



Monitoring report form for CDM project activity
(Version 07.0)

MONITORING REPORT		
Title of the project activity	The TIMARPUR-OKHLA Waste Management Company Pvt Ltd's (TOWMCL) integrated waste to energy project in Delhi	
UNFCCC reference number of the project activity	1254	
Version number of the PDD applicable to this monitoring report	15	
Version number of this monitoring report	02	
Completion date of this monitoring report	31/01/2021	
Monitoring period number	7	
Duration of this monitoring period	01/04/2019 – 03/03/2020	
Monitoring report number for this monitoring period	Not Applicable	
Project participants	TIMARPUR-OKHLA Waste Management Company Pvt. Ltd (TOWMCL) WeAct Pty Ltd	
Host Party	India	
Applied methodologies and standardized baselines	Applied methodology: AM0025 (version 06) "Avoided emissions from organic waste through alternative waste treatment process" Standardized baseline: Not applicable	
Sectoral scopes	Mandatory Sectoral scope: 13 Conditional Sectoral scope: 1	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	98,191
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	384,375	

SECTION A. Description of project activity

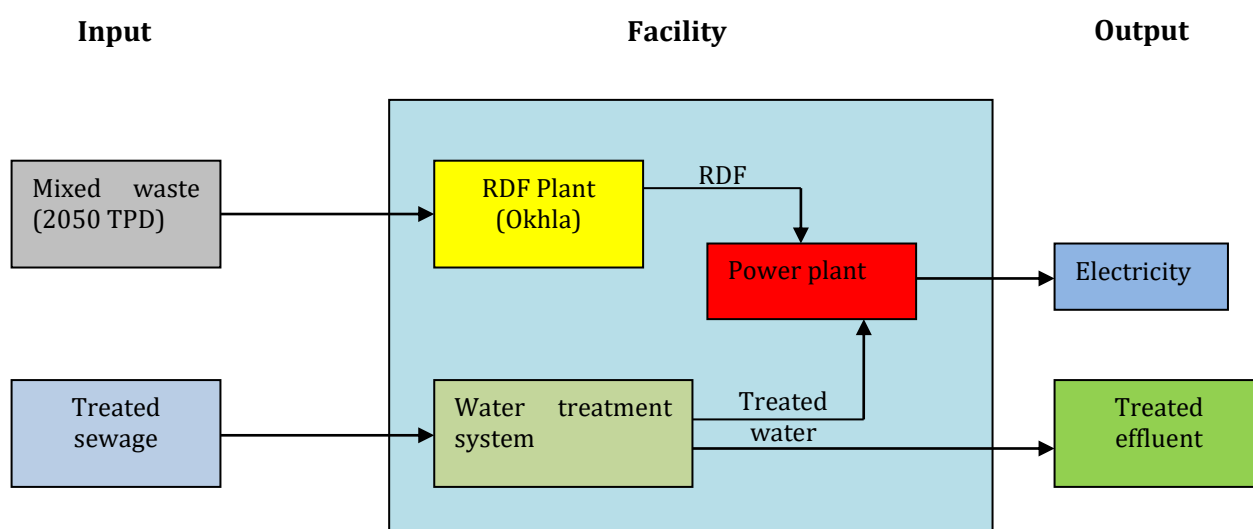
A.1. General description of project activity

The purpose of the project activity is to address a critical environmental problem faced in solid waste management by both Municipal Corporation of Delhi (MCD) and New Delhi Municipal Council (NDMC). This will contribute in significant reduction of greenhouse gas emissions, which otherwise would have taken place in form of methane emission from solid waste being dumped in the open landfill (dump) sites. In addition, the project activity will also address to some extent the acute energy crisis faced by northern India by producing 20.9 MW of clean electricity that will be supplied to the state electricity grid. By displacing carbon intensive grid energy with a renewable, carbon neutral energy source, the project activity further reduces carbon dioxide emissions over the project life. Replicable technology, environmental, and sustainable development benefits also result from the project activity. These include: introducing efficient municipal waste management technology; reducing power shortages in the state of Delhi India; and, fostering sustainable economic growth through promoting energy self-sufficiency and proper waste management in Delhi, India.

The project was earlier envisaged to be developed at two different location, i.e. Timarpur and Okhla. About 650 Tonne Per Day (TPD) of Municipal Solid Waste (MSW) was envisaged to be processed at the Timarpur site while 1300 TPD of MSW was envisaged to be processed at Okhla site for the preparation of Refuse Derived Fuel (RDF). Additionally, 100 TPD of green waste (waste collected from garden like dry leaves, cut grass, etc) was to be utilized at Okhla site for generation of Compost and biogas through composting and biomethanation plants respectively. The PP had also envisaged to generate electricity to the tune of 16 MW by utilizing the RDF produced from the project activity. However, the project design has been changed over the period of time and PP sought the post registration change (Data before approval of the request for post-registration changes on 24 Jun 2014), the revised project design is discussed below:

The project activity involves processing of 2050 TPD of MSW and installation of 20.9 MW waste to energy plant at the Okhla site.

Design implemented



The project activity includes one bleed cum condensing TG set of 20.9MW capacity and three boilers with individual capacity of 26 TPH, amounting to a total of 78 TPH, and a fourth boiler with 26 TPH capacities shall be installed in second phase which is still underway. One deaerator (capacity of 72 m³/hr), one boiler feed water pump (capacity of 40 m³/hr), an Air-cooled condenser (capacity of 9.5 TPH) and a cooling tower (capacity 600 m³/hr) are installed in the project activity.

The technology for the boilers and turbines is well established and the project activity does not involve any transfer of technology. The technology being used is environmentally safe and sound. The specification of major equipment deployed for the project activity is as follows:

Boiler – Technical Specification	
Description	
No of boilers	4
Steam generating capacity of each boiler (tons per hour)	26
Steam pressure at super-heated outlet (kg/cm ²)	41
Steam temperature at super-heated outlet (° C)	400 ± 5
Feed water temperature at economizer inlet (° C)	130

Turbine – Technical Specification	
Turbine make	Siemens Limited
Serial No.	3,20,11,287
Speed	6800 RPM
Capacity of Turbine (MW)	20.9
Steam pressure at the inlet (kg/cm ²)	38
Steam temperature at the inlet (° C)	395
Turbo-Generator – Technical Specification	
Turbo-Generator make	TD Power Systems Pvt. Ltd.
Turbo-Generator Serial No.	2K10121323-01
Capacity of Turbo generator (MW)	21

The project activity has been implemented as per the design and was operational during the monitoring period. The Project activity has been successfully commissioned on 27/01/2012 (Date of grid synchronization of first Boiler) by TOWMCL at Okhla, Delhi, and is operational since the day of commissioning. The project activity is in operation since the grid synchronization of the first Boiler i.e. 27/01/2012; the schedule of project implementation is as follows:

Project Implementation Details			
Major Equipment	Make	Number	Important Dates
Turbine	Siemens	32011287	Final Test: 25/01/2012
Diesel Generator	Greaves Cotton Ltd.	3325121103073	Final stability test: 26/01/2012
Boiler-1	HBG	Registration No. D2243	Grid Synchronization: 27/01/2012 Handover to project proponent: 10/03/2012
Boiler-2	HBG	Registration No. D2244	Grid Synchronization: 15/02/2012 Handover to project proponent: 10/03/2012
Boiler-3	HBG	Registration No. D2245	Grid Synchronization: 18/05/2012 Handover to project proponent: 25/05/2012
Boiler-4	Under planning phase yet to be commissioned		

Water System:

The main source of raw water available for the power plant is treated sewage water from adjacent sewage treatment plant (STP) of Delhi Jal Board (DJB). The STP water from DJB is being treated at project activity site by STP plant of 42m³/hr capacity, the STP water first clarified in a clarifier and clarified water is stored in a storage tank (equalization tank). From this the cooling tower make up will be provided after softening. Clarified water is further treated in a series of filters and fed to the RO plant (10m³/hr). Plant service water shall also be obtained after treatment of treated sewage to the desired norms. The rejects (water) of RO plant, turbine and evaporator condenser water is collected in tank and after PH normalization used for miscellaneous activity like gardening, cleaning etc. within the plant premises.

The leachate generated from the plant is being treated at leachate treatment plant of capacity 100KLD; multiple (triple) effect evaporators are treating the leachate and slurry is being burnt out in the boilers after sludge drying.

This is the Seventh monitoring period for the project activity. Details of the previous and present monitoring period (duration and emission reduction achieved) are as follows:

Monitoring Period details	
First Monitoring Period	From 30/03/2011 to 31/08/2012
CER issued	12,478
Second Monitoring Period	From 01/09/2012 to 09/03/2015

CERs	2,46,180
Third Monitoring Period	From 10/03/2015 to 09/03/2016
CERs	-
Fourth Monitoring Period	From 10/03/2016 to 09/03/2017
CERs	64,889
Fifth Monitoring Period	From 10/03/2017 to 09/03/2018
CERs	36,541
Sixth Monitoring Period	From 10/03/2018 to 31/03/2019
CERs	96,732
Seventh Monitoring Period	From 01/04/2019 to 03/03/2020
CERs	98,191

A.2. Location of project activity

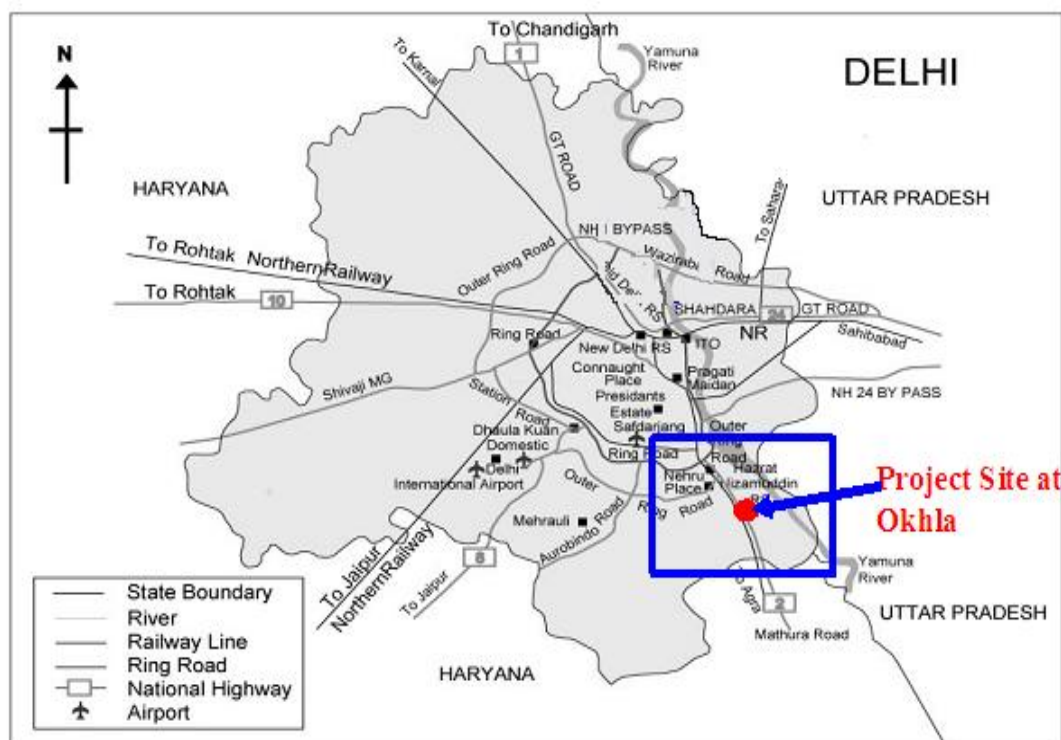
(a) Host Party: India

(b) Region/state/province etc: Delhi

(c) City/town/community, etc: Okhla

(d) Physical/geographical location: The project activity is located in the waste management complex at Okhla in New Delhi, India. The nearest international airport is Indira Gandhi International airport. The location detail of the project activity is given below:

Location	Latitude	Longitude
Okhla (New Delhi)	28° 33'	77° 17'



A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host country)	M/s TIMARPUR-OKHLA Waste Management Company Pvt Ltd	No
Australia	WeAct Pty Ltd	No

A.4. References to applied methodologies and standardized baselines

Applied Methodology: Approved baseline methodology AM0025 (version 06)¹; “Avoided emissions from organic waste through alternative waste treatment processes”

Reference:

- ☐ “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002),
- ☐ Small-scale methodologies 1.D “Renewable electricity generation for a grid”

Methodology tool: “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site²” (Annex 14, EB-26)

“Tool to calculate the emission factor for an electricity system”, version 6.0³.

¹ [Microsoft Word - AM0025ver05 for the web.doc \(unfccc.int\)](https://cdm.unfccc.int/EB/026/eb26_repan14.pdf)

² https://cdm.unfccc.int/EB/026/eb26_repan14.pdf

³ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v6.pdf>

A.5. Crediting period type and duration

A fixed crediting period of 10 years has been chosen for the project activity; the start date of crediting period is 30/03/2011 and duration of crediting period is from 30/03/2011 to 29/03/2021.

