic alternatives to the proposed project activity

P 5: Existing or new constriction of an on-site or off-site renewable based electricity plant

The project is waste to energy project and is implemented to generate power from MSW and export the electricity to grid. The project is an Independent Power Plant (IPP) and will not supply electricity to any facility/factory of the project participants. Since, there is no on-site demand for captive power (except for auxiliary equipment for MSW treatment power generation at project site), there is no requirement to setup on-site fossil fuel fired or renewable based captive power plant. Thus, P5 is not considered as realistic alternatives to the proposed project activity

P 6: Electricity generation in existing and/or new grid-connected electricity plants

The project activity involves generation and export of electricity to the grid system by installing a new waste to energy plant. In the absence of the project activity; the equivalent amount of electricity would have been met by the existing/new grid connected power plant. Therefore, P6 is considered as the most realistic and credible baseline alternative for power generation.

Conclusion

Thus, as discussed in details in section B.5 of PSF, in the absence of the Project activity, the most likely baseline scenario is:

• M3- Disposal of the waste on a landfill (SWDS) without the capture of landfill gas.

• P6 - Existing and/or new grid-connected power plants.

Among the above two scenarios, M3 does not involve any investment as a project and is continuation of current practice. There is no investment required (except land cost, which is generally owned by municipal authorities or provided by govt) for the scenario and has been wide spread and practiced in India.

The alternative P6 is generation of power at grid connected power plants. However, the projects in the grid system are mix of various sources of energy and are dominated by conventional power generation and is business as usual scenario, without any prohibitive barriers for operations

Sub-step1b- Enforcement of applicable laws and regulations

The applicable law in the waste management sector in India is MSW Rule 2000(subsequently amended in 2016). The law stipulates that all municipalities in the country should implement effective MSW treatment facilities by 2003. Thus, all the above alternatives M1, M2 & M3 meets legal requirement in India, but the compliance rate of Indian Municipal Corporations with the MSW Rule 2000 is much less than 50% since municipalities across the country faces acute resource crunch (both financial and technical) to set up modern MSW processing plant.

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

The baseline fuels identified are fossil fuels (coal, gas and diesel), which contribute to more than 50% of the Indian National grid installed capacity and energy generation(https://cea.nic.in/dashboard/?lang=en).

Availability of these baseline fuels are abundant in the country, based on the fuel reserve estimates and various publications. Hence, there is abundant availability of baseline fuel and no supply constraint in the country exists.

Step 3: Barrier analysis

The project was commissioned in Hyderabad, India where the compliance of the MSW rules is poor. This poor compliance rate is because of various barriers faced by the municipalities to implement advanced waste management plant.

All the alternatives except land filling (open dumping on land) without capture of land fill gas faces considerable prohibitive barriers for implementation, which is evident from the above data. This makes the land filling without capture of landfill gas as the baseline scenario. This is the most prevalent mode of waste disposal in the country. Thus electricity generation from fossil fuels will be the baseline scenario. For baseline emissions calculation requires grid emission factor.

A "grid emission factor" refers to a $CO_2$ emission factor ($tCO_2$/MWh) which will be associated with each unit of electricity provided by an electricity system. An emission factor of 0.9 $tCO_2$/MWh for the 2014- 2020 years, recommended by the UCR as a fairly conservative estimate for Indian projects not previously verified under any GHG program is used for baseline emission calculation. Also, for the vintage 2021, the combined margin emission factor calculated from CEA database in India results into same emission factor. Hence, the same grid emission factor of 0.9 $tCO_2/MWh$ has been considered for the entire monitoring period, as a conservative measure.

**Net GHG Emission Reductions and Removals**

To calculate the emission reductions the project participant shall apply the following equation:
$ER_y = (BE_y - PE_y - L_y)$
Where:
$ER_y$ is the emissions reductions in year y (t $CO_2e$)
$BE_y$ is the emissions in the baseline scenario in year y (t $CO_2e$)
$PE_y$ is the emissions in the project scenario in year y (t $CO_2e$)

Baseline Emissions

As per the applied methodology Approved consolidated baseline and monitoring methodology ACM0022- "Alternative waste treatment processes", Version 03.0., baseline emissions are determined according to equation and comprise the following sources:

$$BE_y = \sum_t \left(BE_{CH4,t,y} + BE_{WW,t,y} + BE_{EN,t,y} + BE_{NG,t,y}\right) \times \left(1 - RATE_{compliance,t}\right)$$

Where:

$BE_y$ = Baseline emissions in year y ($tCO_2e$)
$BE_{CH4,t,y}$ = Baseline emissions of methane from the SWDS in year y ($tCO_2e$)
$BE_{WW,t,y}$ = 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 ($tCO_2e$)
$BE_{EN,t,y}$ = 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 ($tCO_2e$)
$RATE_{compliance,t}$ = Discount factor to account for the rate of compliance of a regulatory requirement that mandates the use of alternative waste treatment process t
t = Type of alternative waste treatment process

**Computation of Baseline emissions of methane from the SWDS in year y ($BE_{CH4,t,y}$):**

As per approved consolidated baseline and monitoring methodology, ACM0022: Alternative waste treatment processes --- Version 3.0, baseline methane emissions from the SWDS are determined using the latest "TOOL04: Emissions from solid waste disposal sites" version 08.0. The following requirements shall be complied with when applying the tool:

a) $W_{j,x}$ in the tool is the amount of organic fresh waste prevented from disposal in the baseline SWDS due to its treatment in any (combination) alternative waste treatment process;

$W_{j,x}$ as mentioned in the said tool is the amount of organic fresh waste prevented from disposal in the baseline SWDS due to its treatment by the project activity

b) Emission amounts are calculated using Application B in the Tool. Only fresh waste avoided from disposal after the start of the first crediting period shall be considered;

Emissions shall be calculated using Application B in the said Tool.

c) Sampling to determine the fractions of different waste types is necessary (note that for the case that the waste is combusted in the project activity, then the parameter $Q_{j,c,y}$ in this methodology is equivalent to the variable $W_{j,x}$ in the tool);

A sampling procedure shall be followed to determine the fraction of different waste types in the project activity.

d) The tool instructs that $f_y$ shall be determined based on historic data or contract or regulation requirements specifying the amount of methane that must be destroyed/used (if available). The following additional instruction applies:

i) If the regulation requirements specify a percentage of the LFG that is required to be flared, the amount shall equal $f_y$.;
ii) If the regulation requirements do not specify the amount or percentage of LFG that should be destroyed but require the installation of a capture system, without requiring the captured LFG to be flared then $f_y = 0$; and
iii) If the requirement does not specify any amount or percentage of LFG that should be destroyed but require the installation of a system to capture and flare the LFG, then it is assumed $f_y = 0.2$.

