MAHARASHTRA POLLUTION CONTROL BOARD

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Mumbai - 400 022.

No: BO/MSWA/B- 2884

Date: 23/05/2011

FORM -III
[See – Rule 6 (3)]

To,
The Commissioner
Pune Municipal Corporation
Pune

Sub: Authorization under Municipal solid waste (Management and Handling) Rules, 2000

Ref : Your application for grant of authorization dated 17/01/2010

The Maharashtra Pollution Control Board after examining the proposal hereby authorizes The Commissioner, Pune Municipal Corporation, having their administrative office at, Pune, to set up and operate waste processing / waste disposal facility at various locations mentioned in the Annexure-I, on the terms and conditions (including the standards to be complied with) attached to this authorization.

1. The validity of the authorization is till 30/04/2012. After the validity, renewal of authorizations is to be sought.
2. The Maharashtra Pollution Control Board may at any time revoke any of the condition applicable under the authorization and shall communicate the same in writing.
3. Any violation of provisions of Municipal Solid Waste (Management & Handling) Rules, 2000 attracts the penal provisions of the Environment (Protection) Act, 1986 (29 of 1986).

This is issued with the approval of Consent Appraisal Committee of the Board in its meeting held on 30th April, 2011.

(Radheshyam Mopalwaar, IAS)
Member Secretary

D. A. - Annexure-I
Copy f. w. cs-
The District Collector, Pune - Being one of the implementing authorities, having overall responsibility for the enforcement of the provisions of Municipal Solid Wastes (M & H) Rules, 2000, it is obligatory on your part to see that the Municipal Solid Waste is processed & disposed off in accordance with the said Rules.

Copy to:
1) Regional Officer, MPCB, Pune/Sub Regional Officer, MPCB, Pune
- For information and necessary action.
2] Master File

सह महापालिका आयुक्त घनकचरा व्यवस्थापन/घ.क.व्य./दि.२२/५/११

सह. महापालिका आयुक्त
घनकचरा व्यवस्थापन/सह.डेपो
पुणे महानगरपालिका

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ANNEXURE -I

...ms & Conditions to Set Up and Operate Municipal Solid Waste Processing/ Waste Disposal ...facility by The Commissioner, Pune Municipal Corporation.

1. 2048 MT/day of Municipal Solid Waste projected to be generated shall be processed and disposed as below.

i.

Sr. No	Operating Agency	Location of waste processing site	Municipal Waste	Method of Treatment
1	M/s Rochem Separation Systems PVt. Ltd., Mumbai	Plot No.86,TPS-2, Hadapsar Industrial Estate, Pune	700MT/day	Pyrolysis Gasification
2	M/s Hanjar Biotech energy	Uruli Devachi Fursungi	1000MT/day	Combustion RDF
3	M/s Ajinkya Bio Fertilizes	Hadapsar MSW Ramp	250MT/day	Vermicompost
4	M/s Disha Waste Management Pvt. Ltd.	Hadapsar Ind. Estate(II) Final Plot No. 87 Ramtekdi Hadapsar Pune	100MT/day	Vermicompost
5	Pune Municipal Corp.	Hadapsar Ramp-II	05MT/day	Bio-Methanation
6	Pune Municipal Corp.	Vanvadi Biogas	05MT/day	Bio-Methanation
7	Pune Municipal Corp.	Katraj Ramp-II	05MT/day	Bio-Methanation
8	Pune Municipal Corp.	Pestive Udyan	05MT/day	Bio-Methanation
9	Pune Municipal Corp.	Aundh Kachra Ramp	05MT/day	Bio-Methanation
10	Pune Municipal Corp.	Yerawda Biogas	05MT/day	Bio-Methanation
11	Pune Municipal Corp.	Hadapsar Ramp	05MT/day	Bio-Methanation
12	Pune Municipal Corp.	Ghole Road	03MT/day	Bio-Methanation
13	Pune Municipal Corp.	Bhavdhan Khurd	05MT/day	Bio-Methanation
14	Pune Municipal Corp.	Katraj Ramp-I	05MT/day	Bio-Methanation

Note:The corporation should not establish and or operate any of the plant if falls under RRZ policy, 2009.

ii. Segregated waste like metallic paper, plastic etc. shall be Disposed through rag pickers by sale for recycle.

iii. Construction debris/ and such other innocuous material shall be disposed off by sanitary land filling.

iv. The non biodegradable inert waste, residues of waste processing facilities as well as pre processing rejects from waste processing facilities shall be disposed off by sanitary landfill.

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1] Old quarries and low-lying areas within a city may be earmarked for filling only with construction waste, debris, road- waste, road dust, silt from open drains & other any non- toxic inert material, without any prior preparation. After filling, such sites should preferably be reserved as open spaces, parks, playgrounds, exhibition- grounds or parking - lots with trees.

2] The odour nuisance from the site can be controlled by periodic spraying of microbial culture or any suitable method.

3] At the initial stage of collection of Municipal Solid Wastes the waste minimization and segregation shall be carried out to avoid burden on the waste processing site.

2. The municipal authority shall comply with these rules as per the implementation Schedule laid down in Schedule I as per MSW (M &H) Rules, 2000.

3. Conditions for Landfill sites -

i. The landfill site shall be planned and designed with proper documentation of phased construction plan as well as closure plan.

ii. Bio-medical waste shall be disposed off in accordance with the Bio Medical Waste (Management & Handling) Rules, 1998 and Hazardous Waste shall be management in accordance with the Hazardous Waste (Management & Handling) Rules, 1989 as amended from time to time.

iii. The landfill site shall be large enough to last for 20 to 25 years.

Iv. The landfill site shall be away from habitation, clusters, forest areas, water bodies, monuments, national parks, wet lands and places of important cultural, historical or religious interests.

V. A buffer zone shall be maintained around landfill site and shall be incorporated in the Town Planning Department's land-use plans.

Vi. Landfill site should be 20 Kms away from airport including airbase. Necessary approval of airport or air base authorities prior to the setting up the landfill site shall be obtained in case where the site is to be located Within 20 Km of an airport or an airbase.

4. Facilities at the site :

i Landfill site shall be fenced and hedged and provided with proper gate to Monitor incoming vehicles or other modes of transportation.

ii. The landfill site shall be protected to prevent entry of unauthorized persons and stray animals.

iii. Approach and other internal roads for free movements of vehicles and other machineries shall exist at the landfill site.

iv. The landfill site shall have wastes inspection facilities to monitor waste brought in for landfill, office facilities for record keeping and shelter for keeping equipments and machineries including pollution monitoring equipments.

v Provisions like weigh bridge to measure quantity of waste brought at landfill Site, fire protection equipments and other facilities as may be required shall be provided.

vi. Utilities such as drinking water (preferably Bathing facilities for workers) and lighting arrangements for easy landfill operations when carried out in night hours shall be provided.

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vii. Safety provisions including health inspection of workers at landfill site shall be periodically made.

Specifications for land filling :

i. Waste subjected to land filling shall be compacted in thin layers using landfill compactors to achieve high density of the wastes. In high rainfall areas where landfill compactors cannot be used, alternative measures shall be adopted.

ii. Wastes shall be covered immediately or at the end of each working day with minimum 10 cm of soil, inert debris or construction material till such time wastes processing facilities for composting or recycling or energy recovery are set up as per schedule-I.

iii. Prior to commencement of monsoon season and intermediate cover of 40-60 cm thickness of soil shall be placed on the landfill with proper compaction and gardening to prevent infiltration during monsoon. Proper drainage berms shall be constructed to divert run off away from the active cell of the landfill.

iv. After completion of landfill, the final cover shall be designed to minimize infiltration and erosion. The final cover shall meet the following specifications

viz. - a. The final cover shall have barrier soil layer comprising of 60 cm of clay or amended soil with permeability less than 1×10^{-7} cm/sec.
b. On top of barrier soil layer, there shall be drainage layer of 15 cm.
c. On top of the drainage layer there shall be a vegetative layer of 45 cm to support natural plant growth and to minimize erosion.