SECTION B. Implementation of project activity**B.1. Description of implemented project activity**

The project activity by TOWMCL processed 2050 TPD of municipal solid waste generated in the region of Delhi (MCD and NDMC area) to produce RDF. The RDF was further utilized to produce electricity, which was fed into the state electricity grid. The details of the implemented technology and technical specification of the major equipment has been discussed in the section A.1. Also, the layout of plant and monitoring equipment can be found in appendix I.

The first boiler of the project activity was commissioned on 10/03/2012 and is operational since then; followed by commissioning of the two more boilers. However, fourth boiler is in planning stage.

The project activity was operational during the monitoring period i.e. 01/04/2019-03/03/2020; however, the turbine operation was shutdown at certain instances due to unforeseen instances (mainly due to grid failure and technical reasons). The outage taken by the turbine (shutdown summary) during the monitoring period is as follows:

Plant (Power Generation) Outage during 01/04/2019-03/03/2020			
S.No.	Period	Shutdown Time	Reason
		hrs:mm:ss	
1	03-04-2019	00:21:00	Turbine trip due to grid failure and turbine gone under frequency.
2	03-04-2019	00:09:00	Turbine trip due to grid failure and turbine gone under frequency.
3	03-04-2019	00:11:00	Turbine trip due to last stage DP (pi_105) high
4	06-04-2019	00:16:00	Turbine taken on home load, due to under and over frequency relay setting work.
5	16-04-2019	00:02:00	Turbine came to home load due to grid fluctuation
6	16-04-2019	00:02:00	Plant blackout due to grid failure and turbine auxiliary tripped.
7	26-04-2019	01:26:00	Turbine tripped due to BSES failure.
8	27-05-2019	00:18:00	Plant black out due to heavy grid fluctuation and turbine tripped at last stage DP .
9	01-06-2019	00:08:00	Turbine came to home load due to voltage fluctuation
10	06-06-2019	00:07:00	Turbine came to home load due to voltage fluctuation
11	14-06-2019	00:29:00	Turbine Came to home load due to BSES changeover (BSES requirement)
12	14-06-2019	00:08:00	Turbine Came to home load due to BSES changeover (BSES requirement)
13	16-06-2019	00:03:00	Turbine came to home load due to voltage fluctuation
14	25-06-2019	00:03:00	Turbine came to home load due to voltage fluctuation
15	04-07-2019	00:16:00	Turbine Trip in over frequency/over speed/earth fault
16	04-07-2019	00:31:00	Turbine Trip in over frequency
17	04-07-2019	00:20:00	Turbine Trip in over frequency
18	05-07-2019	01:07:00	Coolin tower level low
19	15-07-2019	01:43:00	Turbine tripped due to over frequency (heavy grid fluctuation) (on line gain value changed 10.507 to

			12.003)
20	15-07-2019	00:03:00	Turbine manually taken in home load for over frequency testing
21	16-07-2019	01:56:00	Turbine manually tripped for CPC calibration
22	05-08-2019	00:05:00	Turbine came to home load due to grid fluctuation
23	16-08-2019	00:09:00	Turbine came to home load due to grid fail
24	16-08-2019	00:02:00	Turbine taken in home load due to BSES requirement for change over
25	17-08-2019	00:03:00	Turbine came to home load due to grid fluctuation
26	28-08-2019	00:17:00	Turbine came to home load due to voltage fluctuation and after 27 sec. trip in high pressure due to Boiler 2 and 3 startup vent MOV not open
27	15-09-2019	00:03:00	Turbine taken in home load due BSES requirement for changeover
28	15-09-2019	00:04:00	
29	15-11-2019	00:40:00	Turbine tripped due to turbine auxiliary breaker tripped
30	17-11-2019	00:05:00	Turbine tripped due to turbine auxiliary breaker tripped
31	27-11-2019	00:02:00	Turbine taken in home load due to BSES requirement for changeover
32	27-11-2019	00:04:00	
33	28-11-2019	01:10:00	Plant black out due to Grid fail and TG auxiliary breaker tripped
34	29-11-2019	00:03:00	Turbine taken in home load due to BSES requirement for changeover
35	04-12-2019	00:03:00	Turbine Came to home due to grid fluctuation
36	11-12-2019	01:15:00	Turbine tripped due to TG auxiliary tripped because of grid fluctuation
37	30-12-2019	00:04:00	Turbine Came to home due to grid fluctuation
38	05-01-2020	10:42:00	Turbine tripped due to voltage fluctuation but late synchronised because of AVR problem
39	11-01-2020	12:10:00	Turbine manually tripped for AVR work
40	08-02-2020	01:02:00	Plant blackout due to grid failure and turbine tripped in over frequency
41	16-02-2020	00:44:00	Plant blackout due to grid failure and turbine tripped in over frequency
42	25-02-2020	11:00:00	Plant annual shutdown
43	26-02-2020	24:00:00	
44	27-02-2020	24:00:00	
45	28-02-2020	24:00:00	
46	29-02-2020	24:00:00	
47	01-03-2020	24:00:00	
48	02-03-2020	24:00:00	
49	03-03-2020	24:00:00	
		214:10:00	

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

The parameter 'FCFi' had been fixed ex-ante in the PDD and IPCC default values were considered. However, reference methodology AM0025 (version 06) "Avoided emissions from

organic waste through alternative waste treatment processes” requires that the parameter FCFi be monitored annually and frequency of sampling of the above parameter shall be determined such that it becomes statistically significant with a maximum uncertainty range of 20% at a 95% confidence level.

PP did not monitor the parameter as it was fixed in the PDD. PP hereby proposes to take a temporary deviation for the period 10th March 2017 to 31st March 2020 for the monitoring parameter. During this period, the IPCC value as per IPCC 2006, volume 5 (waste), Table 2.4 on page no. 2.14 for the parameter will be used following a conservative approach.

Further as per the methodology AM0025 / Version 06, the frequency of sampling should be “determined through sampling where the samples shall be chosen in a manner that ensures estimation with 20% uncertainty at 95% confidence level”. Going forward, the PP will follow the same for the monitoring the parameter.

PRC reference number 1254-001

Approval date: 24/06/2014

<http://cdm.unfccc.int/PRCContainer/DB/prcp743754919/view>

B.2.2. Corrections

Revised PDD was submitted for prior approval along with the corrections made and the same was approved. The value of equation constants of first order decay (FOD) and fixed parameter (Methane correction factor) used for calculation of “The amount of methane that would, in the absence of the project activity, be generated from disposal of waste at the solid waste disposal site (BECH₄,SWDS,y)”; as per the Methodological tool- “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (Annex 14, EB-26) have been included in the PDD. Data / Parameters (pn,j,x) and (zx) have been included in the monitoring plan and editorial changes made under the Value(s) applied for the Parameter Ai.

The value of equation constants of first order decay (FOD) and fixed parameter (Methane correction factor) used for calculation of “The amount of methane that would in the absence of the project activity be generated from disposal of waste at the solid waste disposal site (BECH₄,SWDS,y)”; as per the Methodological tool- “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (Annex 14, EB-26) were presented in the validated emission reduction calculation sheet however not reported in the registered PDD.

The parameter Methane correction factor (MCF) is being used to calculate “The amount of methane produced in the year y (BECH₄,SWDS,y)” as per the applied methodological tool “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (Annex 14 EB 26). The parameter is being validated by DoE during the registration process along with the baseline and project emission reduction calculation; however, the same has not been reported in the registered PDD since it was included in the methodological tool. The project proponent would like to include the parameter in the registered PDD (revised PDD, Version 10 dated 01/08/2016). Project proponent would also like to clarify the value applied for the parameter MCF.

Methane correction factor (MCF): As per the applied methodology tool the parameter shall be sourced from IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Further, in the baseline scenario solid waste being dumped in the open landfill (dump) sites i.e. an unmanaged solid waste disposal site (please also refer pre-project scenario of registered PDD). Hence the MCF value has been considered as 0.8 as per the applied methodological tool (for unmanaged solid waste disposal sites – deep and/or with high water table. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high-water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste).

Further, the study conducted by Central Ground Water Board, Ministry of Water Resources (Govt. of India) on “Study of Groundwater Contamination through Landfill Site, NCT Delhi” (Annexure-1, Copy available on <http://cgwb.gov.in/INCGW/AL%20Ramanathan.pdf>) suggests that the groundwater level in Delhi city varies between 15 to 20-meter depth. The study also suggests that with reference to Okhla landfill, the A deep aquifer was reported by CGWB, water table was obtained at the depth of 60-80 m from ground surface.

Hence, the MCF0.8 for unmanaged solid waste disposal sites – deep and/or with high water Table is appropriate.

PRC reference number 1254-001

Approval date: 24/06/2014

<http://cdm.unfccc.int/PRCContainer/DB/prcp743754919/view>

Corrections made during 3rd MP:

1. Inclusion of fixed parameters under ex-ante list:

- ☐ ϕ , Model correction factor to account for model uncertainties
- ☐ OX, Oxidation Factor
- ☐ F, Fraction of methane in the SWDS gas
- ☐ DOCf, Fraction of degradable organic carbon (DOC) that can decompose
- ☐ MCF, Methane correction factor
- ☐ Fraction of degradable organic carbon (by weight) in the waste type j, DOCj
- ☐ Decay rate for the waste type j, Kj

2. Frequency of MBy corrected to annual

PRC reference number: 1254-004

Approval date: 15/04/2018

<http://cdm.unfccc.int/PRCContainer/DB/prcp334561174/view>

B.2.3. Changes to the start date of the crediting period

The start date of the crediting period has been revised for the project activity; UNFCCC has approved the request of change of crediting period on 24/06/2014. Details of the previous and existing crediting period have been provided in the following table:

Details of Crediting Period (Existing/Previous)	
Existing Crediting Period (Changed)	30/03/2011 – 29/03/2021 (Fixed)
Previous Crediting Period (Changed from)	01/04/2009 – 31/03/2019 (Fixed)
Date of Approval	24/06/2014

PRC reference number 1254-001

<http://cdm.unfccc.int/PRCContainer/DB/prcp743754919/view>

B.2.4. Inclusion of monitoring plan

The monitoring plan for the project activity has been defined in the registered PDD, hence not applicable.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

The project participant while implementing the project activity has not installed the bio methanation and composting process step as the project activity had adopted a better technology available which uses the heat generated in the boiler for pre heating the input waste thereby enhancing the efficiency of the boiler than that was envisaged at the time of registration of the project activity. Hence in the revised monitoring plan, monitoring of the parameters related to composting and bio methanation have not been considered and these are:

- ☐ $P_{i,t}$ - is the leakage of methane emissions from the anaerobic digester.
- ☐ EF_{C,N_2O} -is the Emission factor for N_2O emissions from the composting process
- ☐ EF_{N_2O} - Aggregate N_2O emission factor for waste incineration.
- ☐ EF_{CH_4} - Aggregate CH_4 emission factor for waste incineration.
- ☐ $M_{compost}$ - is the total quantity of compost produced in year
- ☐ M_a - is the total quantity of methane produced by the digester in year.
- ☐ $Q_{biomass}$ - is the amount of RDF combusted in tonnes per year.
- ☐ Km_y -is the distance travelled by each truck for transporting compost

In the registered PDD section B.6.2, the parameter related to emission factor of electricity grid is mentioned under both baseline emission parameters ($CEF_{baseline}$) and project emission parameters (CEF_d). Similarly, NCV_{fuel} are mentioned in the registered PDD section B.6.2 under both project emission parameters and leakage emission parameters. However, the parameters have the same values in the registered PDD under baseline/project/leakage emission parameters. In the revised PDD version 09 dated 30 January 2014 these repetitions have been avoided by retaining once under section B.6.2 of the revised PDD the parameter CEF_d that is emission factor of the grid electricity displaced by the project activity and NCV_{fuel} that is Net Calorific Value of diesel.

$RATE_{Compliancey}$ - In the revised PDD this parameter is included as a monitored parameter under section B.7.1

$EG_{PJ,FF,y}$ - Amount of electricity generated in an on-site fossil fuel fired power plant or consumed from grid in the project activity. This is measured with energy meter of accuracy class 0.2 and will be calibrated on annual basis. The recording will be done on daily basis. This parameter is now being monitored instead of MWh_e –electricity consumption mentioned in the registered PDD.

The following parameters are now proposed to be additionally monitored consequent upon the technology adopted.

- ☐ DT_y - Average additional distance travelled by vehicle for ash and inert disposal compared to the baseline in year y is now proposed to be monitored to account for the project emission.
- ☐ Amount of RDF used outside the project boundary is proposed to be monitored based on the sale invoice. There will normally be no sale and the parameter is used for project emission calculations.
- ☐ R_n -Weight of RDF sold offsite for which no sale invoices can be provided is also monitored. The quantity will be monitored based on weigh bridge report and is being monitored to account for project emission.

