



**Project design document form for
CDM project activities
(Version 08.0)**

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Bundled Waste Processing Facilities in India
Version number of the PDD	04.1
Completion date of the PDD	24/01/2017
Project participant(s)	IL&FS Environmental Infrastructure & Services Limited (IEISL) Norwegian Ministry of Climate and Environment
Host Party	India
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	AM0025, v11 Avoided emissions from organic waste through alternative waste treatment processes
Sectoral scope(s) linked to the applied methodology(ies)	13: Waste handling and disposal
Estimated amount of annual average GHG emission reductions	123,306 tCO ₂ e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Brief summary of the project

The objective of the project is to avoid methane emission through processing of municipal solid waste in compost plants located in three different states of India (Punjab, Kerala and Karnataka). The project involves adopting method for aerobic decomposition of biodegradable component of Municipal Solid Waste (MSW). The compost plants would have an aggregated capacity to process 600 tonnes per day (TPD) of waste: 219 Kilotons of waste/year. These plants are disseminated in the following cities:

1. Jalandhar, Punjab¹ – 200TPD
2. Kozhikode, Kerala – 150TPD
3. Mysore, Karnataka – 250TPD

Purpose of the project activity

Scenario existing prior to the start of the implementation of the project activity

Currently, the local body of each Municipal Corporation collects the municipal solid waste and disposes it in the existing Solid Waste Disposal Sites (SWDS) managed by respective Municipal Corporations. This causes a number of environmental & health hazards including unabated release of methane in the atmosphere.

Thus, the common practice is disposal of solid waste without any measures to avoid methane emissions (**also the baseline scenario as described in detail in section B.4**).

Project scenario

In the project scenario, Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. This change is permanent in nature and the effective input capacity is revised from 600TPD to 400TPD. Hence, the emission reduction has been calculated excluding Jalandhar site from 2014 onwards. Since, the emission reductions have been claimed from Jalandhar site for the period 27/06/2010 to 31/12/2013; therefore, Jalandhar site is still retained in the current version of CDM-PDD-FORM. The compost plants use controlled aerobic decomposition in a windrow composting process. The process of composting would result in the production of compost that will be supplied to the local agriculture farms.

IEISL (previously, IWMUSL) has taken up the initiative of development of the project along with encouraging marketing of the compost produced from the plants and availing CDM benefits. Hence the project will provide an example for an environment friendly and economically viable MSW processing.

Contribution to reduction in GHG emissions by the proposed project activity

Project activity leads to reduction in GHG emissions by avoiding methane emissions from anaerobic decomposition in a solid waste disposal site (SWDS) through controlled aerobic decomposition in a windrow composting process.

Contribution to sustainable development by the project activity

Environmental Benefits:

Composting of Municipal Solid Waste is an attractive option for:

1. Resource recovery and environmental improvement: Local benefits would be the recycling of resources, and better management of solid waste. Open disposal of given waste is prevented resulting in reduction in land requirement for waste disposal, leading to improved environmental conditions and a replicable model.
2. In contrast to the anaerobic decay of biodegradable waste that occurs in the SWDS, which results in methane generation among other landfill gases, the composting project will contribute to mitigation of greenhouse gas (GHG) emissions through aerobic decomposition of the organic waste.

¹ From 01/01/2014, Jalandhar site has been excluded from the registered CDM project activity; however the registered CDM project activity has already claimed emission reductions from 27/06/2010 to 31/12/2013 (both days included) for Jalandhar site. Hence, Jalandhar site is still discussed in the current version of CDM-PDD-FORM.

3. The end product of the project activity is compost that will be used as organic manure and combat soil degradation, since its application will lead to recycling humus, the organic matter, back to soil thus improving soil productivity.

Social and Economic Benefits:

1. Employment generation: The three plants are expected to provide direct employment in the composting facilities (since the plants are semi-mechanized) as well as indirect employments during supply of compost to farmers.
2. Compost as a means of a resource: This project will suitably assist in providing compost supply for urban agriculture, horticulture, floriculture, vegetable production and crop farming in and around the neighbouring states.
3. Improving economic viability of the project: Since the cost of production of compost will be subsidised using revenue from carbon credits, marketing of compost will become easier, thus ensuring the sustainability of the project.

Consistency with sustainable development policies of the host country:

The 'Municipal Solid Waste, Management and Handling, Rules, 2000'² (with an implementation schedule in 2003) recommends the pre-treatment of wastes prior to land filling. The increased need for professional waste management has made solid waste management a top priority for most urban local bodies. This project will serve as a model of financially sustainable waste management project. Appropriate waste management is gaining priority of the Government. The Government of India is also supporting balanced nutrient management for agricultural soil in order to ensure that the productivity of agricultural land does not keep declining due to over use of chemical fertilizers³.

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

A.2. Location of project activity

A.2.1. Host Party

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India

A.2.2. Region/State/Province etc.

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Three plants located in the states of Punjab, Kerala & Karnataka

A.2.3. City/Town/Community etc.

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Punjab : Jalandhar,
Kerala : Kozhikode and
Karnataka : Mysore

A.2.4. Physical/Geographical location

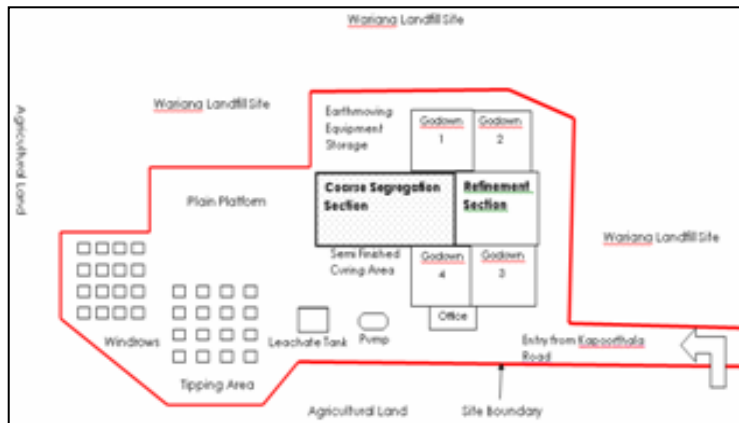
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	Jalandhar ⁴	Kozhikode	Mysore
Location	Disposal site: Wariana, Basti Bawa Khel in Jalandhar near subsidiary Health Centre	Disposal site: Njeliyanparamba	Disposal site: Vidyaranyaapuram
	Geographical Location 31° 20' 56" N 75° 31' 52" E	Geographical Location 11° 12' 16" N 75° 49' 01" E	Geographical Location 12° 16' 20" N 76° 39' 01" E

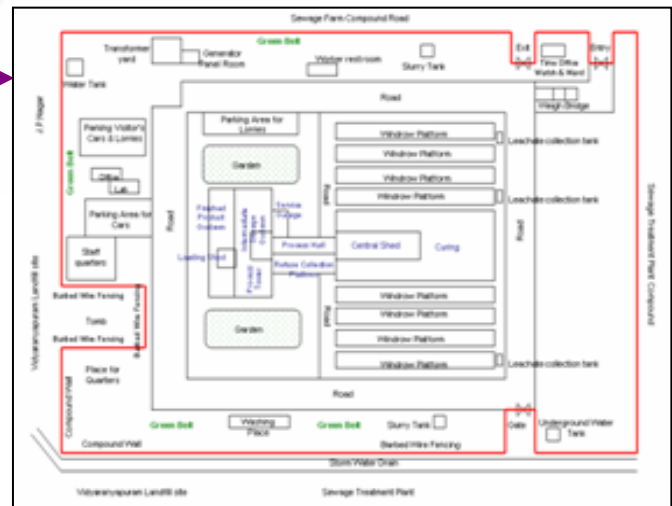
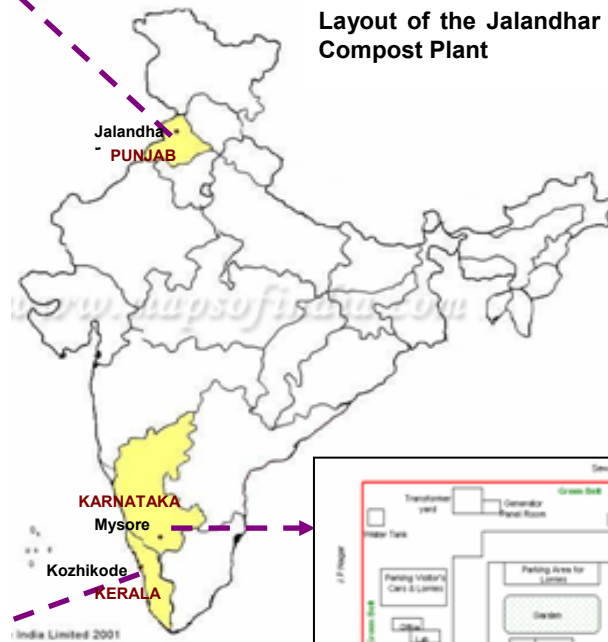
² <http://envfor.nic.in/legis/hsm/mswmhr.html>

³ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India

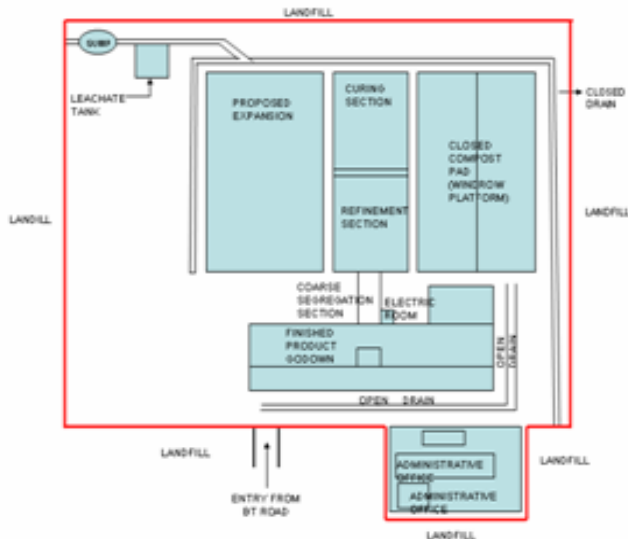
⁴ Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. The emission reductions have been claimed from Jalandhar site from 27/06/2010 to 31/12/2013 (both days included). Hence, Jalandhar site is still discussed in this section of CDM-PDD-FORM.



Layout of the Jalandhar Compost Plant



Layout of the Mysore Compost Plant



Layout of the Kozhikode Compost Plant

A.3. Technologies and/or measures

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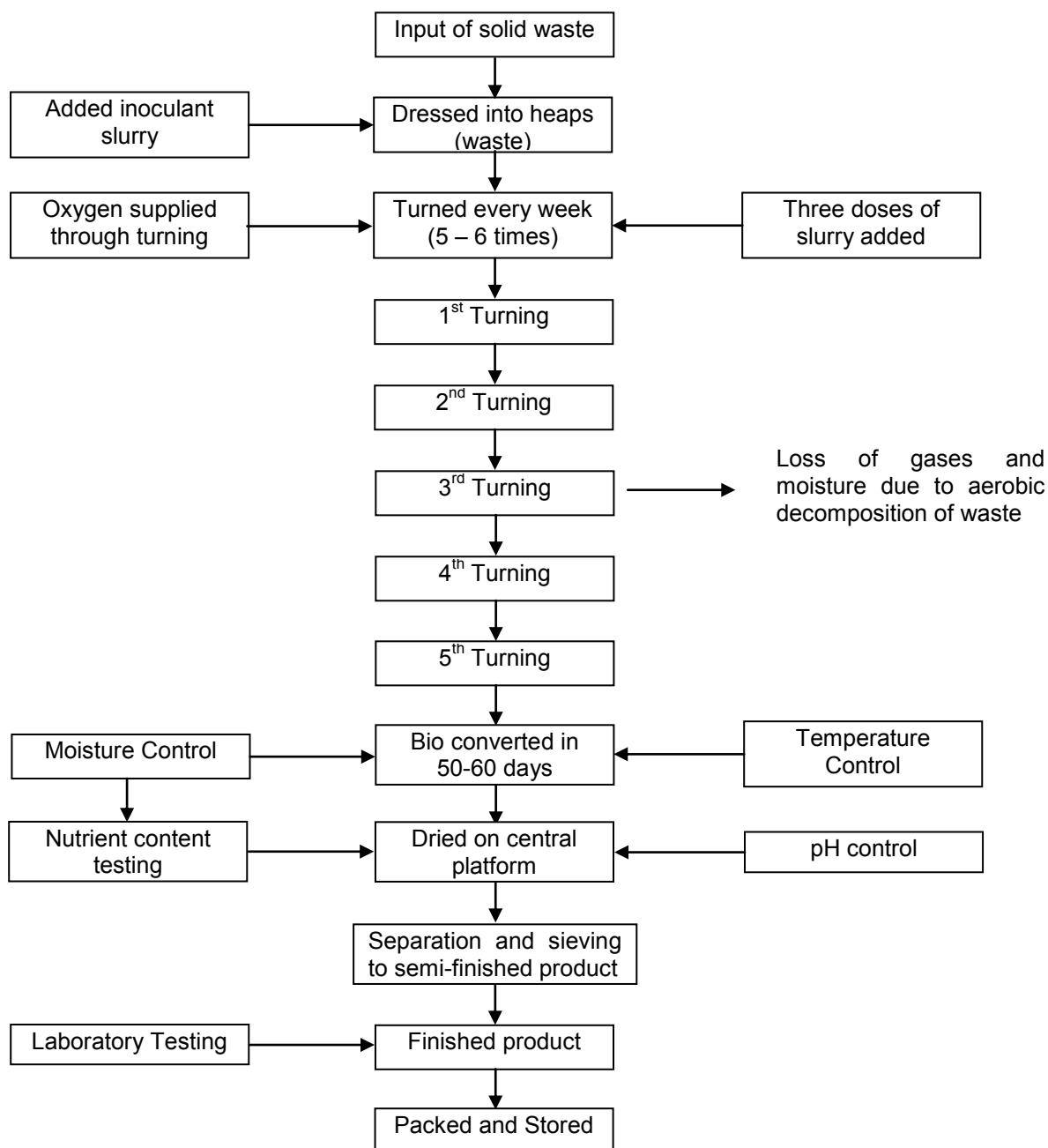
The project activity utilizes composting technology to process the municipal solid waste. Composting is an aerobic process during which microorganisms convert an organic substrate into stabilized organic matter with production of heat, thus avoiding anaerobic decomposition in a disposal site which leads to production of methane. The project activity does not involve capture and flaring of methane. In the absence of the project activity, the business as usual scenario is disposal of waste in a SWDS, which is the same as the baseline scenario.

The technology used in this project is open windrow aerobic composting, which is a simple technology and already known in India. Hence, no technology transfer is required in this project. However, in composting, proper adherence to technological discipline is very critical to optimise the plant efficiency and to ensure quality of the compost. The process of open windrow aerobic composting is a simple biological process of aerobic decomposition in which the end product is compost from the organic matter. This is a complete environment friendly process with no harmful by products formation during the entire process.

The complete process or design can be divided into various components, listed below:

1. **Material intake system comprising of visual inspection and weighing of the incoming waste:** All incoming vehicles containing municipal solid waste are weighed at a weighbridge. The reading is noted to indicate the weight of municipal solid waste received. The waste is then delivered to the reception area.
2. **Yard management system (windrow system):** Once the waste enters the plant, it is stacked in the form of trapezoidal heaps called 'windrows' of 4-6 m width and 2-3 m height on the compost pad. The compost pad constitutes of a concrete platform on which waste is kept and allowed to undergo decomposition. The fresh stacks of waste are sprayed with inoculum/sanitizer to reduce odour and repel vectors.
These windrows are turned every week to ensure proper oxidation and aerobic decomposition, using various types of equipment such as front end loaders/ JCB's. Material is held in the windrows for 4-6 weeks during which time degradation of the composting process results in a loss in mass. During this process temperatures will range from 50°C to 70°C. After the 4-6 week period, the composting heap is shifted to a monsoon shed for further stabilization.
3. **Segregation and sieving system:** Once the material is stabilized, it is fed to the segregation and sieving section. A two stage screening system is adopted to achieve maximum screening efficiency using vibrating screens and trommels. Cascading action inside the trommel ensures better screening of the lumpy municipal solid waste. The equipment in this section is hydraulically driven to ensure greater safety against breakdowns and to lower power consumption.
Screened material coming out is uniform in texture and contains pure organic compost. The organic compost is then finally packed in bags and weighed. Bags are stitched using a portable sewing machine and stacked in the finished product store.
4. **Leachate management system:** The compost pad also constitutes of a peripheral drain to collect any leachate generated from the process, or from rainfall, to prevent seepage into the ground water. The collected leachate is recycled to control the moisture content of windrows.

PROCESS FLOW CHART FOR COMPOSTING MUNICIPAL SOLID WASTE



A.4. Parties and project participants

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Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	IL&FS Environmental Infrastructure and Services Limited (IEISL) - Private entity	No
Norway	Norwegian Ministry of Climate and Environment - Public entity	Yes

A.5. Public funding of project activity

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No public funding from Parties included in Annex I to the convention is involved in this project.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline**B.1. Reference of methodology and standardized baseline**

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Approved baseline and monitoring methodology AM0025 –Avoided emissions from organic waste through alternative waste treatment processes, v11

Referred Tools:

“Tool to determine methane emissions avoided from disposal of waste at a Solid Waste Disposal Site”- v04

“Tool for the demonstration and assessment of additionality”- v05.2

“Tool to calculate the emission factor for an electricity system”- v01.1

B.2. Applicability of methodology and standardized baseline

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The project meets all the applicability criteria as set out in the methodology. The methodology AM0025, v11 is applicable for the project activity since:

Applicability Conditions under AM0025, v11	Project Activity meets the applicability conditions since:
<p>The project activity involves one or a combination of the following waste treatment options for the fresh waste that in a given year would have otherwise been disposed of in a landfill:</p> <p>a) <i>Composting process in aerobic conditions;</i></p> <p>b) <i>Gasification to produce syngas and its use;</i></p> <p>c) <i>Anaerobic digestion with biogas collection and flaring and/ or its use</i></p> <p>d) <i>Mechanical/ thermal treatment process to</i></p>	<p>The proposed project activity for all the sites involves the waste treatment option (a) Composting process in aerobic conditions for the fresh waste⁵ in a given year that would have otherwise been disposed in a landfill without involving capture and flaring of methane⁶.</p>

⁵ Detailed Project Report (DPR) dated 11 July 2007, Jalandhar
Detailed Project Report (DPR) dated 13 May 2008, Kozhikode
Detailed Project Report (DPR) dated 17 July 2008, Mysore

⁶ Detailed Project Report (DPR) dated 11 July 2007, Jalandhar
Detailed Project Report (DPR) dated 13 May 2008, Kozhikode
Detailed Project Report (DPR) dated 17 July 2008, Mysore

<p><i>produce refuse-derived fuel (RDF)/stabilized biomass (SB) and its use.</i></p> <p><i>e) Incineration of fresh waste for energy generation, electricity and/or heat.</i></p>	
In case of composting, the produced compost is either used as soil conditioner or disposed of in landfills.	The produced compost will be used as soil conditioner. The compost will be sold in the nearby regions and it will be monitored as per the monitoring plan.
The proportions and characteristics of different types of organic waste processed in the project activity can be determined, in order to apply a multiphase landfill gas generation model to estimate the quantity of landfill gas that would have been generated in the absence of the project activity.	The proportions and characteristics of different types of organic waste processed in the project activity will be determined as per the process described in section B.7.2 of PDD, in order to apply a multiphase landfill gas generation model to estimate the quantity of landfill gas that would have been generated in the absence of the project activity.
Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill despite environmental regulation that mandates the treatment of the waste using composting or other waste treatment processes.	Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill managed by respective municipal corporations with controlled placement of waste and compaction and leveling being carried out as described in the Section B.3. Since there is no other waste treatment facility in the respective municipal corporations as evident from the letters by respective municipal corporations ⁷ .
The compliance rate of the environmental regulations during (part of) the crediting period is below 50%; if monitored compliance with the MSW rules exceeds 50%, the project activity shall receive no further credit, since the assumption that the policy is not enforced is no longer tenable.	The compliance rate of Indian MSW Rules, 2000 is below 50%. No single municipality or local body in India has complied with the guidelines stipulated in the MSW Rules 2000 ⁸ . However, gradual improvement in MSW management systems is expected over the time. Hence a conservative value of 10% is taken for ex-ante estimations of emission reductions ⁹ .
The project activity does not involve thermal treatment process of neither industrial nor hospital waste.	The project activity does not involve thermal treatment process of industrial or hospital waste, since there are no boilers or similar facilities installed on site ¹⁰ .
The methodology is not applicable to project activities that involve capture and flaring of methane from existing waste in the landfill. This should be treated as a separate project	Project activity does not involve capture and flaring of methane from existing waste in the landfill ¹¹ .

⁷ Letter from the respective Municipal Corporations, the same has been provided to the validator.

