Schedules

Schedule B

1. Performance Guarantee:

The Developer towards due performance of its obligations as per the Terms of this Agreement shall provide to the Municipal Body a Performance Guarantee (in the form of a Fixed Deposit in a nationalised bank or a Bank Guarantee from a Nationalised Bank acceptable to the Municipal Body) equivalent to Rs___/= (Rupees _____ only) {equal to at least 10% of the estimated project cost} valid for the tenure of the Concession Period.
The Performance Guarantee shall be released by the Municipal Body in the event of early Termination of this Agreement subject to the Termination not being as a result of Developer's Event of Default and payment of all dues payable to the Municipal Body by the Developer prior to Termination

2. Monitoring of Project Facility

(A) Construction phase:

(i) Review the Design and Drawings related to the Development of the Project Facilities, submitted by the Developer.

(a) The Developer shall make available the Design and detailed engineering Drawings, at own cost, for the construction/ procurement/ commissioning of the Project Facility to the Committee and Municipal Body within 15 days from the Commencement Date.

(b) Within 7 days of provision of Design and Drawings by the Developer, the Committee and Municipal Body shall review the same.

(c) The Municipal Body shall, within 15 days from the date of submission of Design and Drawings as detailed above, inform in writing the Developer of its approval/ denial to the modifications proposed by the Developer with adequate reasons. The Developer shall accordingly accommodate the observations of the Municipal Body.

(d) If the Developer does not receive any communication, with regards to the proposed Design and Drawings within 15 days from the date of submission of Design and Drawings to the Municipal Body, then Municipal Body shall be deemed to have accepted the Drawings and the Developer is entitled to proceed with the Construction works thereafter.

(ii) Monitoring the Construction/ Installation of the treatment facilities and commenting on the compliance of the same with the construction requirements and bring any deviations to the attention of the Municipal Body.

(iii) Conduct such tests as warranted to ensure the efficacy of the treatment facilities and make note of the same and submit reports on a fortnightly basis to the Municipal Body.

(iv) Verify and approve issuance of Provisional Commissioning Certificate/ Final Commissioning Certificate to the Developer, upon satisfying that the Project Facility is capable catering to the Construction Requirements as per the provisions

of this Agreement. In the event of approval of issuance of the former by the Municipal Body, a list of items pending for completion shall be appended thereto. ("Punch List Items")

(v) Verify and approve issuance of Final Commissioning Certificate upon completion of construction/ commissioning of the Punch List Items.

(vi) Inform the Municipal Body as soon as reasonable on the occurrence of any Event of Default/ Force Majeure (as laid down later in the document) or any event that may have the potential to have a Material Adverse Effect on the Project Facility.

(vii) To monitor the implementation plan with respect to the original implementation schedule (required to be submitted by the Developer) and submit to the Municipal Body a report on a fortnightly basis.

(viii) Within 60 days of completion of the Construction Works and the Certification of the same by the Municipal Body as per the terms set forth in this Agreement, secure from the Developer two sets of As-Built Drawings, each to be submitted to the Committee and to the Municipal Body.

(B) Operations and Maintenance phase:

The Committee shall undertake following activities related to the operations and maintenance of the Project Facility.

(i) Collect information on a daily basis on the quantum of waste brought to the Project Facility from the Weighment Facility.

(ii) Conduct calibration test of the Weighment Facility at least once in a period of six months.

(iii) Conduct sampling, as detailed in Schedule, on the Waste at such intervals on a daily basis to ensure that only Bio-degradable Waste is brought to the Project Facility.

(iv) Conduct such tests as laid down in Schedule for measurement of Performance Standards at an interval of not more than 15 days corresponding to the billing cycle and compile the results in the format prescribed to determine the penalty be recovered from the Developer for non-performance.

(v) Conduct such tests to ensure conformance of the operations of the Project Facilities with the standards prescribed in prevalent Law/ Rules/ Statutes.

(vi) Ensure that the end product that is generated is disposed by the Developer in an environmentally safe manner whereas the rejects are transported to the designated disposal facility in a timely manner.

(vii) Carry out/ assist the Committee for such activities that the Committee may so direct from time to time

(viii) Review the O&M Plan submitted by the Developer from time to time and bring to the attention of the Committee deviations, if any from the same.