- ☐ $MC_{CH_4,r,y}$ - Monitored content of methane in the stack gas from RDF combustion in year y. This will be monitored by third party on quarterly basis. This parameter is being monitored to account for project emission.
- ☐ $MC_{N_2O,r,y}$ - Monitored content of nitrous oxide in the stack gas from RDF combustion in year y. This will be monitored by third party on quarterly basis. This parameter is being monitored to account for project emission.

Monitoring details were added/clarified in Table B.7.1 in for the following monitored parameters

- ☐ R_c - Amount of RDF combusted in year, the parameter will be monitored on daily basis using load cells for the grab crane feeding waste to boiler,
- ☐ $VF_{consumption}$ - Vehicle fuel consumption in litres per kilometre for vehicle type which will be updated on an annual basis based on the latest publicly available data and the conservative value will be adopted for the project and leakage emission calculations,
- ☐ EG_d - Amount of electricity generated utilizing the RDF produced and exported to grid in the project activity during the year y which will be recorded on daily basis with the gross generation measured using meter of accuracy class 0.2. auxiliary consumption measured using meters of accuracy class 0.5,
- ☐ $A_{j,x}$ - Amount of organic waste type j prevented from disposal in the landfill in the year x (tonnes/year) which is based on the weighbridge receipt and characterisation of waste done on quarterly basis by third party.
- ☐ $A_{ci,y}$ - Amount of residual waste type 'ci' from combustion of RDF which is based on the weighbridge receipt and characterization of waste done on quarterly basis by third party
- ☐ $NO_{vehicles}$ - Vehicles per carrying capacity per year. This parameter is measured on daily basis and will be cross checked with the amount of ash and inert material transported and the carrying capacity of the truck.

PRC reference number 1254-001

Approval date: 24/06/2014

<http://cdm.unfccc.int/PRCContainer/DB/prcp743754919/view>

Permanent changes made during 3rd MP:

- ☐ Data / Parameters (pn,j,x) and (zx) were added to the monitoring plan.
- ☐ As per the methodological Tool "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", (Annex 14, EB 26)

The methodological tool also requires that the frequency of sampling of the parameter pn,j,x shall be determined such that it becomes statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. The frequency of the parameter pn,j,x has been increased to "thrice in three months" which will result in more accurate monitoring with 12 samples a year.

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<http://cdm.unfccc.int/PRCContainer/DB/prcp334561174/view>

Changes to monitoring plan have been proposed for parameter during current monitoring period:

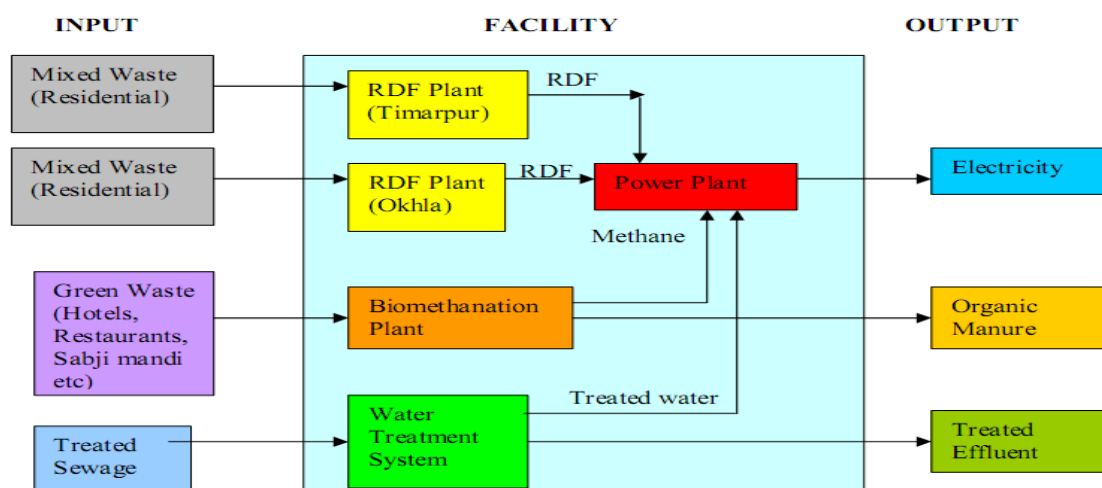
Table 2: Post registration modifications

Sl. No	Parameters	Post-registration scenario
1	Data / Parameters FCF i	<p>The parameter 'FCFi' had been fixed ex-ante in the PDD and IPCC default values were considered.</p> <p>Reference methodology AM0025 (version 06) "Avoided emissions from organic waste through alternative waste treatment processes" requires that the parameter FCFi be monitored annually and frequency of sampling of the above parameter shall be determined such that it becomes statistically significant with a maximum uncertainty range of 20% at a 95% confidence level.</p> <p>PP did not monitor the parameter as it was fixed in the PDD.</p> <p>PP hereby proposes to take a temporary deviation for the period 10th March 2017 to 31st March 2020 for the monitoring parameter. During this period, the IPCC value as per IPCC 2006, volume 5 (waste), Table 2.4 on page no. 2.14 for the parameter will be used following a conservative approach.</p> <p>Further as per the methodology AM0025 / Version 06, the frequency of sampling should be "determined through sampling where the samples shall be chosen in a manner that ensures estimation with 20% uncertainty at 95% confidence level".</p> <p>Going forward, the PP will follow the same for the monitoring the parameter.</p>
2	Data / Parameters EF i	<p>The parameter 'EFi' is being included in the calculation of CERs but was not included in the PDD. The same has been added in the PDD in accordance with the methodology AM0025 (version 06) "Avoided emissions from organic waste through alternative waste treatment processes"</p>

B.2.6. Changes to project design

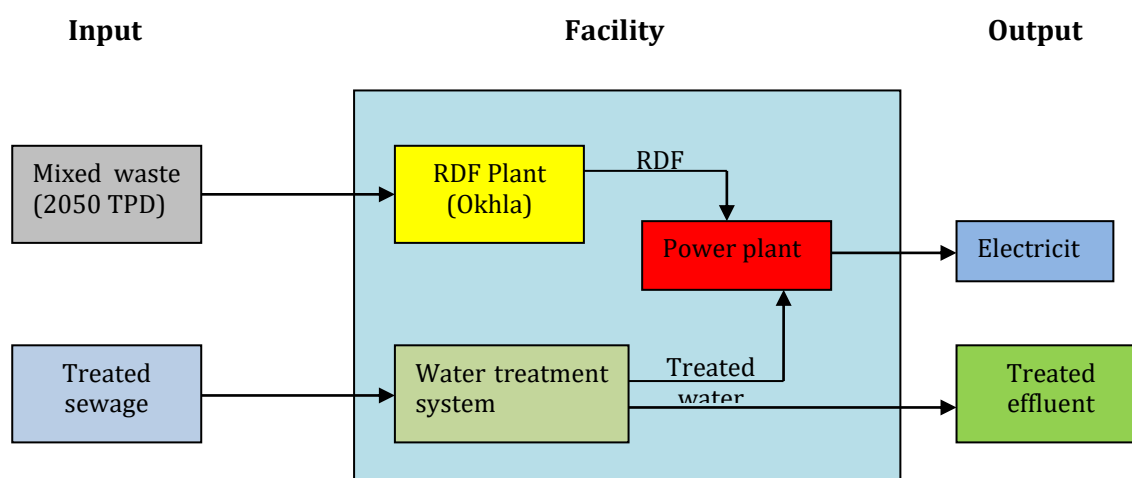
There are certain permanent changes in the project activity from the registered PDD as highlighted below:

- ☐ The project was earlier envisaged to be developed at two different location, i.e. Timarpur and Okhla. About 650 Tonne Per Day (TPD) of Municipal Solid Waste (MSW) was envisaged to be processed at the Timarpur site while 1300 TPD of MSW was envisaged to be processed at Okhla site for the preparation of Refuse Derived Fuel (RDF). Additionally, 100 TPD of green waste (waste collected from garden like dry leaves, cut grass, etc) was to be utilized at Okhla site for generation of Compost and biogas through composting and biomethanation plant respectively. The PP had also envisaged to generate electricity to the tune of 16 MW by utilizing the RDF produced from the project activity.

Earlier design

However, after accessing the success rate of existing technologies and availability of better technologies for such project activities the board took a decision to implement the project activity with a better technology (technical details are provided section A.4.3) and some design changes. The Timarpur site has been dropped from the project and the entire waste (1950 TPD) is now processed at the Okhla site. Further, the envisaged plants of biomethanation and composting are dropped as the green waste envisaged in the initial phase is not supplied to the project activity as a separate tender has been floated for the same. Instead, PP shall now be sourcing an additional 100 TPD of MSW for the project activity. Also, since PP is implementing a better technology for waste processing and power generation, it was established that the RDF produced shall be capable of producing 20.9 MW of electricity instead of 16 MW as envisaged in the first place.

Therefore, the project activity would now involve processing of 2050 TPD of MSW to generate about 20.9 MW of power using a turbine at the Okhla site.

Design implemented

PRC reference number 1254-001

Approval date: 24/06/2014

<http://cdm.unfccc.int/PRCContainer/DB/prcp743754919/view>

B.2.7. Changes specific to afforestation or reforestation project activity

Not Applicable

SECTION C. Description of monitoring system

The monitoring plan for the project activity has been implemented as per the registered monitoring plan and discussed in the following section; further the project plant layout and schematic of monitoring equipment has been presented in the Appendix-I. The monitoring procedures of main parameters are discussed below:

MSW Received (Amount of Fresh Waste) and No of vehicles: The MSW is supplied by NDMC and MCS through the different size of vehicles (trucks) to the project activity site. There are 3 weighbridges have been installed at the gate to monitor the weight of incoming and outgoing vehicles (trucks) i.e. Gross weight and Tare weight of truck difference of the both is the amount of fresh waste received at the plant site. The characterization of MSW carried out on monthly basis by the 3rd party.

MSW Processed and combusted (Amount of RDF produced and Amount of RDF combusted): Both the parameters are being monitored with the load cells at the MSW processing area and boiler feeder.

Electrical Energy (Generated, Export, Import and Auxiliary consumption): The electricity generated from the project activity is being monitored with the turbine generation meter installed at the power plant. The electricity export and import is being monitored with the export/import meter installed at the Jasola sub-station. Auxiliary Consumption at the plant is being monitored with the multiple energy meters installed at the plant.

Stack Monitoring: There are two stacks installed at project activity site for flue gases exhaust from Boilers. Both of the stacks are in operation; Boiler No-1 and Boiler No-2 are connected to stack-1 and Boiler No.3 has been connected to Stack-2. The location of the gas flow meters and all the monitoring equipment depicted in the Annex-I. Further, the concentration of N₂O and CH₄ in the flue gas is being monitored on monthly basis by 3rd party.

Diesel consumption (on-site): The onsite-diesel consumption is being monitored with the oil flow meter installed at diesel tank.

Details and specification of the monitoring instruments and equipment are provided in the following section of Monitoring Report.

Measures to ensure the Results / uncertainty analysis

As per the monitoring plan of the registered PDD; all the monitoring equipment shall be calibrated by an independent agency, which is accredited with National Accreditation Board for Testing & Calibration Laboratories (NABL), Department of Science & Technology, and Government of India on an annual basis. If during the yearly test check, any meter is found to be beyond permissible limits of error, it would be calibrated immediately.

As per the Power Purchase Agreement (PPA), the energy exported to the state Grid is recorded from two independent meters viz., Main Meter and Check Meter and reading of main meter is used for billing. In the event of main meter not in operation / fails, the reading of the check meter shall be used for billing. Power Generation, Export & Auxiliary Consumption, fuel consumption are being recorded on regular interval, as defined in section D.7.2, and the same is being verified and approved by Manager (O&M).

Emergency Procedure

Though, all the measures are taken to avoid erroneous recording of the monitoring parameters, there might be certain situations which may include failure of various metering devices. To minimize the risk of data discrepancy a set of spare for different meters are maintained at the plant site. Further, regular checking and maintenance of all metering devices is carried out by plant personnel at TOWMCL to maintain highest level of accuracy.