⁸ Sunil Kumar ,Bhattacharyya J.K. , Vaidya A.N., Tapan Chakrabarti , Sukumar Devotta , Akolkar A.B. , Assessment of the status of municipal solid waste management in metro cities, state capitals, class I cities, and class II towns in India: An insight, pg 3, Waste Management journal homepage: www.elsevier.com/locate/wasman

⁹ India Infrastructure Report 2006

¹⁰ Detailed Project Report (DPR) dated 11 July 2007, Jalandhar
Detailed Project Report (DPR) dated 13 May 2008, Kozhikode
Detailed Project Report (DPR) dated 17 July 2008, Mysore

¹¹ Detailed Project Report (DPR) dated 11 July 2007, Jalandhar
Detailed Project Report (DPR) dated 13 May 2008, Kozhikode
Detailed Project Report (DPR) dated 17 July 2008, Mysore

activity due to the difference in waste characteristics of existing and fresh waste, which may have an implication on the baseline scenario determination	
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Therefore, the applicability conditions of the methodology AM0025, v11 are satisfied.

B.3. Project boundary

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The summary of gases and sources included in the project boundary, and justification/ explanation where gases and sources are not included is listed below:

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Emissions from decomposition of waste at the landfill site	CO ₂	Yes	This is the major source of emissions in the baseline
		CH ₄	No	CO ₂ emissions from decomposition of organic waste are not accounted
		N ₂ O	No	N ₂ O emissions are small compared to CH ₄ emissions from landfills. Exclusion of this gas is conservative.
	Emissions from Electricity Consumption	CO ₂	No	There is no electricity consumption at the project site in the absence of the project activity.
		CH ₄	No	There is no electricity consumption at the project site in the absence of the project activity.
		N ₂ O	No	There is no electricity consumption at the project site in the absence of the project activity.
	Emission from thermal energy generation	CO ₂	No	There is no energy generation at the project activity.
		CH ₄	No	There is no energy generation at the project activity.
		N ₂ O	No	There is no energy generation at the project activity.
Project scenario	On-site fossil fuel consumption due to the project activity other than for electricity generation	CO ₂	Yes	May be an important emission source. Includes vehicles used on- site.
		CH ₄	No	Excluded for simplification. This emission source is assumed to be very small
		N ₂ O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from onsite Electricity use	CO ₂	Yes	Emissions from electricity consumed by the plant machineries and other equipment.
		CH ₄	No	Excluded for simplification. This emission source is assumed to be very small.
		N ₂ O	No	Excluded for simplification. This emission source is assumed to be very small
	Direct emissions from the waste treatment processes	N ₂ O	Yes	During the storage of waste, as part of composting process itself, and during the application of compost, N ₂ O emissions might be released.

		CO ₂	No	CO ₂ emissions from decomposition of organic waste are not accounted ¹²
		CH ₄	Yes	Composting process may not be complete and result in anaerobic decay resulting in CH ₄ emissions.
	Emission from waste treatment water	CO ₂	No	CO ₂ emissions from decomposition of organic waste are not accounted ¹³
		CH ₄	No	There is no anaerobic waste water treatment in the project activity
		N ₂ O	No	There is no anaerobic waste water treatment in the project activity

According to AM0025, v11, the spatial extent of the project boundary is the site of the project activity where the waste is treated. This includes the facilities for processing the waste, on-site electricity consumption, on-site fuel use and the landfill site. The project boundary does not include facilities for waste collection, sorting and transport to the project site.

Therefore, in the proposed project, the project boundary consists of the waste processing facilities adjacent to existing disposal sites located in:

- **Jalandhar**¹⁴: In the absence of the project activity, the waste was being disposed in the existing disposal site located at Wariana Site, at Basti Bawa Khel in a controlled manner, which is owned and managed by the Jalandhar Municipal Corporation (JMC). In the disposal site, compaction and leveling of MSW was carried out. However, there was no methane capture at the site.
- **Kozhikode**: In the absence of the project activity, the MSW generated in Kozhikode city was being disposed at the existing SWDS at Njeliyanparamba in Kozhikode which is approximately 7 kms from the main city. Kozhikode Corporation owns and manages the disposal site. All the waste collected from different zones of the city was disposed off in this particular landfill in a controlled manner. In the disposal site, compaction and leveling of MSW was carried out. However, there was no methane capture at the site and the waste is covered with earth.
- **Mysore**: The compost plant at Mysore is also located within the existing disposal site at Vidyaranyapuram in Mysore. In the absence of the project activity, the waste collected from different zones of Mysore city was being disposed off in the Vidyaranyapuram disposal site in a controlled manner, which is owned and managed by the Mysore City Corporation (MCC). In the disposal site, compaction and leveling of MSW was carried out. However, there was no methane capture at the site.

A graphical representation of the project boundary is shown in Figure B.1.1- B.1.3.

¹² Project proponents wishing to neglect these emission sources shall follow the clarification in EB22 Annex02 which states that "magnitude of emission sources omitted in the calculation of project emissions and leakage effects (if positive) should be equal to or less than the magnitude of emission sources omitted in the calculation of baseline emissions"

¹³ CO₂ emissions from the combustion or decomposition of biomass (see definition by the EB in EB20 Annex08) are not accounted as GHG emissions. Where the combustion or decomposition of biomass under a CDM project activity results in a decrease of carbon pools, such stock changes should be considered in the calculation of emission reductions. This is not the case for waste treatment projects.

¹⁴ Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. The emission reductions have been claimed from Jalandhar site from 27/06/2010 to 31/12/2013 (both days included). Hence, Jalandhar site is still discussed in this section of CDM-PDD-FORM.

Figure B.1.1 Project Boundary for Jalandhar

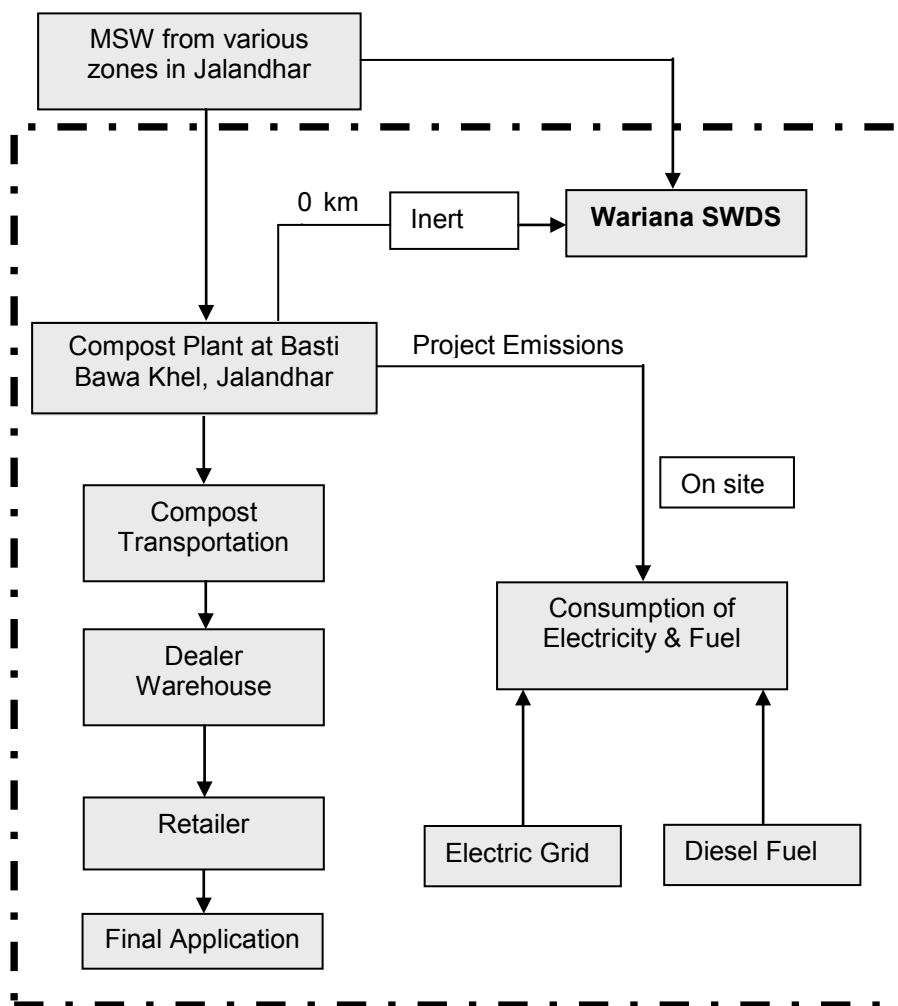


Figure B.1.2 Project Boundary for Kozhikode

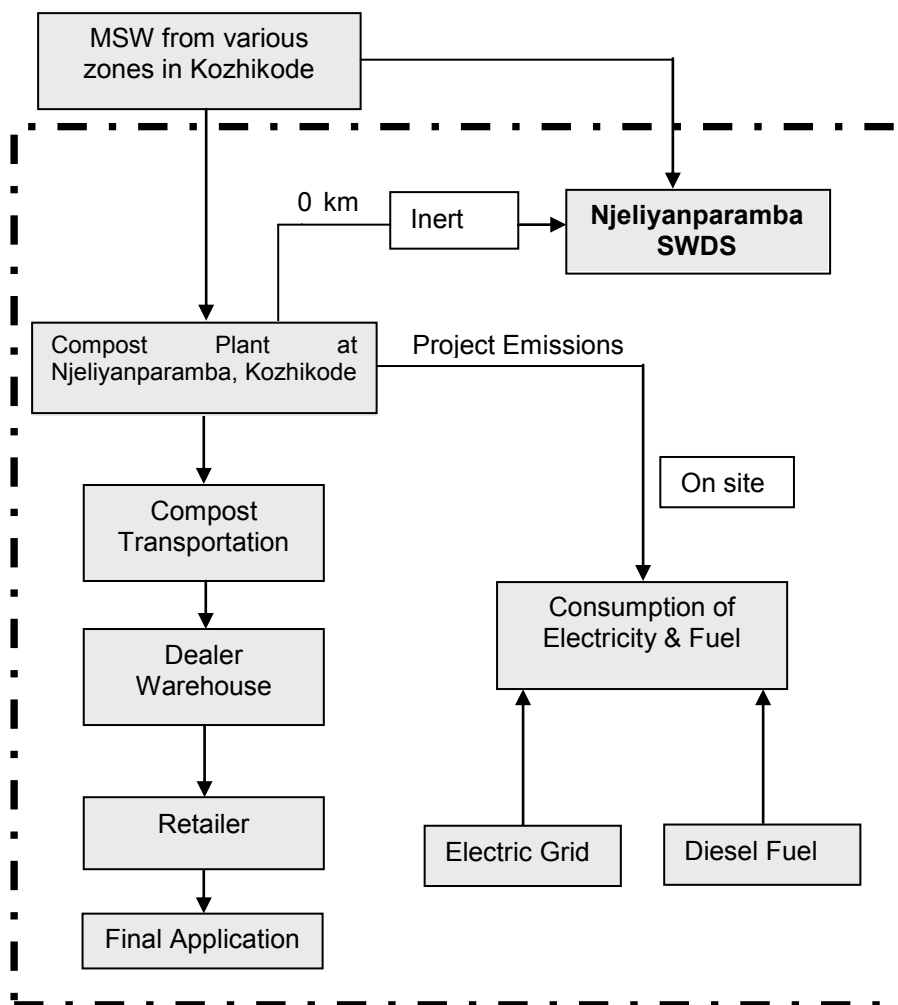
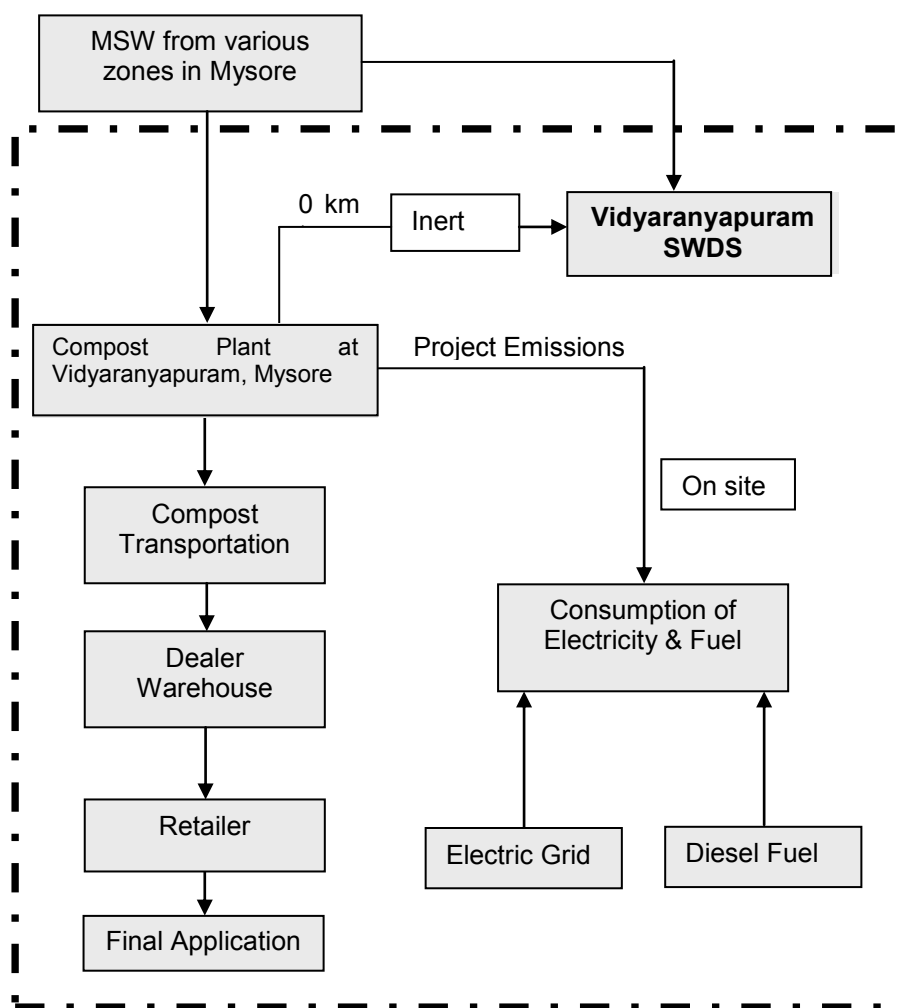


Figure B.1.3 Project Boundary for Mysore



B.4. Establishment and description of baseline scenario

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The baseline scenario is defined as the most likely scenario in the absence of the proposed CDM project activity. As per methodology, three alternatives are examined for the baseline:

M1: The project activity i.e. composting not implemented as a CDM project: this alternative in the absence of CDM and CER revenues is not feasible as discussed in section B5. This option is costly as it provides low return on investment and moreover there is no organized market for compost and investment on marketing is not possible.

M2: Disposal of the waste at a landfill (SWDS) where landfill gas captured is flared: this alternative is not economically viable since it involves infrastructural investment and no revenue accruing out of the activity, thus is eliminated as a viable alternative to the project activity

M3: Disposal of waste on a landfill (SWDS) without the capture of landfill gas: this is the continuation of business as usual scenario as given below for all the sites. This is the least cost alternative and is standard operating procedure in most of the landfills in the country. The pre-project scenario is as follows for all the three sites:

- **Jalandhar¹⁵:** In Jalandhar there is no other waste processing facility other than the one considered in this project. In the absence of the project activity, waste is disposed in the adjacent SWDS managed by Jalandhar Municipal Corporation (JMC). Compaction and levelling of waste is carried out to increase the life of landfill.



**Controlled Placement of MSW
in the Solid Waste Disposal
Site**



**Compaction and Levelling of
waste being carried out in the
Solid Waste Disposal Site**

- **Kozhikode:** Similarly in Kozhikode also there is no other waste processing facility other than the one considered in this project, i.e. the compost plant located in Njeliyanparamba. In the absence of the project activity, waste is disposed in the adjacent SWDS managed by the Kozhikode Corporation. Compaction and levelling of waste is carried out to increase the life of landfill and the waste is covered with earth.

- **Mysore:** In Mysore, the compost plant at Vidyaranyapuram, i.e. the one considered in this project, is the only waste processing facility in the city. In the absence of the project activity, waste is disposed in the adjacent SWDS managed by the Mysore City Corporation (MCC). Compaction and levelling of waste is carried out to increase the life of landfill.



Pursuant to the announcement of MSW Rules, 2000, the compost plants covered under this project activity were established as an attempt to follow guidelines stipulated under Municipal Solid Waste (Management & Handling) Rules, 2000. However the plants faced barriers in operation, as described in detail in Section B.5, and thus were abandoned. With the availability of CDM benefits, IWMUSL

¹⁵ Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. The emission reductions have been claimed from Jalandhar site from 27/06/2010 to 31/12/2013 (both days included). Hence, Jalandhar site is still discussed in this section of CDM-PDD-FORM.

proposed restarting the closed plants since it was envisaged that the CDM benefits could be used to operate the plants in a sustainable manner. When IWMUSL took over the plants, they were in dilapidated conditions due to long period of closure and waste was being disposed in adjoining SWDS without any treatment. Hence under baseline scenario, the plants would not have restarted in absence of CDM and waste generated in the respective municipal corporations would have continued to be disposed in the adjoining SWDS inspite of existence of the plant.

Based on the additionality tool kit analysis (see section on additionality below, Section B.5), the concluding baseline scenario is the “Disposal of waste on a landfill without the capture of landfill gas”, i.e., continued release of methane into the atmosphere, which is the current case and common practice in India.

The proposed project activity comprises measures to avoid the production of methane from organic matter that would have otherwise been left to decay anaerobically in a Solid Waste Disposal site (SWDS) without capture and flaring of methane. Due to the project activity, anaerobic decay of waste is prevented through aerobic treatment by composting and proper soil application of the compost.

Thus, as discussed in detail in Section B.5, the baseline scenario is the situation where, in the absence of the project activity, organic matter is left to decay within the project boundary and methane is emitted to the atmosphere¹⁶. The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the municipal solid waste composted in the project activity.



**Coarse Segregation Section-Trommels
rusted due to long period of unuse**

B.5. Demonstration of additionality

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According to the approved methodology AM0025, v11, the proposed project activity uses Step 1, Step 2 and Step 3 of the “Tool for the demonstration and assessment of additionality”, v05.2, approved by EB to determine the additionality.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

While identifying the alternatives to the project activity, AM0025, v11 directs to use Step 1 of latest additionality tool. The methodology AM0025, v11 states that relevant policies and regulations related to the management of landfill sites should be taken into account. Such policies or regulations may include mandatory landfill gas capture or destruction requirements because of safety issues or local environmental regulations. Other policies could include local policies promoting productive use of landfill gas such as those for the production of renewable energy, or those that promote the processing of solid waste.

Sub-step 1a. Define alternatives to the project activity:

¹⁶ Detailed Project Report (DPR) dated 11 July 2007, Jalandhar
Detailed Project Report (DPR) dated 13 May 2008, Kozhikode
Detailed Project Report (DPR) dated 17 July 2008, Mysore

As per AM0025, v11, alternatives for the disposal/treatment of the fresh waste in the absence of the project activity, i.e. the scenario relevant for estimating baseline methane emissions, to be analysed should include, *inter alia*:

M1: The project activity i.e. composting not implemented as a CDM project.

In this process, methane emission would be avoided from anaerobic decomposition in a SWDS through controlled aerobic decomposition in a windrow composting process. The composting activity includes process of aerobic decomposition which requires initial capital investment and high O&M costs. Moreover the sale of generated compost faces marketing risks and low return on investment (ROI) as described in Step 2 & 3.

M2: Disposal of the waste at a landfill (SWDS) where landfill gas captured is flared

The above alternative is not feasible since it will involve infrastructural investment on LFG capture and destruction facilities without there being any revenue accruing out of the activity. This scenario is not economically viable and therefore is eliminated from the consideration as baseline scenario.

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

There are no additional technical and investment barriers in this process. It is also economically feasible option since no investment is involved and demonstrates continuation of Business-as-Usual scenario as given in the Section B.4 above.

If energy is exported to a grid and/or to a nearby industry, or used on-site realistic and credible alternatives should also be separately determined for:

- Power generation in the absence of the project activity;
- Heat generation in the absence of the project activity.

The proposed project activity involves aerobic composting of MSW and does not involve either power generation or heat utilization, thus all the scenarios from P1 to P6 and H1 to H6 are eliminated as alternative scenarios to the project activity.

Step 1b: Consistency with mandatory laws and regulations

All the above alternatives are consistent with existing law and regulations of the country except M3 which is not as per recommendation of MSW Rules 2000. However, the current practice in India is disposal of municipal solid waste without any treatment and processing¹⁷. Hence the rules are systematically not enforced and the non-compliance with the rules is widespread in the country.

In conclusion, the alternatives identified to the project activity are M1 and M3.

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

Since, there is no power generation or heat utilization in the project activity, thus baseline does not involve use of fuel for energy.