6. Pollution Prevention -

In order to prevent pollution control problems from landfill operations the following provisions shall be made, namely :-

a] Diversion of storm water drain to minimize leachates generation and prevent Pollution of surface water and also for avoiding flooding and creation of marshy conditions.

b] Construction of non permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) minimum liner specifications shall be composite barrier having 1.5 mm high density polyethylene (HDPE) geomembrane, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1×10^{-7} cm/sec.

The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer.

c] Provisions for management of leachates collection and treatment shall be made. The treated leachates shall meet the standards specified in Schedule-IV.

d] Prevention of run-off from landfill area entering any stream, river, lake or pond.

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r Quality Monitoring:-

Before establishing landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 meters of the periphery of landfill site shall be periodically monitored to ensure that the ground water is not contaminated beyond acceptable limit as decided by the Ground Water Board or the State Board. Such monitoring shall be carried out to cover different seasons in a year that is summer, monsoon and post monsoon period.

ii. Usage of groundwater in and around landfill sites for any purposes (including drinking and irrigation) is to be considered after ensuring its quality. The following specifications for drinking water quality shall apply for monitoring purposes namely:-

S. No.	Parameters	IS 10500 1991 Desirable limit (mg/l except for pH)
1	Arsenic	0.05
2	Cadmium	0.01
3	Chromium	0.05
4	Copper	0.05
5	Cynide	0.05
6	Lead	0.05
7	Mercury	0.001
8	Nickel	-
9	Nitrate as NO3	45
10	pH	6.5-8.5
11	Iron	0.3
12	Total hardness (as CaCO3)	300
13	Chlorides	250
14	Dissolved solids	500
15	Phenolic compounds (as C6H5OH)	0.001
16	Zinc	5
17	Sulphate (as SO4)	200

Ambient Air Quality Monitoring:

i. Ambient air quality at the landfill site and at the vicinity shall be monitored to meet the following specified standards, namely :-

S. No.	Parameters	Acceptable levels
1	Sulphur Dioxide	80 ug/m3 (24 hrs)
2	Suspended Particulate Matter	500 ug/m3 (24 hrs)
3	Methane	Not to exceed 25% of the lover explosive limit (equivalent to 650 mg/m3)
4	Ammonia daily average (sample duration 24 hrs)	0.4 mg/m3 (400 ug/m3)
5	Carbon monoxide	1 hour average : 2 mg/m3 8 hour average : 1 mg/m3

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The ambient air quality monitoring shall be carried out by the concerned authority as per the following schedule, viz.

a. Six times in a year for cities having population of more than 50 lakhs
b. Four times in a year for cities having population between 10 & 50 lakhs
c. Two times in a year for town or cities having population between 1 & 10 lakhs.

9. Plantation at landfill site :

A vegetative cover shall be provided over the completed site in accordance with the following specifications, viz.

a. Selection of locally adopted non edible perennial plants that resistant to drought and extreme temperatures shall be allowed to grow,

b. The plants grown be such that their roots do not penetrate more than 30 cm. This condition shall apply till the landfill site is stabilized.

c. Selected plants shall have ability to thrive low nutrient soil with minimum nutrients addition.

d. Plantation to be made in sufficient density to minimized soil erosion.

10. Closure of landfill site and Post-care:

i. The Post-care of landfill site shall be conducted for at least 15 years and long term monitoring or care plan shall consist of the following, viz.

a. Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover,
b. Monitoring leachate collection system in accordance with the requirement,
c. Monitoring of ground water in accordance with the requirements and maintaining ground water quality.
d. Maintaining and operating the landfill gas collection system to meet the Standards.

ii. Use of landfill site after 15 years of post closure monitoring can be considered for human settlement or otherwise only after ensuring that gases and leachates analysis comply with the specified standards.

11. Standards for Composting and Treated Leachates -

i. The waste processing or disposal facilities shall include composting, palletisation, energy recovery or any other facility based on state- of the art technology duly approved by the Central Pollution Control Board.

ii. In case of engagement of private agency by the municipal authority, a specific agreement between the municipal authority and the private agency shall be made particularly, for supply of solid waste and other relevant terms and conditions.

iii. In order to prevent pollution problems from compost plant and other processing facilities, the following shall be complied with, namely :-

a] The incoming wastes at site shall be maintained prior to further processing. To the extent possible, the waste storage area should be covered. If such storage is done in

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an open area, it shall be provided with impermeable base with facility for collection of leachate and surface water run-off into lined drains leading to a leachate treatment and disposal facility;

b] Necessary precautions shall be taken to minimize nuisance of odour, flies, rodents, bird menace and fire hazard;

c] Pre-process and post-process rejects shall be removed from the processing facility on regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclables shall be sent for well designed landfill sites(s);

d] In case of compost plant, the windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay, 50 cm thick, having permeability coefficient less than 10^{-7} cm/sec. The base shall be provided with 1 to 2 percent slope and circled by lined drains for collection of leachate or surface run-off;

e] Ambient air quality monitoring shall be regularly carried out particularly for checking odour nuisance at down wind direction on the boundary of processing plant;

f] In case of breakdown or maintenance of plant, waste infect shall be stopped and arrangements be worked out for diversion of waste to the landfill site.

iv. In order to ensure safe application of compost, the following specification for compost quality shall be met, namely

Parameters	Concentration not to exceed * (mg/kg dry basis, except pH value and C/N ratio)
Arsenic	10
Cadmium	5
Chromium	50
Copper	300
Lead	100
Mercury	0.15
Nickel	50
Zinc	1,000
C/N ratio	20-40
pH	5.5 to 8.5

* Compost (final product) exceeding the above stated concentration limit shall not be used for food crops. However, it may be utilized for purpose other than growing food crops.

v. The disposal of treated leachates shall follow the following standards, namely :-

Sr. No.	Parameter	Standards (Mode of disposal)		
		Island surface water	Public sewers	Land disposal
1	Suspended solids, mg/l, max	100	600	200

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2	Dissolved solids (inorganic) mg/l, max	2,100	2,100	2,100
3	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4	Ammonical nitrogen (as N), mg/l, max	50	50	-
5	Total Kjeldahl nitrogen (as N) mg/l, max	100	-	-
6	Biochemical oxygen demand (3 days at 27 C) max, mg/l	30	350	100
7	Chemical oxygen demand, mg/l, max	250	-	-
8	Arsenic (as As), mg/l, max	0.2	0.2	0.2
9	Mercury (as Hg), mg/l, max	0.01	0.01	-
10	Lead (as pb), mg/l, max	0.1	1	-
11	cadmium (as cd), mg/l, max	2	1	-
12	Total chromium (as Cr), mg/l, max	2	2	-
13	Copper (as Cu), mg/l, max	3	3	-
14	Zinc (as zn), mg/l, max	5	15	-
15	Nickel (as Ni), mg/l, max	3	3	-
16	Cynide (as Cn), mg/l, max	0.2	2	0.2
17	Chloride (as Cl), mg/l, max	1,000	1,000	600
18	Fluoride (as F), mg/l, max	2	1.5	-
19	Phenolic Compounds (as C6H5OH), mg/l, max	1	5	-

Note : While discharging treated leachates into inland surface waters, quantity of leachates being discharged and the quantity of dilution water available in the receiving water body shall be given due consideration.

12. Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for the infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

13. All municipal solid waste generated in a city or a town, shall be managed and handled in accordance with the compliance criteria and the procedure laid down in Schedule-II.

14. The municipal authority shall furnish its annual report in Form-II, to the District Magistrate or the Deputy Commissioner with a copy to the Maharashtra Pollution Control Board, on or before of the 30th day of June every year.