Roles and responsibilities

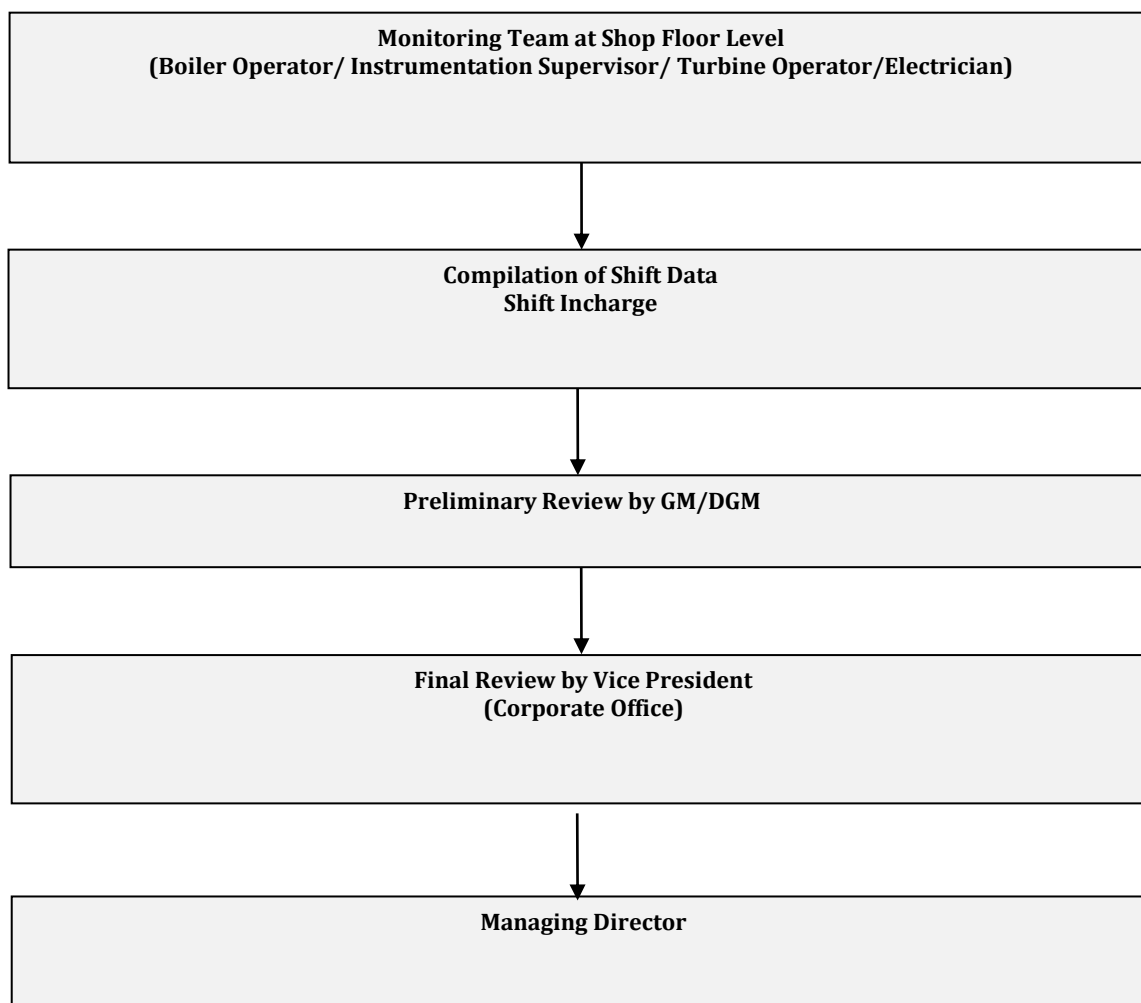
Different operators are responsible for monitoring of daily data of the waste received, RDF produced, RDF combusted, steam generated from boiler, steam fed to turbine, electricity generated, etc. The report is then sent to the Shift in-charge for the review. The plant layout with monitoring point and details of monitoring equipment has been presented in Appendix – I.

Shift Electrician (Electrical) is responsible for taking meter readings for electricity generation daily.

Shift In-charge is responsible for compilation of data which is then sent to GM for preliminary review.

GM is responsible for reviewing the monitored parameters report on a daily basis and presenting a daily executive summary report to the Vice President Corporate office which is finally reported to Managing Director (MD), TOWMCL.

Organization structure responsible for monitoring and reporting of parameters involved in CDM project activity has been presented in the following flow chart.



SECTION D. Data and parameters**D.1. Data and parameters fixed ex ante**

Data/Parameter	CEF _d
Unit	tCO ₂ /MWh
Description	Emission factor of the grid electricity displaced by the project activity
Source of data	Ex-ante as fixed in registered PDD
Value(s) applied	0.75
Choice of data or measurement methods and procedures	Registered PDD
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	The same shall be applicable for the electricity exported to the grid

Data/Parameter	NCV _{fuel}
Unit	MJ/ kg
Description	Net Calorific Value of diesel
Source of data	Ex-ante as fixed in registered PDD
Value(s) applied	43.3
Choice of data or measurement methods and procedures	Registered PDD
Purpose of data/parameter	Estimation of baseline emissions
Additional comments	-

Data/Parameter	EF _{fuel}
Unit	tCO ₂ / TJ
Description	CO ₂ emission factor of diesel
Source of data	Ex-ante as fixed in registered PDD
Value(s) applied	74.1
Choice of data or measurement methods and procedures	Registered PDD
Purpose of data/parameter	Estimation of project emissions
Additional comments	-

Data/Parameter	CCW _i
Unit	%
Description	Fraction of carbon content in waste type i
Source of data	Ex-ante as fixed in registered PDD

Value(s) applied		
Choice of data or measurement methods and procedures	Registered PDD	
Purpose of data/parameter	Estimation of baseline emissions	
Additional comments	-	

Data/Parameter	D _{fuel}
Unit	Kg/l
Description	Density of diesel
Source of data	Ex-ante as fixed in registered PDD
Value(s) applied	0.84
Choice of data or measurement methods and procedures	Registered PDD
Purpose of data/parameter	Estimation of project emissions
Additional comments	Fixed ex-ante as given in PDD, used for calculation of baseline emissions.

Data/Parameter	ϕ
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	Methodological tool "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (Annex 14, EB26)
Value(s) applied	0.9
Choice of data or measurement methods and procedures	Fixed parameter from applied methodological tool
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	Oonk et al. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results. The same shall be applicable for the electricity exported to the grid

Data/Parameter	OX
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Methodological tool "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (Annex 14, EB26)
Value(s) applied	0
Choice of data or measurement methods and procedures	Fixed parameter from applied methodological tool
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	-

Data/Parameter	F
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	Methodological tool "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (Annex 14, EB26)
Value(s) applied	0.5
Choice of data or measurement methods and procedures	Fixed parameter from applied methodological tool
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.

Data/Parameter	DOCf
Unit	-
Description	Fraction of degradable organic carbon (DOC) that can decompose
Source of data	Methodological tool "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (Annex 14, EB26)
Value(s) applied	0.5
Choice of data or measurement methods and procedures	Fixed parameter from applied methodological tool
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	-

Data/Parameter	MCF
Unit	-
Description	Methane correction factor
Source of data	Methodological tool "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (Annex 14, EB26)
Value(s) applied	0.8

Choice of data or measurement methods and procedures	Fixed parameter from applied methodological tool
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	<p>The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.</p> <p>MCF is 0.8 for unmanaged solid waste disposal sites – the sites that have a depth greater than or equal to 5 meters and / or have a high-water table at ground level. The current project qualifies at an unmanaged solid waste disposal site as it fills the depth criteria.</p>

Data/Parameter	DOC _j														
Unit	-														
Description	Fraction of degradable organic carbon (by weight) in the waste type j														
Source of data	Methodological tool “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (Annex 14, EB26)														
Value(s) applied	<p>Apply the following values for the different waste types j:</p> <table border="1"> <thead> <tr> <th>Waste type j</th><th>DOC_j (% wet waste)</th></tr> </thead> <tbody> <tr> <td>Wood and wood products</td><td>43</td></tr> <tr> <td>Pulp, paper and cardboard (other than sludge)</td><td>40</td></tr> <tr> <td>Food, food waste, beverages and tobacco (other than sludge)</td><td>15</td></tr> <tr> <td>Textiles</td><td>24</td></tr> <tr> <td>Garden, yard and park waste</td><td>20</td></tr> <tr> <td>Glass, plastic, metal, other inert waste</td><td>0</td></tr> </tbody> </table>	Waste type j	DOC _j (% 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
Waste type j	DOC _j (% 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														
Choice of data or measurement methods and procedures	Fixed parameter from applied methodological tool														
Purpose of data/parameter	Calculation of Baseline emissions														
Additional comments	-														

Data/Parameter	K _j												
Unit	-												
Description	Decay rate for the waste type j												
Source of data	Methodological tool “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (Annex 14, EB26)												
Value(s) applied	<p>Apply the following default values for the different waste types j: Decay rate for the waste type j (Tropical (MAT>20°C) and Dry (MAP<1000mm))</p> <table border="1"> <thead> <tr> <th>Waste type j</th><th>K_j</th></tr> </thead> <tbody> <tr> <td>Wood and wood products</td><td>0.025</td></tr> <tr> <td>Pulp, paper and cardboard (other than sludge)</td><td>0.045</td></tr> <tr> <td>Food, food waste, beverages and tobacco (other than sludge)</td><td>0.085</td></tr> <tr> <td>Textiles</td><td>0.045</td></tr> <tr> <td>Garden, yard and park waste</td><td>0.065</td></tr> </tbody> </table>	Waste type j	K _j	Wood and wood products	0.025	Pulp, paper and cardboard (other than sludge)	0.045	Food, food waste, beverages and tobacco (other than sludge)	0.085	Textiles	0.045	Garden, yard and park waste	0.065
Waste type j	K _j												
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Food, food waste, beverages and tobacco (other than sludge)	0.085												
Textiles	0.045												
Garden, yard and park waste	0.065												

Choice of data or measurement methods and procedures	Fixed parameter from applied methodological tool
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	-

D.2. Data and parameters monitored

Data/Parameter	EG _{PJ,FF,y}				
Unit	MWh				
Description	Amount of electricity consumed from grid in the project activity				
Measured/calculated/default	Measured				
Source of data	Logbook readings of the electricity import				
Value(s) of monitored parameter	86.7				
Monitoring equipment					
	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/ Class
	Energy Meter	Elster	05252046	MP-06	0.2S
	The calibration frequency as per PDD in annual. However, the same could				
	Date of Calibration	Calibration due on	Gap (if any)		
	07-08-2018	06-08-2019	NA		
02-08-2019	01-08-2020				
not be met and there is a delay from 17-07-2018 to 06-08-2018.					
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis Reporting Frequency- Daily basis in ER spread sheet				
Calculation method (if applicable)	Not applicable; The parameter has been directly monitored with the energy meter.				
QA/QC procedures	All Meters are calibrated by accredited external third party, as per standard procedures, on annual basis. The readings shall be cross checked with the bills received from the State load dispatch center. For the current monitoring period, the meter could not be calibrated within the calibration validity period as mentioned in the calibration certificate. Therefore, a deduction has been applied on the CERs for the period from 17-07-2018 to 06-08-2018. A total of 11 CERs will be deducted after applying a correction factor of 0.2%.				
Purpose of data/parameter	Calculation of the baseline emissions				
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.				

Data/Parameter	CEF _{elec}
Unit	tCO ₂ /MWh
Description	Emission factor for the electricity consumed in the project activity (import)
Measured/calculated/default	Calculated

Source of data	Central Electricity Authority (CEA) – Ministry of Power (Govt. of India) CEA database version 15.0 http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf																
Value(s) of monitored parameter	0.92																
Monitoring equipment	Not Applicable; the parameter has been obtained from the latest database published by the Central Electricity Authority (CEA) – Ministry of Power (Govt. of India).																
Measuring/reading/recording frequency	Measuring Frequency- Annually Recording Frequency- Annually Reporting Frequency- Annually																
Calculation method (if applicable)	<p>The same has been calculated referring the “tool to calculate the emission factor for an electricity system”, version 6.0. The CEA database version 15.0 includes the Carbon emissions factor for electricity generation in the project activity (Combined Margin in tCO₂/MWh for NEWNE Grid of India) for year 2011-2019 as follows:</p> <table border="1"> <tr><td>2018-2019</td><td>0.92 tCO₂/MWh</td></tr> <tr><td>2017-2018</td><td>0.91 tCO₂/MWh</td></tr> <tr><td>2016-2017</td><td>0.92 tCO₂/MWh</td></tr> <tr><td>2015-2016</td><td>0.94 tCO₂/MWh</td></tr> <tr><td>2014-2015</td><td>0.96 tCO₂/MWh</td></tr> <tr><td>2013-2014</td><td>0.98 tCO₂/MWh</td></tr> <tr><td>2012-2013</td><td>0.98 tCO₂/MWh</td></tr> <tr><td>2011-2012</td><td>0.95 tCO₂/MWh</td></tr> </table> <p>The latest value of 0.92 is being used.</p>	2018-2019	0.92 tCO ₂ /MWh	2017-2018	0.91 tCO ₂ /MWh	2016-2017	0.92 tCO ₂ /MWh	2015-2016	0.94 tCO ₂ /MWh	2014-2015	0.96 tCO ₂ /MWh	2013-2014	0.98 tCO ₂ /MWh	2012-2013	0.98 tCO ₂ /MWh	2011-2012	0.95 tCO ₂ /MWh
2018-2019	0.92 tCO ₂ /MWh																
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2012-2013	0.98 tCO ₂ /MWh																
2011-2012	0.95 tCO ₂ /MWh																
QA/QC procedures	Not Applicable																
Purpose of data/parameter	For estimation of project emissions																
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.																