In the absence of the project activity there was no capturing and flaring of methane (particularly or completely) from the SWDS. Moreover, neither there is any existing contract nor any regulations which requires the capture and flaring/ destruction of methane (particularly or completely) resulting from the SWDS. Hence, $f_y = 0$ for the project activity.

As per the Tool, "Emissions from solid waste disposal sites, version 08.1",specify the procedures to calculate baseline, project or leakage emissions of methane from solid waste disposed or prevented from disposal at a SWDS. The tool can be used to determine emissions for the following types of applications

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

**Application B: The CDM project activity avoids or involves the disposal of waste at a SWDS.** An example of this application of the tool is ACM0022, in which municipal solid waste (MSW) is treated with an alternative option, such as composting or anaerobic digestion, and is then prevented from being disposed of in a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period. In these cases, the tool can be applied for both ex ante and ex post estimation of emissions.

For the calculation of baseline emissions from the project activity, **Application B** is chosen due to the following reasons:

The project activity involves combustion of waste that would otherwise be disposed in a SWDS. Thus, the project activity avoids methane emissions.

As per the tool, "Emissions from solid waste disposal sites, version 08.1", the amount of methane generated from 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 amount of methane produced in the year y is calculated as follows.

$BE_{CH4,\,y} =$

$$= \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y}$$

$$\times MCF_y \times \sum_{x=1}^{y} \sum_{j} \left( W_{j,x} \times DOC_j \times e^{-k_j \times (y-x)} \times \left(1 - e^{-k_j}\right) \right)$$

Where,

| | |
|---|---|
| $BE_{CH4,SWDS,y}$ | Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (t $CO_2$e/yr.) |
| $W_{j,x}$ | Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t) |
| $DOC_{f,y}$ | Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction) |
| | Model correction factor to account for model uncertainties for year y |
| $f_y$ | Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y |
| $GWP_{CH4}$ | Global Warming Potential of methane |
| $OX$ | Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste) |
| F | Fraction of methane in the SWDS gas (volume fraction) |
| $MCF_y$ | Methane correction factor for year y |
| $DOC_j$ | Fraction of degradable organic carbon in the waste type j (weight fraction) |
| $k_j$ | Decay rate for the waste type j (1 / yr.) |
| j | Type of residual waste or types of waste in the MSW |

**Determination of model correction factor:**

The model correction factor has been chosen, using option 1 of the methodological tool - "Emissions from solid waste disposal sites, version 08.1", where $\varphi_y = \varphi$ default.

**Determining the amounts of waste types j disposed in the SWDS ($W_{j,x}$)**
Where different waste types j is disposed or prevented from disposal in the it is necessary to determine the amount of different waste types ($W_{j,x}$ or $W_{j,i}$).
For Application B, determine the amount of different waste types through sampling and calculate the mean from the samples using the following equation to determine the value of $W_{j,x}$ for the yearly model

$W_{j,x} = W \times P_{j,x}$

Where,

| | |
|---|---|
| $W_{j,x}$ | Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t) |
| $W_x$ | Total amount of solid waste disposed or prevented from disposal in the SWDS in year x (t) |
| $p_{j,x}$ | Average fraction of the waste type j in the waste in year x (weight fraction) |
| j | Types of solid waste |

| | |
|---|---|
| x | Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y(x = y) |

The fraction of the waste type j in the waste for the year x are calculated as follows:

$P_{j,x} = \sum P_{n,j,x} / Z_x$

Where,

| | |
|---|---|
| $P_{j,x}$ | Average fraction of the waste type j in the waste in year x (weight fraction) |
| $P_{n,j,x}$ | Fraction of the waste type j in the sample n collected during the year x (weight fraction) |
| $Z_x$ | Number of samples collected during the year x |
| N | Samples collected in year x |
| J | Types of solid waste |
| X | Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y) |

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

The value of $DOC_{f,y}$ has been determined using the methodological tool "Emissions from solid waste disposal sites, version 08.1", and $DOC_{f,y} = DOC_{default}$ is chosen.

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

The value of $MCF_y$ has been determined using application A of the above-mentioned methodological tool "Emissions from solid waste disposal sites, version 08.1", and selected as $MCF_y = MCF_{default}$. Default values is chosen as the existing SWDS landfill does not have a water table above the bottom of the SWDS.

**Baseline emissions from generation of energy:**

As per paragraph 47 of the methodology, the baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) shall be calculated using "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". When applying the tool:

(a) The electricity sources k in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and

(b) $EC_{BL,k,y}$ in the Tool is equivalent to the net amount of electricity generated by the alternative waste treatment process t and exported to the grid or displacing fossil fuel fired captive energy plant in year y ($EG_{t,y}$).

As the Project activity supplies the electricity generated to the grid it corresponds to *(a) Scenario I: Electricity is supplied to the grid* of the Tool. The baseline emissions is calculated as follows;

$$BE_{EC,y} = \sum EC_{BL,k,y} \times EF_{EF,k,y} \times (1 + TDL_{k,y})$$

$EC_{BL,k,y}$ = Quantity of electricity that would be consumed by the baseline electricity consumer k in year y (MWh/yr.)