Step 3: AM0025, v11 states that Step 2 and/or Step 3 of the latest approved version of the “Tool for demonstration and assessment of additionality” shall be used to assess which of these alternatives should be excluded from further consideration

Step 2: Investment Analysis

Sub-step 2a. Determine appropriate analysis method

According to the “Tool for the demonstration and assessment of additionality” v05.2, the project proponent has to select one of the three alternative financial analyses for this step. If the project does not generate any financial or economic benefits other than CDM related, then Option-I (Simple Cost Analysis) should be used. Option-I is not applicable to this project because it generates income from sale of compost. Option-II (Investment Comparison Analysis) is based on the comparison of returns of the project investment with the investment required for an alternative

¹⁷ Sunil Kumar ,Bhattacharyya J.K. , Vaidya A.N., Tapan Chakrabarti , Sukumar Devotta , Akolkar A.B. , Assessment of the status of municipal solid waste management in metro cities, state capitals, class I cities, and class II towns in India: An insight, pg 3, Waste Management journal homepage: www.elsevier.com/locate/wasman

to the project. In this case, none of the credible alternatives to the CDM project activity involve investments and returns that could be compared to the project. Therefore, Option-II is also not applicable to this project. So, Option-III (Benchmark Analysis) is the most appropriate method, where the returns on the investment in the project activity is compared to benchmark returns that are available to any investors in the country.

Sub-step 2b: Option III. Apply benchmark analysis

The likelihood of development of the project, as opposed to continuation of its baseline has been determined by comparing its IRR with the benchmark of interest rate considered for the project. The investment decision for the Jalandhar¹⁸ project was taken in 2007 whereas in case of Kozhikode and Mysore it was taken in 2008. The Prime Lending Rate (PLR) of Reserve Bank of India (RBI) as in 2007¹⁹, when investment decision for Jalandhar project was taken was 12.75% whereas the project has sought funding at the rate of 14%. Similarly, for Kozhikode and Mysore, the PLR of Reserve Bank of India (RBI) when investment decision was taken during 2008²⁰ was 12.75% whereas the loan for both the projects was sanctioned at an interest rate of 18%. However to be conservative, the PLR of 12.75% has been taken as the benchmark for all the three projects. Hence, the investment in operation of the plants would be considered financially attractive if the IRR of projects is at least above the benchmark rate of 12.75%.

Sub-step 2c. Calculation and comparison of financial indicators

The additionality tool permits the project proponent to choose the financial indicator, IRR, to demonstrate the additionality of the project. The additionality tool provides an option to choose between project IRR and the equity IRR. Of the options, project proponent has chosen project IRR to demonstrate the additionality. Since, project IRR is used by the banks as well as the investors alike to ascertain the advisability or otherwise of investing in a project, it is the appropriate financial indicator to establish the additionality.

The project IRR for Jalandhar, Kozhikode and Mysore works out to be:

PROJECT	BENCHMARK	PROJECT IRR WITHOUT CDM	PROJECT IRR WITH CDM
Jalandhar	12.75%	1.44%	15.65%
Kozhikode	12.75%	0.86%	20.79%
Mysore	12.75%	2.52%	18.22%

As evident the IRR of all three projects is lower than their corresponding benchmark rates. However, with the additional revenue from sale of carbon credits from CDM, the IRR increases to acceptable rates. This clearly indicates that investment barrier exists in project activity implementation which is overcome through the Clean Development Mechanism and the IRR is unattractive compared to the interest rates provided by local banks in host country. The additionality of the project is thus evident.

Sub-step 2d. Sensitivity analysis

The purpose of sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions. The investment analysis provides a valid argument in favor of additionality only if it consistently supports (for realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive or is likely to be financially attractive.

Thus, a sensitivity analysis was also applied to the IRR calculations to measure the impact, positive or negative, of changes in the indicated parameters. The project proponent has chosen 5 factors as critical to the operations of the project namely capacity of MSW processed per day, yield of compost per MT of MSW (conversion factor), project cost, fuel cost and the overall O&M expenses. These 4 factors were subjected to 10% variation on either side, based on "Guidance on

¹⁸ Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. The emission reductions have been claimed from Jalandhar site from 27/06/2010 to 31/12/2013 (both days included). Hence, Jalandhar site is still discussed in this section of CDM-PDD-FORM.

¹⁹ <http://rbi.org.in/scripts/AnnualReportPublications.aspx?Id=864>

²⁰ <http://rbi.org.in/scripts/AnnualReportPublications.aspx?Id=864>

the Assessment of Investment Analysis, v2.1", EB41 Annex45, to ascertain the impact on the profitability and hence the IRR of the project. The results of the sensitivity analysis are as given below:

Jalandhar

PARAMETER	RESULTANT IRR		
	BASE CASE	INCREASE BY 10%	DECREASE BY 10%
Project Cost	1.44%	1.09%	1.82%
Fuel Cost	1.44%	-0.05%	2.79%
Plant Capacity	1.44%	9.13%	negative
Yield of Compost	1.44%	10.47%	negative
O&M Expenses	1.44%	negative	11.77%

Kozhikode

PARAMETER	RESULTANT IRR		
	BASE CASE	INCREASE BY 10%	DECREASE BY 10%
Project Cost	0.86%	0.44%	1.31%
Fuel Cost	0.86%	-1.25%	2.68%
Plant Capacity	0.86%	8.81%	negative
Yield of Compost	0.86%	10.15%	negative
O&M Expenses	0.86%	negative	11.90%

Mysore

PARAMETER	RESULTANT IRR		
	BASE CASE	INCREASE BY 10%	DECREASE BY 10%
Project Cost	2.52%	1.98%	3.11%
Fuel Cost	2.52%	0.86%	4.00%
Plant Capacity	2.52%	8.99%	negative
Yield of Compost	2.52%	10.15%	negative
O&M Expenses	2.52%	negative	11.55%

- **Project Cost:** Decrease in project cost is not expected since the estimates are based on the minimum requirement of capital for the plants. Moreover, the project remains additional upto more than 100% decrease in project cost for Jalandhar and Kozhikode and 96% decrease for Mysore, which is unrealistic to achieve since it would result in nil cost of project upgradation.
- **Fuel Cost:** The fuel cost is also not expected to reduce so much since as the project remains additional upto more than 100% decrease in fuel cost for Jalandhar, 98% for Kozhikode and Mysore, which are not practical to assume.
- **Processing Capacity:** According to the above analysis, the IRR increases on increasing the plant capacity in case of all the three projects and crosses the benchmark of 12.75% when the plant capacity for any of the plant is increased by 17-20%. The IRR increases on increasing the plant capacity and crosses the benchmark of 12.75% when the plant capacity is increased by about 17% for Jalandhar, 19% for Mysore and 18% for Kozhikode. However, the capacity cannot be increased for any of the plants since for the financial analysis, since they are already assumed to be operating at their maximum rated capacity based on the area of compost pad and number of windrows to be formed. It has also been assumed that the plants shall be running for all the 365 days which is also being conservative.
- **Yield:** The project remains additional upto 14% increase in compost yield for Jalandhar and 15% for Mysore and Kozhikode. The yield for all the three plants has already been taken on the higher side i.e. 20%, as against common industrial practice of 10-20% compost yield for ascertaining the robustness of financial additionality of the project. Moreover, the actual compost yield from the Jalandhar, Kozhikode and Mysore plants over a six month period is

12%, 10.8% and 5.6% respectively²¹ and an aggregate yield of 8% for all three plants. Hence an increase in the yield over and above yield assumed is also practically not possible.

- **O&M Expenses:** The O&M expenses are not expected to decrease since simultaneous decrease in all the parameters in O&M like fuel cost, power cost, packaging, manpower cost, plant repair and maintenance by such high percentage is not possible as the project remains additional upto 12% decrease in O&M expenses for Jalandhar and Mysore and 11% in case of Kozhikode, which are again not possible to achieve.

Thus, the sensitivity analysis for the three projects reveals that even with significant changes in various parameters, the project IRR does not cross benchmark rates. Therefore, the project activity is additional and is not a business – as – usual scenario. The project can become financially attractive only with the CDM benefit.

Step 3: Barrier Analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity

The following category of barriers: (a) other barriers was used in the analysis as explained below:

(a) Other Barrier

Market barrier

In India, marketing of compost produced from MSW has been a key challenge. Besides, the concept of soil conditioner is still not widely known amongst the farmers of the host country, the largest client/ user group of the compost. This problem is further aggravated by the perception of general public that the compost produced from waste is dirty. Therefore a majority of existing compost plants in India are facing major problem in marketing of compost as per the Report of the Inter Ministerial task force on Integrated plant Nutrient Management.²² Due to lack of marketing prospects, there is piling up of product inventory, and many compost plants in India have either slowed down their production activity or sometimes even temporarily stop taking garbage.²³

The compost marketing in India suffers from the following drawbacks:

1. The farmers have a fear psychosis about the quality of compost produced by the compost plants.²⁴
2. State Government and municipalities do not promote the use of compost²⁵
3. No serious attempt in the use of organic manure through an integrated nutrient approach has been taken in India and also no study has been made for assessing the potential market while planning the scheme for installation of compost plant.²⁶
4. Most of the compost plants do not have any proper laboratory facility and there is no consistent effort for rigorous quality control to help in marketing of compost.²⁷
5. Lack of awareness among the farmers regarding use and benefits of city garbage based compost. Farmers in India have not been exposed through field demonstration the benefits of Integrated nutrient management.²⁸
6. The relative advantages of the compost produced from city garbage vis-a vis chemical fertilisers have not been thoroughly worked out and adequately publicised, especially among

²¹ Undertaking by PP regarding compost yield in the Jalandhar, Kozhikode and Mysore compost plants dated 17th June 2009

²² Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India – Page 64-71

²³ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 28

²⁴ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 23

²⁵ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 24

²⁶ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 31

²⁷ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 31

²⁸ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 32

the prospective client groups such as farmers, plantation owners/operators, fruit growers, forester, reclamation of denuded and degradable lands etc.²⁹

Therefore, additional efforts are required for overcoming the market barrier for the compost produced in the plants. In this context the additional incentive available to the plants through Clean Development Mechanism would be utilised for market development of the compost produced in the plants. The market development would focus on generating awareness among the user groups, development of laboratory facilities to ensure quality of the product and promote integrated plant nutrient management through the use of compost. The project proponent would also interact with state and central government to promote use of compost.

The above described barriers pose a serious obstacle to the project activity, and thus would lead to high operational uncertainties if not implemented as a CDM project activity.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

The above identified barriers do not affect Alternative M3 (Continuation of the current situation, Business as usual scenario). It faces no barriers with respect to technology, market and so on as shown in Step 3a. Therefore, it is the economically feasible option for the project proponent.

For investors, the Alternative M2 is not acceptable because of the technology reasons and is economically unattractive since it involves infrastructural investment and no revenue accruing out of the activity. Thus Alternative M2 cannot be used as the baseline. In comparison, Alternative M3 continuing the current disposal of waste and allowing the emission of landfill gas does not require any additional investments, thus is the most economically favourable option.

Step 4: Common Practice Analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity:

For the purpose of common practice analysis, similar projects are defined as MSW based composting facilities operating in the host country. Generally no processing of municipal solid waste is done in the host country. Only a few cities have set up composting facility for Municipal solid waste on a limited scale using aerobic or anaerobic systems of composting³⁰. However, as evident in Table B.4.1, even these facilities are not able to operate successfully due to lack of proper infrastructure/ shortage of technical staff/ inability to sell the compost in the market.

Table B.4.1 presents summary of the compost plants operating in the host country.

Table B.4.1: MSW based Composting – Experience in India

City	Remarks
Dhapa, Kolkata, West Bengal	A compost plant was set up by M/s Eastern Organic Fertilizers Limited with technical backup of Excel Industry in the year 2000 and operated at low capacity until 2003. Since 2003, the plant has stopped operating because the company was unable to meet its commitment to KMC ³¹ .
Ahmedabad	This is a plant set in the year 2000 running at a low capacity. Major problem faced is marketing of the organic manure due to seasonal demand ³² .
Bhopal	This is a compost plant installed in 1993. But the plant is facing acute marketing problem and product is piling up, the cost of production is also high and has been closed ³³ .
Nasik	Live biotech Private Limited, Thane, established and ran the plant initially but backed out later from the contract due to

²⁹ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 45

³⁰ http://3inetwork.org/reports/IIR2006/Solid_Waste.pdf

³¹ Tumpa Hazra, Sudha Goel; "Solid waste management in Kolkata, India: Practices and challenges"; Waste Management journal homepage: www.elsevier.com/locate/wasman

³² Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 67

³³ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India - Page 70

	losses ³⁴ .
Gwalior	Installed in 1995, the plant is not in operation since 2000 due to piling up of organic manure. Marketing is one of the major problems ³⁵ .
Pondicherry	Running at 80% efficiency. Government provides 75% subsidy to farmers for purchase of compost ³⁶ .
Nagarcoil, Tamil Nadu	Although the Govt. of India has released Rs. 20 lakh subsidy, the compost plant is yet to be installed ³⁷ .
Manali, Tamil Nadu	Composting project was shelved as no one came forward to purchase the manufactured compost ³⁸ .
Tirupur, Tamil Nadu	Running at a very low capacity. There are inherent design problems in compost making ³⁹ .
Vijaywada, Andhra Pradesh	The plant is running in loss due to limited marketing of the produce ⁴⁰ .

Apart from the plants listed in Table B.4.1 above, there are number of other MSW based composting plants in host country (as given in Table B.4.2 below) have applied for CDM benefits which have not been considered in the above analysis as per the guidance provided in “Tool for the demonstration and assessment of additionality”, v05.2.

Table B.4.2: Similar MSW based composting projects applying for CDM benefits

City	Remarks
Delhi- Tikri Plant	Plant was shut down due to loss and inventory pile up. It is being revived with the support of CDM benefits ⁴¹ .
Delhi- Okhla plant	Plant was closed. However, it is being revived with the support of CDM benefits ⁴² .
Delhi- Bhalaswa plant	Bhalaswa plant has also applied for CDM benefits ⁴³ .
Varanasi- Lalganj plant	The plant at Lalganj is also being established with the help of CDM benefits ⁴⁴ .
Bangalore	Plant has applied for CDM benefits ⁴⁵ .
Shillong	Plant has applied for CDM benefits and has also signed ERPA with the buyer.
Orissa- Puri	Plant was running at very low capacity or was closed. However, plant has applied for CDM benefits ⁴⁶ .
Coonoor	This plant at Tamil Nadu is being established with the help of CDM benefits ⁴⁷ .
Mettupalayam	This plant at Tamil Nadu has also applied for CDM benefits.
Udumalpet	Plant has applied for CDM benefits
Erode	This plant at Tamil Nadu has applied for CDM benefits.
Trichy	This plant at Tamil Nadu is being established with the help of CDM benefits.

³⁴ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India Page 66

³⁵ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India Page 70

³⁶ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India Page 67

³⁷ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India Page 64

³⁸ <http://www.thehindu.com/2009/01/27/stories/2009012758440300.htm>

³⁹ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India Page 65

⁴⁰ Waste to Wealth- A report by Inter Ministerial Task Force on Integrated Plant Nutrient Management, May 2005, constituted by Ministry of Urban Development, Govt. of India Page 68

⁴¹ <http://cdm.unfccc.int/Projects/Validation/DB/NP8LSWEYWGTL19LAQCGRFM2XXRG27T/view.html>

⁴² <http://cdm.unfccc.int/Projects/Validation/DB/3P08PLZ59EJOWYIJ8I18Y3T685HU0P/view.html>

⁴³ <http://cdm.unfccc.int/Projects/Validation/DB/USEDW99XJ5JYJ8SM8OEHX5RTCTYV7N/view.html>

⁴⁴ <http://cdm.unfccc.int/Projects/Validation/DB/4BYKPD16TEJF9H4ZTR7P5RQO067JJP/view.html>

⁴⁵ <http://cdm.unfccc.int/Projects/Validation/DB/Z9XVURU6LC0KTY76QU6H6QSLP8A09CK/view.html>

⁴⁶ <http://cdm.unfccc.int/Projects/Validation/DB/N4ZC97BBR5PZRZPA1BOGS806GF4T3N/view.html>

⁴⁷ <http://cdm.unfccc.int/Projects/Validation/DB/MENQNGLI69I8ZOEJ97ENVGU6RXKJY/view.html>

Pollachi	This plant at Tamil Nadu is being established with the help of CDM benefits.
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Hence, the business as usual scenario in India is disposal of waste in SWDS without any kind of processing or treatment.

Circumstances relevant to baseline in Jalandhar, Kozhikode and Mysore

➤ **Jalandhar:** The Jalandhar Compost plant at Wariana, Basti Bawa Khel was established vide a Public-Private-Partnership (PPP) agreement with Jalandhar Municipal Corporation. However, the plant ran in losses due to lack of market access and low selling price for the compost produced and stopped receiving fresh waste due to pile up of inventory and was abandoned by the project promoters. Jalandhar Municipal Corporation (JMC) served repeated requests and notices to the project promoter to restart the plant which could not be achieved. In response to the notices served by JMC, the project promoter informed JMC of its inability to run the plant due to non-availability of market to sell compost and piling up of the finished product in the godowns and requested JMC to arrange for the off take of the end product since the plant was not getting any revenue and the company was bearing huge O&M costs. Hence the project was closed leading to disposal of all MSW intended to be treated by the project in nearby SWDS. In 2007, the project proponent approached the promoter with a proposal to restart the closed plant and use CDM revenue as a means of subsidising the production cost of compost and thus make the operation of plant viable. In fact the project proponent also agreed to share a part of CDM revenue against the capital investment that the project promoter has incurred in the project. Thus in absence of additional revenue from CDM the plant would have remained abandoned and closed and waste would have continued being disposed in the adjacent SWDS. The fact that the plant was abandoned by the project promoter further strengthens the conclusion that barriers do exist in operation of the plant which could not be overcome in absence of CDM.



Coarse Segregation Section- Rusted due to long period of closure

➤ **Kozhikode:** The Kozhikode Compost Plant was installed by Kozhikode Municipal Corporation (KMC) as an attempt to follow guidelines prescribed in MSW Rules, 2000. Discussions with the people from the Municipal Corporation revealed that the plant started facing difficulty in its operation due to marketing problems wherein the production cost of processing waste was higher than the price fetched by the compost. KMC could not sell the compost product which led to piling up of the inventory and led to its complete shutdown. After the closure of the plant, all the waste generated in the city was disposed in the adjacent SWDS.



Damaged Plant Machinery- Abandoned since closure of plant

Therefore, closure of the plant after its establishment confirms the barriers faced by the plant as mentioned earlier. In June 2008, the project proponent approached KMC with a proposal to rejuvenate the plant and proposed CDM revenue as a means of restarting the plant. Due to long period of closure, all the equipment in the plant had become corroded and unusable. The project proponent also agreed to repair the equipment and get the plant back in working condition. In absence of CDM benefit the project proponent would not have approached KMC and waste would have been continued being disposed in the adjoining SWDS.

➤ **Mysore:** As part of the MSW Management Program taken up under ADB assisted Karnataka Urban Infrastructure Development Project (KUIDP), a MSW treatment facility was set up by the Mysore City Corporation (MCC). Although the plant was set up with ADB assistance, the operations of the facility had been intermittent right from commencement of operations and finally the plant stopped operations completely. After closure of the plant, waste collected from different zones of Mysore city was being disposed in the existing SWDS located at Vidyaranayapuram, which is owned and managed by MCC. Closure of the plant established through ADB assistance further confirms the barriers faced by the plant in absence of CDM. In June 2008, the project proponent approached MCC with a proposal to restart the plant, and agreed to bear all cost associated with the repairing of the equipment (which had corroded due to long period of disuse). The project proponent envisaged CDM revenue as a means of restarting the plant and also agreed to share a part of revenue with MCC. Hence in absence of CDM, the plant would not have restarted its operation and disposal of MSW in the adjoining SWDS would have continued.



Trommel Screens at abandoned plant- rusted since the plant was not operational for a long

In conclusion, though similar plants were established in past, these plants could not function due to various barriers like marketing problems and high production cost viz a viz the price of compost. Moreover the project activity has been established without any support in form of grant or subsidy and viability of the project activity completely depends on additional revenue available from CDM. Therefore, passing all steps above, the project activity faces barriers against its implementation and is not a business-as-usual case, and is additional.

Sub-step 4b: Discuss any similar Options that are occurring:

There are no similar options commonly occurring in the host country. The common practice in India is disposal of waste without any treatment or processing. Though processing of wastes is a recommendation under the Municipal Solid Waste (MSW) Management Rules 2000 for all municipal bodies in the country and the specified date for setting up of waste processing and disposal facilities was 31 December 2003 for municipalities according to the rules. However, most of the urban local bodies in India have not been able to comply with this rule and disposal of waste in SWDS still remains a common practice inspite of existence of the above mentioned composting units which are able to treat only a part of MSW generated in the respective cities. Thereby most of the municipalities are not able to achieve compliance to the said MSW rule and organic waste still continue to be disposed in the SWDS of cities even after establishment of waste treatment facilities.

Thus it can be concluded that extremely few similar activities can be observed in India which have been discussed in detail in Table B.4.1 and B.4.2, and when they are observed, they face considerable barriers and have not had much success. The proposed project is a conscious move

away from common practice. It will use the CDM Benefits as an additional source of revenue making the project viable. In this way the plant will have demand and reason to supply.