Data/Parameter	F _{cons}					
Unit	Litres					
Description	Diesel consumption on-site during year 'y' of the crediting period					
Measured/calculated/default	Measured					
Source of data	Logbook data					
Value(s) of monitored parameter	2139.00					
Monitoring equipment	Monitoring Equipment		Make	Serial No	Metering Point	Accuracy/Cla ss
	Oil Meter		Kent	110517	MP-05	0.1
	Date of Calibration		Calibration due on		Gap (if any)	
	31-12-2018		30-12-2019		NA	
	31-12-2019		30-12-2020		NA	
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis Reporting Frequency- Daily basis in ER spread sheet					

Calculation method (if applicable)	Not applicable; the parameter has been monitored with the Oil meter installed at the project activity site.
QA/QC procedures	All Meters are calibrated by accredited external third party, as per standard procedures, on annual basis. The quantity of diesel consumed shall be cross checked with inventory and purchase during the monitoring period. The same shall be equal to or less than the checked value.
Purpose of data/parameter	For estimation of project emissions
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.

Data/Parameter	Rc				
Unit	Ton/year				
Description	Amount of RDF combusted in year y				
Measured/calculated/default	Measured				
Source of data	Logbooks prepared using Load cell data				
Value(s) of monitored parameter	429182.6				
Monitoring equipment	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy / Class
	Load Cell	Cell Sensor	1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031	MP-03 and MP-04	1
	Date of Calibration		Calibration due on		Gap (if any)
	12-03-2018		12-03-2019		NA
	01-03-2019		01-03-2020		NA
	29-02-2020		29-02-2021		NA
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis Reporting Frequency- Daily basis in ER spread sheet				
Calculation method (if applicable)	Not applicable; the parameter has been monitored with the load cells.				
QA/QC procedures	The load cells of the grab crane are calibrated by external third party, as per standard procedures, on annual basis.				
Purpose of data/parameter	For estimation of project emissions				
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.				

Data/Parameter	A _i
Unit	Ton/year
Description	Amount of waste type 'i' fed into the RDF combustor
Measured/calculated/default	Measured values
Source of data	Logbook data for incoming waste and third-party report for physical characterization of waste

Value(s) of monitored parameter	<p>Amount of waste type 'i' fed into the RDF combustor during 01/04/2019-03/03/2020 are as follows (Daily Data has been provided in Emission reduction calculation sheet):</p> <table border="1"> <thead> <tr> <th>Waste type</th><th>Quantity (MT)</th></tr> </thead> <tbody> <tr><td>Paper/cardboard</td><td>18230</td></tr> <tr><td>Textiles</td><td>69723</td></tr> <tr><td>Food Waste</td><td>197647</td></tr> <tr><td>Wood</td><td>13025</td></tr> <tr><td>Garden & park waste</td><td>74825</td></tr> <tr><td>Rubber and Leather</td><td>5325</td></tr> <tr><td>Plastics</td><td>20957</td></tr> <tr><td>Other, inert waste</td><td>143378</td></tr> </tbody> </table> <p>The values have been calculated using the third-party characterization certificates.</p>	Waste type	Quantity (MT)	Paper/cardboard	18230	Textiles	69723	Food Waste	197647	Wood	13025	Garden & park waste	74825	Rubber and Leather	5325	Plastics	20957	Other, inert waste	143378							
Waste type	Quantity (MT)																									
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Monitoring equipment	<table border="1"> <thead> <tr> <th>Monitoring Equipment</th><th>Make</th><th>Serial No</th><th>Metering Point</th><th>Accuracy/Ci ass</th></tr> </thead> <tbody> <tr> <td>Weighbridge-1, 2 & 3</td><td>Endevour</td><td>85, 46, 47</td><td>MP-01, MP-02 and MP-12</td><td>Class III (eValue 5 kg)</td></tr> <tr> <td colspan="2">Date of Calibration</td><td colspan="2">Calibration due on</td><td>Gap (if any)</td></tr> <tr> <td colspan="2">31-12-2018</td><td colspan="2">31-12-2019</td><td rowspan="2">NA</td></tr> <tr> <td colspan="2">30-12-2019</td><td colspan="3">30-12-2020</td></tr> </tbody> </table> <p>The calibration frequency as per PDD in annual. However, the same could not be met and there is a delay from 28-12-2018 to 31-12-2018.</p>	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/Ci ass	Weighbridge-1, 2 & 3	Endevour	85, 46, 47	MP-01, MP-02 and MP-12	Class III (eValue 5 kg)	Date of Calibration		Calibration due on		Gap (if any)	31-12-2018		31-12-2019		NA	30-12-2019		30-12-2020		
Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/Ci ass																						
Weighbridge-1, 2 & 3	Endevour	85, 46, 47	MP-01, MP-02 and MP-12	Class III (eValue 5 kg)																						
Date of Calibration		Calibration due on		Gap (if any)																						
31-12-2018		31-12-2019		NA																						
30-12-2019		30-12-2020																								
Measuring/reading/recording frequency	<p><u>Incoming MSW</u> Monitoring frequency: Daily basis Recording frequency: Daily basis</p>																									
Calculation method (if applicable)	<p>Based on the physical characterization analysis, the quantity of different type of waste present in the MSW received shall be calculated. (The incoming MSW shall be measured on daily basis and consolidated on annual basis). Formulae: Quantity of annual waste * % of a type of waste (Paper, food, etc) as per third party report</p>																									
QA/QC procedures	<p>All weighbridge/load cells are calibrated by accredited external third party, as per standard procedures, on annual basis.</p> <p>For the current monitoring period, the meter could not be calibrated within the calibration validity period as mentioned in the calibration certificate. Therefore, a correction factor of ± 5 kg was applied for the period of 28-12-2018 to 31-12-2018. This has lead to deduction of 2 CERs.</p>																									
Purpose of data/parameter	Calculation of the baseline emissions																									
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.																									

Data/Parameter	SG _{r,y}
Unit	m ³ /hr
Description	Total volume of stack gas from RDF combustion in year y
Measured/calculated/default	Measured
Source of data	Online monitoring records

Value(s) of monitored parameter	Parameter is being monitored in NM3/hr:				
	Boiler-1	Boiler-2	Boiler-3		
	20995337.72	19776039.39	19955287.57		
Monitoring equipment	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/C lass
	Gas Flow Meter- 1, 2 & 3	Yokoga wa	01HTA20C F901	MP-07	±0.11 kg/cm ²
			02HTA20C F901		
			03HTA20C F901		
	Date of Calibration		Calibration due on		Gap (if any)
	15-01-2019		14-01-2020		NA
15-01-2020		14-01-2021		NA	
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis				
Calculation method (if applicable)	Not applicable, the parameter has been monitored with the gas flow meters.				
QA/QC procedures	Maintenance of the equipment is being carried out on regular basis. Also, the calibration of the equipment has been undertaken on annual basis.				
Purpose of data/parameter	For estimation of project emissions				
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.				

Data/Parameter	MC _{N2O,r,y}
Unit	tN ₂ O/m ³
Description	Monitored content of nitrous oxide in the stack gas from RDF combustion in year y
Measured/calculated/default	Monitored
Source of data	Third party certificates

Value(s) of monitored parameter	Date	Stack-1	Stack-2	Avg.
		tN ₂ O/m ³	tN ₂ O/m ³	tN ₂ O/m ³
	15-04-2019	2.79 x 10 ⁻⁶	2.87 x 10 ⁻⁶	2.83 x 10 ⁻⁶
	22-05-2019	2.84 x 10 ⁻⁶	2.89 x 10 ⁻⁶	2.87 x 10 ⁻⁶
	17-06-2019	2.81 x 10 ⁻⁶	2.96 x 10 ⁻⁶	2.89 x 10 ⁻⁶
	20-07-2019	2.65 x 10 ⁻⁶	2.67 x 10 ⁻⁶	2.66 x 10 ⁻⁶
	21-08-2019	2.63 x 10 ⁻⁶	2.69 x 10 ⁻⁶	2.66 x 10 ⁻⁶
	30-09-2019	2.84 x 10 ⁻⁶	2.84 x 10 ⁻⁶	2.84 x 10 ⁻⁶
	30-10-2019	2.88 x 10 ⁻⁶	2.88 x 10 ⁻⁶	2.88 x 10 ⁻⁶
	30-11-2019	2.88 x 10 ⁻⁶	2.88 x 10 ⁻⁶	2.92 x 10 ⁻⁶
	31-12-2019	2.92 x 10 ⁻⁶	2.92 x 10 ⁻⁶	2.92 x 10 ⁻⁶
	25-01-2020	3.02 x 10 ⁻⁶	3.02 x 10 ⁻⁶	3.02 x 10 ⁻⁶
	25-02-2020	2.85 x 10 ⁻⁶	2.85 x 10 ⁻⁶	2.85 x 10 ⁻⁶
	14-03-2020	2.69 x 10 ⁻⁶	2.69 x 10 ⁻⁶	2.69 x 10 ⁻⁶
Monitoring equipment	Third party monitoring is carried out and hence no monitoring equipment are maintained at the site.			
Measuring/reading/recording frequency	Measuring Frequency- Quarterly basis Recording Frequency- Quarterly basis			
Calculation method (if applicable)	Not applicable, the parameter has been monitored with the gas flow meters by third party on a monthly basis from each of the stack (Stack 1 and Stack 2), as presented above.			
QA/QC procedures	The data obtained is compared with previous values and the same is found to be in the same range. Also, calibration records of the equipment used by third parties shall be checked.			
Purpose of data/parameter	For estimation of project emissions			
Additional comments	Data will be archived till 2 years after the end of crediting period			

Data/Parameter	VF _{consumption}
Unit	Litre/km
Description	Vehicle fuel consumption in liters per kilometer for vehicle type i
Measured/calculated/default	Credible publicly available data source has been referred
Source of data	Literature available by IISD (International institute of sustainable development): (https://www.iisd.org/gsi/sites/default/files/ffs_india_transport_policy_brief.pdf)
Value(s) of monitored parameter	0.24
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Monitoring frequency: Annually Recording frequency: Annually
Calculation method (if applicable)	Not Applicable, the parameter has been obtained from the reliable source i.e. the IISD report on "The Impacts of Diesel Price Increases on India's Trucking Industry".
QA/QC procedures	Latest publicly available data has been considered for calculation.
Purpose of data/parameter	Calculation of the project and leakage emissions
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.

Data/Parameter	MC _{CH₄,r,y}		
Unit	tCH ₄ /m ³		
Description	Monitored content of methane in the stack gas from RDF combustion in year y		
Measured/calculated/default	Monitored		
Source of data	Third party certificates		
Value(s) of monitored parameter			
	Period	Stack-1	Stack-2
		tCH ₄ /m ³	tCH ₄ /m ³
	15-04-2019	0	0
	22-05-2019	0.00	0.00
	17-06-2019	0.00	0.00
	20-07-2019	0.00	0.00
	21-08-2019	0.00	0.00
	30-09-2019	0.00	0.00
	30-10-2019	0.00	0.00
	30-11-2019	0.00	0.00
	31-12-2019	0.00	0.00
25-01-2020	0.00	0.00	
25-02-2020	0.00	0.00	
Monitoring equipment	Third party monitoring is carried out and hence no monitoring equipment are maintained at the site.		
Measuring/reading/recording frequency	Measuring Frequency- Quarterly basis Recording Frequency- Quarterly basis		
Calculation method (if applicable)	Not Applicable, the parameter has been obtained from 3 rd party test result.		
QA/QC procedures	The data obtained is compared with previous values and the same is found to be in the same range		
Purpose of data/parameter	For estimation of project emissions		
Additional comments	Data will be archived till 2 years after the end of crediting period		

Data/Parameter	MB _y
Unit	tCO _{2e}
Description	Methane produced in the landfill in the absence of the project activity in year 'y'.
Measured/calculated/default	Calculated
Source of data	Calculated values as per the tool "Emission from solid waste disposal site", version 06.0.1
Value(s) of monitored parameter	176,215.59 tCO _{2e}
Monitoring equipment	-
Measuring/reading/recording frequency	Recording Frequency- Annual basis Reporting Frequency- Annual basis in ER spread sheet
Calculation method (if applicable)	Calculated as per the tool "Emission from solid waste disposal site"
QA/QC procedures	-
Purpose of data/parameter	For estimation of baseline emissions

Additional comments	Data shall be archived till 2 years after the expiry of the crediting period. In case the annual values are not available, the monthly values will be used for the estimation reductions as per the Ver 7.0 of the methodological tool: Emission from solid waste disposal sites.
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Data/Parameter	EG _d
Unit	MWh
Description	Amount of electricity generated utilizing the RDF produced and exported to grid in the project activity during the year y
Measured/calculated/default	Measured
Source of data	Metering Records
Value(s) of monitored parameter	134,081.32

Monitoring equipment	Gross generation meters:				
	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/Class
	Energy Meter	Secure meters Ltd.	GJU61733	MP-10	-
	Date of Calibration		Calibration due on		Gap (if any)
	03-01-2019		02-01-2020		NA
	02-01-2020		01-01-2021		NA
	Import/Export meter:				
	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/Class
	Energy Meter	Elster	O5252046	MP-06	0.2
	Date of Calibration		Calibration due on		Gap (if any)
	07-08-2018		06-08-2019		NA
	02-08-2019		01-08-2020		
	The calibration frequency as per PDD in annual. However, the same could not be met and there is a delay from 17-07-2018 to 06-08-2018.				
	Auxiliary consumption meters:				
	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/Class
Energy Meter	Conzerv	203987/8965-2810 205056/9635-3310 205503/10130-3410	MP-11	-	
Date of Calibration		Calibration due on		Gap (if any)	
03-01-2019		02-01-2020		NA	
02-01-2020		01-01-2020		NA	
Measuring/reading/recording frequency	Measuring Frequency- Continuous Recording Frequency- Daily basis Reporting Frequency- Daily basis in ER spread sheet				
Calculation method (if applicable)	Not applicable, the parameter has been monitored from the energy meter.				
QA/QC procedures	The electricity exported to the state grid may be cross checked from the invoices raised by the state load dispatch centre. It may be equal or lesser than the electricity injected in the grid based on accounting done for actual scenario.				
Purpose of data/parameter	For estimation of baseline emissions				
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.				