$EF_{EF,k,y}$ = Emission factor for electricity generation for source k in year y (t $CO_2$/MWh), UCR recommended emission factor of 0.9 t$CO_2$/MWh has been considered

(Reference: General Project Eligibility Criteria and Guidance, UCR Standard, page 4)

$TDL_{k,y}$ = Average technical transmission and distribution losses for providing electricity to source k in year y
k = Sources of electricity consumption in the baseline.

**Project Emissions**

As per approved consolidated baseline and monitoring methodology, ACM0022: Alternative waste treatment processes --- Version 3.0, the project emissions in year y are calculated for each alternative waste treatment process implemented in the project activity as follows:

$$PE_y = PE_{COMP,y} + PE_{AD,y} + PE_{GAS,y} + PE_{RDF\_SB,y} + PE_{INC,y}$$

Where,

$PE_y$ = Project emissions in year y (**$tCO_2e$**)
$PE_{COMP,y}$ = Project emissions from composting or co-composting in year y (**$tCO_2e$**)
$PE_{AD,y}$ = Project emissions from anaerobic digestion and biogas combustion (**$tCO_2e$**)
$PE_{GAS,y}$ = Project emissions from gasification in year y (**$tCO_2e$**)
$PE_{RDF\_SB,y}$ = Project emissions associated with RDF/SB in year (**$tCO_2e$**)
$PE_{INC,y}$ = Project emissions from incineration in year y (**$tCO_2e$**)

The parameters which are applicable for calculating the project emissions for the project activity are summarized in table below:

| **Symbol** | **Parameters** | **Applicable** | **Justification** |
|---|---|---|---|
| $PE_{COMP,y}$ | Project emissions from composting or co-composting in year y (**$tCO_2e$**) | No | Project activity does not involve composting process. Composting of MSW is undertaken in existing facility at the same site. So, this parameter is not considered for calculating project emission. |
| $PE_{AD,y}$ | Project emissions from anaerobic digestion and biogas combustion (**$tCO_2e$**) | No | Project activity does not involve any process where anaerobic digestion occurs, so this parameter is not included. |
| $PE_{GAS,y}$ | Project emissions from gasification in year y (**$tCO_2e$**) | No | Project activity does not involve gasification of MSW, so this parameter is not included. |
| $PE_{RDF\_SB,y}$ | Project emissions associated with RDF/SB in year (**$tco_2e$**) | No | Project activity doesn't involve preparation of RDF. However this parameter is included, as required by ACM0022, version 3.0. |
| $PE_{INC,y}$ | Project emissions from incineration in year y ((**$tCO_2e$**)) | Yes | This project activity involves combustion of RDF/waste through incineration process. So, this parameter is applicable for calculating the project emissions. |

Based on the parameters applicable for the proposed project activity, the Project Emissions are calculated based on the following basis.

$PE_y = PE_{INC,y} + PE_{RDF\_SB,y}$

**Project emissions from incineration ($PE_{INC,y}$)**

As per approved consolidated baseline and monitoring methodology, ACM0022: Alternative waste treatment processes --- Version 3.0, project emissions from incineration include emissions from combustion within the project boundary ($PE_{COM,INC,y}$). If associated with the incineration process, then project emissions shall also account for electricity consumption, fossil fuel consumption and wastewater treatment (if associated with the incineration process). Project emissions are therefore determined as follows.

$$PE_{INC,y} = PE_{COM,INC,y} + PE_{EC,INC,y} + PE_{FC,INC,y} + PE_{ww,INC,y}$$

Where,

| | |
|---|---|
| $PE_{INC,y}$ | Project emissions from incineration in year y (t $CO_2e$) |
| $PE_{COM,INC,y}$ | Project emissions from combustion within the project boundary of fossil waste associated with incineration in year y (t $CO_2$) |
| $PE_{EC,INC,y}$ | Project emissions from electricity consumption associated with incineration year y (t $CO_{2e}$) |
| $PE_{FC,INC,y}$ | Project emissions from fossil fuel consumption associated with incineration in year y (t $CO_{2e}$ ) |
| $PE_{ww,INC,y}$ | Project emissions from the wastewater treatment associated with incineration in year y (t $CH_4$) |

$PE_{EC,INC,y}$ is determined according to the procedure "Project emissions from electricity use", were

$PE_{EC,INC,y}$= $PE_{EC,t,y}$ and the alternative waste treatment process t is incineration. The electricity generated by onsite incineration may be excluded

$PE_{COM,INC,y}$ is determined according to the procedure "Project emissions from combustion within the project boundary", where $PE_{INC,COM,y}$ = $PE_{COM,t,y}$ and the combustor c is the incinerator

$PE_{FC,INC,y}$ is determined according to the procedure "Project emissions from fossil fuel use", where $PE_{FC,INC,y}$ = $PE_{FC,t,y}$ and the alternative waste treatment process t is incineration

$PE_{ww,INC,y}$ is determined according to the procedure "Project emissions from wastewater treatment", where $PE_{ww,INC,y}$ = $PE_{ww,t,y}$ and the alternative waste treatment process t is
incineration

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

The project emissions from electricity consumption due to waste treatment process t (combustion here) implemented under the project activity ($PE_{EC,t,y}$) shall be calculated using "*TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*".

When applying the tool:

(a) Project emissions shall be calculated for the sources of electricity consumed due to the alternative waste treatment process t, excluding consumption of electricity that was generated by the project activity ($EC_{t,y}$);

(b) If the project activity consists of more than one alternative waste treatment process, then project participants may choose to monitor electricity consumption for the entire site and then allocate this consumption to one of the different alternative waste treatment processes (e.g., apportionment based on sub-metering data is not required).

As per approved methodological Tool 05: "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0)*, the project emissions are calculated using following formula.

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

Where,

| | |
|---|---|
| $PE_{EC,y}$ | Project emissions from electricity consumption in year y (t $CO_2$ / yr.) |
| $EC_{PJ,j,y}$ | Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr.) |
| $EF_{EF,j,y}$ | Emission factor for electricity generation for source j in year y (t $CO_2$/MWh) |
| $TDL_{j,y}$ | Average technical transmission and distribution losses for providing electricity to source j in year y |

<u>Determination of the emission factor for electricity generation (EF $_{EL,j,y}$)</u>

The determination of the emission factors for electricity generation (EF $_{EL,j/k/l,y}$) in the project scenario depends on which scenario (A, B or C), as described in Section 2.2, paragraph 5 that applies to the source of electricity consumption that would be displaced in the baseline by electricity generated in the project.