15. When an accident occurs of any municipal solid wastes collection, segregation, storage, processing, treatment and disposal facility or landfill site or during the transportation of such wastes, the municipal authorities shall forthwith report the accident in Form-V to the Secretary In charge of the Urban Development Department in metropolitan cities and to the District Collector in all other cases.

16. The waste processing and disposal facilities to be setup by the Municipal Authority On their own or through an operator of a facility shall meet the specifications and Standards as specified in schedule-III and IV.

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ROCHEM
SEPARATION SYSTEMS
Rochem Separation Systems (India) Pvt. Ltd.
101, Dheeraj Arma, Anant Kanekar Marg
Bandra (East)
Mumbai – 400 051, India

To
Hon. Deputy Commissioner
Pune Municipal Corporation
Pune

Maharashtra

Ref: ROC/PUN/3/2010
Date: 30th. July, 2010

Kind Attention: Sri Suresh Jagtap

Sub: Proprietary Information of Detailed Project Report for proposed Waste to Energy for disposal of solid waste of 700 tonnes per day
Ref.: Your Letter of Intent with Ref. No. – 517 dated 28th. June, 2010

Respected Sir,

This has reference to the Letter of Intent for award of solid waste disposal contract to M/S Rochem Separation Systems (I) Pvt. Ltd. as per the EoI dated 28th. July, 2009. and subsequently, the Hon. Standing Committee Resolution No. 208, dated 19th. May, 2010.

We would like to state, that the Detailed Project Report, submitted by M/S Rochem Separation Systems (I) Pvt. Ltd. In line with Clause I, Pt. 2 of the referred LoI, is a confidential document containing business information alongside details of technology which forms the basis of our solution offered to Pune Municipal Corporation.

We would request the Corporation to kindly consult us, prior to divulging the details of the solution based on which, Rochem has offered its solution to PMC, since it violates our business confidentiality. We remain open towards clarifying any third party queries if raised from the latter. However, we would wish to keep the business details of the solution confidential to protect our commercial interests.

We remain confident of your support in the aforementioned subject.

Assuring you of the best of our services!

Sincerely

For Rochem Separation System Pvt. Ltd.

Soumya Bhattacharya
Business Development Manager

2/C/10

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Detailed Project Report for Municipal Solid Waste Management of 700 TPD Pune Municipal Corporation

CONCORD BLUE

ROCHEM GREEN ENERGY PVT. LTD.

CONFIDENTIALITY

This document is being submitted to Pune Municipal Corporation by ROCHEM GREEN ENERGY PVT. LTD. AND GROUP on the explicit understanding that the contents would not be divulged to any third party without prior written consent from the MoU Group.

Submitted By ROCHEM GREEN ENERGY PVT. LTD.

Address: 101, Dheeraj Arma, Near Bandra Court, Bandra (E), Mumbai, 400015.

Tel. +91 - 22 - 67049000

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Email : ct@the-bluetower.com

Submitted To Pune Municipal Corporation

Municipal Commissioner

Shivajinagar

Pune - 41005

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Contents

EXECUTIVE SUMMARY 3

1. SECTION 1: SCENARIO ANALYSIS 10
   - BIOMASS GENERATION AND DISPOSAL IN INDIA 10
   - PMC WASTE DISPOSAL SCENARIO 12
2. SECTION 2: TECHNOLOGY COMPARISON 15
3. SECTION 3: PROJECT METHODOLOGY 22

DEFINITION 22

PLANT DATA 24

METHODOLOGY 25

BENEFITS TO PMC 34

4. SECTION 4: PROJECT GOVERNANCE 35
5. SECTION 5: IMPACT OF THE PROJECT 52
6. SECTION 6: PROJECT QUALITY 53
7. SECTION 7: COMMERCIALS 54

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Executive Summary

ROCHEM GREEN ENERGY PVT. LTD. is delighted to partner with Pune Municipal Corporation (PMC) in implementing its turn-key, customized waste to energy solution* under a Build Own Operate Transfer (BOOT) model in disposition of its Municipal Solid Wastes as well as generate high quality syngas to produce power from therein for a load of 700 Tonnes per day of Segregated MSW. Rochem Green would utilize its unique patented know-how in treatment of solid wastes to ensure minimal emissions to the atmosphere and adhere to established norms within the industry. Further to this, Rochem Green would deliver a clean green solution with for PMC in this venture.

*

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Brief introduction to Rochem Green company background

Contact Information

Country	Address
India	101, Dheeraj Arma, 1st. Floor, Anant Kanekar Marg, Bandra (E), Mumbai - 400 051. Tel. - +91 - 22 - 67049000 Fax - +91 - 22 - 6704 9010 Web: www.concordblueenergy.com
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About Us

Rochem Green Energy Pvt. Ltd. Is a waste to Energy Company offering turn-key solutions to disposal of wastes from a wide range of sources. As comprehensive waste-solution innovator, Rochem Green delivers environmentally friendly, economically viable, turn-key, waste-to-energy solutions. As the official manufacturer and contractor for the Concord Blue Tower, we hold worldwide patents (pending) and are the only company that provides this turn-key, carbon-neutral, waste-to-energy technology. We offer the following features in our solution:

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1. Accommodate small to very large volumes of waste e.g. be a scalable system that is economically viable and self-sustaining;
2. Decentralized system - capable of working in remote / extreme conditions;
3. Stand-alone system - no special infrastructure or utility requirements;
4. Self-perpetuating system - minimal additional fuel sources needed (only for startup);
5. No specific segregation required for MSW, other than inerts removal;
6. Safe disposal even for plastic wastes
7. Fully automated system - easy and cost-effective to operate;
8. Environmentally friendly - meets or exceeds all regulatory standards;
9. Tailor-made scalability and flexibility - Is able to handle different through-put feedstock volumes and varying multi-waste input (from 40 pounds/hr to 20 tons/hr)
10. High efficiency - regardless of scale, the system is highly efficient
11. High flexibility - total control of plant in order to maximize desired output depending on current economics, i.e. produce maximum electricity2 during peak use hours and then produce maximum amounts of biochar during off-peak hours.

About Rochem Green's Waste to Energy Practice

The offered system is a revolutionary, waste-to-energy, close coupled Pyrolysis - gasification technology that provides the cleanest and most efficient platform for managing waste disposal and creating sustainable green energy.

In order to maximize plant profitability, Rochem Green can variably control each plant's operation to accommodate different waste streams and to maximize production of selected end-products: up to 60% biochar, up to 80% electricity or any ratio in between, depending on client take-off agreements for or other needs. For example, if one has negotiated an electric power purchase agreement for peak demand times, the plant can be programmed to produce more electricity during peak hours and then to produce maximum amounts of biochar during off-peak hours. Each system - anywhere in the world - can be easily controlled via an internet connection by Rochem Green engineers (on request basis) who will custom program the desired energy output(s) to exact client specifications while monitoring the plant's operation to maintain top efficiency.

- Multi-feedstock waste input capability: utilizes any mix of organic-based materials;
- Produces high value / high quality, hydrogen-rich, syngas;
- Produces high value biochar - and allows output to be tuned to meet client demands;
- High input and output flexibility - easy, complete plant control
- Highest input to output ratio: 1 ton waste input ≈ (upto) 1.3 MW electricity net output
- High efficiency rate (about 80%);
- Clean, green energy with lesser CO_2 emissions than a small car;
- Meets or exceeds all EPA and renewable energy emissions requirements worldwide;
- Process creates no pollutants or releases heavy metals;
- Self-sustaining plant: no additional fuel source needed to operate;
- No additives required: no water (assuming feedstock has 15% of higher moisture content), external fuel source(except initial start-up), chemicals or bacteria;
- Low space requirements with no odours and low noise;
- Closed-circuit production system eliminates emissions (fossil fuel) and promotes efficiency;

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- Qualifies for operation in residential areas;
- Owners / operators receive certified carbon credits for sale/trade.