Data/Parameter	RATE _{Compliance_y}
Unit	%

Description	Rate of Compliance
Measured/calculated/default	Latest publicly available information
Source of data	Rate of Compliance has been taken from the latest status report on Municipal Solid Waste Management published by Central Pollution Control Board (CPCB), Ministry of Environment & Forests – Govt. of India. (http://164.100.107.13/divisionsofheadoffice/pcp/MSW_Report.pdf)
Value(s) of monitored parameter	12.45%
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Monitoring Frequency- Annually Recording Frequency- Annually
Calculation method (if applicable)	Not Applicable; the parameter has been obtained from the latest available information available from Government organization i.e. CPCB.
QA/QC procedures	The source of the information is an authentic government source
Purpose of data/parameter	Estimation of baseline emissions
Additional comments	For the ex-post emission reduction calculation, the most recent RATE _{Compliance_y} as published by Central Pollution Control Board (CPCB) has been considered for calculating baseline emission for methane emission from dumping of solid waste in unmanaged landfill in the baseline scenario. The project will stop receiving any credit once the compliance reaches 50% limit. If the rate exceeds 50%, no CERs can be claimed

Data/Parameter	NO _{vehicles}
Unit	Number
Description	Vehicles per carrying capacity per year
Measured/calculated/default	Monitored
Source of data	Logbook records
Value(s) of monitored parameter	7785
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis Reporting Frequency- Daily basis in ER spread sheet
Calculation method (if applicable)	Not Applicable, the parameter has been monitored directly and recorded.
QA/QC procedures	The number of vehicles shall be cross checked with the amount of ash and inert material transported and the carrying capacity of the truck. Measure of full truck load consignment and consignment not sent on full truck load shall be assessed separately.
Purpose of data/parameter	Calculation of the project emissions
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.

Data/Parameter	DT _y
Unit	Km
Description	Average additional distance travelled by vehicle for ash and inert disposal compared to the baseline in year y
Measured/calculated/default	Monitored
Source of data	Logbook records

Value(s) of monitored parameter	20
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Monitoring Frequency- Annually Recording Frequency- Annually Reporting Frequency- Annually
Calculation method (if applicable)	Not Applicable, the distance between the landfill site and project activity plant is about 7.5km (trip distance will be 15km); hence the trip distance of 20 km has been considered conservative.
QA/QC procedures	Not Applicable
Purpose of data/parameter	Calculation of the leakage emissions
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.

Data/Parameter	Amount of RDF used outside the project boundary
Unit	Tons
Description	Project proponent shall monitor the amount of RDF sold for use outside of the project boundary
Measured/calculated/default	Monitored
Source of data	Sale invoices, if any
Value(s) of monitored parameter	0 (The PP is using the produced RDF to generate electricity at the project site. Therefore, the RDF is not envisaged to be sold outside the project boundary as per the project design)
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Measuring Frequency- Weekly basis Recording Frequency- Weekly basis
Calculation method (if applicable)	Not Applicable
QA/QC procedures	The records of RDF production, RDF consumption and available inventory shall be checked to ascertain that there is no RDF sold outside the project boundary. During the monitoring period RDF has not been sold outside. Also, weighbridge shall be calibrated on annual basis.
Purpose of data/parameter	Calculation of the project emissions
Additional comments	Data will be archived till 2 years after the end of crediting period

Data/Parameter	$A_{j,x}$												
Unit	tonnes/year												
Description	Amount of organic waste type j prevented from disposal in the landfill in the year x (tonnes/year)												
Measured/calculated/default	calculated using measured values												
Source of data	Records of incoming waste and physical characterization certificate from third party												
Value(s) of monitored parameter	<table border="1"> <thead> <tr> <th>Waste type</th><th>Quantity (MT)</th></tr> </thead> <tbody> <tr> <td>Paper/cardboard</td><td>18230</td></tr> <tr> <td>Textiles</td><td>69723</td></tr> <tr> <td>Food Waste</td><td>197647</td></tr> <tr> <td>Wood</td><td>13025</td></tr> <tr> <td>Garden and park waste</td><td>74825</td></tr> </tbody> </table>	Waste type	Quantity (MT)	Paper/cardboard	18230	Textiles	69723	Food Waste	197647	Wood	13025	Garden and park waste	74825
Waste type	Quantity (MT)												
Paper/cardboard	18230												
Textiles	69723												
Food Waste	197647												
Wood	13025												
Garden and park waste	74825												

Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis, consolidated on annual basis
Calculation method (if applicable)	The total amount of the waste received in the plant shall be segregated according to the physical characterization, carried out by the third party on a quarterly basis. The sampling plan of the registered monitoring plan has been followed.
QA/QC procedures	The composition of waste shall be determined quarterly by a third party and weighbridge shall be calibrated on annual basis. The third party follows sampling plan of the registered monitoring plan to collect the waste sample.
Purpose of data/parameter	For estimation of baseline emissions
Additional comments	Data will be archived till 2 years after the end of crediting period

Data/Parameter	$A_{ci,y}$
Unit	Tones/year
Description	Amount of residual waste type 'ci' from combustion of RDF
Measured/calculated/default	Measured
Source of data	weighbridge records and the physical characterization of the ash
Value(s) of monitored parameter	0 (The amount of residual waste coming out of RDF combustion is only inert material which could not be separated in the pre-processing stage)
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis Reporting Frequency- Daily basis in ER spread sheet
Calculation method (if applicable)	Not Applicable
QA/QC procedures	The weighbridge shall be calibrated on annual basis
Purpose of data/parameter	For estimation of leakage emissions
Additional comments	Data will be archived till 2 years after the end of crediting period

Data/Parameter	R_n
Unit	Ton
Description	Weight of RDF sold offsite for which no sale invoices can be provided
Measured/calculated/default	Monitored
Source of data	Weighbridge records
Value(s) of monitored parameter	0 (The PP is using the produced RDF to generate electricity at the project site. Therefore, the RDF is not envisaged to be sold outside the project boundary as per the project design)
Monitoring equipment	The RDF sold offsite shall be monitored by the weighbridge. However, during the monitoring period PP has not sold RDF outside. The weighbridge details may be referred from data provided in previous parameters
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis
Calculation method (if applicable)	Not applicable
QA/QC procedures	The weighbridges are calibrated on annual basis by a third party
Purpose of data/parameter	Not Applicable
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.

Data/Parameter	R _t				
Unit	Ton				
Description	Total weight of RDF produced				
Measured/calculated/default	Measured				
Source of data	Logbooks prepared using Load cell data				
Value(s) of monitored parameter	612,566.679				
Monitoring equipment					
	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/Class
	Load Cell	Cell Sensor	1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031	MP-03 and MP-04	1
	Date of Calibration		Calibration due on		Gap (if any)
	12-03-2018		12-03-2019		NA
	01-03-2019		01-03-2020		NA
	29-02-2020		29-02-2021		NA
Measuring/reading/recording frequency	Measuring Frequency- Daily basis Recording Frequency- Daily basis, consolidated on monthly basis Reporting Frequency- Monthly basis in ER spread sheet				
Calculation method (if applicable)	Not applicable, the parameter is being monitored with the load cells.				
QA/QC procedures	The load cells of the grab crane are calibrated by accredited external third party, as per standard procedures, on annual basis.				
Purpose of data/parameter	-				
Additional comments	Data shall be archived till 2 years after the expiry of the crediting period.				

Data/Parameter	pn,j,x	
Unit	%	
Description	Weight fraction of the waste type in the sample collected during the year	
Measured/calculated/default	Measured	
Source of data	Sample measurements	
Value(s) of monitored parameter	Type of waste	Average
	Food waste	37.62%
	Garden waste	19.12%
	Wood pieces	1.15%
	Paper/Cardboard	3.10%
	Textile/cotton/Jute	12.00%
	Rubber/Leather/Tyre	0.82%
	Polythene/plastic	3.17%
	Inert and other	25.80%

Monitoring equipment	This parameter is monitored by the third part
Measuring/reading/recording frequency	Measuring Frequency- Thrice in a quarter Recording Frequency- Thrice in a quarterly basis, consolidated on annual basis. A minimum of three samples shall be undertaken every three months with the mean value valid for year y
Calculation method (if applicable)	Not applicable
QA/QC procedures	The characterization of Municipal Solid Waste (MSW) are conducted by the accredited 3 rd party agency/laboratory at least once in a quarter.
Purpose of data/parameter	To calculate the amount of particular waste from the total waste received at site
Additional comments	Data will be archived till 2 years after the end of crediting period. This parameter is introduced as per the requirement of the tool: Emission from solid waste disposal sites version 7

Data/Parameter	Z
Unit	-
Description	Number of samples collected during the year y
Measured/calculated/default	Measured
Source of data	Third party reports
Value(s) of monitored parameter	12
Monitoring equipment	Sampling is done by third party
Measuring/reading/recording frequency	Measuring Frequency- Thrice in a quarter Recording Frequency- Thrice in a quarter A minimum of three samples shall be undertaken every three months
Calculation method (if applicable)	Not applicable
QA/QC procedures	The sampling will be conducted by the accredited 3 rd party agency/laboratory at least three times in a quarter In case there is a wide variation in the samples we will apply the correction estimates as per the tool "Sampling and surveys for CDM project activities and programmes of activities"
Purpose of data/parameter	To calculate the amount of particular waste from the total waste received at site
Additional comments	Data will be archived till 2 years after the end of crediting period. This parameter is introduced as per the requirement of the tool: Emission from solid waste disposal sites version 7.

Data/Parameter	FCF_i
Unit	Fraction
Description	Fraction of fossil carbon in waste type i
Measured/calculated/default	Measured
Source of data	Third party reports

Value(s) of monitored parameter	<table> <tr> <th>Waste type</th><th>Fraction of carbon content</th></tr> <tr> <td>Paper/cardboard</td><td>5</td></tr> <tr> <td>Textiles</td><td>50</td></tr> <tr> <td>Food Waste</td><td>0</td></tr> <tr> <td>Wood</td><td>0</td></tr> <tr> <td>Garden and park waste</td><td>0</td></tr> <tr> <td>Rubber and leather</td><td>20</td></tr> <tr> <td>Plastics</td><td>100</td></tr> <tr> <td>other, inert waste</td><td>100</td></tr> </table>	Waste type	Fraction of carbon content	Paper/cardboard	5	Textiles	50	Food Waste	0	Wood	0	Garden and park waste	0	Rubber and leather	20	Plastics	100	other, inert waste	100
Waste type	Fraction of carbon content																		
Paper/cardboard	5																		
Textiles	50																		
Food Waste	0																		
Wood	0																		
Garden and park waste	0																		
Rubber and leather	20																		
Plastics	100																		
other, inert waste	100																		
Monitoring equipment	The parameter to be determined through sampling where the samples shall be chosen in a manner that ensures estimation with 20% uncertainty at 95% confidence level.																		
Measuring/reading/recording frequency	A minimum of three samples shall be undertaken every three months.																		
Calculation method (if applicable)	Not applicable																		
QA/QC procedures	The sampling will be conducted by the accredited 3 rd party agency/laboratory at least three times in a quarter.																		
Purpose of data/parameter	Calculation of the baseline emissions																		
Additional comments	<p>The parameter FCF_i has to be monitored annually through sampling where samples shall be chosen in a manner that ensures estimation with 20% uncertainty at 95% confidence level.</p> <p>However, the PP failed to comply with the above requirement. A temporary deviation is proposed for the period 10th March 2017 to 31st March 2020 for the monitoring parameter. During this period, the IPCC default values as per IPCC 2006, volume 5 (waste), Table 2.4 on page no. 2.14 for the parameter will be used.</p>																		

Data/Parameter	EF_i
Unit	Fraction
Description	Combustion efficiency for waste type i
Measured/calculated/default	Measured
Source of data	IPCC 2006, Volume 5: Waste, Section 5.4.1.3 on page 5.20
Value(s) of monitored parameter	1

Monitoring equipment	As per IPCC the combustion efficiency for incineration can be considered as 100%. IPCC factors have been considered here since country or project specific data is not available.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Not applicable
QA/QC procedures	-
Purpose of data/parameter	Calculation of the baseline emissions
Additional comments	-

D.3. Implementation of sampling plan

Sampling Plan: Waste collection for characterization

Waste characterization assessment for the Municipal Solid Waste (MSW) received from MCD/NDMC is conducted by a NABL accredited laboratory in line with the applicable IS standards laid down for the municipal solid waste.