Option A1 to calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" (EF $_{EL,j,y}$ = EF $_{grid,CM,y}$), has been adopted here.

**Project emissions from combustion within the project boundary (PE $_{COM,c,y}$)**

This procedure estimates emissions from gasifiers, incinerators, RDF/SB combustors and syngas burners (PE $_{COM,c,y}$). Emissions consist of carbon dioxide, and small amounts of methane and nitrous oxide, as follows:

$PE_{COM,c,y} = PE_{COM,CO2,c,y} + PE_{COM,CH4,N2O,c,y}$

Where,

| | |
|---|---|
| $PE_{COM,C,y}$ | Project emissions from combustion within the project boundary associated with combustor c in year y (t $CO_2$e) |
| $PE_{COM,CO2,c,y}$ | Project emissions of CO2 from combustion within the project boundary associated with combustor c in year y (t $CO_2$) |
| $PE_{COM,CH4,N2O,c,y}$ | Project emissions of CH4 and N2O from combustion within the project boundary associated with combustor c in year y (t $CO_2$) |
| C | Combustor used in the project activity: gasifier or syngas burner, incinerator or RDF/SB combustor |

**Project emissions of $CO_2$ from combustion within the project boundary (PE $_{COM\_CO2,c,y}$)**

Carbon dioxide project emissions associated with on-site combustion (PE $_{COM\_CO2,c,y}$) are calculated based either on the fossil carbon content of the fresh waste or RDF/SB combusted, or on the fossil carbon content of the stack gas. The biogenic carbon content is not considered.

Out of the 3 options available for calculation of $PE_{COM,CO2,c,y}$ option 1 has been chosen.

Option 1: Waste sorted into waste type of fractions

$$PE_{COM,CO2,c,y} = EFF_{COM,c,y} \times \frac{44}{12} \times \sum_j Q_{j,c,y} \times FCC_{j,y} \times FFC_{j,y}$$

Where:

$PE_{COM,CO2,c,y}$ = Project emissions of $CO_2$ from combustion within the project boundary associated with combustor $c$ in year $y$ (t $CO_2$)

$Q_{j,c,y}$ = Quantity of fresh waste type $j$ fed into combustor $c$ the in-year $y$ (t)

$FCC_{j,y}$ = Fraction of total carbon content in waste type $j$ in year $y$ (t C/t)

$FFC_{j,y}$ = Fraction of fossil carbon in total carbon content of waste type $j$ in year $y$ (weight fraction)

$EFF_{COM,c,y}$ = Combustion efficiency of combustor $c$ in year $y$ (fraction)

$\frac{44}{12}$ = Conversion factor (t $CO_2$/t C)

$c$ = Combustor used in the project activity: gasifier, incinerator or RDF/SB combustor

$j$ = Waste type

Project participants may select to either directly monitor the amount of waste type $j$ fed into the combustor $c$ in year $y$ ($Q_{j,c,y}$) or calculate this parameter based on monitoring the total waste fed to the combustor and sampling the waste to determine the fraction of waste type $j$ as per the following equation:

$$Q_{j,c,y} = Q_{waste,c,y} \times \frac{\sum_{n=1}^{z} p_{n,j,y}}{z}$$

Where:

$Q_{j,c,y}$ = Quantity of waste type $j$ fed into combustor $c$ in year $y$ (t)

$Q_{waste,c,y}$ = Quantity of fresh waste or RDF/SB fed into combustor $c$ in year $y$ (t)

$P_{n,j,y}$ = Fraction of waste type $j$ in the sample $n$ collected during the year $y$ (weight fraction)

$z$ = Number of samples collected during the year $y$

$n$ = Samples collected in year $y$

$j$ = Waste type

**Project emissions of $CH_4$ and $N_2O$ from combustion within the project boundary ($PE_{COM\_CH4,N2O,c,y}$)**

Emissions of $N_2O$ and $CH_4$ from combustion of RDF/SB are neglected because they are considered very minor. For the case of gasification or incineration, project participants may choose either Option 1 or Option 2 to estimate emissions of $N_2O$ and $CH_4$ from combustion within the project boundary. Option 1 calculates the emissions based on monitoring the $N_2O$ and $CH_4$ content in the stack gas. Option 2 calculates the emissions using default emission factors for the amount of $N_2O$ and $CH_4$ emitted per tonne of fresh waste combusted.
The option2 using default emission factors is chosen

**Option 2: Using default emission factors**

$PE_{COM\_CH4,N2O,c,y} = Q_{waste,c,y} \times (EF_{N2O,t} \times GWP_{N2O} + EF_{CH4,t} \times GWP_{CH4})$

Where:

| | | |
|---|---|---|
| $PE_{COM\_CH4,N2O,c,y}$ | = | Project emissions of $CH_4$ and $N_2O$ from combustion within the project boundary associated with combustor *c* in year *y* (t $CO_2$) |
| $Q_{waste,c,y}$ | = | Quantity of fresh waste or RDF/SB fed into combustor *c* in year *y* (t) |
| $EF_{N2O,t}$ | = | Emission factor for $N_2O$ associated with waste treatment process *t* (t $N_2O$/t waste) |
| $EF_{CH4,t}$ | = | Emission factor for $CH_4$ associated with treatment process *t* (t $CH_4$/t waste) |
| $GWP_{N2O}$ | = | Global Warming Potential of nitrous oxide (t $CO_2$e/t $N_2O$) |
| $GWP_{CH4}$ | = | Global Warming Potential of methane valid for the commitment period (t $CO_2$e/t $CH_4$) |
| $c$ | = | Combustor used in the project activity: gasifier, incinerator |
| $t$ | = | Type of alternative waste treatment processes: gasification, incineration |

**$CO_2$ emissions from fossil fuel combustion**

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO2 emission coefficient of those fuels, as follows:

$PE_{FC,j,y} = \sum FC_{i,j,y} \times COEF_{i,y}$

Where: $PE_{FC,j,y}$ = $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr).