Some projects as mentioned in previous step are being developed under CDM. Thus, it has been clearly demonstrated how the approval and registration of the project as a CDM activity, and the attendant benefits and incentives derived from the project activity, will alleviate the barriers showed in Step 3 and thus enable the project to be undertaken.

Therefore, as demonstrated by the investment and barrier analysis in Step 2 and 3, it is clear that the project is not financially viable without the revenue from CDM, and there are significant barriers to its implementation.

In addition, as detailed in Step 4, the proposed project activity is not common practice either, and in the limited cases where aerobic composting is taking place, it is proving to be a failure from an economic perspective. It can therefore be concluded that the proposed project activity is additional, and would not occur without CDM, due to the financial and marketing barriers in place.

In conclusion, passing all the steps above, the project is clearly additional and would not be realised if proposed without the CDM and will contribute to sustainable waste management practices.

Serious Consideration of CDM

EB41 Annex46 requires the serious consideration of the benefits to be demonstrated by a) the awareness of CDM by project participant prior to the project activity start date and b) parallel action having been taken for the registration of the project as CDM activity along with the implementation of the project.

Awareness of CDM is demonstrated by the fact that the project proponent has developed similar CDM project "Upgradation, Operation and Maintenance of 200 TPD Composting Facility at Okhla, Delhi" in past. CDM benefits were seriously considered by IWMUSL and approvals for investment were given only based on the availability of the CDM benefits for the candidate projects. This is reflected in the approval memorandums as well as Detailed Project Reports for the composting facilities at Jalandhar, Kozhikode and Mysore where CDM revenues were considered while ascertaining the viability of the project. The consideration of CDM before start date of project activity is also evidenced in the agreements signed for all the three plants by the project proponent which clearly mention inclusion of CDM benefits.

As evident from the above, the project proponent was aware of the CDM benefits before the start date of the project activity in as much as it is evidenced by CDM being mentioned in the concession agreements for each of the projects. The parallel steps taken for availing CDM benefits are further listed in the Table B.4.3 below.

Table B.4.3: Chronology of events

Date	Events
12/07/2007	Approval for Jalandhar composting project which envisaged CDM benefits to make the project viable.
28/07/2007	Agreement for Jalandhar compost plant signed by project proponent which considers CDM revenue sharing.
06/08/2007	Discussion with CDM Consultant for availing CDM benefits for the project.
08/08/2007	Project proponent confirms award of work to CDM consultant for availing CDM benefits for Jalandhar Composting Project.
24/08/2007	CDM Consultant suggests IWMUSL to take PoA approach for Jalandhar and all future projects as Okhla composting project was being developed as a small scale project activity
30/08/2007	First Work Order placed for Jalandhar plant for procurement of JCB JS 80; Quotation Ref No. JSV/AN/JCB-2007 (project start date)
14/09/2007	IWMUSL agrees to take the PoA approach and requests CDM consultant to start the documentation process.
05/10/2007	Local stakeholders consultation for plant at Jalandhar
30/11/2007	Stakeholders consultation with local municipality officials and Mayor at Jalandhar
01/02/2008	First Draft of PoA DD for Jalandhar sent to IWMUSL
15/02/2008	Approval of PoA by IWMUSL

03/03/2008	Initiation of discussion with DOE for validation of the PoA and other relevant stakeholders
12/06/2008	CDM consultant asks IWMUSL to take up Jalandhar as individual small scale project envisaging delay in PoA approach based on their experience and interaction with number of stakeholders
20/06/2008	IWMUSL agrees to take up the Jalandhar project as small scale individual project
06-08/2008	Two more projects (Kozhikode and Mysore) were awarded to IWMUSL
11/08/2008	Small scale PDD of Jalandhar completed by CDM consultant and shared with IWMUSL for approval
14/08/2008	Jalandhar small scale PDD finalised; IWMUSL requests CDM consultant for appointment of DOE
20/08/2008	DOE appointed for Jalandhar Small Scale project
15/09/2008	CDM consultant suggests a bundled approach for all the three projects comprising of Jalandhar, Kozhikode and Mysore
30/09/2008	IWMUSL gives a go ahead to bundle all three projects of Jalandhar, Kozhikode and Mysore
15/10/2008	Baseline calculation of bundled large scale project is completed
20–29/10/2008	Buyers contacted for the Bundled Large Scale Project
10/11/2008	DOE informed about change in project approach from Small Scale to Large Scale bundled project
26/11/2008	Large Scale PDD “Bundled Waste Processing Facilities in India” completed for submission to IWMUSL
28/11/2008	IWMUSL agrees to appoint DNV as validator for CDM bundled project and the PDD was submitted to DNV for validation.
21/02/2009	Global Stakeholder Consultation of the large scale project on UNFCCC website
31/03/2009	ERPA was signed for the Large Scale Bundled project
22/04/2009	Host Country Approval meeting for large scale project

The agreement for Jalandhar plant was signed by project proponent on 28/07/2007. By 08/08/2007, the CDM consultant was awarded the work towards availing CDM benefits from the project. The first work order was placed for Jalandhar on 30/08/2007 for procurement of JCB JS 80; Quotation Ref No. JSV/AN/JCB-2007. As per the Glossary of Terms (Para 67 of EB 41) 30/08/2007 becomes the start date of the project activity. The project proponent had taken parallel steps to register the project as a CDM project activity immediately after signing the concession agreement. Local stakeholder's meeting for Jalandhar project was held on 05/10/2007 and another stakeholder's consultation with local municipality officials and Mayor was held at Jalandhar on the 30/11/2007.

The CDM consultant who were already working for IWMUSL on a similar small scale project titled “Upgradation, Operation and Maintenance of 200 TPD Composting Facility at Okhla, Delhi”, considering plans of IWMUSL to develop similar waste processing plants in other parts of India, recommended the development of a programmatic approach for waste processing sector having pan- India coverage would be a good strategy to obtain CDM benefits for the company. Thus it was decided to launch the Jalandhar composting project along with other upcoming projects as a programmatic approach.

Accordingly the company focused on launching a CDM-PoA on “Municipal Solid Waste Management Programme through Composting, India”. The documentation process for the CDM-PoA-DD was initiated in 09/2007. Since the programmatic approach was a new approach, it took some time for the CDM consultant to prepare the CDM-PoA-DD. The first version of CDM-PoA-DD was prepared by 01/02/2008 and was circulated among a number of stakeholders including DOE for their comments and way forward. Over the next couple of months, the CDM consultant interacted with the DOE and other stakeholders and provided regular feedback, evidence of which have been shared with the DOE. However by 06/2008, it was clear that the PoA was a time consuming approach and may cause a delay in registration and thereby loss of pre-registration credits. CDM being an important factor in the success of the plant, it was decided on advice of CDM consultant to abandon the PoA approach and register the project as a stand-alone CDM

project. Accordingly the small scale CDM PDD was prepared by 08/2008 and DOE was appointed for validation of the same.

In the meantime, agreements were signed for Kozhikode and Mysore plants as well. The agreement for the Kozhikode compost plant was signed on 16/06/2008. Serious consideration of CDM is evidenced both by the approval memorandum for the project and the agreement which clearly mentions inclusion of CDM benefits in future. The first purchase order was placed on 04/07/2008 for procurement of JCB 3DXL model. This was followed by local stakeholder's meeting held on 19/07/2008 at Kozhikode. Similarly, the agreement for the Mysore plant was signed on 30/08/2008. Both the agreement and the approval memorandum for the project clearly mentions inclusion of CDM benefits thus reflecting the serious consideration of CDM before start of project activity. The first purchase order was placed for procurement of JCB JS140 Tracked Excavator on 23/09/2008. The local stakeholder's consultation was held on 27/11/2008 at Vidyaranyapuram.

Considering two more projects of similar nature were in pipeline for obtaining CDM approval, IWMUSL (now IEISL) decided to bundle the three plants under one CDM project activity and proceed with the bundling approach rather than the small scale or programmatic approach for registration of the projects. The decision was taken by IWMUSL (now IEISL) based on the feedback received by the CDM consultant. The DOE who was contacted for validation of the small scale Jalandhar project was now requested to validate the bundled large scale project and by 28/11/2008, award of work to the DOE was approved and PDD was submitted to the DOE. The bundled project activity was subsequently hosted on the UNFCCC website for global stakeholder consultation on 21/02/2009.

Hence it can be concluded from the above discussion that the project proponent was aware of CDM benefits before signing of agreement and had taken parallel actions for registration of project, first using the PoA approach, then the small scale approach followed by the use of bundling approach.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Approved baseline and monitoring methodology *AM0025- Avoided emissions from organic waste through alternative waste treatment processes, v11* has been used to calculate emission reductions from the project. The project activity involves composting of organic content of MSW which was originally intended for disposal at SWDS. By preventing the disposal of organic waste at SWDS site, there is complete avoidance of methane emission that would have taken place in the SWDS due to on setting of anaerobic process. The following conditions apply:

- ↳ The project activity involves a composting process in aerobic conditions
- ↳ The proportions and characteristics of different types of organic waste can be determined in order to apply a multiphase First order decay model in estimating the quantity of landfill gas that would have been generated in the absence of the project activity.

Calculation of Emission Reductions

Project Emissions

As per Eq. 1 of approved methodology AM0025, v11

$$PE_y = PE_{elec,y} + PE_{fuel, on-site,y} + PE_{c,y} + PE_{a,y} + PE_{g,y} + PE_{r,y} + PE_{i,y} + PE_{w,y} \dots\dots (1)$$

Where:

PE_y	Is the project emissions during the year y (tCO ₂ e)
$PE_{elec,y}$	is the emissions from electricity consumption on-site due to the project activity in year y (tCO ₂ e)
$PE_{fuel, on-site,y}$	Is the emissions on-site due to fuel consumption on-site in year y (tCO ₂ e)
$PE_{c,y}$	Is the emissions during the composting process in year y (tCO ₂ e)
$PE_{a,y}$	Is the emissions from the anaerobic digestion process in year y (tCO ₂ e)
$PE_{g,y}$	Is the emissions from the gasification process in year y (tCO ₂ e)
$PE_{r,y}$	Is the emissions from the combustion of RDF/stabilized biomass in year y (tCO ₂ e)
$PE_{i,y}$	Is the emissions from waste incineration in year y (tCO ₂ e)

$PE_{w,y}$ Is the emissions from waste water treatment in year y (tCO_2e)

Since project activity involves only composting, leachate generated if any from composting process will be recycled in windrows under aerobic conditions hence $PE_{a,y}$, $PE_{g,y}$, $PE_{r,y}$, $PE_{i,y}$, $PE_{w,y}$ need not be considered and thus equation 1 becomes:

$$PE_y = PE_{elec,y} + PE_{fuel, on-site,y} + PE_{c,y} \quad \dots\dots\dots(2)$$

Emissions from electricity use on site ($PE_{elec,y}$)

The project uses electricity from the Northern grid (in case of Jalandhar) and Southern grid (in case of Kozhikode and Mysore). The emissions from electricity use are therefore calculated as (Eq. 2 of AM0025, v11):

$$PE_{elec,y} = EG_{PJ,FF,y} \times CEF_{elec} \quad \dots\dots\dots(3)$$

Where:

$EG_{PJ,FF,y}$ Is the amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid as a result of the project activity, measured using an electricity meter (MWh)

CEF_{elec} Is the carbon emissions factor for electricity generation in the project activity (tCO_2e/MWh)

Emissions from on-site fuel consumption ($PE_{fuel, on-site,y}$)

Emissions from fuel use are related to vehicles used on-site for waste and compost management and also for other technical installations. The emissions are calculated from the quantity of fuel used and the specific CO_2 emission factor of the fuel, as follows (Eq. 3 of AM0025, v11):

$$PE_{fuel, on-site,y} = F_{cons,y} \times NCV_{fuel} \times EF_{fuel} \quad \dots\dots\dots(4)$$

$$F_{cons,y} = F_{cons,y}(L) \times D_{diesel} \quad \dots\dots\dots(5)$$

Where:

$PE_{fuel, on-site,y}$ Is the CO_2 emissions due to on-site fuel consumption in year y (tCO_2e)

$F_{cons,y}$ Is the fuel consumption on site in year y (tonnes)

NCV_{fuel} Is the net calorific value of the fuel (MJ/l or MJ/kg)

EF_{fuel} Is the CO_2 emissions factor of the fuel (tCO_2e/MJ)

$F_{cons,y}(L)$ Is Fuel consumption on site in the year "y" (Litres)

D_{diesel} Is Average Density of Diesel (kg/L)

Emissions from composting ($PE_{c,y}$)

As per Eq. 4 of AM0025, v11

$$PE_{c,y} = PE_{c,N_2O,y} + PE_{c,CH_4,y} \quad \dots\dots\dots(6)$$

Where:

$PE_{c,N_2O,y}$ Is the N_2O emissions during the composting process in year y (tCO_2e)

$PE_{c,CH_4,y}$ Is the emissions during the composting process due to methane production through anaerobic conditions in year y (tCO_2e)

N_2O Emissions

The N_2O emissions from composting are calculated as follows⁴⁸ (Eq. 5 of AM0025, version 11):

$$PE_{c,N_2O,y} = M_{compost} \times EF_{c,N_2O} \times GWP_{N_2O} \quad \dots\dots\dots(7)$$

Where:

⁴⁸ Assuming 650 kg dry matter per ton of compost and 42 mg N_2O -N, and given the molecular relation of 44/28 for N_2O -N, an emission factor of 0.043 kg N_2O / tonne compost results.

$PE_{c, N_2O, y}$	Is the N_2O emissions from composting in year y (tCO_2e)
$M_{compost, y}$	Is the total quantity of compost produced in year y (tonnes/a)
EF_{c, N_2O}	Is the emission factor for N_2O emissions from the composting process (tN_2O/t compost)
GWP_{N_2O}	Is the Global Warming Potential of nitrous oxide, (tCO_2e / tN_2O)

Based on these values, default emission factor of 0.043 kg N_2O per tonne of compost for EF_{c, N_2O} is used.

CH₄ emissions

During the composting process, pockets of anaerobic conditions – isolated areas in the composting heap where oxygen concentrations are so low that the biodegradation process turns anaerobic – may occur. The emission behaviour of such pockets is comparable to the anaerobic situation in a landfill. This is a potential emission source for methane similar to anaerobic conditions which occur in unmanaged landfills. Through pre-determined sampling procedures, the percentage of waste that degrades under anaerobic conditions can be determined. Using this percentage, project methane emissions from composting is calculated as follows (Eq. 6 of AM0025, version 11):

$$PE_{c, CH_4, y} = MB_{compost, y} \times GWP_{CH_4} \times S_{a, y} \quad \dots\dots\dots(8)$$

Where:

$PE_{c, CH_4, y}$	Is the project methane emissions due to anaerobic conditions in the composting process in year y (tCO_2e)
$S_{a, y}$	Is the share of the waste that degrades under anaerobic conditions in the composting plant during year y (%)
$MB_{compost, y}$	Is the quantity of methane that would be produced in the landfill in the absence of the composting activity in year y (tCH_4). $MB_{compost, y}$ is estimated by multiplying MB_y estimated from equation 8 by the fraction of waste diverted, from the landfill, to the composting activity (f_c) relative to the total waste diverted from the landfill to all project activities (composting, gasification, anaerobic digestion and RDF/stabilized biomass, incineration)
GWP_{CH_4}	Is the Global Warming Potential of methane (tCO_2e / tCH_4)

Calculation of $S_{a, y}$

To determine the oxygen content during the process, oxygen content will be measured according to a predetermined sampling scheme and frequency. The percentage of the measurements that show oxygen content below 10% is presumed to be equal to the share of waste that degrades under anaerobic conditions (i.e. that degrades as if it were landfilled); hence the emissions caused by this share are calculated as project emissions ex-post on an annual basis (Eq. 7 of AM0025, version 11):

$$S_{a, y} = S_{OD, y} / S_{total, y} \quad \dots\dots\dots(9)$$

Where:

$S_{OD, y}$	Is the number of samples per year with an oxygen deficiency (i.e. oxygen content below 10%)
$S_{total, y}$	Is the total number of samples taken per year, where $S_{total, y}$ should be chosen in a manner that ensures the estimation of $S_{a, y}$ with 20% uncertainty at a 95% confidence level

Baseline Emissions (BE_y)

Baseline emissions are calculated using the following equations (Eq. 19 of AM0025, version 11):

$$BE_y = (MB_y - MD_{reg, y}) + BE_{EN, y} \quad \dots\dots\dots(10)$$

Where:

BE_y	Is the baseline emission in year y (tCO ₂ e)
MB_y	is the methane produced in the landfill in the absence of the project activity in year y (tCO ₂ e)
$MD_{reg,y}$	Is methane that would be destroyed in the absence of the project activity in year y (tCO ₂ e)
$BE_{EN,y}$	Baseline emissions from generation of energy displaced by the project activity in year y (tCO ₂ e)

Since the project does not involve any energy generation hence equation 10 becomes

$$BE_y = MB_y - MD_{reg,y} \quad \text{.....(11)}$$

As per Eq. 20 of AM0025, version 11

$$MD_{reg,y} = MB_y \times AF \quad \text{.....(12)}$$

Where:

AF Is Adjustment Factor for MB_y (%)

In cases where regulatory or contractual requirements do not specify $MD_{reg,y}$; an Adjustment Factor (AF) shall be used and justified, taking into account the project context.

The parameter AF is estimated as follows:

- In cases where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements, the ratio between the destruction efficiency of that system and the destruction efficiency of the system used in the project activity is used.
- In cases where a specific percentage of the “generated” amount of methane to be collected and destroyed is specified in the contract or mandated by the regulation, this percentage divided by an assumed efficiency for the collection and destruction system used in the project activity is used.

The Adjustment Factor shall be revised at the start of each new crediting period taking into account the amount of GHG flaring that occurs as part of common industry practice and/or regulation at that point in future.

None of the above case applies for this project activity, hence Adjustment Factor is considered as zero, resulting in $MD_{reg,y} = 0$. Thus equation 11 becomes

$$BE_y = MB_y \quad \text{.....(13)}$$

Rate of Compliance

In cases where there are regulations that mandate the use of one of the project activity treatment options and which is not being enforced, the baseline scenario is identified as a gradual improvement of waste management practices to the acceptable technical options expected over a period of time to comply with the MSW 2000 Management Rules. The adjusted baseline emissions ($BE_{y,a}$) are calculated as follows (Eq. 19 of AM0025):

$$BE_{y,a} = BE_y \times (1 - RATE_{Compliance_y}) \quad \text{.....(14)}$$

Where:

BE_y	Is the CO ₂ -equivalent emissions as determined from equation 13
$RATE_{Compliance_y}$	Is the state- level compliance rate of the MSW Management Rules in that year y

BE_y shall be replaced by $BE_{y,a}$ in calculating emission reductions.

Out of 4377 ULBs in India, till date, Most of the municipalities or local body in India have not complied with the guidelines stipulated in the MSW Rules 2000⁴⁹. However gradual improvement in MSW management systems is expected in the future. Still complete compliance to MSW Rules 2000 remains a distant dream. There is no official data available about the status of compliance to MSW Rules in the country, thus in absence of the same, a conservative value of 10% is assumed for ex-ante estimations⁵⁰. However, this parameter would be monitored for ex-post calculations and updated.

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

The amount of methane that is generated each year (MB_y) is calculated as per the latest version of the approved “*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*” version04, considering the following additional equation (Eq. 22 of AM0025, version 11):

$$MB_y = BE_{CH_4,SWDS,y} \quad \dots\dots\dots(15)$$

Where:

BE_{CH₄,SWDS,y} Methane generation from the landfill in the absence of the project activity at year y (tCO₂e), calculated as per the “*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*”. The tool estimates methane generation adjusted for, using adjustment factor (f) for any landfill gas in the baseline that would have been captured and destroyed to comply with relevant regulations or contractual requirements, or to address safety and odor concerns. As this is already accounted for in equation 6, “f” in the tool shall be assigned a value 0.