(ix) Obtain and maintain records with regards to the operation of the Project Facilities namely the composition (physical as well as chemical) of the End Product, weight of rejects, weight of end product, composition of rejects (approximate weighment basis or volumetric basis), resources deployed by the Developer on a daily basis and any other records as required by the Municipal Body

(x) In case of any dispute/ disagreement between the designated transporting agency and the Developer related to the Waste, then the Committee shall immediately

inform the Municipal Body of the same and take steps as deemed necessary to resolve the dispute amicably without affecting the Project Facilities. However, if the resolution involves any financial burden on the part of the Municipal Body then the same shall be approved by the Municipal Body.

3. Developers Specific Obligations

(A) Construction Phase:

(i) Prepare the Design and detailed engineering Drawings for the construction/ procurement/ commissioning of the Project Facility and submit the same to the Committee and the Municipal Body within 15 days of the Commencement Date

(ii) The Developer shall accommodate such remarks/suggestions that the Municipal Body shall have with regards to the Design and Drawings.

(iii) The Developer at its own cost and expense make such arrangements for arranging finances as would be necessary for the development of the Project Facility in a timely manner. The Concessionaire shall submit its financing plan for the development of the Project Facility within 15 days of signing of this Agreement to the Committee and the Municipal Body.

(iv) The Developer shall not commence Construction works before the formation of the Committee unless otherwise authorised to do so by the Municipal Body.

(v) The Developer shall within 15 days from the approval/ deemed approval of the Municipal Body as detailed hereinabove, submit to the Municipal Body, the construction schedule to be adhered to by the Developer for the implementation of the Project Facility.

(vi) The Developer undertakes to adhere to the Construction Schedule and complete the construction activities within the stipulated timeframe and achieves COD within the Scheduled Project Completion Date.

(vii) The Developer shall on the 15^{th} of every month, during the Construction Period, submit to the Committee, a progress statement indicating the progress achieved by the Developer over the previous month and the target for the next month as per the activities highlighted in the Construction Schedule to be submitted to the Municipal Body as per the terms set forth in this Agreement.

(viii) The Developer shall before 15 days of the completion of the Construction of the Project Facilities notify the Committee in writing to conduct the requisite Tests required to certify the completion of the Project Facilities.

(ix) The notification of the likely completion by the Developer would not construe as the achievement of Completion of the Construction works and only the Certification by the Municipal Body to that effect would construe the Completion of the Construction works.

(x) All the Tests shall be conducted to ensure compliance with the Construction requirements. If the Tests are successful and the Project Facilities can be safely and reliably opened for operation, the Municipal Body shall issue the Commissioning Certificate upon approval by the Committee.

Provided, notwithstanding that certain works or things forming part of Construction Works are not complete, if following Tests the Committee determines that the Project Facilities can safely be commissioned and opened for operations, the Committee may approve issuance of Provisional Commissioning Certificate to the Developer. The Provisional Commissioning Certificate shall be accompanied by a list of items yet to be completed ("the Punch List items"). All the Punch List items shall be completed by the Developer within a period of 90 days from the date of issue of the same.

The Municipal Body shall, upon completion of the Punch List items, within 15 days issue the Final Commissioning Certificate to the Developer.

(xi) If the Developer fails to complete the Punch List items as required under the Provisional Commissioning Certificate, then without prejudice to any other rights that the Municipal Body may have as per this Agreement, the Municipal Body shall have the option to undertake the said works by engaging the services of any third party, at the cost of the Developer and claim 130% of the amounts so incurred from the Developer for the same.

(xii) The said Project Facilities shall be opened and ready for accepting the Municipal Solid Waste only after securing the Provisional Commissioning Certificate or the Final Commissioning Certificate as stipulated above.

(B) Operations and Maintenance Phase:

(i) Acceptance of Municipal Waste

The Municipal Body shall endeavour to supply segregated Biodegradable waste to the Developer in quantities as indicated in *Schedule* herein. The Developer shall be responsible at all times to accept the daily quantities of Waste.

In the event of inability of the Municipal Body to supply Waste, due to reasons attributable to the generators of Waste or due to reasons attributable to the transporting agency, the Municipal Body shall be obliged to supply Waste by collecting Waste from alternative sources or by engaging the services of any alternative transporter respectively.

Failure of Municipal Body to supply Waste continuously for a period of five consecutive days shall entitle the Developer to engage the services of any third party transporter to collect Waste from the generators of Waste and claim 120% of the cost involved in collection, transporting and segregation from the Municipal Body.