Technology

The System uses regenerative feedstock like municipal sewage sludge cake, woody biomass, household garbage/municipal solid waste (MSW), hospital and related bio-medical waste, hazardous industry waste, plastic waste, manure or agriculture waste to produce clean, renewable, CO_2-neutral, high energy content syngas.

We turn classical gasification upside down. Conventional gasification plants typically turn input biomass material into a product (also called producer gas, syngas or synthesis gas) by means of pyrolyzing it into biochar and gasifying the material by introducing air (as an oxygen source). The poor quality, low energy syngas that results is then used to create energy through heat via steam turbines.

In contrast, the CBS uses a multi-stage process, beginning with Pyrolysis to create a product gas and biochar. Some of the biochar is then combusted to create the heat needed for the process, making the plant self-sustaining. The syngas is then reformed with steam input in a second stage and further refined to produce a very high quality gas product.

Approvals

The technology of Gasification, as patented (pending) by Rochem Green has special approvals/subsidies from the State. It has received support from the Central Government for Waste-to-Energy Projects and various Incentives are made available to it, as outlined in table 2.6 detailed below.

Table 2.6 Incentives under the National Program on Energy Recovery

Program	*Incentive*
Project for power generation from municipal solid waste involving refused-derived fuel	Rs 1.5 crores per megawatt
Power project based on high-rate biomethanation technology	Rs 2 crores per megawatt
Demonstration project for power generation from municipal solid waste based on gasification-pyrolysis and plasma arc technology	Rs 3 crores per megawatt
Biomethanation technology for power generation from cattle dung, vegetable market waste, and slaughterhouse waste above 250 kilowatt capacity	50% of project cost; maximum of Rs 3 crores per megawatt
Biogas generation for thermal application	Up to Rs 1 crore per megawatt equivalent
Project development assistance	Up to Rs 10 lakhs per project
Training course, seminar, workshop	Rs 3 lakhs per event

Source: Author.
Note: 1 lakh equals 100,000 rupees; 1 crore equals Rs 10 million.

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Scope of Services

In Scope Activities

Rochem Green will provide the following support leveraging its delivery capability. The following activities are considered as Rochem Green's scope of work for this engagement:

- Engineering of requisite components
- Procurement and supply of CB system components
- Pre conditioning of MSW
- Site Preparation
- Design, erection and Commissioning;
- All instrumentation and cabling within the CB system
- All equipments for erection and commissioning

Out-Scope Activities

The following services and/or functions are excluded from the scope of this response:

- Conveyance of MSW upto onsite MSW storage unit.
- Provisioning of Freehold lease land as required for plant setup;
- All cabling outside the CB systems
- Provisioning of Utilities

Key objectives of PMC are:

- Obtain an environmentally friendly & economically viable MSW disposal solution;
- Meet Environmental and State permitting & emission regulations;
- Qualify for Carbon Credits (sharing basis);
- Provide a secure and easily calculable investment opportunity with a high Return on Investment.
- Create Jobs

**The detailed scope will be discussed while freezing project specifications;*

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Value Proposition to PMC

An over view of the value additions that will be leveraged by PMC from this engagement with Rochem Green are stated below:

Rochem Green's Value Proposition	Description	Benefits to PMC
Flexibility	The plant is extremely scalable and capable of taking fluctuating loads	PMC would have the flexibility to vary its input material (however, we would have to agree upon a minimum threshold quantity) . Also, depending on the requirements, it could generate requisite quantities of syngas and Biochar;
Decentralized system	Able to work in extreme conditions	The climate prevailing at the Geography will not be a concern as the plant is designed to run at stated climates
Self Perpetuating System	Minimal Auxiliary fuel is required	One of the greatest advantages of this plant is that it is self sustaining, resulting in minimum additional fuel being used, as it utilizes a fraction of the syngas it generates to provide it with the requisite heat, thereby providing huge cost advantages to PMC
Clean Process	Process creates no heavy metals or toxic substances	One of the challenges faced by current disposition techniques of MSW are the production of toxic gases which are biologically harmful; The Rochem Green Tower produces a high quality syngas devoid of any toxic gases (which are inhibited from being produced) thereby ensuring that the environment and prevailing life forms are in no way endangered;

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Commercials

Rochem Green would like to propose a 30 Yr. Agreement in line with the requirements of PMC, for treatment and disposition of MSW under a Build-Own-Operate-Transfer model.

A tipping fee of Rs. 300/MT would be charged to PMC as a cost of avoidance of disposal. This would amount to approximately Rs. 765 lacs/annum based on the total MSW made available each year, and would be payable on a monthly basis.

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1. Section 1: Scenario Analysis

• Biomass Generation and Disposal in India

India also produces huge amounts of biomass that is infinitely sustainable if managed properly. Biomass can be efficiently and sustainably transformed into a variety of green energy end-products with high commercial value that also earn carbon offset credits; these include green electricity, biofuels and densified (pelletized) biochar or biocoal pellets that can be used for residential and industrial heating, or co-fired with coal for cleaner power generation. The following image shows an estimate of the Solid Wastes generated in India in the coming decades.

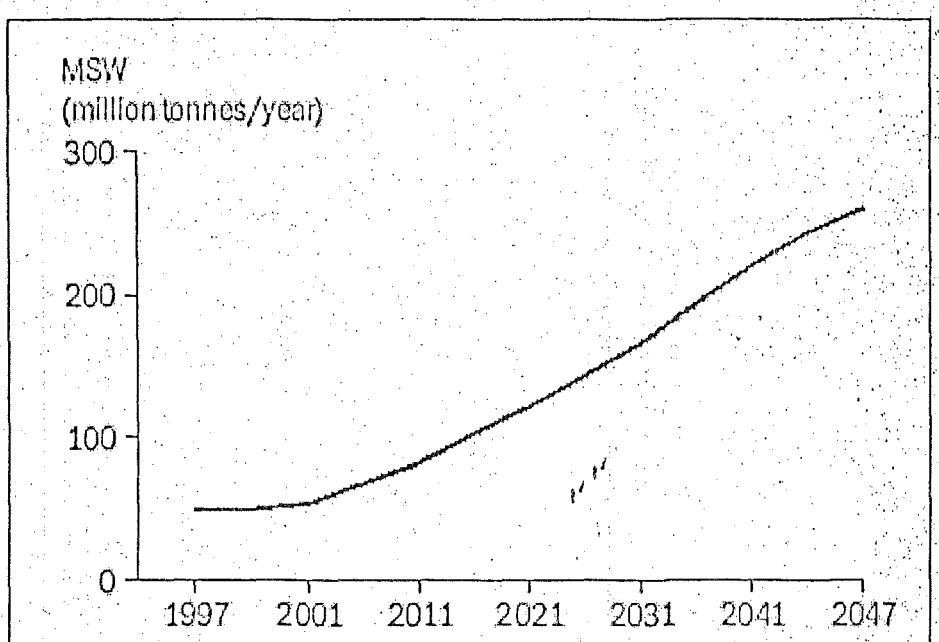

Figure 1 Projected trends in the generation of municipal solid waste (million tonnes/year) according to BAU scenario

Royal Dutch Shell's energy team predicts in its 2008 report that global consumption of all forms of energy will *at least double* between now and 2040 because of population growth and greater distributed wealth and consumption driven by the globalization of markets. This will result in more people consuming more products and energy while producing more sewage and waste of all kinds.

By utilizing an end-product of our waste-to-energy system - BIOCHAR or BIOCOAL - we can, not only provide a cleaner alternative for coal, but provide a natural fertilizer. In both cases we are considerably saving the use of fossil fuels (natural gas for hydrogen/ammonia as fertilizer & coal).