Sampling procedure for collecting a representative sample at Okhla plant is as follows:

MSW is received through roughly 250 trucks/day. MSW in each vehicle is weighed at the weighbridge station and weight is noted. Subsequently, about 10 kgs of MSW is collected from the truck from different locations and depths within the truck quantity. This procedure is carried out for collecting samples from all the trucks for the day. The collected samples are heaped up under a roof so that moisture loss does not occur.

The MSW heap is thoroughly turned repeatedly (for about 5-6 times) for mixing the contents. The MSW is then spread on concrete floor and one final sample of about 10 kg is collected. This sample is then segregated into 15 parts according to the requirements of the physical characterization. The sample thus collected is taken for analysis for the following physio-chemical parameters.

Physio-Chemical Parameters:
<ol style="list-style-type: none"> 1. Net content (Material) 2. Density of material 3. Temperature 4. pH 5. Moisture content 6. Components <ul style="list-style-type: none"> <input type="checkbox"/> Food waste (Kitchen Waste, Lemon Chilka, Vegetables, Dry Sugar Canes, Coconut shell/hair) <input type="checkbox"/> Garden waste (Straw/Hay, Flowers, Green leaves/Green Matter, Dry leaves/Dry Matter) <input type="checkbox"/> Wooden Pieces (Wooden Pieces, Broom, Cardboard (wooden)) <input type="checkbox"/> Paper/Cardboard <input type="checkbox"/> Textile/cotton

- ☐ Rubber/Leather/Tyre
- ☐ Polythene/plastics
- ☐ Metals
- ☐ Glass
- ☐ Sand/soil/earth
- ☐ Stones/brick/concrete
- ☐ Ceramic and other
- ☐ Human Hair
- ☐ Batteries
- ☐ PVC
- ☐ Hazardous waste (if any)
- ☐ Thermocol
- ☐ Inert and other

Test protocols adopted for waste analysis are in accordance with standards prescribed by IS/ USEPS/ AISTM.

The characterization of Municipal Solid Waste (MSW) has been conducted by the accredited 3rd party agency/laboratory on quarterly basis. The MSW characterization results have been provided in the ER calculation sheet.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

Baseline Emissions (BE_y):

Baseline emissions are calculated as follows:

$$BE_y = (MB_y - MD_{reg,y}) * GWP_{CH_4} + EG_y * CEF_{Baseline,elec,y} + EG_{d,y} * CEF_d + HG_y * CEF_{baseline,therm,y}$$

Where:	
BE _y	Baseline emissions in year y (tCO _{2e})
MB _y	Methane produced in the landfill in the absence of the project activity in year y (tCH ₄)
MD _{reg,y}	Methane that would be destroyed in the absence of the project activity in year y (tCH ₄) (As per the registered PDD this value has been considered as 0)
GWP _{CH₄}	Global warming potential of Methane (tCO _{2e} /tCH ₄)
EG _y	Amount of electricity in the year y that would be consumed at the project site in the absence of the project activity and which is not consumed anymore due to the implementation of the project activity, (MWh). (As per the registered PDD this value has been considered as 0; Since, the project activity is a green field project EG _y is zero.)
CEF _{baseline,elec,y}	Carbon emissions factor for electricity consumed at the project site in the absence of the project activity (tCO ₂ /MWh) (As per the registered PDD this parameter has not been used for Baseline emission calculations)
EG _{d,y}	Amount of electricity generated utilizing the biogas/syngas collected or RDF produced, and exported to the grid in the project activity during the year y (MWh)
CEF _d	Carbon emissions factor for the displaced electricity source in the project scenario (tCO ₂ /MWh)
HG _y	Quantity of thermal energy that would be consumed in year y at the project site in the

	absence of the project activity and which is not consumed anymore due to the implementation of the project activity (MWh). (As per the registered PDD this value has been considered as 0; Since, the project activity is a green field project HG_y is zero.)
CEF baseline,therm,y	CO2 emissions intensity for thermal energy generation (tCO2e/MJ) (As per the registered PDD this parameter has not been used for Baseline emission calculations)

Formulae	$MB_y = BE_{CH4,SWDS,y}$	$EG_{d,y}$	CEF_d	EG_y	HG_y	$CEF_{baseline,elec,y}$	$EG_{d,y} * CEF_d$	BE_y
	tCO2e	MWh	tCO2/MWh	MWh	MWh	tCO2/MWh	tCO2e	tCO2e
01/04/2019 to 03/03/2020	176,215.59	134,081.32	0.75	0	0	0	100,560.99	276,776.58

Adjusted baseline emissions ($BE_{y,a}$):

The adjusted baseline emissions ($BE_{y,a}$) are calculated as follows:

$$BE_{y,a} = BE_y * (1 - RATE_{y,compliance})$$

Where:	
BE_y	Baseline emissions in year y (tCO _{2e})
$BE_{y,a}$	Adjusted baseline emissions in year y (tCO _{2e})
MB_y	Is the state-level compliance rate of the MSW Management Rules in that year y. The compliance rate shall be lower than 50%; if it exceeds 50% the project activity shall receive no further credit.

Total Baseline Emissions	Rate of Compliance	Compliance adjusted baseline emission from avoidance of methane emission
BE_y	$RATE_{Compliance,y}$	$BE_{y,a} = BE_y * (1 - RATE_{Compliance,y})$
t CO _{2e}	%	t CO _{2e}
276,776	12.45 %	242,317

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

$$MB_y = BE_{CH4,SWDS,y}$$

Where $BE_{CH4,SWDS,y}$ is calculated in accordance of the methodological tool "Emissions from solid waste disposal sites (Annex-14, EB 26)" as follows:

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

$$BE_{CH4,SWDS,y} = BE_{CH4,foodwaste,y} + BE_{CH4,gardewaste,y} + BE_{CH4,paper\ waste,y} + BE_{CH4,textilewaste,y} + BE_{CH4,wooden\ waste,y}$$

Where:

$BE_{CH_4,SWDS,y}$	Methane generation from the landfill in the absence of the project activity at year y (Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y) (tCO_{2e})
$A_{j,x}$	Amount of organic waste type j prevented from disposal in the landfill in the year x (tonnes/year)
ϕ	Model correction factor to account for model uncertainties (0.9)
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner. (value used is 0 as no methane is being captured in the project activity)
GWP_{CH_4}	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose
MCF	Methane correction factor
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	Decay rate for the waste type j
J	Waste type category (index)
X	Year during the crediting period: x runs from the first year of the first crediting period ($x = 1$) to the year y for which avoided emissions are calculated ($x = y$)
Y	Year for which methane emissions are calculated

$BE_{CH_4,SWDS,y}$	$BE_{CH_4,foodwaste,y}$	$BE_{CH_4,gardewaste,y}$	$BE_{CH_4,paper\ waste,y}$	$BE_{CH_4,wooden\ waste,y}$	$BE_{CH_4,textilewaste,y}$
t CO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}
176,215.59	79,393.65	42,567.53	22,539.97	7,341.66	24,372.77

E.2. Calculation of project emissions or actual net removals

Project Emission (PE_y):

The project emissions are calculated as follows:

$$PE_y = PE_{elec,y} + PE_{fuel,onsite,y} + PE_{a,y} + PE_{r,y}$$

Where:	
PE_y	Project emissions in year y (tCO_{2e})
$PE_{elec,y}$	Emissions from electricity consumption on-site due to the project activity in year y (tCO_{2e})
$PE_{fuel,onsite,y}$	Emissions on-site due to fuel consumption on-site in year y (tCO_{2e}).
$PE_{a,y}$	Emissions from the anaerobic digestion process in year y (tCO_{2e})
$PE_{r,y}$	Emissions from the combustion of RDF in year y (tCO_{2e})

PE _y	PE _{elec,y}	PE _{fuel,onsite,y}	PE _{a,y}	PE _{r,y}
t CO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
164,512.18	118.8	5.76	0	164,426.06

Project emissions from electricity use (PE_{elec,y}) :

The project activity involves electricity consumption and emissions are calculated as follows:

$$PE_{elec,y} = MWH_{e,y} * CEF_{elec}$$

Where:	
MWH _{e,y}	Amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid in the project activity, measured using an electricity meter (MWh) <i>MWH_{e,y} is same as EG_{PJ,FF,y} as per the methodology</i>
CEF _{elec}	Carbon emissions factor for electricity generation in the project activity (tCO ₂ /MWh)

PE _{elec,y}	MWH _{e,y}	CEF _{elec}
tCO ₂ e	MWh	tCO ₂ e/MWh
118.87	129.21	0.92

Emission from fuel use on-site (PE_{fuel,onsite,y}):

Emissions are calculated from the quantity of fuel used and the specific CO₂-emission factor of the fuel, as follows:

$$PE_{fuel,onsite,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel} * D_{fuel}$$

Where:	
F _{cons,y}	Fuel consumption on site in year y (l or kg)
NCV _{fuel}	Net caloric value of the fuel (MJ/l or MJ/kg)
EF _{fuel}	CO ₂ emissions factor of the fuel (tCO ₂ /MJ)
D _{fuel}	Density of the fuel (kg/l)

PE _{fuel,onsite,y}	F _{cons,y}	NCV _{fuel}	EF _{fuel}	D _{fuel}
tCO ₂ e	Litres	MJ/kg	tCO ₂ e/TJ	Kg/l
5.70	2114.00.00	43.3	74.1	0.84

Emission from anaerobic digestion (PE_{a,y}):

Since, there is no anaerobic digestion taking place in the project activity, emissions under this parameter have been considered as Zero.

Emissions from combustion of RDF ($PE_{r,y}$):

The project emission from RDF combustion is calculated as follows:

$$PE_{r,y} = PE_{r,f,y} + PE_{r,s,y}$$

Where:	
$PE_{r,f,y}$	Fossil-based waste CO ₂ emissions from RDF-combustion in year y (tCO _{2e})
$PE_{r,s,y}$	Emissions from the final stacks from RDF-combustion in year y (tCO _{2e})

$PE_{r,y}$	$PE_{r,s,y}$	$PE_{r,f,y}$
tCO _{2e}	tCO _{2e}	tCO _{2e}
143,900.03	2431.40	141,468.62

Emissions from fossil based waste ($PE_{r,f,y}$)

$$PE_{r,f,y} = \sum A_i * CCW_i * FCF_i * EF_i * (44/12)$$

Where:	
A_i	Amount of waste type i fed (t/yr)
CCW_i	Fraction of carbon content in waste type i (fraction)
FCF_i	Fraction of fossil carbon in waste type i (fraction)
EF_i	Combustion efficiency for waste type i (fraction)
44/12	Conversion factor (tCO ₂ /tC)

	Paper/ Cardboard	Textiles	Food Waste	Wood	Garden and park waste	Rubber and leather	Plastics	Other, inert waste
$PE_{r,f,y}$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$	$PE_{r,f,y,i} = A_i * CCW_i * FCF_i * EF_i * (44/12)$
t CO _{2e}	t CO _{2e}	t CO _{2e}	t CO _{2e}	t CO _{2e}	t CO _{2e}	t CO _{2e}	t CO _{2e}	t CO _{2e}
161,090.51	1537.42	63,912.41	0	0	0	2616.12	57,631.06	15,771.61

Emissions from RDF combustor ($PE_{r,s,y}$):

For the calculation of the project emissions from stack gases of the RDF combustor Option 1 of the registered PDD has been chosen by the PP. The stack emission from project activity is as follows:

Option 1:

$$PE_{r,s,y} = SG_{r,y} * MC_{N2O,r,y} * GWP_{N2O} + SG_{r,y} * MC_{CH4,r,y} * GWP_{CH4}$$

Where:	
$SG_{r,y}$	Total volume of stack gas from the RDF combustion (m ³ /yr)
$MC_{N2O,r,y}$	Monitored content of nitrous oxide in the stack gas from RDF combustion in year y