The amount of methane that is generated each year (BE_{CH₄,SWDS,y}, tCO₂e) is calculated for each year with the recommended multi-phase model, the First Order Decay (FOD) model. The amount of methane produced in the year y is calculated as follows:

$$BE_{CH_4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH_4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot (1-e^{-k_j}) \quad \dots\dots\dots(16)$$

Where:

BE_{CH₄,SWDS,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 (tCO₂e)

φ Model correction factor to account for model uncertainties

f Fraction of methane captured at the SWDS and flared, combusted or used in another manner

GWP_{CH₄} Global Warming Potential (GWP) of methane, valid for the relevant commitment period

OX Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)

F Fraction of methane in the SWDS gas (volume fraction)

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)

⁴⁹ Sunil Kumar ,Bhattacharyya J.K. , Vaidya A.N., Tapan Chakrabarti , Sukumar Devotta , Akolkar A.B. , Assessment of the status of municipal solid waste management in metro cities, state capitals, class I cities, and class II towns in India: An insight, pg 3, Waste Management journal homepage: www.elsevier.com/locate/wasman

⁵⁰ http://3inetwork.org/reports/IIR2006/Solid_Waste.pdf

- x Year during the crediting period: x runs from the first year of the project activity (x = 1) to the year y for which avoided emissions are calculated (x = y)
- y Year for which methane emissions are calculated

The amount of organic waste prevented from disposal in the SWDS ($W_{j,x}$) in a particular year is substituted by $A_{j,x}$. Where different waste types j are prevented from disposal, the amount of different waste types ($A_{j,x}$) is determined through sampling and the mean is calculated from the samples, as follows:

Thus,

$$A_{j,x} = \frac{W_x \cdot \sum_{n=1}^z p_{n,j,x}}{z} \quad \text{.....(17)}$$

Where:

- $A_{j,x}$ Amount of organic waste type j prevented from disposal in the SWDS in year x (tonnes/year), this value to be used to substitute variable $W_{j,x}$ in the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”.
- W_x Total amount of waste prevented from disposal in year x (tonnes)
- $p_{n,j,x}$ Weight fraction of the waste type j in the sample n collected during the year x
- z Number of samples collected during year x

Leakage (L_y)

The sources of leakage considered in the methodology for the project activity are CO_2 emissions from off- site transportation of waste materials which can be calculated from the following equations (As per Eq. 28 of AM0025, version 11):

$$L_y = L_{t,y} + L_{r,y} + L_{i,y} + L_{s,y} \quad \text{.....(18)}$$

Where:

- $L_{t,y}$ Is the leakage emissions from increased transport in year y (tCO_2e)
- $L_{r,y}$ Is the leakage emissions from the residual waste from compost in case it is disposed of in landfills in year y (tCO_2e)
- $L_{i,y}$ Is the leakage emissions from the residual waste from MSW incinerator in year y (tCO_2e)
- $L_{s,y}$ Is the leakage emissions from end use of stabilized biomass (tCO_2e)

Since the project activity does not include the use of MSW incinerator, the above Eqn 18 becomes:

$$L_y = L_{t,y} + L_{r,y} + L_{s,y} \quad \text{.....(19)}$$

Emissions from Transportation ($L_{t,y}$)

This would occur when the waste is transported from waste collecting points, in the collection area, to the treatment facility, instead of the existing landfills. The emissions are calculated (As per Eq. 29 of AM0025, version 11) from the quantity of fuel (diesel) used and the specific CO_2 emission factor of the fuel (diesel):

$$L_{t,y} = \sum_i^n \text{NO}_{\text{vehicles},i,y} * \text{DT}_{i,y} * \text{VF}_{\text{cons},i} * \text{NCV}_{\text{fuel}} * \text{D}_{\text{fuel}} * \text{EF}_{\text{fuel}} \quad \text{.....(20)}$$

Where:

- $\text{NO}_{\text{vehicles},i,y}$ Is the number of vehicles for transport with similar loading capacity
- $\text{DT}_{i,y}$ Is the average additional distance travelled by vehicle type i compared to baseline in year y (km)
- VF_{cons} Is the vehicle fuel consumption in litres per kilometre for vehicle type i (l/km)
- NCV_{fuel} Is the Calorific value of the fuel (MJ/Kg or TJ/Gg)

D_{fuel} Is the fuel density (kg/l), if necessary
 EF_{fuel} Is the Emission factor of the fuel (tCO₂e/MJ)

For estimation of $NO_{vehicles,i,y}$ the following equation has been used for ex-ante calculation:

$$NO_{vehicles,i,y} = W_x / CT_y \quad \dots\dots\dots(21)$$

Where:

W_x Is the quantity of waste composted in the year “y” (tonnes)
 CT_y Is the average truck capacity for waste transportation (tonnes/truck)

For transport of compost to the users, the same formula applies. W_x is replaced by $M_{compost}$ where $M_{compost}$ is the total quantity of compost produced in year y.

Emissions from residual waste or compost in case it is disposed of in landfills ($L_{r,y}$)

In case the residual waste or the compost is delivered to a landfill, CH₄ emissions are estimated through the following equation using estimated weights of each waste type ($A_{c,i,x}$).

$$L_{r,y} = BE_{CH_4,SWDS,y} \quad \dots\dots\dots(22)$$

$BE_{CH_4,SWDS,y}$ can be determined using equation 16 where estimated weights of each waste type ($A_{c,i,x}$) would be considered instead of variable $W_{j,x}$.

While calculating the ex-ante emissions for this project activity, the compost delivered to the landfill is considered as zero. Also for ex-ante estimations, the residual waste is taken as 100% inerts. Hence $L_{r,y} = 0$. The value of $L_{r,y}$ will be calculated during determination of the ex-post emissions using the above equation.

Off-site Emissions from end use of the stabilized biomass ($L_{s,y}$)

For amount of stabilized biomass used off-site for which no sale invoices can be provided, leakage emissions should be accounted for as follows:

Quantities of different types of waste input ($A_{j,x}$) to the RDF/biomass processing should be adjusted by an annual adjustment factor SA_y as follows:

$$A_{s,j,x} = SA_y \times A_{j,x} \quad \dots\dots\dots(23)$$

$$SA_y = \{R_n / R_t\} \quad \dots\dots\dots(24)$$

Where:

SA_y Is an adjustment factor for a specific year.
 R_n Is the weight of stabilized biomass sold offsite for which no sale invoices can be provided (t/yr)
 R_t Is the total weight of stabilized biomass produced (t/yr)

For *ex-ante* estimations for this project activity, the weight of stabilized biomass sold offsite for which no sale invoices can be provided is considered as zero. Hence $L_{s,y} = 0$. The value of $L_{s,y}$ will be calculated during determination of the ex-post emissions using the above equation.

Calculation of emission reductions

The following discussion of the methodological choices concentrates only on the formulae and approaches for the composting process in aerobic conditions as appropriate for this project activity. As per Equation 36 of AM0025, version 11, emission reductions are calculated as follows:

$$ER_y = BE_{y,a} - PE_y - L_y \quad \dots\dots\dots(25)$$

Where:

ER _y	Emission reductions in year y (tCO ₂ e)
BE _{y,a}	Adjusted Baseline emissions in year y (tCO ₂ e)
PE _y	Project emissions in year y (tCO ₂ e)
Ly	Leakage in year (tCO ₂ e)

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data and parameter.)

Data / Parameter	EF_{C,N2O}
Unit	tN ₂ O/tonnes of compost
Description	Emission factor for N ₂ O emissions from the composting process
Source of data	Approved baseline methodology AM0025, v11
Value(s) applied	0.000043
Choice of data or Measurement methods and procedures	Default value of 0.043 kg-N ₂ O/ t-compost is taken after Schenk et al, 1997 as given in approved methodology AM0025, v11.
Purpose of data	Calculation of project emissions
Additional comment	---

Data / Parameter	CEF_{elec}
Unit	tCO ₂ /MWh
Description	Combined emission factor of NEWNE and Southern Grid
Source of data	CEA CO ₂ Baseline Database, Version 4.0, October 2008 (www.cea.nic.in)
Value(s) applied	Jalandhar: 0.80 Kozhikode: 0.85 Mysore: 0.85
Choice of data or Measurement methods and procedures	Information available from authorised government agencies – national standard value has been calculated by Central Electricity Authority (CEA) as per guidelines of ACM0002 methodology Combined margin as provided by CEA for 2007-08. PP has chosen the parameter to be fixed <i>ex-ante</i> .
Purpose of data	Calculation of project emissions
Additional comment	See Annex 3 for details

Data / Parameter	φ
Unit	Unitless
Description	Model correction factor to account for model uncertainties
Source of data	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", v04
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	As per value proposed in "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"- v04
Purpose of data	Calculation of baseline emissions
Additional comment	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.

Data / Parameter	<i>OX</i>
Unit	Unitless
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	The disposal sites were characterized through site visits and review of practices
Value(s) applied	Jalandhar ⁵¹ : 0 Kozhikode: 0.1 Mysore: 0
Choice of data or Measurement methods and procedures	The Wariana site in Jalandhar and the Vidyaranyapuram site in Mysore where the waste would be disposed in the absence of the composting project activity are not covered with oxidizing material. Hence a value of 0 is appropriate. 0.1 is to be used for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. The Kozhikode site where the waste would be disposed in the absence of the composting project activity is covered with oxidizing material. Hence a value of 0.1 is appropriate.
Purpose of data	Calculation of baseline emissions
Additional comment	---

Data / Parameter	<i>MCF</i>
Unit	Unitless
Description	Methane Correction Factor
Source of data	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", Version 04 which is based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories, volume 5, Table 3.1, p. 3.14
Value(s) applied	Jalandhar: 1 Kozhikode: 1 Mysore: 1
Choice of data or Measurement methods and procedures	The disposal sites at Jalandhar, Kozhikode and Mysore where the waste would be disposed in the absence of the composting project activity have controlled placement of waste with compaction and levelling being done and are managed by the respective Municipal Corporations. Hence a value of 1 is chosen.
Purpose of data	Calculation of baseline emissions
Additional comment	---

Data / Parameter	<i>NCV_{fuel, onsite}</i>
Unit	TJ/Gg
Description	Net calorific value of fuel used onsite (diesel)
Source of data	Used IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1.2, p.1.18
Value(s) applied	43

⁵¹ Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. The emission reductions have been claimed from Jalandhar site from 27/06/2010 to 31/12/2013 (both days included). Hence, Jalandhar site is still discussed in this section of CDM-PDD-FORM.

Choice of data or Measurement methods and procedures	In the absence of project specific data and region specific data, IPCC 2006 default value has been taken. Moreover, IPCC 2006 default value is a conservative selection since the amount of emissions resulting from onsite use of fuel is relatively low.
Purpose of data	Calculation of project emissions
Additional comment	---

Data / Parameter	EF_{fuel}
Unit	kg/TJ
Description	CO ₂ emission factor of fuel used onsite (Diesel)
Source of data	Used IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1.4, p 1.23
Value(s) applied	74100
Choice of data or Measurement methods and procedures	In the absence of project specific data and region specific data, IPCC 2006 default value has been taken. Moreover, IPCC 2006 default value is a conservative selection since the amount of emissions resulting from onsite use of fuel is relatively low.
Purpose of data	Calculation of leakage emissions
Additional comment	---

Data / Parameter	$NCV_{fuel,transport}$
Unit	TJ/Gg
Description	Net calorific value of fuel used for transport (diesel)
Source of data	Used IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1.2, p.1.18
Value(s) applied	43
Choice of data or Measurement methods and procedures	In the absence of project specific data and region specific data, IPCC 2006 default value has been taken. Moreover, IPCC 2006 default value is a conservative selection since the amount of emissions resulting from transport is relatively low ⁵² .
Purpose of data	Calculation of leakage emissions
Additional comment	---

Data / Parameter	DOC_f
Unit	Unitless
Description	Fraction of degradable organic carbon (DOC) that can decompose
Source of data	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", Version 04 which is based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	IPCC 2006 default value as proposed by the tool is applied.
Purpose of data	Calculation of baseline emissions
Additional comment	---

⁵² http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

Data / Parameter	DOC_j														
Unit	Unitless														
Description	Fraction of degradable organic carbon (by weight) in the waste type j														
Source of data	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", Version 04 which is based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 5, Tables 2.4 and 2.5.														
Value(s) applied	<table border="1"> <thead> <tr> <th>WASTE TYPE j</th><th>DOC_j (%)</th></tr> </thead> <tbody> <tr> <td>Wood and wood products, A</td><td>50</td></tr> <tr> <td>Pulp, paper and cardboard, B</td><td>44</td></tr> <tr> <td>Food, food waste, beverages and tobacco, C</td><td>38</td></tr> <tr> <td>Textiles, D</td><td>30</td></tr> <tr> <td>Garden, yard and park waste, E</td><td>49</td></tr> <tr> <td>Glass, plastic, metal other inert, F</td><td>0</td></tr> </tbody> </table>	WASTE TYPE j	DOC_j (%)	Wood and wood products, A	50	Pulp, paper and cardboard, B	44	Food, food waste, beverages and tobacco, C	38	Textiles, D	30	Garden, yard and park waste, E	49	Glass, plastic, metal other inert, F	0
WASTE TYPE j	DOC_j (%)														
Wood and wood products, A	50														
Pulp, paper and cardboard, B	44														
Food, food waste, beverages and tobacco, C	38														
Textiles, D	30														
Garden, yard and park waste, E	49														
Glass, plastic, metal other inert, F	0														
Choice of data or Measurement methods and procedures	The choice of DOC_j value is based on chemical analysis of waste at the respective sites. Based on the analysis of DOC content of waste, the waste as received at site has been characterized as dry waste and hence the default values have been used accordingly.														
Purpose of data	Calculation of baseline emissions														
Additional comment	---														

Data / Parameter	k_j																									
Unit	Unitless																									
Description	Decay rate for the waste type j																									
Source of data	“Tool to determine methane emissions avoided from disposal of waste at a Solid Waste Disposal Site” version 04 which is based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 5, Table 3.3.																									
Value(s) applied	<table><tr><th rowspan="2">TYPE OF WASTE</th><th colspan="2">k_j</th></tr><tr><th>DRY (MAP<1000mm)</th><th>WET (MAP>1000mm)</th></tr><tr><td>Wood and wood products, A</td><td>0.025</td><td>0.035</td></tr><tr><td>Pulp, paper and cardboard, B</td><td>0.045</td><td>0.070</td></tr><tr><td>Food, food waste, beverages and tobacco, C</td><td>0.085</td><td>0.400</td></tr><tr><td>Textiles, D</td><td>0.045</td><td>0.070</td></tr><tr><td>Garden, yard and park waste, E</td><td>0.065</td><td>0.170</td></tr><tr><td>Glass, plastic, metal other inert, F</td><td>0</td><td>0</td></tr></table>			TYPE OF WASTE	k_j		DRY (MAP<1000mm)	WET (MAP>1000mm)	Wood and wood products, A	0.025	0.035	Pulp, paper and cardboard, B	0.045	0.070	Food, food waste, beverages and tobacco, C	0.085	0.400	Textiles, D	0.045	0.070	Garden, yard and park waste, E	0.065	0.170	Glass, plastic, metal other inert, F	0	0
TYPE OF WASTE	k_j																									
	DRY (MAP<1000mm)	WET (MAP>1000mm)																								
Wood and wood products, A	0.025	0.035																								
Pulp, paper and cardboard, B	0.045	0.070																								
Food, food waste, beverages and tobacco, C	0.085	0.400																								
Textiles, D	0.045	0.070																								
Garden, yard and park waste, E	0.065	0.170																								
Glass, plastic, metal other inert, F	0	0																								

Choice of data or Measurement methods and procedures	Kozhikode is located in tropical area with an average annual temperature (MAT) of 27.46 °C and mean annual precipitation (MAP) of 3063 mm, hence the wet values for 'k' are taken. Jalandhar is located near Amritsar which is in a tropical area with an average annual temperature (MAT) of 22.84 °C and mean annual precipitation (MAP) of 759.96 mm. Similarly the mean annual temperature (MAT) of Bangalore which is the nearest station near Mysore is 24.11°C and mean annual precipitation (MAP) is 905.04 mm. Hence dry values for 'k' have been considered for both Jalandhar and Mysore. Appropriate default values based on Tool has been used.
Purpose of data	Calculation of baseline emissions
Additional comment	---

Data / Parameter	F
Unit	Unitless
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	"Tool to determine methane emissions avoided from disposal of waste at a Solid Waste Disposal Site", Version 04 which is based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	The factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the solid waste disposal site. The IPCC 2006 default value (cited above) has been used as no local data was available.
Purpose of data	Calculation of baseline emissions
Additional comment	---

Data / Parameter	D_{diesel}
Unit	kg/L
Description	Density of diesel
Source of data	Indian Oil Corporation Limited
Value(s) applied	0.88
Choice of data or Measurement methods and procedures	Average density of diesel in India has been used as provided by Indian Oil Corporation Limited (IOCL) which gives density of diesel in range of 820-880 kg/m ³ . When converted to kg/L, it gives a value of 0.82- 0.88 kg/L. Hence 0.88 kg/L has been used since it is more conservative.
Purpose of data	Calculation of project emissions
Additional comment	---

Data / Parameter	f
Unit	Unitless
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data	Approved Methodology AM0025 v11
Value(s) applied	0%
Choice of data or Measurement methods and procedures	As per the approved methodology, AM0025 Version 11, 'f' in the tool shall be assigned a value 0. As it is already accounted for in the methodology as Adjustment Factor and hence the parameter 'f' has been fixed <i>ex-ante</i> .

Purpose of data	Calculation of baseline emissions
Additional comment	---

Data / Parameter	AF
Unit	%
Description	Methane destroyed due to regulatory or other requirements
Source of data	Local and/or national authorities
Value(s) applied	0
Choice of data or Measurement methods and procedures	As per the approved methodology, AM0025 Version 11, AF shall be assigned a value taking into account the amount of methane generated by the landfills that may be captured and destroyed to comply with relevant regulations and contractual requirements of the host country. Since there exists no regulations or contractual requirement to capture and destroy the methane generated from the landfills in India, hence AF has been fixed <i>ex-ante</i> and assigned a value of 0%.
Purpose of data	Calculation of baseline emissions
Additional comment	---

B.6.3. Ex ante calculation of emission reductions

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Calculation of Project Emissions for all three plants:

Emissions from electricity use ($PE_{elec,y}$): For the purpose of calculations, the consumption has been taken from the DPR. The actual consumption of electricity shall be monitored based on the billing by the State Electricity Board or any Private Supplier.

Formula Applied:

$$PE_{elec,y} = EG_{PJ,FF,y} \times CEF_{elec}$$

PARAMETER	DESCRIPTION	UNIT	VALUE APPLIED			SOURCE
			JALANDHAR	MYSORE	KOZHIKODE	
$EG_{PJ,FF,y}$	Amount of electricity used by project activity per year	MWh	657.0	821.3	492.8	Detailed Project Report
CEF_{elec}	Grid emission factor of the Southern grid (Combined Margin)	tCO ₂ e/MWh	0.80	0.85	0.85	CEA CO ₂ Baseline Database, v4.0, October 2008
$PE_{elec,y}$	Emissions from grid electricity use per year	tCO ₂ e	526	698	419	Calculated

Total emissions from grid electricity use per year ($PE_{elec,y}$) = 1,643 t CO₂e

However, on exclusion of Jalandhar site from 2014 onwards, the value of $PE_{elec,y}$ is revised to 1,117tCO₂e.

Emissions from on-site fuel consumption: For ex-ante calculations the fuel consumption has been taken from the DPR. Fossil fuel consumption within the project boundary for the waste handling equipments will be monitored. There will be provision for HSD fired DG sets for any exigency that may arise. The project emissions for these have been considered zero for the purpose of calculations but will be monitored ex-post.

Formula applied:

$$PE_{fuel, onsite, y} = F_{cons} \times NCV_{fuel} \times EF_{fuel}$$

PARAMETER	DESCRIPTION	UNIT	VALUE APPLIED			SOURCE
			JALANDHAR	MYSORE	KOZHIKODE	
$F_{CONS, y}$	Fuel consumption on site per year (diesel)	Litres	54,750	73,000	43,800	Detailed Project Report
D_{diesel}	Density of diesel	kg/L	0.88	0.88	0.88	Indian Oil Corporation Limited
$F_{CONS, y(t)}$	Fuel consumption on site per year (diesel)	Tonnes	48.2	64.2	38.5	Calculated
NCV_{fuel}	Net calorific value of fuel (diesel)	TJ/Gg	43	43	43	IPCC 2006 Guidelines for National GHG Inventories
EF_{fuel}	CO ₂ emission factor for fuel (diesel)	kg/TJ	74100	74100	74100	IPCC 2006 Guidelines for National GHG Inventories
$PE_{fuel, onsite, y}$	Emissions from on-site fuel consumption per year	tCO ₂ e	153.5	204.7	122.8	Calculated

Total emissions from on-site fuel consumption per year ($PE_{fuel, onsite, y}$) = 481 tCO₂e

The value of ($PE_{fuel, onsite, y}$) has been revised to 327.5 tCO₂e after excluding Jalandhar site from 2014 onwards.

Emissions from Composting

Formula applied:

$$PE_{c, y} = PE_{c, N_2O, y} + PE_{c, CH_4, y}$$

N₂O Emissions

Formula applied:

$$PE_{c, N_2O, y} = M_{compost, y} \times EF_{c, N_2O} \times GWP_{N_2O}$$

PARAMETER	DESCRIPTION	UNIT	VALUE APPLIED			SOURCE
			JALANDHAR	MYSORE	KOZHIKODE	
$M_{compost}$	Total amount of compost produced in a year y	Tonnes/year	14600	18250	10950	Calculated @ 20% conversion rate
EF_{c, N_2O}	Emission Factor for N ₂ O emissions from composting process	TN ₂ O/tonne compost	0.00043	0.00043	0.00043	Default value taken from methodology AM0025, v11
GWP_{N_2O}	Global Warming Potential of Nitrous Oxide	tCO ₂ e/tN ₂ O	310	310	310	Default value taken from IPCC 2006 Guidelines
$PE_{c, N_2O, y}$	N ₂ O emissions from composting in year y	tCO ₂ e	195	243.3	146	Calculated

Total N₂O emissions from composting in year y ($PE_{c, N_2O, y}$) = 584.3 tCO₂e

The value of $PE_{c, N_2O, y}$ is revised to 389.3 tCO₂e after excluding Jalandhar site from 2014 onwards.