In the event the Developer is unable to hire the services of any third party transporter due to reasons attributable to the transporting industry per se, then the Municipal Body shall be obliged to pay to the Developer an amount that is equivalent to the manpower costs, operational costs other than interest payment and principal repayment for the period for which the Municipal Body has failed to supply the Waste ("Idling Charge")

The Developer shall be penalised for any non- acceptance of the Waste, other than for events in this Clause (i) herein above or due to Planned Maintenance for a period not more than 2 consecutive days, calculated as follows:

$P_{NA} = 0.6 * Q_{AVG} * R_T$

Where: -

$P_{NA:}$ Penalty for Non acceptance
R_T: Rate per Tonne quoted by the Developer for the purpose of Treatment of the Waste
Q_{AVG}: Average Quantity of Waste supplied by the Municipal Body over the immediately preceding week

The Municipal Body shall have a liberty of recovering the penalty due from the Developer' subsequent billing or by invoking the Performance Guarantee to the extents of the amounts due. In the event that the Performance Guarantee is invoked, the Developer shall within 15 days of such an event, replenish the Performance Guarantee to the stipulated amount. Failure on account of the Developer to do so shall be construed as an Event of Default on the part of the Developer.

(ii) Segregation/ Screening of Accepted Municipal Waste

The Developer shall provide for a screening/ segregation facility at the Project Facility.
The screening/ segregation facility should be a mechanised facility with an ability to handle all types of Waste both dry as well as wet waste. The Developer can deploy partial mechanised segregation of the waste upon a written approval from the Municipal Body. The Waste other than the Bio-degradable Waste so segregated shall have to be separately stored in a separately demarcated area from where the same has to be transported to the Disposal Facility.
The Municipal Body undertakes to supply Waste in compliance of the Acceptability Criterion as detailed below:

Acceptability Criterion:

Random sampling shall be undertaken of the Waste that is being supplied by Municipal Body to ascertain the composition of the Waste supplied by Municipal Body. The sampling procedure, detailed herein *Schedule* is to be conducted for at least two Waste loads on a daily basis by a Committee representative and the observations of the same are to be recorded and produced before the Committee upon demand.

Acceptability Criterion= the ratio of biodegradable waste to total waste shall not be less than 90%

If the Waste supplied by the Municipal Body to the Developer is found to be in deviation of the Acceptability Criterion, then the Developer shall deploy labour to segregate the same. The cost of deploying additional labour shall be separately recorded and initialled by the Committee representatives comprising the Developer representative as well as the Municipal Body representative. The Developer shall recover 120% of the amounts so spend by the Developer in segregating the Waste and transporting the rejects to the designated disposal agency by submitting a bill in this regard from the Municipal Body.

(iii) Treatment of Municipal Waste

The Developer shall operate and maintain the Project Facility as per *Schedule* .
The Developer shall ensure that the Treatment of the Waste shall at all times comply with the Statutory Regulations including MSW Rules and other environmental laws/ regulations, emission norms, etc.
The Developer shall be responsible for the sale/ disposal after Treatment of the End Product so generated as a result of the Treatment process. The Developer shall ensure that the composition of the compost is in compliance with the MSW Rules and that the

same is transported/ stored / packed in line with the regulatory stipulations at all times during the Contract Period.

(iv) Transportation of Rejected Waste

The Developer shall consolidate/ collect all the rejects of the Waste during the Treatment process and stockpile the same at the designated location as mentioned in sub-clause (v) above.

The Developer shall, towards the end of each day but under any case not more than 48 hours from the time of separation/ identification of such waste, at its own cost, shall collect, load and transport the rejects to the Disposal Facility as designated by the Municipal Body from time to time. The Developer shall ensure that till the time the rejected Waste is handed over to the designated Disposal Facility, the rejects are safely stored and care would be taken to ensure that the same is in no way adversely affecting the surrounding environment.

The Developer shall be responsible for maintaining records of the rejected waste so handed over to the designated Disposal Facility.

The Developer shall use its own resources including manpower, machinery, etc to handle the rejected waste including storage, intermediate treatment, loading/ unloading, etc.