	(t _{N2O} /m ³)
GWP _{N2O}	Global Warming Potential of nitrous oxide (tCO _{2e} /t _{N2O})
MC _{CH4,r,y}	Monitored content of methane in the stack gas from RDF combustion in year y (t _{CH4} /m ³)
GWP _{CH4}	Global Warming Potential of methane (tCO _{2e} /t _{CH4})

PE _{r,s,y}	SG _{r,y}	MC _{N2O,r,y}	GWP _{N2O}	MC _{CH4,r,y}	GWP _{CH4}
tCO _{2e}	m ³ /yr	t N ₂ O/m ³	t CO _{2e} /tN ₂ O	t CH ₄ /m ³	t CO _{2e} /t
3335.56	1979344459.80	2.73	298	0	25

E.3. Calculation of leakage emissions

Leakage (L_y):

The leakage emissions from the project activity are calculated as follows:

$$L_y = L_{t,y} + L_{r,y}$$

Where:	
L _{t,y}	Leakage emissions from increased transport in year y (tCO _{2e})
L _{r,y}	Leakage emissions from the residual waste from the anaerobic digester, the processing/combustion of RDF in year y (tCO _{2e}) (Since there is no residual waste from the processing activity in project activity, the value of this parameter is zero)

L _y	L _{t,y}	L _{r,y}
tCO _{2e}	tCO _{2e}	tCO _{2e}
102.1015138	102.1015138	0

Leakage emission from increased transport:

There is no increase in the distance travelled for disposal of the collected waste from the collection points. This is because of the reason that the waste processing unit is being established at the landfill sites only where the waste was being dumped earlier also. However, there is transport of ash to the disposal site developed at a distance of 10 km from the project site. Project emissions for the same are accounted as leakage emissions for the project activity as follows:

$$L_{t,y} = \sum NO_{\text{vehicles},i,y} * km_{i,y} * VF_{\text{cons},i} * CV_{\text{fuel}} * D_{\text{fuel}} * EF_{\text{fuel}}$$

Where:	
NO _{vehicles,i,y}	Number of vehicles for transport with similar loading capacity
km _{i,y}	Average additional distance travelled by vehicle type i
VF _{cons,i}	Vehicle fuel consumption in litres per kilometre for vehicle type i (l/km)
CV _{fuel}	Calorific value of the fuel (MJ/Kg or another unit)
D _{fuel}	Fuel density (kg/l)
EF _{fuel}	Emission factor of the fuel (tCO ₂ /MJ)

L _y	NO _{vehicles,i,y}	km _{i,y}	VF _{cons,i}	NCV _{fuel}	D _{fuel}	EF _{fuel}
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tCO ₂ e	No	Km	l/km	MJ/kg	Kg/l	tCO ₂ /TJ
102.1015138	7785	20	0.24	43.3	0.84	74.1

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	242,318	144,024.66	126	0	98,191	98,191

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
98,191	384,375

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

The composition of waste considered for calculation of amount estimated ex-ante is very different from the composition used for the current monitoring period. The amount of paper/cardboard and garden waste has decreased while the amount of textiles, plastics and inert waste has increased in the waste. This has led to a decrease in the CERs. Also, 10% rate of compliance was considered in the PDD but currently rate of 12.5 is being taken, leading to decrease in the CERs.

E.6. Remarks on increase in achieved emission reductions

The baseline emission from the methane production in absence of project activity is dependent on the physical characterization of the waste collected in year y and also on the parameters like “fraction of degradable organic content” and “decay rate for the waste”.

The composition of waste is dynamic the emission reduction may vary from the registered PDD and from one year to another. Also, the values for parameters “fraction of degradable organic content” and “decay rate for the waste” has been significantly decreased in the latest version of applicable tool – “Emissions from solid waste disposal sites”, version 06.0.1.

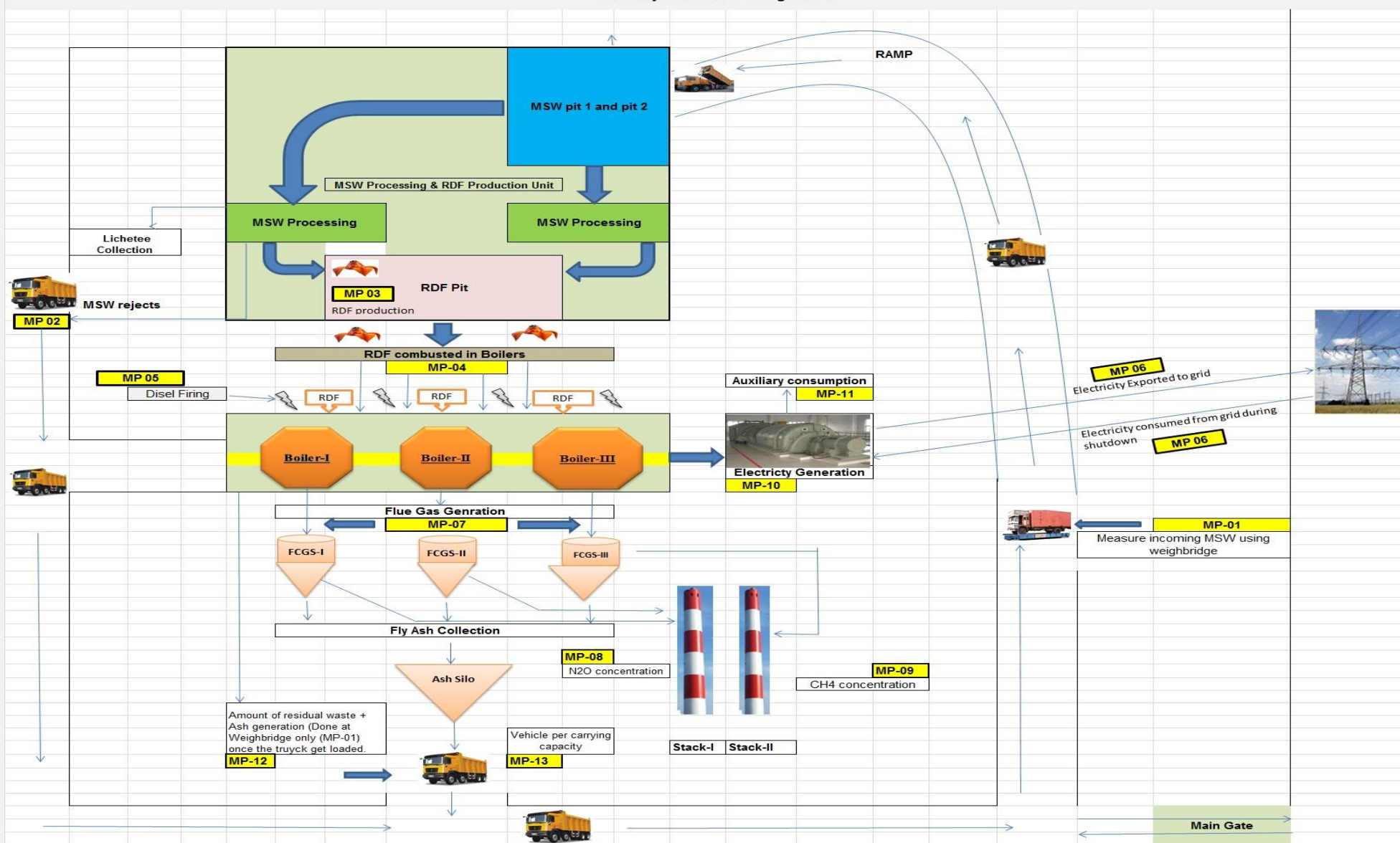
The actual emission reductions achieved during the monitoring period (98,191 tCO₂e) are 74% less than the estimated value of emission reduction (384,375 tCO₂e) for the equivalent period (i.e. 01/04/2019-03/03/2020).

E.7. Remarks on scale of small-scale project activity

Not applicable

Appendix-I: Plant Layout and Monitoring Equipment

Plant Layout and Monitoring Points



Appendix -II: Calibration Details of Monitoring Equipment

Parameter (s)	Monitoring Equipment	Make	Serial No	Metering Point	Accuracy/Class	Date of Calibration	Calibration due on
Amount of electricity consumed from grid in the project activity (EGPJ,FF,y)	Energy Meter	Elster	O5252046	MP-06	Class 0.25	07-08-2018	06-08-2019
						02-08-2019	01-08-2020
Diesel consumption on-site during year 'y' of the crediting period (F con)	Oil Meter	Kent	110517	MP-05	0.1 ltr/minute	31-12-2018	30-12-2019
						31-12-2019	30-12-2020
(1) Amount of RDF combusted in year y (Rc) (2) Total weight of RDF produced (Rt)	Load Cell	Cell Sensor	1024	MP-03 and MP-04	Class I	12-03-2018	12-03-2019
						01-03-2019	01-03-2020
						29-02-2020	29-02-2021
	Load Cell	Cell Sensor	1025		Class I	12-03-2018	12-03-2019
						01-03-2019	01-03-2020
						29-02-2020	29-02-2021
	Load Cell	Cell Sensor	1026		Class I	12-03-2018	12-03-2019
						01-03-2019	01-03-2020
						29-02-2020	29-02-2021
	Load Cell	Cell Sensor	1027		Class I	12-03-2018	12-03-2019
						01-03-2019	01-03-2020
						29-02-2020	29-02-2021
	Load Cell	Cell Sensor	1028		Class I	12-03-2018	12-03-2019
						01-03-2019	01-03-2020
						29-02-2020	29-02-2021
Load Cell	Cell Sensor	1029	Class I	12-03-2018	12-03-2019		
				01-03-2019	01-03-2020		
				29-02-2020	29-02-2021		
Load Cell	Cell	1030	Class I	12-03-2018	12-03-2019		

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		Sensor				01-03-2019	01-03-2020
						29-02-2020	29-02-2021
	Load Cell	Cell Sensor	1031		Class I	12-03-2018	12-03-2019
						01-03-2019	01-03-2020
						29-02-2020	29-02-2021
Amount of waste type i fed into the RDF combustor (Ai)	Weighbridge-1	Endevour	85	MP-01, MP-02 and MP-12	Class III (e value 5 kg)	31-12-2018	31-12-2019
						30-12-2019	30-12-2020
	Weighbridge-2	Endevour	46		Class III (e value 5 kg)	31-12-2018	31-12-2019
						30-12-2019	30-12-2020
	Weighbridge-3	Endevour	47		Class III (e value 5 kg)	31-12-2018	31-12-2019
						30-12-2019	30-12-2020
Total volume of stack gas from RDF combustion in year y (SGr,y)	Gas Flow Meter	Yokogawa	01HTA20CF901	MP-07	±0.11 kg/cm²	15-01-2019	14-01-2020
						15-01-2020	14-01-2021
	Gas Flow Meter	Yokogawa	02HTA20CF901		±0.11 kg/cm²	15-01-2019	14-01-2020
						15-01-2020	14-01-2021
	Gas Flow Meter	Yokogawa	03HTA20CF901		±0.11 kg/cm²	15-01-2019	14-01-2020
						15-01-2020	14-01-2021
Amount of electricity generated utilizing the RDF produced and exported to grid in the project activity during the year y=	Energy Meter (Gross Generation)	Secure meters Ltd.	GJU61733	MP-10	-	03-01-2019	02-01-2020
						02-01-2020	01-01-2021
	Energy Meter (Import/Export)	Elster	O5252046	MP-06	0.2	07-08-2018	06-08-2019
						02-08-2019	01-08-2020
=	Energy Meter (Auxiliary Consumption)	Conzerv	203987/8967-2810	MP-11	-	03-01-2019	02-01-2020
						02-01-2020	01-01-2020
	Energy Meter (Auxiliary Consumption)	Conzerv	205056/9635-3310		-	03-01-2019	02-01-2020
						02-01-2020	01-01-2020
	Energy Meter (Auxiliary Consumption)	Conzerv	205503/10130-3410		-	03-01-2019	02-01-2020
						02-01-2020	01-01-2020

Appendix III: Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD				
S.No.	Period	Values estimated in ex ante calculation of registered PDD (t CO2e)	Actual values achieved during this monitoring period (t CO2e)	% Difference
Formulae		A	B	$(A-B)/A * 100\%$
1	01/04/2019-03/03/2020 7 th Year	384,375	98,191	74%

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> <input type="checkbox"/> Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); <input type="checkbox"/> Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; <input type="checkbox"/> Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; <input type="checkbox"/> Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; <input type="checkbox"/> Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> <input type="checkbox"/> Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); <input type="checkbox"/> Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> <input type="checkbox"/> Include provisions related to delayed submission of a monitoring plan; <input type="checkbox"/> Provisions related to the Host Party; <input type="checkbox"/> Remove reference to programme of activities; <input type="checkbox"/> Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <input type="checkbox"/> Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); <input type="checkbox"/> Include provisions related to standardized baselines; <input type="checkbox"/> Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; <input type="checkbox"/> Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; <input type="checkbox"/> Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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