$FC_{i,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr.)

$COEF_{i,y}$ = Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit)

$i$ = Are the fuel types combusted in process j during the year y

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

**Option A:** The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type i, using the following approach: If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = w_{C,i,y} \times 44/12$ , If $FC_{i,j,y}$ is measured in a volume unit:

$COEF_{i,y} = w_{C,i,y} \times \rho_{i,y} \times 44/12$,

Where: $COEF_{i,y}$ = Is the $CO_2$ emission coefficient of fuel type i ($tCO_2$/mass or volume unit);

$w_{C,j,y}$ = Is the weighted average mass fraction of carbon in fuel type i in year y ($tCO_2$/mass unit of the fuel)

$\rho_{i,y}$ = Is the weighted average density of fuel type i in year y (mass unit/volume unit of the fuel)

$i$ = Are the fuel types combusted in process j during the year y

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

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

Where: $COEF_{i,y}$ = Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit)
$NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) $i$ = Are the fuel types combusted in process j during the year y

These project emissions from fossil fuel combustion and electricity consumption are considered in electricity generation.

**Emissions from wastewater discharge management ($PE_{ww,t,y}$)**

1. If the wastewater discharge generated by the project activity is treated using an aerobic treatment process, such as by co-composting, then project emissions from wastewater treatment are assumed to be zero.
2. If the wastewater discharge is treated in an anaerobic digester, then the associated emissions are calculated according to the section above, "Project emissions from anaerobic digestion".
3. If the project activity generates wastewater discharge that is treated anaerobically (through other than in an anaerobic digester that is part of the project activity), stored anaerobically or released without further treatment in accordance with applicable regulations, then project participants shall determine $PE_{ww,t,y}$ as follows:

In case of the project activity, waste water (leachate) from the plant is sent to already existing Leachate treatment plant, which is owned by other company is being operated since 2012 onwards. However the leachate generated from Waste to Energy is being sent to that leachate treatment plant from the COD of the Waste to Energy facility.. This waste water facility is a physical process and doesn't have any anaerobic unit process. Hence methane emission is not involved during waste water treatment in the project.

Project participants may use IPCC default values for the net calorific values and $CO_2$ emission factors.

**Project emissions associated with mechanical or thermal production of RDF/SB ($PE_{RDF,y}$)** . Project emissions associated with offsite production of RDF form fresh MSW comprise both the emissions from the mechanical/thermal production process (e.g. electricity, fossil fuel consumption).
$PE_{EC,RDF\_y}$ is determined according to the procedure "Project emissions from electricity use" , as per which this shall be calculated using "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". The equation mentioned against Project emissions from electricity use" , will be used for calculating the project emission . Quantity of electricity consumed for offsite production of RDF from the grid will be monitored and
Emission factor of grid electricity generation sourced from CEA data base will be used for calculating the project emission.

**Project emissions from fossil fuel consumption associated with RDF** transportation to WTE facility,y ($PE_{TR,y}$) will be calculated following the "CDM TOOL12 Methodological tool: Project and leakage emissions from transportation of freight , Version 01.1.0" choosing Option B: Using UCR default values (to apply a net-to-gross adjustment of 10%).

**Leakage ($L_y$)**

Leakage emissions are associated with composting/co-composting, anaerobic digestion and the use of RDF/SB that is exported outside the project boundary. For the case that waste by-products of the alternative waste treatment process are:

a. Used for soil application, these emissions shall be neglected;
b. Composted or co-composted, then these shall be treated as fresh waste with emissions estimated according to the procedure project emissions from composting ($PE_{COMP,y}$).

Leakage emissions are determined as follows: $LE_y = LE_{COMP,y} + LE_{AD,y} + LE_{RDF,SB,y}$
Where: $LE_y$ = Leakage emissions in the year y (t $CO_2$e)
$LE_{COMP,y}$ = Leakage emissions from composting or co-composting in year y (t $CO_2$e)
$LE_{AD,y}$ = Leakage emissions from anaerobic digester in year y (t $CO_2$e)
$LE_{RDF,SB,y}$ = Leakage emissions associated with RDF/SB in year y (t $CO_2$e)

Leakage emissions associated with composting ($LE_{COMP,y}$) ) is not applicable for the project activity as no composting /co-composting are involved in the project
Leakage emissions from anaerobic digestion ($LE_{AD,y}$) is not applicable for the project activity as no anaerobic digester is involved in the project.
Leakage emissions associated with the use of RDF/SB that is exported outside the project boundary. So leakage emissions ($LE_{RDF,SB,y}$) is not applicable for the project activity as no RDF manufacturing is involved in the project.
Therefore, Leakage emissions are zero, $LE_y$ = 0.

**B.6. Prior History>>**

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits for the said crediting period.

**B.7. Changes to start date of crediting period >>**

There is no change in the start date of crediting period.

**B.8. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>**

Not applicable.

## B.9. Monitoring period number and duration>>

First Issuance Period: 02 years, 10 months, 12 days – 20/08/2020 to 30/06/2023.