4. Payments to the Developer (Two Options)

Option I: *This option could be exercised by the Municipal Body when the Project I found to be feasible on a stand alone basis and that the project is likely to attract developers without any efforts from the Municipal Body' side.*

(A) Payment Terms

(i) The Municipal Body hereby undertakes to pay the Developer an amount as calculated herein below in lieu of services rendered towards the operation and maintenance of the Project Facility for the acceptance of the Waste supplied by the Municipal Body;

$$A = R_T * Q_{Act} * (100-P)$$

Where;
A: Amount payable as per the terms of the Agreement
R_T: Rate per Tonne of Waste (as agreed between the Developer and the Municipal Body subsequent to the bidding process)
$Q_{Act:}$ Quantity of waste accepted by the Developer as per provisions of the Agreement
P: Performance Parameter as determined by the procedure laid down in Schedule

(ii) The Municipal Body shall make available the requisite funds to the credit of the Developer as per the Payment Mechanism detailed in Clause 7.1

Option II *This option could be exercised by the Municipal Body when the treatment option is not found to be feasible on a stand alone basis and to make it attractive the Municipal Body could offer the Development of the Project Facility to that short listed*

bidder who quotes the minimum capital grant. The Municipal Body in this case can fix the Per tonne charge based on the estimated O&M cost plus reasonable margins

(A) Payment Terms

(i) The Municipal Body hereby undertakes to pay the Developer an amount as calculated herein below in lieu of services rendered towards the operation and maintenance of the Project Facility for the acceptance of the Waste supplied by the Municipal Body;

$A = R_T * Q_{Act} * (100-P)$

Where;
A: Amount payable as per the terms of the Agreement
R_T: Rate per Tonne of Waste (as fixed by the Municipal Body before 1bidding process)
$Q_{Act:}$ Quantity of waste accepted by the Developer as per provisions of the Agreement
P: Performance Parameter as determined by the procedure laid down in Schedule

(ii) The Municipal Body shall make available the requisite funds to the credit of the Developer as per the Payment Mechanism detailed in Clause 7.1

(iii) The Municipal Body shall remit such amounts to the Developer as agreed, subsequent to the bidding process. The Developer shall incur 50% of the project outlay on the Project Facility on its own and only subsequently approach the Municipal Body for the Capital Grant. The Developer shall produce such supporting that the Municipal Body may so demand for ascertaining the contribution by the Developer.

5. Termination Payments

(A) Due to Events of Default

Option I

The Termination Payments that shall be payable to the Developer shall be governed by the following table:

(This has been worked out for a seven-year contract period)

Year	Investment in non-movable assets *	Mun. Body EoD	Dev. EoD
Upto Construction	X	120	70
At COD	Say 100		
Yr 1	85.71	102.86	60.00
Yr 2	71.43	85.71	50.00
Yr 3	57.14	68.57	40.00
Yr 4	42.86	51.43	30.00
Yr 5	28.57	34.29	20.00
Yr 6	14.29	17.14	10.00
Yr 7	0.00	0.00	0.00

* Investment in Non-movable assets shall mean those assets that the Developer has deployed for the Project Facility that cannot be utilised if the Project Facility has to be wound up. For eg. a shed for equipments/ office, construction of plant, etc.
Where as assets like vehicles. Which can be utilised by the Developer even if the Project Facility is shut down, would not qualify as non-movable assets.

Option II

In case the Agreement is structured as per the Option II i.e. Municipal Body contributes to the capital cost, then in the event of Termination as per the provisions of the Agreement the following shall be the method deployed for computing the Termination Payments:

Year	Investment in non-movable assets *	Mun. Body EoD	Dev. EoD
Upto Construction	X	120	70
At COD	Say (100 – Y)		
Yr 1	((100 – Y)- Z)	120%*((100 – Y)- Z)	70%*((100 – Y)- Z)
Yr 2	((100 – Y)- 2Z)	120%*((100 – Y)- 2Z)	70%*((100 – Y)- 2Z)
Yr 3	((100 – Y)- 3Z)	120%*((100 – Y)- 3Z)	70%*((100 – Y)- 3Z)
Yr 4	((100 – Y)- 4Z)	120%*((100 – Y)-4Z)	70%*((100 – Y)- 4Z)
Yr 5	((100 – Y)- 5Z)	120%*((100 – Y)- 5Z)	70%*((100 – Y)- 5Z)
Yr 6	((100 – Y)- 6Z)	120%*((100 – Y)- 6Z)	70%*((100 – Y)- 6Z)
Yr 7	((100 – Y)-7 Z)	120%*((100 – Y)- 7Z)	70%*((100 – Y)- 7Z)

Where;
Y= capital contribution made by the Municipal Body
Z= (100-Y)/ Concession Period (*in this case 7*)

(B) Due to Force Majeure Events (For Either options the corresponding table has to be referred to)

Upon Termination of this Agreement due to Force Majeure Event, Termination Payment shall be made to the Developer by the Municipal Body in accordance with the following:

(i) If Termination is due to a Force Majeure Event, described under Clause 9.1 sub-clause (i) to (v), no Termination Payments shall be made to the Concessionaire by the Municipal Body, but the Developer shall be entitled to receive and appropriate the proceeds of any amounts receivable under the Insurance Policies.