According to the International BioChar Initiative, the world's leading scientific authority on the subject, biochar is a fine-grained charcoal high in organic carbon and largely resistant to

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decomposition. As a soil amendment agent, biochar creates a nearly permanent soil carbon pool that is carbon-negative, making a net withdrawal of atmospheric carbon dioxide by storing carbon in the soil. Greenhouse gases (mainly CO2) not only cause global warming but an array of harmful effects to our environment, agriculture and wild life. The enhanced nutrient and carbon retention capacity of biochar-amended soil not only reduces total fertilizer requirements but also the climactic and environmental impact of expanding croplands. Char-amended soil research has shown 50 - 80 percent reductions in nitrous oxide emissions, reduced runoff of phosphorus into surface waters, and reduced leaching of nitrogen into groundwater.

Rochem Green offers an affordable solution to multiple waste-related problems by providing an environmentally friendly, long term, economically sustainable solution that can process huge amounts of biomass - and virtually any other waste material - to meet today's energy and environmental challenges.

The Threat of Methane Emissions

Indiscriminate landfilling leads to deterioration of water quality in neighborhood areas of landfill sites due to contamination by leachate from the landfills. This has adverse health impacts on people living nearby, causes bad odours, and the people living nearby live in the constant fear of explosion of methane gas that can accumulate at the landfill sites. Landfill gas, which is 50%-60% methane, contributes significantly to global warming. It is estimated that in 1997, the landfills released about 7 million tonnes of methane into the atmosphere, which would increase to 39 million tonnes by 2047 under BAU scenario (Figure 3). Emissions have been calculated using Bingemer and Crutzen's (1987) approach, which assumes that 50% of the carbon emissions in the landfills are transformed into methane. The following image shows an estimate of the Methane generation upto the year 2047.

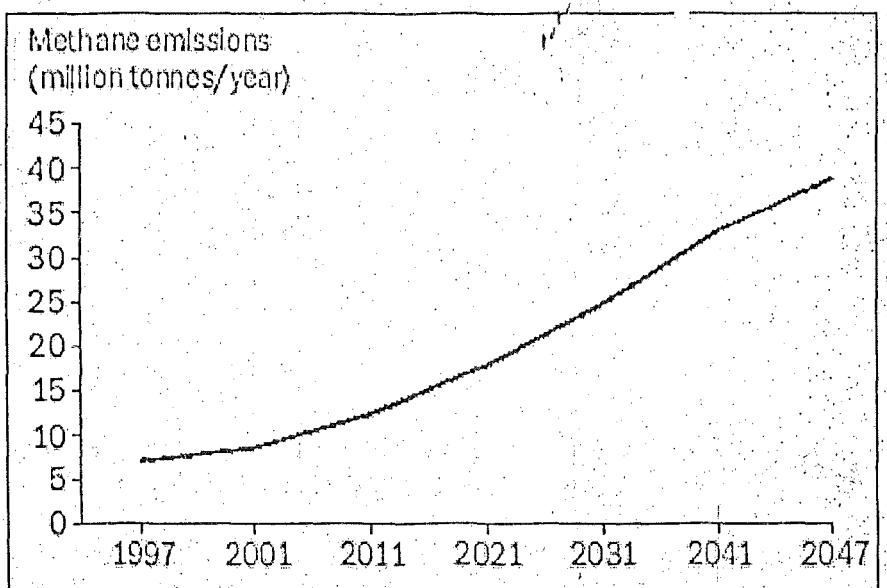

Figure 3 Emission of methane from landfills

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Land Requirement

The burden that the increase in solid waste generation would impose is evident from the fact that the cumulative requirement of land (base year 1997), for disposal of MSW, would amount to around 1400 km2 by 2047 (Figure 2).The estimates under the BAU scenario are made considering the average collection efficiency of waste as 72.5%, average depth of landfill site as 4 m, and average waste density as 0.9 tonne/m3 (NIUA 1989). Diversion of land for waste disposal would be physically impossible since areas with the largest concentration of solid waste would also be the areas with serious scarcity of vacant land. The implication, therefore, is that if the current methods of solid waste disposal persist, the waste would have to be carried over long distances, which would require the creation of a great deal of transport facilities and infrastructure. This would involve enormous additional finances. The following image shows the estimate of the land requirements for the next half of the century.

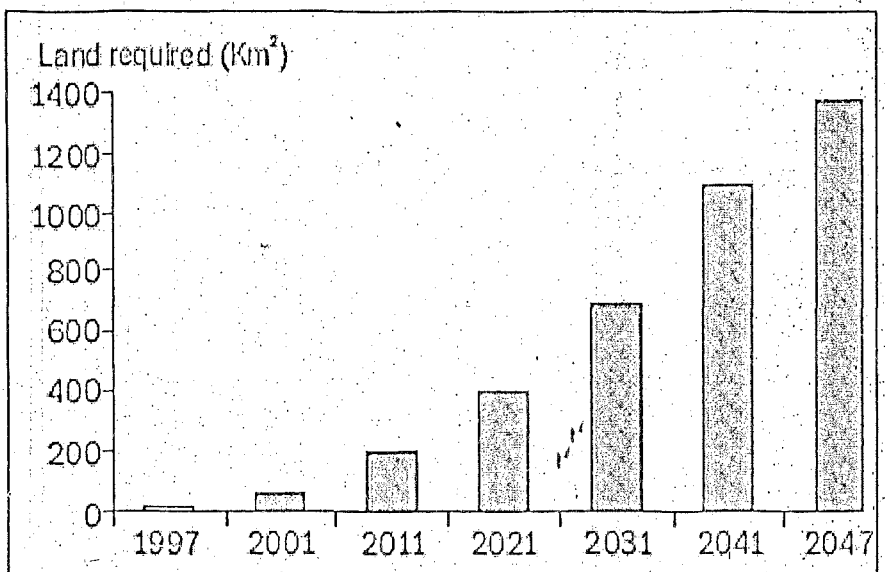

Figure 2 Cumulative land requirement for disposal of municipal solid waste (Km^2)

- PMC Waste Disposal Scenario

PMC has its waste disposal landfill site at Uruli Devachi with an estimated existent waste of 3 Million tonnes and a further input of 1200 tonnes per day of waste generation. The high economic and environmental costs of transporting waste in Pune, India - whether for land filling, incineration or recycling - can be transformed with waste-to-energy processing using state-of-the-art, non-combustion, Rochem Green staged reforming and pyrolysis-gasification technology. Ideally located at or near the site where the waste is produced, virtually ANY waste stream - including woody biomass, municipal waste, biosolids (animal manure, sewage sludge), plastics, hospital/medical waste, agricultural residues, hazardous waste, contaminated soil and much more - can be converted efficiently, environmentally and safely into pure energy: This case being electricity; Rochem Green also has the

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wherewithal to produce biocoal/biochar, hydrogen gas, high quality syngas and/or biofuels with substantial calorific value.

As per a paper from the Dept. of Environmental Science, the 1200 Tonnes per day of Solid wastes that are deposited in the village of Urali Devachi have caused significant problems due to the unscientific nature of the waste disposal therein. The average annual emission of SPM found at the disposal site is 1708.3 µg/m3. The average annual emission of SO2 in landfill site is 285.33 µg/m3 and NOx is 234.07 µg/m3. The SPM, SO2 and NOx concentrations are more than those stipulated by the Indian standard limit. The leachate samples are acidic and corrosive in nature. The COD and BOD of tested well-water samples III and IV are 834, 703 mg/l and 716, 412.16 mg/l respectively. The concentration of sodium in well-water samples III and IV is 2437 and 2612 mg/l respectively. The COD, BOD and sodium concentration in well water are higher than the limits of IS:. 2291. Rag-pickers, workers, vehicle drivers, and those residing in the nearby areas are continuously exposed to air pollution. It has been found that leachates originate from solid waste landfill-contaminated groundwater. Well water found in Urali-Devachi village is not safe for drinking, outdoor bathing, propagation of aquatic life, industrial cooling and for irrigation. If this municipal solid waste landfill continues, it may create a toxic bomb in future. Conversion technology entailing conversion of solid waste to energy is proving helpful for decomposing solid waste without affecting the environment.