## B.8. Monitoring plan>>

**Data and Parameters available at validation (ex-ante values):**

| Data/Parameter | $RATE_{COMPLIANCE,t}$ |
|---|---|
| Data unit | Fraction |
| Description | Rate of compliance with a regulatory requirement to implement the alternative waste treatment implemented in the project activity |
| Source of data<br>Value(s) applied | 0% |
| Measurement methods and procedures | - |
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| Data/Parameter | $\Phi_{default}$ |
|---|---|
| Data unit | |
| Description | Default value for the model correction factor to account for model uncertainties. |
| Source of data<br>Value(s) applied | Methodological Tool-"Emissions from solid waste disposal site"(version.08.0)<br>For baseline emissions: 0.80 applicable for dry conditions<br>For project or leakage emissions: $\varphi_{default}$ = 1. |
| Measurement methods and procedures | - |
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| Data/Parameter | OX |
|---|---|
| Data unit | |
| Description | Oxidation Factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste) |
| Source of data<br>Value(s) applied | Methodological Tool-"Emissions from solid waste disposal site"(version.08.0)<br>0.1 |
| Measurement methods and procedures | Default value as per the Methodological Tool |

| | |
|---|---|
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| Data/Parameter | F |
|---|---|
| Data unit | |
| Description | Fraction of methane in the SWDS gas (volume fraction) |
| Source of data<br>Value(s) applied | IPCC 2006 Guidelines for National Greenhouse Gas Inventories<br>0.5 |
| Measurement methods and procedures | Default value as per the Methodological Tool |
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| Data/Parameter | $DOC_{f,default}$ |
|---|---|
| Data unit | Weight fraction |
| Description | Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS |
| Source of data<br>Value(s) applied | IPCC 2006 Guidelines for National Greenhouse Gas Inventories<br>0.5 |
| Measurement methods and procedures | Default value as per the Methodological Tool |
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| Data/Parameter | $MCF_{default}$ |
|---|---|
| Data unit | |
| Description | Methane correction factor |
| Source of data<br>Value(s) applied | IPCC 2006 Guidelines for National Greenhouse Gas Inventories<br>1.0 |
| Measurement methods and procedures | As per Methodological Tool “Emissions from solid waste disposal site”(version.08.0) value of 1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e. Waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste; In the baseline, the waste sent to dump yard situated at Jawaharnagar, is managed by Greater Hyderabad Municipal Cooperation.. |

| | |
|---|---|
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| | |
|---|---|
| Data/Parameter | $DOC_j$ |
| Data unit | |
| Description | Fraction of degradable organic carbon in the waste type j (weight fraction) |
| Source of data<br>Value(s) applied | IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)<br>Default values for $DOC_j$ |

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

| | |
|---|---|
| Measurement methods and procedures | Default values as per Methodological Tool "Emissions from solid waste disposal site"(version.08.0) |
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| | |
|---|---|
| Data/Parameter | $k_j$ |
| Data unit | 1/year |
| Description | Decay rate for the waste type j |
| Source of data<br>Value(s) applied | IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 3.3)<br>Default values for the different waste type j |

| **Waste type j** | **Tropical (MAT>20˚C, Dry (MAP≤1000 mm** |
|---|---|
| Pulp, paper, cardboard(other than sludge),textile | 0.045 |
| Wood, wood products and straw | 0.025 |
| Other (non-food) organic putrescible garden and park | 0.065 |

| | |
|---|---|
| | <table><tr><td>waste</td><td></td></tr><tr><td>Food, food waste, sewage sludge ,beverages and tobacco</td><td>0.085</td></tr></table><br>The above values are used as the plant is located at a place with MAT = 25.9°C that is greater than 20°C and MAP = 745mm that is less than 1000mm.( https://en.climate-data.org/asia/india/hyderabad/hyderabad-2801/) |
| Measurement methods and procedures | Default values as per Methodological Tool "Emissions from solid waste disposal site"(version.08.0) |
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| Data/Parameter | $GWP_{CH4}$ |
|---|---|
| Data unit | $tCO_2e/tCH_4$ |
| Description | Global Warming Potential of CH4. |
| Source of data<br>Value(s) applied | UCR standard<br>21 |
| Measurement methods and procedures | UCR standard |
| Monitoring frequency | - |
| Purpose of data | For calculation of Baseline emission and fixed for the crediting period |

| Data/Parameter | $EF_{CH4,t}$ |
|---|---|
| Data unit | $tCH_4$/t of waste (wet) |
| Description | emission factor of methane associated with waste treatment process t |
| Source of data<br>Value(s) applied | Table 5.3, chapter 5, volume 5 of IPCC 2006 guidelines<br>0.24 |

<table>
<tr><td>Measurement methods and procedures</td><td>If country-specific data is available, then this shall be applied and the method used to derive the value as well as the data sources need to be documented in the CDM-PDD. If country-specific data are not available, then apply the default values listed in Table 2. For continuous incineration of industrial waste, apply the CH4 emission factors provided in Volume 2, Chapter 2, Stationary Combustion of IPCC 2006 Guidelines.<br><br>Table 2. $CH_4$ emission factors for combustion<br>
<table>
<tr><th>Waste type</th><th colspan="2">Type of incineration/technology</th><th>$CH_4$ emission factors<br>($t\ CH_4$ / t waste) wet basis</th></tr>
<tr><td rowspan="6">MSW</td><td rowspan="2">Continuous incineration</td><td>stoker</td><td>1.21x $0.2x10^{-6}$</td></tr>
<tr><td>fluidised bed</td><td>~0</td></tr>
<tr><td rowspan="2">Semi-continuous incineration</td><td>stoker</td><td>1.21x $6x10^{-6}$</td></tr>
<tr><td>fluidised bed</td><td>1.21x $188x10^{-6}$</td></tr>
<tr><td rowspan="2">Batch type incineration</td><td>stoker</td><td>1.21x $60x10^{-6}$</td></tr>
<tr><td>fluidised bed</td><td>1.21x $237x10^{-6}$</td></tr>
<tr><td colspan="3">Sludge (semi-continuous or batch type incineration)</td><td>1.21x $9\ 700x10^{-6}$</td></tr>
<tr><td colspan="3">Waste oil (semi-continuous or batch type incineration)</td><td>1.21x $560x10^{-6}$</td></tr>
</table>
<br>A conservativeness factor of 1.21 has been applied to account for the uncertainty of the IPCC default values</td></tr>
<tr><td>Monitoring frequency</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>For calculation of Project emission and fixed for the crediting period</td></tr>
</table>

| | |
|---|---|
| Data/Parameter | $EF_{N2O,t}$ |
| Data unit | $tN_2O$/t of waste (wet) |
| Description | emission factor of $N_2O$ associated with waste treatment process t |
| Source of data<br>Value(s) applied | Table 5.6, chapter 5, volume 5 of IPCC 2006 guidelines<br>60.5 |