(ii) If Termination is due to the occurrence of any Force Majeure Event as described under Clause 9.1 sub-clause (vi), (vii) or (viii), Municipal Body shall pay to the Developer, Termination Payment equal to 110% of the Investment in non-movable assets made by the Developer, as on Termination Date ascertained from the table 1 herein above, and as certified by an independent firm of chartered accountants mutually agreed upon and appointed by the Parties for the purpose. The costs for the expenses related to the independent chartered accountant firm shall be borne equally by the Municipal Body and the Developer.

(iii) If Termination is due to the occurrence of any Force Majeure Event as described under Clause 9.1 sub-clause (ix), Municipal Body shall subject to the certification of the Committee, pay to the Developer, Termination Payment equal to 100% of the Investment in non-movable assets made by the Developer, as on Termination Date ascertained from the table 1 herein above, and as certified by an independent firm of chartered accountants mutually agreed upon and appointed by the Parties for the purpose. The costs for the expenses related to the independent chartered accountant firm shall be borne equally by the Municipal Body and the Developer.

Provided Municipal Body shall be entitled to deduct from the Termination Payment any amount due and recoverable by Municipal Body from the Developer as on the Termination Date.

Schedule C Work Specifications

1. Construction Requirements

(This has been designed for Bio-methanation technology; if some other technology has to be deployed then the same shall be elaborated as per the structure given below)

(A) Introduction

Nisargruna Biogas plant developed by Bhabha Atomic Research Centre (BARC) for processing of solid biodegradable waste is based on dual phase digestion process. The first phase is aerobic whereas the second phase is anaerobic.
The various components of the plant are:

(i) A mixer/ pulper (5 HP motor) for crushing the solid waste
(ii) Premix tanks (3)
(iii) Pre-digester tank
(iv) Air Compressor
(v) Solar heater for water heating
(vi) Main digestion tank (35 m^3)
(vii) Gas delivery system
(viii) Covered Manure pits (4)
(ix) Tank for recycling of water and water pump
(x) Gas utilisation system

The waste generated in kitchens in the form of vegetable refuge, stale cooked and uncooked food, extracted tea powder, waste milk and milk products can all be processed in this plant. The waste to be introduced in the pre-digester plant has to be shredded and mixed with water to make fine slurry. The waste is converted into slurry by mixing it with water in a 1:1 ratio. Usually this is the failure point as solid waste is difficult to digest and can easily clog the system by scum formation. Degradation of the waste is ensured with the help of thermophilic microbes. The growth of thermophiles in the pre-digester tank is assured by mixing the waste with hot water and maintaining the temperature in the range of 55-60^oC

After the pre-digester tank the slurry enters the main tank where it undergoes mainly anaerobic degradation by a consortium of archaebacteria belonging to *Methanococcus* group. These bacteria are naturally present in the alimentary canal of ruminant animals (cattle). They produce mainly methane from the cellulosic materials in the slurry. The undigested lignocellulosic and hemicellulosic materials are then passed on to the settling tank. After about a month, high quality manure can be dug out from the settling tanks. There is no odour to the manure at all. The organic contents are high and this can improve the quality of humus in soil, which in turn is responsible for the fertility.
Methane gas is generated in the main tank from where it is transported through Galvanised Iron pipes to the utilisation site. Drains for condensed water vapour are provided on the pipeline. This gas burns with a blue flame and can be used for cooking as

well. The manure generated, as a by-product is high quality and could be used for supplementing organic farming requirements.