Pune, India is now perfectly positioned to resolve some of the most challenging solid waste problems anywhere in the world, spurred by heightened government, industry and public consciousness and new incentive programs.

The summary of the requirements from this project as envisaged by PMC is as under:

- Preparation of detailed project design for 700 TPD Mixed Solid Waste as per the norms of Maharashtra State Pollution Control Board (MPCB) & MSW rule 2000.
- Coordination & getting approvals/consent for the project from all relevant authorities including MPCB / CPCB.
- Reclaim the land from the existing dumping Area.
- Construction of 700 TPD mixed Solid Waste plant at the land fill site provided by Pune Municipal Corporation within period of 12 months including monsoon.
- Construction of project related activities such as compound wall, weighing platform, internal roads, water lines, drainage lines, storm water drain, watchman quarter etc.
- Actual execution of entire work purely on BOOT/BOT basis for the period of 30 years as per the norms of Maharashtra State Pollution Control Board (MPCB) & MSW Rules 2000.
- Operation & maintenance for 30 years after completion of the project.

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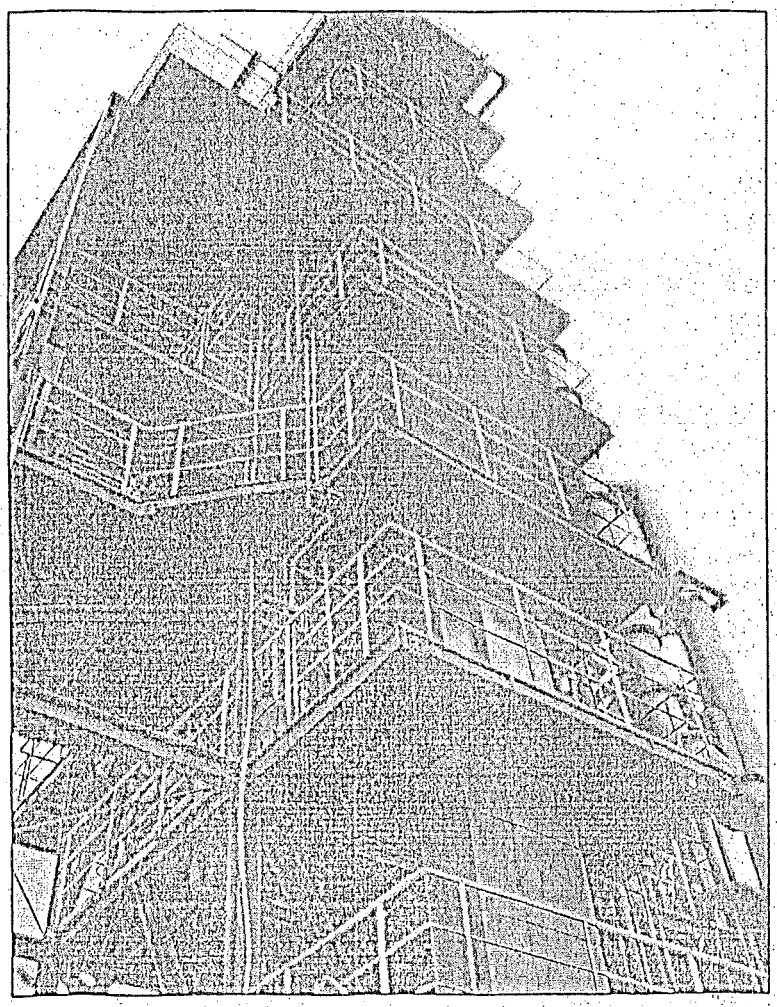

Picture: Blue Tower Plant in Japan

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2. Section 2: Technology Comparison

Current Technologies for MSW Management

The following table outlines the current approaches to disposing of various categories of bio medical wastes:

Technique	Description
Landfill	Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits.
Incineration	Incineration is a disposal method that involves combustion of waste material. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash.
Recycling	PVC, LDPE, PP, and PS (see resin identification code) are also recyclable, although these are not as commonly collected. These items are usually composed of a single type of material, making them relatively easy to recycle into new products.
Composting	An aerobic, biological process of degradation of biodegradable organic matter. Waste materials that are organic in nature, such as plant material, food scraps, and paper products, can be recycled using biological composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes.

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Features of current approaches and comparison with proposed technology

Composting

Composting is the purposeful biodegradation of organic matter, such as yard and food waste. The decomposition is performed by micro-organisms, mostly bacteria, but also yeasts and fungi. There are a wide range of organisms in the decomposer community.

A compostable material biodegrades substantially under specific composting conditions. Large pieces of hardwood may not be compostable under a specific set of composting conditions, whereas sawdust of the same type of wood may be. Some biodegradeable materials are only compostable under very specific conditions, usually with an industrial process.

Composting has the distinction of being the waste management system with the largest number of failed facilities worldwide. In cities of developing countries, most large mixed-waste compost plants, often designed by foreign consultants and paid for by aid from their home countries, have failed or operate at less than 30% of capacity.

The challenges most often cited for the composting process include:

- High operation and management costs;
- High transportation costs, poor quality product as a result of poor pre-sorting (especially of plastic and glass fragments);
- Biowaste composting facilities have generally relied on complex mechanical pre-processing to remove non-compostables. These systems have by and large failed at their tasks. It is an open question as to whether there is any mechanical system which could ever adequately identify and separate all of the materials that occur in mixed waste, but no existing systems do this sufficiently to ensure good compost quality.
- Poor understanding of the composting process, and competition from chemical fertilizers (which are often subsidized).
- In many urban places, collection systems are too unreliable for urban authorities to consider running composting facilities efficiently.
- No recovery of Energy from therein and extremely high seasonal variation;

The economic viability of composting depends on three factors; failure of any of the three can cause the system to fail:

- In the absence of a tradition of composting, landfilling or dumping must be controlled and sufficiently expensive to make the moderate cost of composting (US$20 - 40 per ton) competitive with the cost of dumping.
- There must be a market or use for the compost at the quality it is produced. The market price can dip sharply with an increased production of composting rendering the project unviable.

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- The waste streams composted have a large effect on the quality and marketability of the compost. Support and enhancement of materials recovery of non-compostables is a necessary step in many developing countries, and manual picking and final screening can help. In industrialized and transition countries, the emphasis in sound practice is on source separation.

Cost Economics

Some of the features of the above analysis:

- For the same payback period, the revenue generated for a Waste-To-Energy Solution is around 3 times.
- The Revenue available from the Waste-To-Energy solution after the payback is around 4 times that of composting.
- The demand of Compost at a feasible market price fluctuates far more rapidly than the demand for Electricity and Biochar as available from the Waste-to-Energy solution.
- The Carbon Credits available from diminishing Methane generation as available from Composting is one fifth of that available from producing electricity as available from the Waste-to-Energy solution.
- Further to this, Composting, as stated in Para. 3 above operates around 30% of its capacity, as not all matters are compostable. Hence, the client has to incur a hidden cost of disposal of the rejects resulting from the Composting unit. As in this case, for a 700 TPD load, the Composting unit sends back around 400 TPD which results into an additional expenditure. Not only this, the client looses out on land reclamation as the rejects are sent back to the landfill resulting into further loss of revenue.