CH₄ Emissions

Good practices of composting will be followed and there will be adherence to technology discipline, thus the factor $S_{a, y}$ has been taken as zero for determining the project emissions due to CH₄. This

will however be monitored and calculated based on actual values and will be incorporated as project emissions.

Formula applied:

$$PE_{c,CH_4,y} = MB_{compost,y} \times GWP_{CH_4} \times S_{a,y}$$

PARAMETER	DESCRIPTION	UNIT	VALUE APPLIED	SOURCE
$MB_{compost,y}$	Quantity of methane that would be produced in the landfill in the absence of project activity in year y	tCH ₄	To be taken as actual values <i>ex-post</i>	Calculated
$S_{a,y}$	Share of waste that degrades under anaerobic conditions in the composting process in year y	%	0	Assumed for ex-ante calculations
GWP_{CH_4}	Global Warming Potential of Methane	tCO ₂ e/tN ₂ O	21	Default Value taken from IPCC 2006 Guidelines
$PE_{c,CH_4,y}$	Methane emissions due to anaerobic conditions in the composting process in year y	tCO ₂ e	0	Calculated

This methane emissions value is same for all the three sites. Therefore,

Total methane emissions due to anaerobic conditions in the composting process in year y ($PE_{c,CH_4,y}$) = 0

Total emissions from the project scenario in year y (PE_y)

Formula used:

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

Jalandhar⁵³:

Emissions during composting process, $PE_{c,y}$ = 195 tCO₂e; however the same has been revised to 0 from 2014 onwards.

Total Project Activity Emissions, which was PE_y = 874 tCO₂e has been revised to 0 tCO₂e from 2014 onwards.

Mysore:

Emissions during composting process, $PE_{c,y}$ = 243.3 tCO₂e

Total Project Activity Emissions, PE_y = 1146 tCO₂e

Kozhikode:

Emissions during composting process, $PE_{c,y}$ = 146 tCO₂e

Total Project Activity Emissions, PE_y = 687.8 tCO₂e

The project activity emissions for the 10 years (2009-2018) is:

PE_y	Total project emissions activity emissions	tCO ₂ e	21,408.5
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Calculation of baseline emissions

⁵³ Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. The emission reductions have been claimed from Jalandhar site from 27/06/2010 to 31/12/2013 (both days included). Hence, Jalandhar site is still discussed in this section of CDM-PDD-FORM.

The amount of methane that is generated each year ($BE_{CH_4,SWDS,y}$, tCO₂e) is calculated for each year with the recommended multi-phase model, the First Order Decay (FOD) model. The amount of methane produced in the year y is calculated as follows:

$$BE_{CH_4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH_4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot (1-e^{-k_j}) \cdot e^{-k_j \cdot (y-x)} \dots (26)$$

Steps for calculation of baseline emission using above equation

Step 1: Calculate W_x for the given year x. However, for the estimation purpose, W_x of 2,190,000 tons (which is now revised to 1,716,600 tonnes, after excluding Jalandhar from 2014 onwards) for each year of the crediting period has been considered, corresponding to the total capacity of all the three plants of 600 Tons per day.

Step 2: The variable $W_{j,x}$ is substituted by $A_{j,x}$ which is calculated for the given year x using eq 17 for all 6 categories of waste. The value for weight fraction of each waste type j, is to be taken from the samples collected during each year. However, for estimation purpose, these values are taken from the waste sampling conducted during feasibility study.

Step 3: Divide the equation 26 into 2 parts for calculation of methane potential:

Part a: $\sum_{x=1}^y (1-e^{-k_j}) e^{-k_j(y-x)}$. For every category of organic waste (j = A to E), calculate the rate of decay for every year, y during the crediting period, using exponential decay formula from equation 26

Part b: Multiply $\varphi \cdot (1-f) \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF$ factor with **part a** and $A_{j,x}$ for every year during the crediting period, to calculate methane potential for the given quantity of waste processed during the year x in each year.

Step 4: Add the methane potential calculated for the waste quantity processed in the given year x.

Step 5: Replicate the calculations for every year during the crediting period for each category of organic waste.

Step 6: Add the methane potential for all the waste categories for every year. Multiply with global warming potential of methane (21) to obtain the tonnes CO₂e (CER) for each year.

PARAMETER	UNIT	TOTAL FOR 10 YEAR CREDITING PERIOD			
		JALANDHAR	MYSORE	KOZHIKODE	TOTAL
Avoided waste deposition, processed for composting		730,000	91,2500	547,500	2,190,000
Emissions from (A): wood and wood products	tCO ₂ e	9,868	10,158	13,000	33,026
Emissions from (B): pulp. paper and cardboard	tCO ₂ e	9,900	9,147	7,516	26,563
Emissions from (C): food and food waste	tCO ₂ e	420,154	541,459	647,712	1,609,325
Emissions from (D): textiles	tCO ₂ e	22,891	20,544	14,805	58,240
Emissions from (E): garden, yard and park waste	tCO ₂ e	15,594	30,863	34,858	81,315
Total baseline methane emissions (MB _v)	tCO ₂ e	478,407	612,171	717,892	1,808,469
Net Baseline Emissions (BE _y)	tCO ₂ e	430,566	550,954	646,103	1,627,623

The value of net baseline has been revised as follows after excluding Jalandhar site from 2014 onwards:

PARAMETER	UNIT	TOTAL FOR 10 YEAR CREDITING PERIOD
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		TOTAL (WITH JALANDHAR)	TOTAL (WITHOUT JALANDHAR)
Avoided waste deposition, processed for composting		2,190,000	1,716,600
Emissions from (A): wood and wood products	tCO ₂ e	33,026	24,681
Emissions from (B): pulp. paper and cardboard	tCO ₂ e	26,563	18,251
Emissions from (C): food and food waste	tCO ₂ e	1,609,325	1,261,611
Emissions from (D): textiles	tCO ₂ e	58,240	39,020
Emissions from (E): garden, yard and park waste	tCO ₂ e	81,315	68,317
Total baseline methane emissions (MB _y)	tCO ₂ e	1,808,469	1,411,880
Net Baseline Emissions (BE _y)	tCO ₂ e	1,627,623	1,270,692

For details, see Annex 3.2.

Leakage Estimation

Emissions from Transportation:

Formula applied:

$$L_{t,y} = \sum_i NO_{vehicles,i,y} * DT_{i,y} * VF_{cons,i} * NCV_{fuel} * D_{fuel} * EF_{fuel}$$

In case of emissions from incremental transportation of waste ($L_{t,y, waste}$) for the project activity, the distance $DT_{i,y}$ is considered as zero since the landfill and the compost plant are located adjacent to each other for all the three sites at Jalandhar, Kozhikode and Mysore. So there is no emission from incremental transportation of waste.

In case of emissions from incremental transportation of compost ($L_{t,y, compost}$) for all the three sites, for the purpose of *ex-ante* calculations it is assumed that compost will be transported to users within a distance of 300 km radius in case of Jalandhar and Kozhikode and 450 km radius in case of Mysore. However it will be monitored *ex-post* and actual values will be used.

Emissions from incremental transportation of waste

PARAMETER	DESCRIPTION	UNIT	VALUE APPLIED			SOURCE
			JALANDHAR	MYSORE	KOZHIKODE	
W_x	Quantity of waste composted	Tonnes	73000	91250	54750	Detailed Project Report
CT_y	Average Truck capacity for waste transportation	Tonnes	5	5	5	Based on capacity of trucks
$NO_{vehicles,waste,y}$	Number of vehicles for transport	-	14600	18250	10950	Calculated as W_x/CT_y
$DT_{i,y}$	Average additional distance travelled by vehicle i compared to baseline	km	0	0	0	Distance of plant from SWDS
VF_{CONS}	Vehicle fuel consumption	g/km	195.2	195.2	195.2	Anthropogenic Emission from energy activities India: Generation and source characterization
NCV_{fuel}	Calorific value of fuel (diesel)	TJ/Gg	43	43	43	Default value taken from IPCC 2006 Guidelines for National Greenhouse

						Gas Inventories
EF_{fuel}	Emission factor of the fuel	kg/TJ	74100	74100	74100	Default value taken from IPCC 2006 Guidelines for National Greenhouse Gas Inventories
$L_{t,y,waste}$	Emissions from incremental transportation of waste	tCO ₂ e	0	0	0	Calculated

Total emissions from incremental transportation of waste ($L_{t,y,waste}$) = 0 t CO₂e (same emissions even after exclusion of Jalandhar site)

Emission from incremental transportation of compost

PARAMETER	DESCRIPTION	UNIT	VALUE APPLIED			SOURCE
			JALANDHAR	MYSORE	KOZHIKODE	
$M_{compost}$	Quantity of compost produced	Tonnes	14600	18250	10950	Calculated @ 20% conversion rate (Detailed Project Report)
$CT_{y,compost}$	Average truck capacity for compost transportation	tonnes	5	5	5	Based on capacity of trucks
$NO_{vehicles,comp,y}$	Number of vehicles for transport	-	2920	3650	2190	Calculated as $M_{compost}/CT_y$
$DT_{i,y}$	Average additional distance travelled by vehicle i compared to baseline	km	300	450	300	Detailed Project Report
VF_{CONS}	Vehicle fuel consumption	g/km	195.2	195.2	195.2	Anthropogenic Emission from energy activities India: Generation and source characterization
NCV_{fuel}	Calorific value of fuel (diesel)	TJ/Gg	43	43	43	Default value taken from IPCC 2006 Guidelines for National Greenhouse Gas Inventories
EF_{fuel}	Emission factor of the fuel	kg/TJ	74100	74100	74100	Default value taken from IPCC 2006 Guidelines for National Greenhouse Gas Inventories
$L_{t,y,compost}$	Emissions from incremental transportation of waste	tCO ₂ e	544.8	1022	409	Calculated

Total leakage emissions from incremental transportation of compost ($L_{t,y,compost}$) = 1975.05 tCO₂e
The value of $L_{t,y,compost}$ has been revised to 1,430.21 tCO₂e from 2014 onwards after exclusion of Jalandhar site from project activity.

Emissions from residual waste or compost in case it is disposed of in landfills ($L_{r,y}$)

Formula applied

$$L_{r,y} = BE_{CH_4,SWDS,y}$$

While calculating the ex-ante emissions for this project activity, the compost delivered to the landfill is considered as zero. Also for ex-ante estimations, the residual waste is taken as 100% inerts. Hence $L_{r,y}$ for all the sites = 0. The value of $L_{r,y}$ will be calculated during determination of the ex-post emissions using the above equation.

Off-site Emissions from end use of the stabilized biomass ($L_{s,y}$)

Formula applied:

Quantities of different types of waste input ($A_{j,x}$) to the RDF/biomass processing should be adjusted by an annual adjustment factor SA_y as follows:

$$A_{s,j,x} = SA_y * A_{j,x}$$

$$SA_y = \{R_n/R_t\}$$

For ex-ante estimations for this project activity, the weight of stabilized biomass sold offsite for which no sale invoices can be provided is considered as zero. Hence $L_{s,y} = 0$. The value of $L_{s,y}$ will be calculated during determination of the ex-post emissions using the above equation.

$L_{t,y}$	Total Leakage emissions from transportation	tCO ₂ e	1975
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The value has been revised to $L_{t,y} = 1,430$ tCO₂e after exclusion of Jalandhar site from 2014 onwards.

B.6.4. Summary of ex ante estimates of emission reductions

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Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
April 2010- March 2011	47,885	2,707	1,975	43,203
April 2011- March 2012	85,941	2,707	1,975	81,259
April 2012- March 2013	116,939	2,707	1,975	112,257
April 2013- March 2014 ⁵⁴	125,898	2,284	1,711	121,903
April 2014- March 2015	122,865	1,834	1,430	119,601
April 2015- March 2016	135,359	1,834	1,430	132,095
April 2016- March 2017	146,048	1,834	1,430	142,784
April 2017- March 2018	155,346	1,834	1,430	152,082
April 2018- March 2019	163,548	1,834	1,430	160,284
April 2019- March 2020	170,863	1,834	1,430	167,599
Total	1,270,692	21,409	16,216	1,233,067

⁵⁴ Jalandhar site has been excluded from the registered CDM project activity from 01/01/2014 onwards. The emission reductions have been claimed from Jalandhar site from 27/06/2010 to 31/12/2013 (both days included). Hence, Jalandhar site is still discussed in this section of CDM-PDD-FORM.

Total number of crediting years	10			
Annual average over the crediting period	127,069	2,141	1,622	123,306

B.7. Monitoring plan**B.7.1. Data and parameters to be monitored***(Copy this table for each piece of data and parameter.)*

Data / Parameter	$EG_{PJ,FF,y}$
Unit	MWh
Description	Amount of electricity consumed from the grid as a result of the project activity
Source of data	Electricity meter reading from electricity meter bill by the State Electricity Board or any Private Supplier.
Value(s) applied	Jalandhar :657 Kozhikode :492.8 Mysore :821.3
Measurement methods and procedures	Data is measured and recorded continuously through meters and meter readings are archived electronically. The data will be calculated by monitoring the difference between the reading in meter at the end of the month and beginning of the month. This parameter will be updated ex-post each year over the crediting period. Calibration of electricity meter: Annual
Monitoring frequency	Monthly
QA/QC procedures	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Purpose of data	
Additional comment	Uncertainty level: low

Data / Parameter	GWP_{CH_4}
Unit	tCO ₂ e/tCH ₄
Description	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
Source of data	Decisions under UNFCCC and the Kyoto Protocol (a value of 21 is to be applied for the first commitment period of the Kyoto Protocol)
Value(s) applied	21
Measurement methods and procedures	Global Warming Potential of methane
Monitoring frequency	Annual
QA/QC procedures	Data value as provided in relevant decisions of UNFCCC and Kyoto Protocol will be used. Therefore no QA/QC is required. Data will be archived for the crediting period.
Purpose of data	Calculation of baseline and project emissions
Additional comment	---

Data / Parameter	GWP_{N_2O}
Unit	tCO ₂ e/tN ₂ O
Description	Global Warming Potential (GWP) of nitrous oxide, valid for the relevant commitment period
Source of data	Decisions under UNFCCC and the Kyoto Protocol (a value of 310 is to be applied for the first commitment period of the Kyoto Protocol)
Value(s) applied	310

Measurement methods and procedures	Global Warming Potential of nitrous oxide
Monitoring frequency	Annual
QA/QC procedures	Data value as provided in relevant decisions of UNFCCC and Kyoto Protocol will be used. Therefore no QA/QC is required. Data will be archived for the crediting period.
Purpose of data	Calculation of project emissions
Additional comment	---

Data / Parameter	$F_{cons,y}$
Unit	Litre
Description	Fuel (diesel) consumption on-site during year 'y' of the crediting period
Source of data	Purchase Invoices
Value(s) applied	Jalandhar: 54,750 Kozhikode: 43,800 Mysore: 73,000
Measurement methods and procedures	Data is calculated annually based on invoices and archived electronically.
Monitoring frequency	Monthly
QA/QC procedures	The amount of fuel will be derived from the paid fuel invoices (administrative obligation).
Purpose of data	Calculation of project emissions
Additional comment	Uncertainty level: low

Data / Parameter	W_x
Unit	Tonnes/year
Description	Total amount of organic waste prevented from disposal in year 'x'
Source of data	Plant records, weighbridge
Value(s) applied	219,000 Jalandhar :73,000 ($\rightarrow 200 \text{ TPD} \times 365$) Kozhikode :54,750 ($\rightarrow 150 \text{ TPD} \times 365$) Mysore :91,250 ($\rightarrow 250 \text{ TPD} \times 365$)
Measurement methods and procedures	The amount of fresh waste carried in each and every truck, being brought to the composting plant and selected for further processing is weighed, using electronic weighbridge. Records are maintained electronically. Weighbridge calibration to be done annually.
Monitoring frequency	Continuous with Annual aggregation
QA/QC procedures	Procedures will be checked daily by plant supervisor.
Purpose of data	Calculation of baseline emissions
Additional comment	---

Data / Parameter	CT_y
Unit	Tonnes/truck
Description	Average truck capacity for waste transportation
Source of data	Plant records
Value(s) applied	5
Measurement methods and procedures	Trucks will be weighed in a weighbridge regularly and records are kept on paper and electronically. Weighbridge calibration to be done annually

Monitoring frequency	Continuous with annual aggregation
QA/QC procedures	Regular weighing of waste by project proponent will be carried out in a weighbridge according to Monitoring plan. Procedures will be checked daily by plant supervisor.
Purpose of data	Calculation of leakage emissions
Additional comment	Uncertainty level: low

Data / Parameter	$NO_{vehicles,waste,y}$
Unit	Unitless
Description	Number of vehicles for transport of waste to the plant in year y
Source of data	Plant records
Value(s) applied	Jalandhar : 14,600 Kozhikode : 10,950 Mysore : 18,250
Measurement methods and procedures	Logbook will be kept at the entrance of the plant. Each truck supplying waste to the plant will be entered in the logbook. Records are kept on paper and electronically.
Monitoring frequency	continuous with annual aggregation
QA/QC procedures	100% data will be monitored. Procedures will be checked regularly by DOE.
Purpose of data	Calculation of leakage emissions
Additional comment	Uncertainty level: Low

Data / Parameter	$DT_{i,waste,y}$
Unit	km
Description	Average additional distance travelled by vehicle type 'i' compared to baseline in year 'y' for waste transportation
Source of data	Odometer reading from project site to SWDS
Value(s) applied	0
Measurement methods and procedures	As the plants are situated in the disposal sites, in case of all the plants there exists no incremental distance from plant to disposal site.
Monitoring frequency	Annual
QA/QC procedures	---
Purpose of data	Calculation of leakage emissions
Additional comment	---

Data / Parameter	$M_{compost}$
Unit	Tonnes/year
Description	Quantity of compost produced in year 'y'
Source of data	Plant records
Value(s) applied	Jalandhar :14,600 Kozhikode :10,950 Mysore :18,250
Measurement methods and procedures	The produced compost will be weighed before stored at warehouse. The weight will be measured continuously. The total amount of compost is calculated annually based on these records and archived electronically.
Monitoring frequency	Annual

QA/QC procedures	Weighed on calibrated scale; also cross checked with sales of compost. Sales/ Delivery of the compost final product will be checked on a sample basis during internal Audit by Ecosmart (now IEISL).
Purpose of data	Calculation of project and leakage emissions
Additional comment	Uncertainty level: low

Data / Parameter	$CT_{compost,y}$
Unit	Tonnes/truck
Description	Average truck capacity for compost transportation
Source of data	Plant records
Value(s) applied	5
Measurement methods and procedures	All outgoing trucks carrying compost would be monitored and hence average truck capacity can be estimated. Weigh scale calibration to be done annually
Monitoring frequency	Continuous with annual aggregation
QA/QC procedures	Regular weighing of compost by project proponents will be carried out in a weighing scale according to Monitoring plan. Procedures will be checked daily by plant supervisor.
Purpose of data	Calculation of leakage emissions
Additional comment	Uncertainty level: low

Data / Parameter	$NO_{vehicles,compost,y}$
Unit	Unitless
Description	Vehicles for compost transportation per year
Source of data	Plant records
Value(s) applied	Jalandhar :2,920 Kozhikode :2,190 Mysore :3,650
Measurement methods and procedures	Logbook will be kept with the plant guard
Monitoring frequency	Monthly
QA/QC procedures	Number of vehicles and average load should match with total amount of compost delivered. Procedures will be checked regularly by DOE.
Purpose of data	Calculation of leakage emissions
Additional comment	Uncertainty level: Low

Data / Parameter	$DT_{i,compost,y}$
Unit	km
Description	Average additional distance travelled by vehicle type 'i' compared to baseline in year 'y' for compost transportation
Source of data	Locations of warehouses of the compost buyers
Value(s) applied	Jalandhar :300 Kozhikode :300 Mysore :450
Measurement methods and procedures	The supply of compost to warehouses would be monitored and records would be kept manually and electronically
Monitoring frequency	Annual
QA/QC procedures	---
Purpose of data	Calculation of Leakage emissions
Additional comment	Uncertainty level: medium

Data / Parameter	VF_{CONS}
Unit	L/km
Description	Average fuel consumption per kilometre of vehicles for compost transportation
Source of data	Plant records, sampling
Value(s) applied	0.222
Measurement methods and procedures	195.2 g/km divided by density of diesel (0.880 kg/L) to get the value in L/km (Anthropogenic Emission from energy activities India: Generation and source characterisation, Part II, Emissions from vehicle transport in India, Appendix B: Moti. L. Mittal, and C. Sharma ⁵⁵) For ex-post calculations, value will be taken from plant records. Sampling will be done 24 times a year for average fuel consumption per vehicle. (See Annex 4 for details on sample size)
Monitoring frequency	24 times per annum
QA/QC procedures	Every time the sample is monitored, record will be kept electronically and in a Logbook. (See Annex 4 for details on sample size)
Purpose of data	Calculation of leakage emissions
Additional comment	---