It must be stressed that the success of this biogas plant depends a great deal on proper segregation of the kitchen waste. The materials that can pose problems to the efficient running of the plant are coconut shells and coir, eggshells, bones and plastic pieces. Steel utensils like dishes, spoons etc. are likely to appear in the waste bags from hotels and household kitchens. While bones, shells and utensils can spoil the mixer physically; coir and plastic can have detrimental effects on microbial consortium in the pre-digester and main digestion tanks, which could be disastrous for the plant. Hence it is necessary that following precautions may be taken while collecting the kitchen waste. There should be a separate container for coconut shells, coir, eggshells, and bones. These will not be processed in the biogas plant. There should be separate containers of small volumes (5 L capacity) to collect the wet waste (spoilt or stale cooked food, waste milk products etc.). The vegetable refuse like peels of various vegetables, rotten potatoes, and tomatoes, coriander leaves etc. may be collected in garbage bags of 5-kilo capacity. *It must be noted that such segregation is of utmost importance for smooth running of the biogas plant.*

Thus the efficient disposal of kitchen waste can be eco-friendly as well as cost effective. While calculating the cost effectiveness of such waste disposal one has to consider more than monetary aspects. The dumping of uncooked food in unmanned areas may not be very civilized. It can also lead to growth in the population of nuisance animals. It is undoubtedly unhygienic and can pose a threat to the habitat. These factors will add to the value of such plants. Using the natural friends in the form of thermophiles, methanogenic micro organisms and their consortia we can certainly handle the kitchen waste and a variety of other biodegradable wastes.

The Municipal Body has to mention details of the land housing the plant viz. area, location. Area requirements are 300-600-1000 meter square for 1 Tonne - 5 Tonne and 10 Tonne plant respectively. The Municipal Body has to ensure that the transportation of the waste has to be minimal and so also the transportation of the gas generated, hence the location of the plant should be close to the generators as well as end users to the extent possible.

(B) Review of Project Site

(i) Undertake an assessment of the present Project Site jointly with the Committee, engaged to assist the Municipal Body towards Development of the Project Facility.
(ii) Undertake necessary studies to undertake the Design of the Project Facilities.
(iii) Ensure that the Project Site is free from encumbrances and submit a report to the Municipal Body on the status of the Project Site and necessary steps that would be required to be undertaken by the Municipal Body to facilitate the development of the Project Facility.

(C) Clearances, Permits and Approvals

(i) Assess the permits, approvals and clearances that would be required for the operations and maintenance of the Project Facility.
(ii) Determine the approvals, permits and clearances that are currently in place and highlight the list of balance permits, approvals and clearances, if any.
(iii) Undertake necessary environmental studies to ascertain the impact of the Project Facility on the neighbouring surroundings
(iv) Submit a report to the Municipal Body and the time frame for obtention of the same along with the support that might be required from the Municipal Body in obtention of the same.

2. O&M Requirements

(A) Operation and Maintenance of Treatment Facility

As stated above, the plant is based on microbial activities. The initial microbial culture development is therefore becomes extremely important for successful commissioning of the plant. There are two digesters. The microbial culture in the pre-digester builds up naturally. It will start building up only after biodegradable waste is processed. Before this happens, it is necessary to build up inoculum in the main digester. This is achieved by seeding with cattle dung. Usually 15-20% by volume seed is required. Fresh cattle dung is preferred. It is to be mixed with 1:1 water and proper slurry is made. The floating straw has to be removed. It is recommended that 80% of this slurry is put directly into the main digester while remaining 20% is passed through primary digester. This is required to provide some base material before waste is actually processed. It takes about 10-12 days for establishment of culture in the main digester. In hot summer this may be 5-6 days, in winter it would tale more than 20 days. The rising of dome would be an indication of establishment of culture. The first filling of dome contains very less quantity of methane. Hence when dome fully rises, it is recommended to open the valve fully and drive out all the gas contents. After this evacuation, methane will start filling in larger quantities and can be effectively used. Still it would take few more weeks to reach the expected purity of methane.

The capacity build up is very tricky in the operation of plant. It must be remembered that the whole operation depends upon microorganisms. The various cultures have to develop and coexist in tandem for successful processing of a variety of biodegradable wastes. The conditions required for their optimum activities have to be carefully monitored.

Following instructions should be strictly adhered to while making the plant operational:

- The first waste feeding of the plant will begin after 15 days of gobar seeding.
- The feeding should be as per the schedule given in the table given below. This schedule is given for 5 tonne plant. It would be different for different capacity plants.
- There is a need to monitor the type of waste being processed. Generally the pH of the raw slurry entering the pre-digester should be around 7-8. If this pH is too acidic, then materials responsible for acidity (mainly lemon and citrus skins, pickles, soured

foods) may be segregated and processed in smaller aliquots by mixing with larger volumes of non-acidic materials.