Landfill

To date, landfill is the most widely utilized technique for disposal of biomedical wastes but it is also the source infectious organisms and hazardous chemicals. The large number of municipal solid waste (MSW) landfills and the many hazardous materials which they contain pose a serious environmental threat to our groundwater reserves. There are ongoing health and safety issues (and hence legal implications) associated with disposal of untreated MSW. With the availability of suitable landfill sites being reduced, the physical problem of disposing of large volumes of waste must be considered. Disposing of infectious wastes into a landfill greatly increases the risks to human health and the environment of exposure to infection from this source. If the waste is disturbed by any means, or not properly covered, further risks will arise. Leakage of hazardous material into the ground and the resulting contamination of soil and aquifers can have devastating effects on local plant, animal, and human life. Furthermore, the financial cost of detection, delineation and clean-up of contaminated subsurface material and aquifers can run many times the initial cost of the landfill itself.
Generally MSW is collected and deposited in sanitary landfills. Such unscientific disposal practices attract birds, rodents and fleas to the waste dumping site and create unhygienic conditions. The anaerobic decomposition by microorganisms brings about degradation of most of the solid waste. This results in the emission of carbon dioxide (CO2), methane (CH4) and other trace gases8,9. Methane gas

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constitutes about 60% in a solid waste landfill. Methane gas is explosive in nature and causes the burning of solid waste, thus giving rise to air pollution10. Along with methane gas, many toxic, volatile air pollutants are emitted such as chlorinate hydrocarbon compounds like vinyl chloride and tetrachloroethylene from solid waste landfill. These air pollutants cause a plethora of health problems among the nearby residents. During land-filling of solid waste, continuous pressure results in the quizzing of a contaminated liquid as leachate8. Leachate is a liquid emanating from a land-disposal site that contains dissolved, suspended and microbial contaminants from solid waste. The leachate has high organic contents, soluble salts and other constituents capable of polluting groundwater, This polluted groundwater is unfit for drinking and causes jaundice, nausea, asthma, miscarriage and infertility.
Currently it is realized that unscientific solid waste disposal is one of the dominant reasons for global warming.

Incineration

The primary hazard with incineration is the toxic chemicals in the emissions leaving the stack. According to the reports, MSW incineration is one of the leading sources of toxic emissions. These gases may be dispersed over a wide area, settling on the food we eat and the water we drink. Various chlorinated hydrocarbons are synthesized during the incineration process, including the highly toxic chemicals known as dioxins and furans. These are formed during combustions involving chlorine-containing organic materials, at a rate influenced by the temperature of the combustion and the types of material being burned, including the presence of metallic catalysts. The synthesis of dioxins and furans is especially efficient at 572-932°F (300-500°C), when copper, aluminum, and iron are present as catalysts, especially in presence of Oxygen. These reactions are an important consideration when incineration is used to dispose of chlorinated plastics such as polyvinyl chloride (PVC, commonly used to manufacture piping and other rigid plastic products) and polychlorinated biphenyls (PCBs). Dioxins are among the most toxic chemicals on earth, the. Dioxins are Class 1 human carcinogens and according to the EPA, the average human's cancer risk is increased 1000-fold because of dioxin stored in our bodies. Dioxins also cause multiple reproductive and developmental abnormalities. They have been linked to disrupted sexual development, birth defects and damage to the immune system.
Dioxins are extraordinarily persistent in the environment, resisting physical, chemical and biological degradation for decades and longer. Because they are oil soluble, they bioaccumulate in fatty tissue and are found in highest concentrations in dairy products, eggs, meat and fish. Humans are particularly contaminated because of eating at the apex of the food chain. A health analysis of the incinerator burning on communities has shown increased negative health impacts. To cite just a couple of examples: Residents living <1 km from municipal waste incinerators in a locality of research were found to have higher rates of stomach, colon, liver and lung cancer than those living further away. Another study showed greater rates of stillbirths, spina bifida and heart defects in babies born to mothers that lived near incinerators. In Columbus, OH, children who had lived near an incinerator for at least two years were found to have significantly higher cadmium levels in their hair and increased learning and behavioral problems. Several studies in Japan and Korea have shown that incinerator workers and nearby residents had much higher levels of dioxin in their blood than citizens who worked or lived elsewhere. Current legal structures require the pathological wastes to be incinerated. However, pathological wastes form only 2 - 10% of the total bio medical wastes emanating from a system. The balance wastes ought to be disposed off in a more efficient manner so as to ensure the inhibition of production of dioxins and other toxic gases.
Also, the following factor features amongst the drawbacks of Incineration:

- Fuel consumption in Incineration

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Unlike a waste to energy solution like the CBS, incinerators require an additional fuel to dispose of the medical wastes. Usually diesel, kerosene, propane or electricity in presence of air is used in these incinerators to achieve complete combustion of the wastes. While the amount of fuel involved varies commensurate to the calorific value of the input material, estimates show that anywhere around 0.03 - 0.1 kg. of fuel per kg. of solid waste is utilized which adds to a substantial fuel cost (not required in CBS resulting into a direct saving).

Recycling

The biggest drawback of recycling of MSW is that not all materials can be recycled. It leaves a huge portion that has to go for landfill thereby providing additional grounds for leakage to groundwater. Also, Recycling poses a health hazard, not only for ragpickers but also during recycling of plastic. This process doesn't account for any energy recovery.

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Proposed Technology

The Blue tower is significant in its approach as its unique pyrolysis technique ensures that the drawbacks presented in the above processes are eliminated. To summarize, the primary disadvantages of the alternate processes are:

- Discharge of Toxic gases in the atmosphere - Dioxins predominantly;
- Low recovery of energy
- High Capital and maintenance costs;
- Unsuitable for many types of wastes;

The CB approach, with its Oxygen starved atmosphere ensures that the volatiles that are pyrolysed are devoid of the toxic gases that are generally emitted from other sources. Several reports of researchers have shown that pyrolysis in such circumstances lead to inhibition of dioxin creation. A sample report is replicated herein (reports are indicative and will vary with input material) that show the amount of PCDD/Fs in the stack emission of the pyrolysed gas:

Isomers		PCDDs (ng/m³)				PCDFs (ng/m³)		
		Mass	I-TEF	I-TEQ		Mass	I-TEF	I-TEQ
2,3,7,8	T_4CDD	0.003	1	0.003	T_4CDF	0.04	0.1	0.004
1,2,3,7,8	P_5CDD	0.007	0.5	0.0035	P_5CDF	0.077	0.05	0.00385
2,3,4,7,8					P_5CDF	0.015	0.5	0.0075
1,2,3,4,7,8	H_6CDD	0.096	0.1	0.0096	H_6CDF	0.080	0.1	0.008
1,2,3,6,7,8	H_6CDD	0.076	0.1	0.0076	H_6CDF	0.061	0.1	0.0061
1,2,3,7,8,9	H_6CDD	0.085	0.1	0.0085	H_6CDF	0.033	0.1	0.0033
2,3,4,6,7,8					H_6CDF	0.018	0.1	0.0018
1,2,3,4,6,7,8	H_7CDD	0.070	0.01	0.0007	H_7CDF	0.774	0.01	0.00774
1,2,3,4,7,8,9					H_7CDF	0.167	0.01	0.00167
	O_8CDD	0.712	0.001	0.000712	O_8CDF	0.643	0.001	0.000643
Total	PCDDs	1.649	1	0.039612	PCDFs	1.938		0.05339
PCDDs + PCDFs		3.587		0.093002	PCDDs/PCDFs		0.851	

- The total toxicity equivalent concentration is 0.093 ng/m3 I-TEQ. This value is below the upper limit concentration for land application according to U.S EPA standards in which the maximum PCDD/F level is 0.1 ng/m3 I-TEQ. However, for Medical Waste Incinerators, this number reaches 1.64, which is way over the permissible limit.

- Also, since the Blue Tower technology is self sustainable, the user has to spend minimal on operating costs and owing to generating high value syngas, leading to power generation as well as bio char, the process ensures that the client earns back his investment in a relatively short period of time. It is useful for disposition of a wide range of wastes as its application encompasses a vast range thereby ensuring that an auxiliary system is not required. The Blue Tower boasts of a very high range of efficiencies which allows it to maintain a very high input to output ratio (Indicative ratio - 1 Tonne Input: {approximately} 1.4 Tonne output).

- Owing to its compact design, unlike landfills, the CBS doesn't require huge spaces and hence can be accommodated in conditions which suffer from space constraints.