<table>
<tr><td>Measurement methods and procedures</td><td>If country-specific data is available, then this shall be applied, and the method used to derive the value as well as the data sources need to be documented in the CDM-PDD. If country-specific data are not available, then apply the default values listed in Table 7.<br><br>Table 3. $N_2O$ emission factors for combustion<br>
<table>
<tr><th>Type of waste</th><th>Technology / Management practice</th><th>Emission factor (t $N_2O$/t waste wet basis)</th></tr>
<tr><td>MSW</td><td>Continuous and semi-continuous incinerators</td><td>$1.21x\ 50x10^{-3}$</td></tr>
<tr><td>MSW</td><td>Batch-type incinerators</td><td>$1.21x\ 60x10^{-3}$</td></tr>
<tr><td>Industrial waste</td><td>All types of incineration</td><td>$1.21x\ 100x10^{-3}$</td></tr>
<tr><td>Sludge (except sewage sludge)</td><td>All types of incineration</td><td>$1.21x\ 450x10^{-3}$</td></tr>
<tr><td>Sewage sludge</td><td>Incineration</td><td>$1.21x\ 900x10^{-3}$</td></tr>
</table>
<br>A conservativeness factor of 1.21 has been applied to account for the uncertainty of the IPCC default values</td></tr>
<tr><td>Monitoring frequency</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>For calculation of Project emission and fixed for the crediting period</td></tr>
</table>

| | |
|---|---|
| Data/Parameter | $GWP_{N2O}$ |
| Data unit | $tCO_{2e}/tN_2O$ |
| Description | Global Warming Potential of $N_2O$ |
| Source of data<br>Value(s) applied | IPCC AR6-WG1 , Chapter 7,Table 7.15 \| Emissions metrics for selected species: global warming potential (GWP), global temperature-change potential (GTP)<br><br>273 |
| Measurement methods and procedures | IPCC AR6-WG1 , Chapter 7,Table 7.15 \| Emissions metrics for selected species: global warming potential (GWP), global temperature-change potential (GTP) |
| Monitoring frequency | - |
| Purpose of data | For calculation of Project emission and fixed for the crediting period |

<table>
<tr><td>Data/Parameter</td><td>Fcc,j</td></tr>
<tr><td>Data unit</td><td>%</td></tr>
<tr><td>Description</td><td>Fraction of total carbon content in waste type j</td></tr>
<tr><td>Source of data<br>Value(s) applied</td><td>Table 2.4, chapter 2, volume 5 of IPCC 2006 guidelines<br><br>For MSW the following values for the different waste types j may be applied:<br><br>Table 4: Default values for $FCC_{j,y}$
<table>
<tr><td>Waste type j</td><td></td></tr>
<tr><td>Paper/cardboard</td><td>50</td></tr>
<tr><td>Textiles</td><td>50</td></tr>
<tr><td>Food waste</td><td>50</td></tr>
<tr><td>Wood</td><td>54</td></tr>
<tr><td>Garden and Park waste</td><td>55</td></tr>
<tr><td>Nappies</td><td>90</td></tr>
<tr><td>Rubber and Leather</td><td>67</td></tr>
<tr><td>Plastics</td><td>85</td></tr>
<tr><td>Metal*</td><td>NA</td></tr>
<tr><td>Glass*</td><td>NA</td></tr>
<tr><td>Other, inert waste</td><td>5</td></tr>
</table></td></tr>
<tr><td>Measurement methods and procedures</td><td>Default values as per Methodology ACM0022</td></tr>
<tr><td>Monitoring frequency</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>Calculation of Project emission</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>FFCj</td></tr>
<tr><td>Data unit</td><td>%</td></tr>
<tr><td>Description</td><td>Fraction of fossil carbon in total carbon content of waste type j</td></tr>
<tr><td>Source of data<br>Value(s) applied</td><td>For MSW the following values for the different waste types j may be applied:<br><br>Table 5: Default values for $FFC_{j,y}$
<table>
<tr><td>Waste type j</td><td></td></tr>
<tr><td>Paper/cardboard</td><td>5</td></tr>
<tr><td>Textiles</td><td>50</td></tr>
<tr><td>Food waste</td><td>-</td></tr>
<tr><td>Wood</td><td>-</td></tr>
<tr><td>Garden and Park waste</td><td>0</td></tr>
<tr><td>Nappies</td><td>10</td></tr>
<tr><td>Rubber and Leather</td><td>20</td></tr>
<tr><td>Plastics</td><td>100</td></tr>
<tr><td>Metal*</td><td>NA</td></tr>
<tr><td>Glass*</td><td>NA</td></tr>
<tr><td>Other, inert waste</td><td>100</td></tr>
</table></td></tr>
<tr><td>Measurement methods and procedures</td><td>Default values as per Methodology ACM0022</td></tr>
<tr><td>Monitoring frequency</td><td>-</td></tr>
</table>

| | |
|---|---|
| Purpose of data | For calculating the Project emission |

| | |
|---|---|
| Data/Parameter | $EFgrid,y$ |
| Data unit | $tCO_2$ /MWh |
| Description | Combined margin emission factor for Indian grid connected power generation in year y |
| Source of data<br>Value(s) applied | The UCR Standard<br>0.9 |
| Measurement methods and procedures | As per recommendation by The UCR Standard for the 2014- 2020 years for Indian projects not previously verified under any GHG program. |
| Monitoring frequency | Yearly |
| Purpose of data | Calculation of baseline emission |

| | |
|---|---|
| Data/Parameter | $EF_{CO2,f}$ |
| Data unit | g $CO_2$/t km |
| Description | For Heavy vehicles |
| Source of data<br><br>Value(s) applied | TOOL12 Methodological tool: Project and leakage emissions from transportation of freight Version 01.1.0<br><br>129 |
| Measurement methods and procedures | default $CO_2$ emission factor takes into account emissions generated by loaded outbound trips and empty return trips. |
| Monitoring frequency | |
| Purpose of data | |

| | |
|---|---|
| Data / Parameter: | $EFF_{COM,c,y}$ |
| Data unit: | Fraction |
| Description: | Combustion efficiency of combustor c in year y |
| Source of data:<br><br>Value(s) applied | The source of data shall be the following, in order of preference:<br>1. Project specific data;<br>2. Country specific data; or<br>3. **IPCC default values** |
| Measurement methods and procedures : | Default values |
| Monitoring Frequency: | |
| Purpose of data: | For calculation of fossil based CO2 emission from RDF |

| | |
|---|---|
| | combustion<br>For estimation project emission a value of 1.0 is used (refer table 1.4, Volume 2 of IPCC Guidelines for National Green House Gas Inventories 2006) |