- Floating materials in the raw slurry may be collected and reprocessed in the mixer. This is to ensure uniform homogenisation of the waste material. It would also help in reducing the scum formation. Providing a strainer at the pre-digester entry point can ensure this.
- The addition of hot water is an important step. Everyday two additions of 500L hot water (85-90^{o}C) each are recommended for a five tonne plant. If the solar heater is not efficient due to weather conditions, it is recommended that part of methane generated in the plant may be used for provision of hot water. The heating system may be provided and included in the initial design.
- The microorganisms in pre-digester are mainly aerobic. Hence it is necessary to maintain aeration intermittently using compressed air. Generally aeration at 2-3 intervals of 1-hour duration during a day through a 1 HP compressor would serve this purpose.
- The pH of the slurry entering the main digester is about 5-5.5. If it is in the range of 4-4.5, it is recommended that the pH of raw slurry may be checked. If the raw slurry were maintained at pH 7-8, there would not be any problem of pH maintenance. However careful monitoring of pH at these two levels is absolutely important for efficient running of the plant.
- The pH of manure slurry flowing into manure pits must be more than 7. If it is acidic, it means the problem in digestion process. Intervention at right time would ensure smooth running of the plant. The intervention may be either controlling the pH of raw slurry or addition of gobar (usually 5% of digester volume). The latter alternative may be tried immediately after noticing the indigestion in main digester. This would be evident by sour and foul smell of the manure slurry. The insect larvae in manure pits are another indication of improper digestion.

Schedule for capacity build up in a five tonne Nisargruna plant

First seeding	0 day
No feeding	1-15 days
500 Kg waste/day	15-30 days
1 tonne waste/day	30-45 days
1.5 tonne/day	45-60 days
2 tonne/day	60-75 days
3 tonne/day	75-90 days
4 tonne/day	90-120 days
5 tonne/day	After 120 days

(B) Utilization of methane gas

Methane generated during processing of biodegradable waste can be used in 3 different ways:

1. **Cooking:** Methane can be supplied using GI pipelines. The pressure in the dome may not be interfered with. The diffusion process can carry methane up to 1-2 Km. Water traps have to be provided to remove condensing water from the gas. Specially developed burners are needed to utilize the gas for cooking purpose. This is the best application of methane. Only limitation would be the end user must be available in the vicinity, otherwise pipeline may become very expensive. Industrial canteens, crematoria or boilers would be ideal users of such methane. This would give good returns (in the range of 15-16 Rs./Kg of methane). It must be remembered that every tonne of biodegradable waste can generate about 30-40 Kg of methane.

2. **Generation of electricity:** Methane can be converted into electricity using a diesel generator attached with biogas mixing unit. Such generators of 10, 25 and higher KVA capacity are available and can be locally obtained from Kirloskars. This may not be very beneficial proposition, but would be ideal at places where no end user of gas is available. Five tonne plant can generate about 200 units of electricity per day. However it would incur an additional expenditure for diesel supply and generator maintenance.

3. **Compression of methane:** Compression of methane in cylinders opens up a possibility of transporting and utilization of methane as vehicle fuel. Such usage is being done in European countries.

(C) Utilization of manure

Manure generated in the plant can serve as an excellent soil conditioner. It can be supplied to farmers for use at farms, etc. Alternatively municipal gardens and local gardens can be assured of regular manure supply from the Nisargruna plants. Thus money would be saved in the budgets of these gardens for procurement of manure, and that would be indirect earning from the Nisargruna plant.

(D) Replacement/ Replenishment of any or all parts of the Treatment Facility

(i) The Developer shall, in the event requiring replacement/ replenishment of any or all parts of the Project Facility, submit an application in these regards to the Independent Engineer stating clearly the reasons for replacement/ replenishment and the specifications of such replacements/ replenishments.

(ii) The Independent Engineer shall forthwith conduct an assessment of the application and shall seek such details as required from the Developer to ascertain the need of the replacement/ replenishment of the requisitioned Project Facility.

(iii) The Developer shall however, if the need be, go ahead and procure the replacement/ replenishment of the requisitioned Project Facility pending the approval from the Municipal Body. Subsequently, upon submission of the above-mentioned report by the Independent Engineer, depending on the Independent Engineer's opinion, Municipal Body shall decide on the reimbursement to be paid to the Developer for such replacement/ replenishment of the Project Facility. If in the opinion of the Independent Engineer, it is decided by the Municipal Body that such replacement/ replenishment of the Project Facility is indeed required then the

Municipal Body shall reimburse the Developer upto such amounts expended by the Developer for the purpose of such replacement/ replenishment.