Data / Parameter	$P_{n,j,x}$																																										
Unit	%																																										
Description	Share of different types of organic waste																																										
Source of data	Plant records, sampling /sorting / weighing																																										
Value(s) applied	<p>For Jalandhar</p> <table border="1"> <thead> <tr> <th>WASTE TYPE</th><th>% COMPOSITION</th></tr> </thead> <tbody> <tr> <td>Wood and Wood Products</td><td>3.4%</td></tr> <tr> <td>Pulp, paper and Cardboard</td><td>2.3%</td></tr> <tr> <td>Food, food waste, beverages and tobacco</td><td>67.8%</td></tr> <tr> <td>Textiles</td><td>7.8%</td></tr> <tr> <td>Garden, Yard and park waste</td><td>2.4%</td></tr> <tr> <td>Glass, plastic, metal and other inert</td><td>16.3%</td></tr> <tr> <td>Total</td><td>100%</td></tr> </tbody> </table> <p>For Kozhikode</p> <table border="1"> <thead> <tr> <th>WASTE TYPE</th><th>% COMPOSITION</th></tr> </thead> <tbody> <tr> <td>Wood and Wood Products</td><td>4.9%</td></tr> <tr> <td>Pulp, paper and Cardboard</td><td>1.8%</td></tr> <tr> <td>Food, food waste, beverages and tobacco</td><td>68.6%</td></tr> <tr> <td>Textiles</td><td>5.2%</td></tr> <tr> <td>Garden, Yard and park waste</td><td>4.1%</td></tr> <tr> <td>Glass, plastic, metal and other inert</td><td>15.4%</td></tr> <tr> <td>Total</td><td>100%</td></tr> </tbody> </table> <p>For Mysore</p> <table border="1"> <thead> <tr> <th>WASTE TYPE</th><th>% COMPOSITION</th></tr> </thead> <tbody> <tr> <td>Wood and Wood Products</td><td>2.8%</td></tr> <tr> <td>Pulp, paper and Cardboard</td><td>1.7%</td></tr> <tr> <td>Food, food waste, beverages and tobacco</td><td>69.9%</td></tr> <tr> <td>Textiles</td><td>5.6%</td></tr> </tbody> </table>	WASTE TYPE	% COMPOSITION	Wood and Wood Products	3.4%	Pulp, paper and Cardboard	2.3%	Food, food waste, beverages and tobacco	67.8%	Textiles	7.8%	Garden, Yard and park waste	2.4%	Glass, plastic, metal and other inert	16.3%	Total	100%	WASTE TYPE	% COMPOSITION	Wood and Wood Products	4.9%	Pulp, paper and Cardboard	1.8%	Food, food waste, beverages and tobacco	68.6%	Textiles	5.2%	Garden, Yard and park waste	4.1%	Glass, plastic, metal and other inert	15.4%	Total	100%	WASTE TYPE	% COMPOSITION	Wood and Wood Products	2.8%	Pulp, paper and Cardboard	1.7%	Food, food waste, beverages and tobacco	69.9%	Textiles	5.6%
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⁵⁵ http://www.osc.edu/research/archive/pcrm/emissions/India_Report_1Pagelayout.pdf

	Garden, Yard and park waste	3.8%
	Glass, plastic, metal and other inert	16.2%
	Total	100%
	Based on waste characterisation survey report compiled by IWMUSL. Survey findings available to validator.	
Measurement methods and procedures	Determine the fraction of each waste stream of the total waste input to the treatment facility (A: Wood and wood products; B Pulp paper and cardboard; C: Food, food waste, beverages and tobacco; D: Textiles; E: Garden, yard and park waste; F: Glass, plastic, metal and other inert). The regular sorting and weighing of the waste streams will be done by the project participant as per sampling plan. The respective determined proportions will be aggregated over the year and used in the baseline calculations. Records are kept on paper and electronically. Estimation of the composition of the incoming waste would be carried out for all waste through sampling. The sample size is determined as per Annex 4 (24 times per annum).	
Monitoring frequency	24 times per annum	
QA/QC procedures	Regular sorting & weighing of waste will be carried out by project proponent. Procedures will be checked.	
Purpose of data	Calculation of baseline emissions	
Additional comment	Uncertainty level: low	

Data / Parameter	<i>RATE</i>^{compliance_y}
Unit	%
Description	State- level compliance rate of the MSW Management Rules in that year y
Source of data	Preferably from secondary sources and alternatively from the respective State Pollution Control Boards (SPCBs) for all the states in India.
Value(s) applied	10
Measurement methods and procedures	The ex-ante value has been taken as 10%. For ex-post calculation of emission reductions, the individual state level compliance rates taken from secondary sources and from SPCBs would be aggregated to find out the national level compliance rate.
Monitoring frequency	Annually
QA/QC procedures	Monitoring Frequency: Annually
Purpose of data	Calculation of baseline emissions
Additional comment	Uncertainty level: low

Data / Parameter	<i>z</i>
Unit	Unitless
Description	No. of samples collected during the year x
Source of data	Project Proponent
Value(s) applied	24
Measurement methods and procedures	Sampling will be done for waste composition and other parameters as per monitoring plan. Every time the sample is monitored, record will be kept electronically and in a Logbook. (See Annex 4 for details on sample size)
Monitoring frequency	Annual

QA/QC procedures	---
Purpose of data	Calculation of baseline, project and leakage emissions
Additional comment	Uncertainty level: low

Data / Parameter	$A_{c,i,x}$																																																
Unit	%																																																
Description	Amount of residual waste type 'ci' from stabilized biomass																																																
Source of data	Plant records, sampling /sorting / weighing																																																
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Monitoring frequency	24 times per annum																																																
QA/QC procedures	Regular sorting & weighing of residual waste will be carried out by																																																

	project proponent. Procedures will be checked.
Purpose of data	Calculation of leakage emissions
Additional comment	Uncertainty level: low

Data / Parameter	R_n
Unit	Tonnes/year
Description	Weight of stabilized biomass sold offsite for which no sale invoices can be provided
Source of data	Plant Records, weighbridge
Value(s) applied	0 (for <i>ex-ante</i> estimations)
Measurement methods and procedures	The <i>ex-ante</i> value has been taken as zero. For ex-post calculation of emission reductions, actual values will be used. Sale invoices shall be kept at the project site.
Monitoring frequency	Annual
QA/QC procedures	---
Purpose of data	Calculation of leakage emissions
Additional comment	Uncertainty level: low

Data / Parameter	R_t
Unit	Tonnes/year
Description	Total weight of stabilized biomass produced
Source of data	Plant records
Value(s) applied	Jalandhar: 14,600 Kozhikode: 10,950 Mysore: 18,250
Measurement methods and procedures	The produced compost will be stored and sold in bags, which are weighted after filling. The number of bags and the weight will be measured continuously. The total amount of compost is calculated annually based on these records and archived electronically.
Monitoring frequency	Annual
QA/QC procedures	Weighed on calibrated scale; also cross checked with sales of compost.
Purpose of data	Calculation of leakage emissions
Additional comment	---

Data / Parameter	$S_{a,y}$
Unit	%
Description	Share of the waste that degrades under anaerobic conditions in the composting plant during the year 'y'
Source of data	Plant records
Value(s) applied	0
Measurement methods and procedures	O ₂ -measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a weekly basis.
Monitoring frequency	Weekly
QA/QC procedures	---
Purpose of data	Calculation of project emissions

Additional comment	The windrows will be turned on a weekly basis to ensure proper aerobic conditions.
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Data / Parameter	$S_{OD,y}$
Unit	Unitless
Description	Number of samples with oxygen deficiency (i.e., oxygen content below 10%)
Source of data	Oxygen Monitoring Device
Value(s) applied	0 (for <i>ex-ante</i> calculations)
Measurement methods and procedures	O ₂ -measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardised mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a weekly basis.
Monitoring frequency	Weekly
QA/QC procedures	---
Purpose of data	Calculation of project emissions
Additional comment	Samples with oxygen content <10%. Weekly measurements throughout the year but accumulated once per year only.

Data / Parameter	$S_{total,y}$
Unit	Number
Description	Number of samples
Source of data	Oxygen measuring device
Value(s) applied	24
Measurement methods and procedures	Total number of samples taken per year, where $S_{total,y}$ should be chosen in a manner that ensures estimation of $S_{a,y}$ with 20% uncertainty at 95% confidence level. To determine the oxygen content during the process it should be sampled 24 times per annum. (See Annex 4 for details on sampling)
Monitoring frequency	24 times per annum
QA/QC procedures	O ₂ -measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier). Measurement itself to be done by using a standardized mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple measurements throughout the different stages of the composting process according to a predetermined pattern (depths and scatter) on a weekly basis.
Purpose of data	Calculation of project emissions
Additional comment	---

Data / Parameter	$Q_{COD,y}$
Unit	m ³ /yr
Description	Amount of wastewater treated anaerobically or released untreated from the project activity in year y
Source of data	The value will be monitored using calibrated dip stick/ flow meter.
Value(s) applied	For <i>ex-ante</i> estimations, it is taken as 0.
Measurement methods and procedures	The ex-ante value has been taken as zero. For ex-post calculation of emission reductions, actual values will be used.

Monitoring frequency	Monthly aggregated annually
QA/QC procedures	The monitoring instrument will be subject to regular maintenance and testing to ensure accuracy.
Purpose of data	Calculation of project emissions
Additional comment	Since the wastewater is treated aerobically in windrows, emissions are assumed to be zero. Any leachate that is not sent to the windrows will be monitored.

B.7.2. Sampling plan

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Detailed Procedure for sampling waste composition

The composition of incoming waste will be done by sampling fresh waste. At least 24 samples will be collected annually with minimum two samples every month. The procedures laid down in Chapter 3, Section 3.3 of Manual on Municipal Solid Waste Management, prepared by the expert committee constituted by the Government of India, Ministry of Urban Development; Central Public Health and Environmental Engineering Organisation (CPHEEO), will be followed to determine the composition of waste.

Methodology for testing

For each of the sample, waste from the freshly arrived solid waste will be collected from randomly selected four incoming trucks. 100 Kg (approx.) sample will be collected from each truck and a quarter of sample (25 kg approx.) will be retained for sampling. Hence, the composite sample size will be 100 Kg (25 kg each from 4 trucks). Physical inspection of the waste in the truck would be required to see that the waste is of uniform nature. Care should be taken to verify that the samples are taken from trucks so as to represent the entire batch.

Using coning and quartering method about 100 kg of composite sample will be drawn out from the original solid waste. The waste should be sorted to segregate to the required constituents for weighing of each component. This would be done at the site itself. The parameters would be noted down in format as provided in table provided below:

S. No.	WASTE COMPOSITION	WEIGHT (IN GRAMS)
1.	Wood and wood products and straw	
2.	Pulp, paper and cardboard (other than sludge)	
3.	Food, food waste, beverages, Fruit and vegetable and tobacco (other than sludge)	
4.	Textiles	
5.	Other (non-food) organic putrescible, Garden, yard and park waste	
6.	Glass, plastic, metal, other inert waste	
7.	Total	
8.	Date	

B.7.3. Other elements of monitoring plan

>>

The monitoring plan defines the standards and rules according to which the emission reductions of the project activity are monitored and verified in conformance with all relevant requirements of the CDM. The monitoring plan and procedures can be updated and adjusted to meet the operational requirements and are verified each year by the verifying organisation (DOE).

Ecosmart [now, **IL&FS Environmental Infrastructure & Services Limited (IEISL)**] is the coordinating and managing entity, which will supervise the monitoring of each of the three plants. The operators of each plant will have to report to the representative of IEISL. The monitoring plan for each operator for individual plants at Jalandhar, Kozhikode and Mysore is given below.

Use of the Monitoring Plan (MP) by the Operator

This Monitoring Plan identifies key performance indicators of the project and sets out the procedures for metering, monitoring, calculating and verifying the ERs generated by the three compost plants, annually. Adherence to the instructions in the Monitoring Plan will be issued to the operator to measure and track the impact of the project on the environment. The operator will prepare all data required for the periodic audit and verification process that must be undertaken to confirm the achievement of the corresponding ERs. The MP is thus the basis for the production of ERs and accreditation of the ERs within the CDM mechanism.

If the Monitoring Plan is updated and adjusted to meet operational requirements, it will be done so with DOE approval. Any shifts in the baseline scenario may lead to such amendments, which may be mandated by the DOE. Amendments may also be necessary as a consequence of new circumstances that affect the ability to monitor ERs as described here or to accommodate new or modified CDM rules. All the results of monitoring shall be preserved by the project proponents for two years beyond the end of crediting period or the last issuance of CERs for the project activity whichever occurs later.

Organizational, Operational and Monitoring Obligations

Obligations of the Operator

Monitoring the project's performance in terms of ERs achievement requires the fulfillment of operational data collection and processing obligations from the operator. IWMUSL (now IEISL), the operator of the three compost plants has the primary obligation to collect data that would facilitate the calculation of the project ERs. The data shall be collected by the operator based on the most recent available information as per the procedures presented in this PDD. In addition, roles and responsibilities of monitoring personnel would be well defined. Examples of roles and responsibilities for monitoring of data and parameters are provided with this monitoring plan (Table B3); however these need to be updated on a regular basis. Soil application of the compost in agriculture or related activities will be monitored. This includes documenting the sales or delivery of the compost final product.

It is believed that the monitoring plan approach presented here will result in an accurate, yet conservative calculation of ERs. However some uncertainties may lead to a deviation between monitored and verified ERs, especially errors in the data monitoring and processing system. The operator is expected to prevent such errors and the verification audits are expected to uncover any possible errors. The operation of the composting facilities will be documented in a quality control program, monitoring the conditions and procedures that ensure the aerobic condition of the waste during the composting process.

AGENT	DELIVERABLE
The Operator IWMUSL (now IEISL)	<p>Overall responsible for completeness of data, reliability of data (calibration of meters, weighing machines measuring samples) and monthly report generation. Following shall be measured and recorded:</p> <ul style="list-style-type: none"> ➤ Electricity consumption for equipment used on site. Data can be collected from electricity meter installed by state electricity board (a kWh-instrument) ➤ Fuel consumption for equipment used on site. Data can be based upon the received invoices for fuel. Operator shall keep/file receipt of invoices ➤ Produced compost that is trucked off of site. ➤ Quantity of waste supplied to the compost plant will be measured by weighing on a weighbridge as described in the Monitoring plan. This information is required for calculation of the CER's ➤ Measurement of the composition of the incoming waste in accordance with the procedure as indicated in the sampling plan ➤ Number and detail of vehicles that bring in the waste and the vehicles that transport compost to the end user. ➤ Rate of compliance to Indian MSW Rules 2000 ➤ Average fuel consumption per vehicle

	<ul style="list-style-type: none"> ➤ Share of waste that degrades under anaerobic conditions ➤ Amount of residual waste type 'ci' from stabilized biomass ➤ Weight of stabilized biomass sold offsite for which no sale invoices can be provided
Advisor CDM/ Quality	<p>Estimation of incremental distance traveled for compost transportation. Operator will provide information regarding the physical location of the market for compost. This information will be shared with the DOE or expert and based upon that the incremental distance traveled will be updated.</p> <p>Overall responsibility of CDM registration and compliance with the CDM Monitoring plan</p>

Roles and responsibilities for data collection and archiving

PARAMETER	DESCRIPTION	FREQUENCY	RESPONSIBLE PERSON	SUPERVISOR
CT_y	Average truck capacity for waste transportation	Continuous with annual Aggregation	Plant Supervisor	Plant Manager
$NO_{vehicles,waste,y}$	Number of trucks supplying waste in the plant	Every Truck	Plant Guard	Plant Manager
$CT_{compost,y}$	Average truck capacity for compost transportation	Continuous with annual Aggregation	Plant Supervisor	Plant Manager
$EG_{PJ,FF,y}$	Electricity consumption of the composting facility	Monthly	Plant Accountant	Plant Manager
F_{cons}	Fuel consumption onsite	Monthly	Plant Accountant	Plant Manager
$M_{compost}$	Total quantity of compost produced	Annual	Plant Supervisor	Plant Manager
$P_{n,j,x}$	Share of different types of organic waste	24 times per annum	Plant Supervisor	Quality Advisor-CDM
$NO_{vehicles,compost,y}$	No. of vehicles for compost transport per year	Every Truck	Plant Guard	Plant Manager
$DT_{i,compost,y}$	Average distance travelled per vehicle type and year for compost transportation	Annual	Plant Manager	Quality Advisor-Operations
$DT_{i,waste,y}$	Average distance travelled per vehicle type and year for waste transportation	Annual	Plant Manager	Quality Advisor-Operations
GWP_{CH4}	Global warming potential (GWP) of methane	Annual	Quality Advisor-CDM	
GWP_{N2O}	Global warming potential (GWP) of nitrous oxide	Annual	Quality Advisor-CDM	
W_x	Amount of waste prevented from disposal in the landfill	Continuous with Annual Aggregation	Quality Advisor-CDM	Quality Advisor-Operations
$S_{a,y}$	Share of waste that degrades under anaerobic conditions	Continuous with Annual Aggregation	Plant Supervisor	Quality Advisor-Operations
$Rate^{compliance}_y$	Rate of Compliance	Annually	Quality Advisor-CDM	
VF_{cons}	Average fuel	24 times per annum	Plant Supervisor	Quality Advisor-

	consumption per kilometre of vehicles for compost transportation			Operations
$A_{c,j,x}$	Amount of residual waste type 'ci' from stabilized biomass	24 times per annum	Plant Supervisor	Quality Advisor-Operations
R_n	Weight of stabilized biomass sold offsite for which no sale invoices can be provided	Annually	Plant Supervisor	Quality Advisor-Operations
$Q_{COD,y}$	Amount of waste water treated anaerobically or released untreated from the project activity	Monthly with Annual Aggregation	Plant Supervisor	Quality Advisor-Operations
CT_y	Average truck capacity for waste transportation	Continuous with annual Aggregation	Plant Supervisor	Plant Manager

Detailed Procedure for Sustainable Development Monitoring

In addition to this, as a requirement for large scale CDM project activities stipulated by National CDM Authority, project proponent commits 2% of the CERs revenue every year towards Sustainable Development of India. The main contribution of the project activity to sustainable development is recycling of humus in the soil and use of organic manure supplementing the use of chemical fertilizers. Project Proponent shall commit the money to conduct training and seminar sessions for farmers in order to educate them about the benefits of compost and train them about proper soil application of compost.

- Total CDM Revenue envisaged from the project in first commitment period – 113.62 million INR
- 2% of the CDM revenue every year which amounts to 2.2 million INR would be committed towards sustainable/ society/ community development
- Project Proponent commits a minimum of 2.2 million INR every year towards sustainable/society/community development.
- The funds would be used to
 - ↳ Educate farmers regarding benefits of compost application through capacity building workshops, seminars, etc. in rural areas
 - ↳ Distribute free samples of compost among farmers
 - ↳ Create awareness among general public regarding proper waste management practices
- The capacity building workshops would be conducted during off-take season every year in each of the three sites.
- Training programmes regarding proper application of compost would be held in rural areas the states of Punjab, Karnataka and Kerala and adjoining states as well.

Detailed records of the capacity building workshops and Training Programmes with attendance sheets would be kept by the Project Proponent and shall be monitored at the end of each crediting year.

Detailed Procedure for sampling waste composition

The composition of incoming waste will be done by sampling fresh waste. At least 24 samples will be collected annually (Refer Annex 4). The procedures laid down in Chapter 3, Section 3.3 of Manual on Municipal Solid Waste Management, prepared by the expert committee constituted by the Government of India, Ministry of Urban Development; Central Public Health and Environmental Engineering Organisation (CPHEEO), will be followed to determine the composition of waste.

Methodology for testing

For each of the sample, waste from the freshly arrived solid waste will be collected from randomly selected four incoming trucks. 100 Kg (approx) sample will be collected from each truck and a quarter of sample (25 kg approx) will be retained for sampling. Hence the composite sample size will be 100 Kg (25 kg each from 4 trucks). Physical inspection of the waste in the truck would be

required to see that the waste is of uniform nature. Care should be taken to verify that the samples are taken from trucks so as to represent the entire batch.

Using coning and quartering method about 100 kg of composite sample will be drawn out from the original solid waste. The waste should be sorted to segregate to the required constituents for weighing of each component. This would be done at the site itself. The parameters would be noted down in format as provided in table B 4 below.

Format for physical testing

S. No.	WASTE COMPOSITION	WEIGHT (IN GRAMS)
1.	Wood and wood products and straw	
2.	Pulp, paper, and cardboard (other than sludge)	
3.	Food, food waste, beverages, Fruit and vegetable and tobacco (other than sludge)	
4.	Textiles	
5.	Other (non-food) organic putrescibles, Garden, yard and park waste	
6.	Glass, plastic, metal, other inert waste	
7.	Total	
8.	Date	

Training and maintenance procedures

IEISL will conduct internal audit of all the records of the plant twice a year. During these audits all the data and parameters that need to be monitored as per the monitoring plan would be checked. Special emphasis would be given to results of waste characterisation studies and calibration of equipment along with procedures kept for maintaining records. Representatives of IEISL would train the staff of the compost plant to ensure adherence to the Monitoring Plan. Training of the staff on good practices of composting would also take place as and when found necessary. Proper records of the training along with attendance sheet would be kept and provided to the verifier at the end of each crediting period.