**Data and Parameters to be monitored (ex-post monitoring values):**

| | |
|---|---|
| Data / Parameter: | $Q_{waste,c,y}$ |
| Data unit: | Tonnes |
| Description: | Quantity of RDF/SB fed into combustor c in year y |
| Source of data: | Project Participant's Daily log book of WTE plant |
| Measurement methods and procedures (if any): | The quantity fed to the combustor is measured/recorded from weigh bridge readings. |
| Measurement Frequency: | Continuously, aggregated monthly |
| QA/QC procedures: | Calibration of the weigh bridge is done atleast once in a year |
| Any comment: | For calculation of project emissions from RDF combustion |

| | |
|---|---|
| Data / Parameter: | $p_{n,j,x}$ |
| Data unit: | Weight fraction |
| Description: | Weight fraction of waste type j in the sample n collected during the year x |
| Source of data: | From Waste analysis report |
| Measurement methods and procedures (if any): | |
| Measurement Frequency: | Every three months |
| QA/QC procedures: | - |
| Any comment: | For calculation of baseline emissions |

| | |
|---|---|
| Data / Parameter: | $z_x$ |
| Data unit: | Number |
| Description: | Number of samples collected during the year x |
| Source of data: | Records at site |
| Measurement methods and procedures (if any): | |
| Measurement Frequency: | Continuously, aggregated annually |
| QA/QC procedures: | - |
| Any comment: | For calculation of baseline emissions |

| | |
|---|---|
| Data / Parameter: | $EC_{t,y}$ |
| Data unit: | MWh |
| Description: | Electricity consumption of electricity generated in an on-site fossil fuel fired power plant or from the grid as a result of the alternative waste treatment process t in year y |
| Source of data: | Electricity meter records or consumption statement at site |
| Measurement methods and procedures (if any): | |
| Measurement Frequency: | Monthly |
| QA/QC procedures: | Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked against invoices when available |
| Any comment: | For calculation of baseline emissions |

| | |
|---|---|
| Data / Parameter: | $EG_{t,y}$ |
| Data unit: | MWh |
| Description: | Electricity generated by the alternative waste treatment process t |

| | |
|---|---|
| | and exported to the grid or displacing fossil fuel fired power-only and/or cogeneration captive energy generation in year y |
| Source of data: | Energy Meter records and/or monthly generation statement<br><br>**Main Meter:**<br>Make: secure<br>Type: APEX150<br>S.No : APZ00677<br>Class: 0.2S<br>Meter CT ratio: 100/1A<br><br>**Check Meter:**<br>Make: secure<br>Type: APEX150<br>S.No : APZ00678<br>Class: 0.2S<br>Meter CT ratio: 100/1A<br><br>**Standby Meter:**<br>Make: secure<br>Type: APEX150<br>S.No : APZ00679<br>Class: 0.2S<br>Meter CT ratio: 100/1A |
| Measurement methods and procedures (if any): | Monitoring equipment: Energy Meters are used for monitoring<br>Archiving Policy: Paper & Electronic<br>Calibration frequency: Once in every five years (as per provision of CEA).<br><br>Difference of staring reading of current month and ending reading of previous month will be considered for arriving at the gross generation from the project activity.<br><br>Cross Checking:<br>Quantity of net electricity supplied to the grid will be cross checked from the monthly bills or invoices. |
| Measurement Frequency: | Monthly |
| QA/QC procedures: | - |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | TDLj,y |
| Data unit: | Percentage |
| Description: | Average technical transmission and distribution losses for providing electricity to source j |
| Source of data: | “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” Annex 5, EB 96 |
| Measurement methods and procedures (if any): | Losses percentage = {Gross generation(site data) – Export to grid at Substation (JMR value)-}/{Gross generation} |
| Measurement Frequency: | Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years. |
| QA/QC procedures: | - |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $D_{f,,y}$ |
| Data unit: | Kilometre |

| | |
|---|---|
| Description: | Return trip distance between the origin and destination of freight transportation activity f in year y |
| Source of data: | Records of vehicle operator or records by project participants |
| Measurement methods and procedures (if any): | Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources) |
| Measurement Frequency: | To be updated whenever the distance changes |
| QA/QC procedures: | - |
| Any comment: | For Option B Using conservative default values of CDM Tool 12 |

| | |
|---|---|
| Data / Parameter: | $FR_{f,,y}$ |
| Data unit: | Tonnes |
| Description: | Total mass of freight transported in freight transportation activity f in year y |
| Source of data: | Records of vehicle operator or records by project participants |
| Measurement methods and procedures (if any): | |
| Measurement Frequency: | Continuously |
| QA/QC procedures: | - |
| Any comment: | For Option B Using conservative default values of CDM Tool 12 |

| | |
|---|---|
| Data / Parameter: | $EC_{RDF,y}$ |
| Data unit: | MWh |
| Description: | Electricity consumption from the grid for off-site RDF preparation in year y |
| Source of data: | Electricity meter records or consumption statement at RDF preparation site |
| Measurement methods and procedures (if any): | |
| Measurement Frequency: | Monthly |
| QA/QC procedures: | Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked against invoices when available |
| Any comment: | For calculation of project emissions from RDF preparation |