Schedule D Correspondences that may form part of the Agreement

Schedule E Details of Project Site and Project Facility

To be filled in by the respective ULB with the details of the Project Site and the Project Facilties.

Schedule F Indicative Waste Quantities

The Municipal Body shall endeavour to supply the following quantities of waste on an annual basis through out the tenure of the Contract Period:

Year	**Waste Quantity (in tonnes)**
1	
2	
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Year 1 denotes the period beginning from COD until the corresponding end of the Financial Year i.e. 31st March

Year 2,3,4… denotes the Financial Year beginning 1st April and ending at 31st March unless for Year 10 which denotes the Financial Year beginning 1st April and ending at the Termination Date.

In case of early determination of this Agreement, the interpretation of this clause shall according be modified to read the last year as the year in which the Termination Date falls.

Schedule G Performance Evaluation Framework

Performance Measurement of MSW Treatment for the City of ***	
Time of Inspection From To	Date
Performance Measured By Name Designation Signature 1 2	

Section A: Daily Evaluation

Treatment of Bio-degradable MSW through bio-methanation

Performance Factors	**Yes / No**
1. Mixer is working without any hassle. Whether the slurry gets properly filtered and filters are not getting clogged?	
2. IS the drain from slurry tank to water recycling tank working properly?	
3. Incidents of rodents & flies?	
4. Breakdown/ Malfunctioning of plant?	
5. Removal of pre-process and post-process rejects from the site?	
Payment dedn. If any of the above criteria are not met	2.50%

Section B: Random checks with regards to Air Pollution

Ambient air quality measurement (at the boundary of the site on the down wind direction)

S.No.	**Parameters**	**Acceptable levels**	**Satisfactory: Yes / No**
(i)	Sulphur dioxide	120 μ g/m^3 (24 hours)	
(ii)	Suspended Particulate Matter	500 μ g/m^3 (24 hours)	
(iii)	Methane	Not to exceed 25 per cent of	

		the lower explosive limit (equivalent to 650 µg/m^3)	
(iv)	Ammonia daily average (Sample duration 24 hrs)	0.4 mg/m^3 (400 µ g/m^3)	
(v)	Carbon monoxide	1 hour average: 2 mg/m^3 8 hour average: 1 mg/m^3	
Payment deduction if Ambient air quality is not met: 2.50%			

Section C: Monthly

Compost quality measurement (only if intended to be used for food crops)

Parameters	Concentration not to exceed * (mg/kg dry basis, except pH value and C/N ratio)	Concentration measured	Satisfactory: Yes/No
Arsenic	10.00		
Cadmium	5.00		
Chromium	50.00		
Copper	300.00		
Lead	100.00		
Mercury	0.15		
Nickel	50.00		
Zinc	1000		
C/N ratio	10:1 – 15:1		
PH	7.5-8		

Process Checks (mandatory)

Parameters	Not to exceed/ Desired result	Measured level/ Observation	Satisfactory: Yes/No
pH of feed slurry	7 - 8		
pH of pre-digested slurry	4.5 – 6		
Colour of pre-digested slurry	Yellow		
pH of digested slurry	7 – 8		
Colour of digested slurry	Black		

Payment deduction if above criteria are not met for the Month: 2.50%

Section D: Random Check with regards to Leachate generation / disposal

Recycled water disposal standards

S. No	Parameter	Standards for the various modes of disposal of Leachate		
		Disposal standards	Measurement recorded	Does it violate the minimum / maximum standard: Yes / No
1.	Bio-chemical oxygen demand, ppm, max	100		
2.	Chemical oxygen demand ppm, max.	200		
3.	Methane composition %, min.	70		
Payment deduction if any one of the Leachate standards are not satisfied: 2.50 %				

Schedule G Schedule of Rates quoted by the Developer during the bidding stage

Financial Year Beginning	Amount in Rs. per month

Schedule H Sampling Procedure

(i) The Waste is first unloaded on to a clean and impervious hard surface.

(ii) The Waste is then thoroughly mixed with the help of a spade and a cone is formed of the Waste.

(iii) The cone of Waste is then flattened and divided into four quarters.

(iv) Remove two opposite quarters and mix together the remaining two quarters.

(v) Repeat the process until a sample having approximately 20% of the original waste volume is obtained.

(vi) After such a representative sample is obtained, segregate the waste based on biodegradable, non-biodegradable waste.

(vii) Weigh the biodegradable waste and divide it by the total sample weight.