The main risk identified is the amount of incoming waste. However, the same will be monitored ex-post using weighbridge. Also, respective municipal corporations have agreed to deliver determined/fixed quantity of waste daily.

A document control system will be implemented by the plant manager in order to ensure proper storage of the monitored data and other relevant documents. A copy of monitored data will also be kept in fire proof cabins in order to ensure their safety. Regular internal audits will be conducted in order to ensure correct implementation of the monitoring plan. All audit findings, including corrective actions will be recorded and shall be made available at the time of verification.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date of completion of the application of the baseline study and monitoring methodology:
18/02/2009

Application completed by:

Organization	Ecosmart (now IL&FS Environmental Infrastructure and Services Limited (IEISL))
Salutation:	Mr.
Name:	Mahesh
Surname:	Babu
Street/P.O.Box:	28, Barakhamba Road

Building:	4 th floor, Gopaldas Bhawan
City:	New Delhi
State/Region:	Delhi
Postfix/ZIP:	110 001
Country:	India
Telephone:	+91-11-49691000
FAX:	+91-11-49601099
E-Mail:	ieisl.cdm@ilfsindia.com
URL:	http://www.ilfsenv.com
Project participant:	No

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

30/08/2007: date on which First Purchase Order was issued to a machine and equipment supplier (Purchase order for procurement of JCB JS 80 with Dozer blade complete; Quotation Ref No:JSV/AN/JCB - 2007, dated August 30, 2007).

As per definition of Start Date as mentioned in para 67, EB, start date can be considered as the date on which contract has been signed for equipment or construction/ operations services.

C.1.2. Expected operational lifetime of project activity

>>

20 years (as per Detailed Project Report)

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

C.2.2. Start date of crediting period

>>

01/04/2010 or date of registration whichever is later

C.2.3. Length of crediting period

>>

10 years, 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

The project involves the setting up of three composting plants in Punjab, Kerala and Karnataka. It does not use any scarce resources (like water); it doesn't produce any solid waste or emissions to water and soil. The limited number of vehicles onsite (few dumpers, front end loaders etc.), do produce local combustion gases. The engines of vehicles however, will comply with existing norms; therefore the amount of emissions will be very limited. The electricity used on the site causes off – site pollution related to electricity generation in power station. The amount of electricity used in the project is marginal and therefore off site GHG emissions are negligible.

Composting can have some local environmental impact, mainly odour emissions. Odour reduction techniques are applied by the use of inoculants. The fresh stacks of material are sprayed with inoculums/ sanitizer via sprayer to reduce odour and repel vectors. The inoculums will also reduce the problems of flies and bird menace.

During composting some dark coloured thick fluid may get generated. This fluid is known as "leachate". It should not percolate in the soil or else it will pollute the ground water. To avoid this, proper concreting of the 'Compost Pad' is done and a peripheral drain is provided to collect the

leachate generated during the process. The leachate so collected will be recycled over the windrows.

The air born litter is controlled by providing a green belt around the plant.

The compost produced in the plants will act as a soil conditioner and will enrich the organic content of soil. This will reduce soil erosion and chemical imbalance in soil associated with excessive use of chemical fertilizers.

D.2. Environmental impact assessment

>>

Thirty categories of activities with a certain investment criteria are required to undertake an Environmental Impact Assessment (EIA) under the Ministry of Environment and Forests, Environment Impact Assessment Notification S.O.1533, dated 14/09/2006⁵⁶. The project activity does not fall under the purview of Environmental Impact Assessment notification of the Ministry of Environment and Forests (MoEF), Government of India (GOI) and the project activity is exempted from environmental clearances, however due consideration has been given to environmental aspects.

A detailed environmental impact assessment is therefore not necessary. However, the project proponent has obtained Consent to Establish from respective pollution control boards.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The first stakeholder consultation for Jalandhar compost plant was held at Wariana Site, Jalandhar, Punjab on 05/10/2007 followed by a second meeting with local municipality officials and Mayor of Jalandhar on 30/11/2007. The notice for the consultation was put on the site prior to the consultation. The stakeholder consultation for Kozhikode compost plant was held at Njeliyanparamba, Kozhikode, Kerala on 19/07/2008 and the same for the Mysore compost plant was held at Vidyaranyapuram, Mysore, Karnataka on 27/11/2008.

Objective

- To conduct open discussion where stakeholders are encouraged to raise questions, express their concern and comments about the proposed project through a participatory process.
- To list down the concerns of stakeholders

The identified stakeholders were local residents residing around the Compost plants and landfill, city residents, officers from the Municipal Corporation, farmers around the project area, buyers of compost and representatives of project developers.

These identified stakeholders were invited through letters and notices were put at respective sites and municipal corporation offices. Stakeholders were given project introduction and informed about its objective through a presentation. The information shared included the project description, objective, environmental impacts and benefits, applicability of technology, implementation strategy, case studies where technology implemented has been successful, global and local benefits, contribution towards sustainable development, and status of projects implementation.

The presentation was followed by a detailed open discussion with the identified stakeholders, the details of which are provided below in Section E.2.

E.2. Summary of comments received

>>

⁵⁶ <http://envfor.nic.in/legis/eia/so1533.pdf>

The stakeholders' consultation started with a brief presentation from representatives of Ecosmart (now IL&FS Environmental Infrastructure and Services Limited, IEISL) about composting and its benefits. The stakeholders' consultations were well attended with a number of participants coming from the Urban Local Bodies, local residents from each plant's location, farmers around the project area and representatives from IWMUSL (now IEISL).



Jalandhar Compost Plant

The consultation process started with welcome speech by IWMUSL (presently, IEISL) representative, who gave brief description about the company, about the process of composting and its positive environmental benefits. He then introduced Ecosmart's (presently, IEISL) representative Mr. Sumit Barat, Manager-CDM, who gave a brief description of the project. The stakeholders raised their concern on environmental and social impact of the project, its financial viability and marketability of compost. These concerns were appropriately addressed by the project proponent, and following table briefs the concerns raised by stakeholders and their corresponding response.

PARTICIPANT'S QUESTIONS/ CONCERN	RESPONSE
The price of compost is too high as compared to fertilizers. What is IWMUSL (now IEISL) doing to make it easily accessible to farmers at cheap rates?	IWMUSL (now IEISL) is providing assistance by communicating with Ministry of Agriculture, Ministry of Environment and Forests (MoEF) and taking proactive steps to encourage use of compost, at reasonable price. Cross subsidisation of cost of production of compost using the CDM revenue will reduce the sale price of the compost and make it marketable.
Currently, the compost plants in India are unable to run to their optimum capacity due to financial barrier. What are the govt. plans to overcome the financial problems associated with the proposed projects	Regarding the capital investment, the govt. has invited the private parties to invest in such projects on PPP (Public – Private – Partnership) mode. The projects can be made sustainable by generating revenues partly from selling of compost and partly from CDM benefits from the CERs generated in the project.
How will the compost plant get CDM benefit, what is the methodology of calculating CDM benefit?	A brief description of CDM project cycle was given followed by an overview of the approved baseline methodology AM0025 was provided.
Have similar kinds of composting plants been set up by Ecosmart (now IEISL) earlier, and at what rate is it selling the compost in other parts of India?	Ecosmart (now IEISL) experience with relevant examples in India as well as the pricing structure of compost was explained.
Would Ecosmart (now IEISL) be responsible for cleaning of city and collection of waste?	The waste would be provided by the Jalandhar Municipal Corporation, at the plant. The stakeholders were given detailed explanation on mandate of processing the waste.
Will the compost plant use only fruit/vegetable waste or animal waste can also be composted.	The compost plant is designed to treat both fruit and vegetable waste along with animal waste.
Leachate produced during the windrowing process is an environmental concern. How to deal with this problem?	This problem can be overcome through recycling of the leachate and again sending it to the windrows. During high precipitation when excess of leachate is formed the leachate is collected in drains at the periphery of the windrows. Leachate can also be dried in the solar ponds.

A meeting was organized with the local municipal corporation officials and mayor of Jalandhar on 30/11/2007 to discuss about the project. Meeting was attended by representatives of Ecosmart Limited, IWMUSL (both organizations are now IEISL) and officials of Municipal Corporation. A brief introduction was given to municipal corporation officials about the project and benefits of composting.

Representatives from Ecosmart (now, IEISL) gave a description about the project activity and how it will help to benefit the environment.

Kozhikode Compost Plant

The stakeholders' consultation was attended by 30 residents from the nearby community, representatives from the Urban Local Body, representatives of IWMUSL and Ecosmart (both organizations are now IEISL). The stakeholders focused mainly on the possible environmental and social impact of the compost plant and role of government. These were all addressed by IWMUSL (now IEISL) as summarized in the table below.



PARTICIPANT'S QUESTIONS/ CONCERN	RESPONSE
What would be the minimum labour wages for the workers?	The minimum labour wages provided would be as per the rules and regulations of the Labour Law in Kerala.
What labour laws are to be followed by IWMUSL (now IEISL)?	The local labour laws prevalent in the state of Kerala would be followed by IWMUSL (now IEISL).
Will IWMUSL (now IEISL) provide ESI/PF facilities to the workers?	IWMUSL (now IEISL) assured the workers that they will be provided with ESI/PF facilities.
What kind of safety equipment are to be installed in the plant?	Fire safety equipment, cautionary signage and other safety accessories would be provided to the workers in the plant.
Will the workers be on the pay roll of IWMUSL (now IEISL)?	The workers will work on contract basis for IWMUSL (now IEISL). After the completion of the contract the workers would be taken on payroll.
In how many shifts the plant will be run?	The plant will be run in 2 shifts daily: 1 st shift: 6 am – 2 pm 2 nd shift: 2 pm – 10 pm
What is the sale price of compost?	The sale price of compost is Rs. 2000/ ton
What will be the packaging size of the compost bags?	The compost will be packed into 50 kg bags.
If vehicle is brought to the plant, can the compost be loaded directly? If so, then what will be the concession provided to the farmers?	Yes, IWMUSL (now IEISL) will have the facility of direct sale of compost from the plant. The farmers can avail concession on direct purchase from the plant and can contact the administrative office for this purpose.
How to deal with the marketing problems associated with selling of the compost?	Cross subsidization of compost using the CDM revenue will reduce the sale price of the compost and make it marketable. Additional revenue from CDM would be used to develop market for compost in the region.

Will the local community be employed in the plant?	The plant would employ skilled and semi-skilled workers. Employees from local areas would be preferred.
Currently, the compost plants in India are unable to run to their optimum capacity. What are the government's plans to overcome the problems associated with the project?	Regarding the capital investment, the government has invited the private parties to invest in such projects on PPP (Public – Private – Partnership) mode. The projects can be made sustainable by generating revenues partly from selling of compost and partly from CDM benefits from the CERs generated in the project.
What will happen if the subsidy from CDM stops, will the plant close down?	The prime barrier faced by a compost plant is the market barrier. With the use of CDM the market of end product is expected to be developed and the plant would be sustainable in years to come, even after CDM benefit is no longer available.

Mysore Compost Plant

The stakeholder's consultation started with a brief introduction from the representatives of Ecosmart (now IEISL) about composting, CDM and their benefits. The meeting was well attended by nearly 45-50 participants comprising of local residents, farmers around the project area, officers from the Mysore City Corporation (MCC) and representatives from IWMUSL and Ecosmart (both organizations are now called IEISL).

The stakeholders focused mainly on the environment problems, marketability of compost and the potential benefits the community may get out of CDM. These were all addressed by IWMUSL and Ecosmart (both organizations are now called IEISL) as summarized below:



PARTICIPANT'S QUESTIONS/ CONCERN	RESPONSE
What is the sale price of compost?	The sale price of compost is Rs. 2000/ ton
What will be the packaging size of the compost bags?	The compost will be packed into 50 kg bags.
If vehicle is brought to the plant, can the compost be loaded directly? If so, then what will be the concession provided to the farmers?	Yes, IWMUSL (now IEISL) will have the facility of direct sale of compost from the plant. The farmers can avail concession on direct purchase from the plant and can contact the administrative office for this purpose.
Leachate produced during the windrowing process is an environmental concern. How to deal with this problem?	This problem can be overcome through recycling of leachate and sending it back again to the windrows. Excess of leachate is collected in the drains at the periphery of the windrows. Excess leachate may be sent to STP for treatment.
How to deal with the marketing problems associated with selling of the compost?	Cross subsidization of compost using the CDM revenue will reduce the sale price of the compost and make it marketable. Additional revenue from CDM would be used to develop market for compost in the region.
Will the local community be employed in the plant?	The plant would employ skilled and semi-skilled workers. Employees from local areas would be preferred.
Currently, the compost plants in India are unable to run to their optimum capacity. What are the government's plans to	Regarding the capital investment, the government has invited the private parties to invest in such projects on PPP (Public – Private – Partnership)

overcome the problems associated with the project?	mode. The projects can be made sustainable by generating revenues partly from selling of compost and partly from CDM benefits from the CERs generated in the project.
The odour due to the waste accumulated at the site is a major concern among the local residents. How would IWMUSL (now IEISL) deal with this problem?	Odour reduction techniques are applied by the use of inoculants. The fresh stacks of material are sprayed with inoculums/ sanitizers via sprayer to reduce odour and repel vectors.
What will happen if the availability of CDM benefits to the plant stops?	The prime barrier faced by a compost plant is the market barrier. With the use of CDM the market of end product is expected to be developed and the plant would be sustainable in years to come, even after CDM benefit is no longer available.
The price of compost is too high as compared to fertilizers. What is IWMUSL (now IEISL) doing to make it easily accessible to farmers at cheap rates?	IWMUSL (now IEISL) is taking proactive steps to encourage use of compost, at reasonable price by communicating with Ministry of Agriculture, Ministry of Environment & Forests (MoEF) and Ministry of Urban Development (MoUD). It explained the initiatives taken by the government by stating extracts from Inter-Ministerial Task force on Integrated Plant Nutrient Management by MoUD. Cross subsidization of compost price using CDM was explained.

E.3. Report on consideration of comments received

>>

The project proponent will take up suggestion and inform the stakeholders regularly on the progress of project. The project proponents were commended for their action towards environment protection. Apart from the above comments and questions, no major issues were raised that could be related to the environmental or CDM aspect of the project. All comments and questions were duly taken into account by the project developer. The main concern of the community was related to the environmental, social and monetary impacts to the local community. All concerns were addressed by the project developer.



SECTION F. Approval and authorization

>>

Letter of Approval was received and submitted.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project and/or participant responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input checked="" type="checkbox"/> Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	IL&FS Environmental Infrastructure and Services Limited
Street/P.O. Box	28, Barakhamba Road
Building	4 th floor, Dr. Gopaldas Bhawan
City	New Delhi
State/Region	Delhi
Postcode	110001
Country	India
Telephone	+91-11-49691000
Fax	+91-11-49691099
E-mail	ieisl.cdm@ilfsindia.com
Website	www.ilfsenv.com
Contact person	Mahesh Babu
Title	Managing Director
Salutation	Mr.
Last name	Babu
Middle name	
First name	Mahesh
Department	
Mobile	+919871671613
Direct fax	
Direct tel.	+91-11-49691000
Personal e-mail	ieisl.cdm@ilfsindia.com

Project and/or participant responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Person/entity responsible for completing the CDM-MR-FORM
Organization name	Norwegian Ministry of Climate and Environment
Street/P.O. Box	Kongens
Building	Gate 20
City	Oslo
State/region	Oslo
Postcode	0153
Country	Norway
Telephone	+47 22246057
Fax	-
E-mail	Edit-Anita.Nordgaard@kld.dep.no
Website	https://www.regjeringen.no/en/id4/
Contact person	Edit Anita Nordgaard
Title	Senior Advisor

Salutation	Ms.
Last name	Nordgaard
Middle name	Anita
First name	Edit
Department	Department of Climate Change
Mobile	-
Direct fax	-
Direct tel.	+47 22246057
Personal e-mail	Edit-Anita.Nordgaard@kld.dep.no

Appendix 2. Affirmation regarding public funding

No public funding and no ODA from a country listed in Annex 1, is involved in this project activity.

Appendix 3. Applicability of methodology and standardized baseline

Appendix 4. Further background information on ex-ante calculation of emission reductions

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION

4.0

DATE

Sep-08

BASELINE METHODOLOGY

ACM0002 / Ver 07 and "Tool to Calculate the Emission Factor for an Electricity System", Version 1.1

EMISSION FACTORS

*Using approach (c) on p. 4 of "Tool to Calculate the Emission Factor for an Electricity System", Ver.01

Weighted Average Emission Rate (tCO₂/MWh) (excl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.84	0.83	0.82
South	0.73	0.72	0.72
India	0.82	0.80	0.80

Weighted Average Emission Rate (tCO₂/MWh) (Incl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.84	0.82	0.81 *
South	0.73	0.72	0.72 *
India	0.81	0.80	0.79

Simple Operating Margin (tCO₂/MWh) (excl. Imports)

	2005-06	2006-07	2007-08
NEWNE	1.02	1.02	1.01
South	1.01	1.00	0.99
India	1.02	1.01	1.01

Simple Operating Margin (tCO₂/MWh) (Incl. Imports)

	2005-06	2006-07	2007-08
NEWNE	1.02	1.01	1.00 *
South	1.01	1.00	0.99 *
India	1.02	1.01	1.00

Build Margin (tCO₂/MWh) (excl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.67	0.63	0.60
South	0.71	0.70	0.71
India	0.68	0.65	0.63

Build Margin (tCO₂/MWh) (not adjusted for imports)

	2005-06	2006-07	2007-08
NEWNE	0.67	0.63	0.60
South	0.71	0.70	0.71
India	0.68	0.65	0.63

Combined Margin (tCO₂/MWh) (excl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.85	0.82	0.80
South	0.86	0.85	0.85
India	0.85	0.83	0.82

Combined Margin in tCO₂/MWh (Incl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.85	0.82	0.80
South	0.86	0.85	0.85
India	0.85	0.83	0.81

Source: **BASELINE CARBON DIOXIDE EMISSIONS FROM POWER SECTOR**, Government of India, Ministry of Power, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-66
 Weblink: <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

Appendix 5. Further background information on monitoring plan

Sampling plan for determining various monitoring parameters

The sampling plan for determining possible waste composition and other monitoring parameters is based upon general statistical methods and the formula is given below⁵⁷.

$$x = Z^{(c/100)^2} r(100-r) \dots\dots\dots(27)$$

$$n = \frac{N x}{((N-1)E^2 + x)} \dots\dots\dots(28)$$

Where

N	=	sample size
N	=	population size
E	=	margin of error
$Z^{(c/100)}$	=	critical value for the confidence level c
r	=	response distribution
x	=	Constant calculated based on confidence level and response distribution

The size of sampling has been determined so that it is statistically significant with a Margin of Error of 20% at a 95% confidence level. The critical value at a 95% confidence level is 1.96⁵⁸

The response distribution is kept at a conservative 50% as this gives the maximum sample size.

Thus the value of 'x' as per Equation 27 is calculated as:

$$x = (1.96)^2 \times 50 \times 50 = 9,604$$

Calculation of Sample Size

The Kozhikode plant (150 TPD) will receive 10,950 truck load of waste. Thus the population size (N) is 10,950.

Given

$$x = 9,604$$

$$N = 10,950$$

$$E = 20$$

The sample size as per Equation 28 is calculated as:

$$n = 10950 \times 9604 / ((10950 - 1) \times 20^2 + 9604) = 24$$

Therefore, the Sample Size is 24.

Similarly for the other two plants, the sample size has been calculated as 24 with population size as follows:

➤ Jalandhar (200 TPD): The plant will receive 14600 truck load of waste. Thus the population size (N) is 14,600

➤ Mysore (250 TPD): The plant will receive 18250 truck load of waste. Thus the population size (N) is 18,250

Required Sample size for Variable Population size at 95% confidence level and 20% margin of Error

POPULATION SIZE	SAMPLE SIZE
50	17
100	20

⁵⁷ <http://www.raosoft.com/samplesize.html>

⁵⁸ www.ucd.ie/statdept/classpages/introquantmethods/introqmchp12.pdf (Page 3)

500	23
5,000	24
8,000	24
12,000	24
15,000	24
18,000	24
21,000	24
24,000	24
27,000	24
30,000	24

The above table demonstrates that irrespective of population size the sample size remains constant at 24. Hence sample size of 24 is chosen in case of all the three plants for sampling of the parameters.

Also refer to section B.7.2 of CDM-PDD-FORM.

Appendix 6. Summary of post registration changes

In-line with the requirement of §289(c) of CDM Project Standard, v09.0; PP wishes to confirm the removal of Jalandhar site from the registered CDM project activity. This change is permanent in nature and the effective output capacity of the registered CDM project activity is revised from 600TPD to 400TPD, effective from 01/01/2014 onwards.