- The CB thus provides a tremendous value addition in terms of comparison with other technologies in its ability to treat bio medical wastes without causing adverse reactions to the atmosphere or the biological spread surrounding it.

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The following table gives a summary of the technology comparison:

Technology / Features	Composting	Landfill	Incineration	Concord Blue Solution
Emissions to Atmosphere	Low	Median	High	Negligible
Recovery of Energy	Low	Nil	Low	High
Maintenance Costs	Low	Low	High	Low
Suitability for various kinds of wastes	Low	N/A	Low	High
Rejects back to Landfill	High	N/A	Low	Low
Seasonal Variation	High	N/A	Low	Low

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3. Section 3: Project Methodology

Definition

Rochem Green (RG) has developed this proposal for a MSW management for PMC based on the input data from PMC as well as aided by the general assumptions using our industry know-how, and from information drawn from multiple entities, as well as the economic practicality and market data in India.

- Rochem Green will propose processing 700 tons per day of municipal solid waste as input material per year.
- The input biomass is assumed to have excess moisture of 40% and an inert of 10%, which will be removed and the pre-conditioned input, after drying to 15% moisture content, shall be input to the pyrolysis section.
- Drying is achieved automatically as part of the turn-key CB system by utilizing waste heat from the process. A feed segregation for inerts and a suitable waste heat based Dryer are integral parts of the complete turnkey package offered by us.
- The segregation usually entails an automated sieve and magnet system which takes out inert materials (in this case, soil, rocks and metals). Both are included in Rochem Green scope of supply.
- This CBS will require a sieve and shredder system to prepare the biomass material (into chips) for system input, which will be fed into the CB plant from a small, covered storage bunker with a day supply of input material.
- The fully automated system can include (optionally) a fully enclosed conveyor system so that no moisture can be added during delivery to the CB plant.

Output

The Concord Blue Tower produces the following outputs:

- Flue gases: Emissions are cleaner / less than a car's emissions
- Clean Water (depending on input material)
- Ash: Used in fertilizer and construction industry
- Heat for conversion of further energy: ORC
- Heat for producing hot water
- Heat for cooling / cooling water
- Dust

A unique advantage of the CB plant is that the desired input and output can be changed as required, depending on the market economics of selling the following:

- High quality, high energy value syngas: Can be used in gas powered electric generating motors or as a replacement or blender for natural gas.
- Hydrogen: Is currently used in a multitude of industrial and manufacturing applications and holds great potential in automotive hydrogen fuel cell technology.
- Electricity: Turnkey system creates electricity via proprietary syngas firing gas-motors
- Bio Char: Is currently used in fertilizer and as a soil amendment, as well as its environmental value as a sequestered carbon.

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WE HAVE CURRENTLY DESIGNED BASED ON ELECTRICAL OUTPUT. Design shows maximal electric output in a plant of approximately 10 MW.

Added Value

- Job Creation;
- Labor: Rochem Green will gladly work with local labor & contractors to employ the skilled labor needed for the following scopes of work: installation, construction, piping, electrical and manufacturing.
- Biochar: In addition to producing renewable energy, CBT can produce up to 60% biochar from biomass. Biochar, as defined by The International Biochar Initiative foundation, is as follows:
- Biochar is a fine-grained charcoal high in organic carbon and largely resistant to decomposition. It is produced from pyrolysis of plant and waste feed stocks. As a soil amendment, biochar creates a recalcitrant soil carbon pool that is carbon-negative, serving as a net withdrawal of atmospheric carbon dioxide stored in highly recalcitrant soil carbon stocks. The enhanced nutrient retention capacity of biochar-amended soil not only reduces the total fertilizer requirements but also the climate and environmental impact of croplands. Char-amended soils have shown 50 - 80 percent reductions in nitrous oxide emissions and reduced runoff of phosphorus into surface waters and leaching of nitrogen into groundwater. As a soil amendment, biochar significantly increases the efficiency of and reduces the need for traditional chemical fertilizers, while greatly enhancing crop yields. Renewable oils and gases co-produced in the pyrolysis process can be used as fuel or fuel feedstock. Biochar thus offers promise for its soil productivity and climate benefits.

For more information please visit http://biochar-international.com

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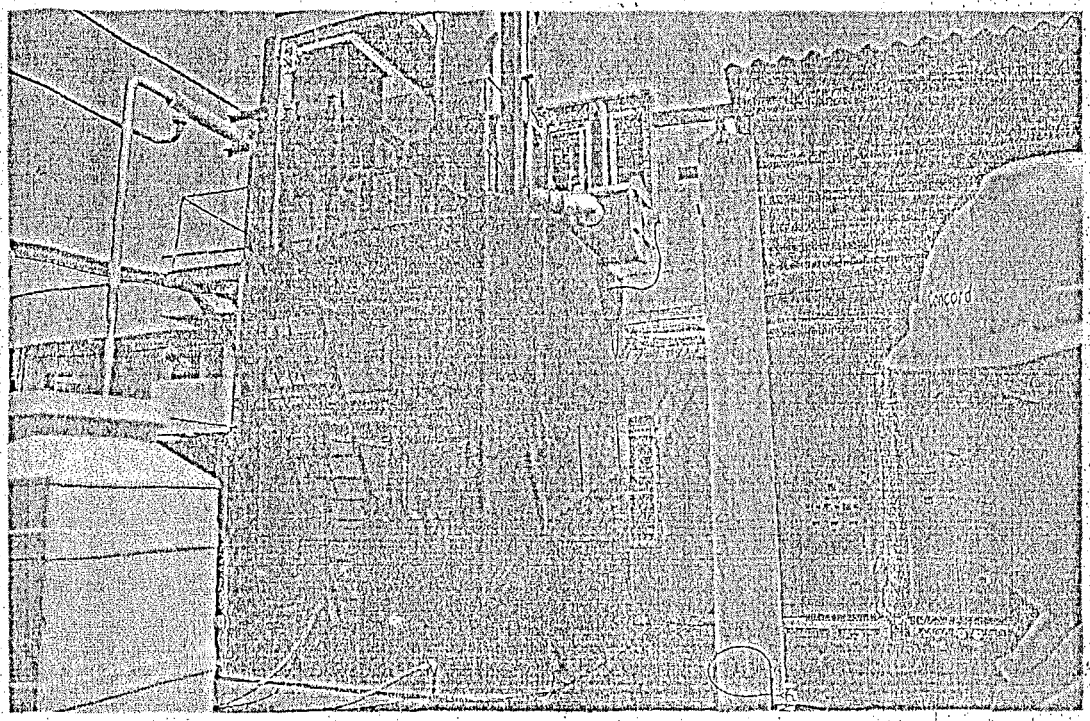

Mini Blue Tower in Mumbai

Plant Data

Plant data estimated for this proposed configuration of Rochem Green are based on the following assumptions:

- 700 tons of waste daily equaling 1,46,000 tons of input ready material;
- 50% comprises of moisture content (40%) and inert material (10%) of waste input (40% is excess water);
- Calorific value is 9 GJ/ton (on dry basis)(2153 kcal/kg);
- 100 tons of biochar produced daily for combustion;
- 75 million kW hours of electricity generated annually.

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ROCHEM GREEN WASTE TO ENERGY		
Calculation Overview	Unit	Values are Rounded
Input per Year	t/a	255,500
Operating Hours per Year	h/a	7,500
Energy Value of Input	GJ/Ton	9.00
Wet as received Waste input	t/h	34.1
Thermal Plant Capacity	MWth	37
Net Electricity Output per Hour	MWel	10
Megawatts produced per Year	MW/ a	75000
Kilowatts produced per Year	KW/a	75000000

Methodology

Our system has proven the ability to fulfill all environmental regulations, and in comparison to other technologies, has the highest input-to-output ratio. Unlike with other waste to energy technologies, the Rochem Green system does not need an additional source of energy to be powered or to operate and produces the highest quality product gas to be used for energy production in gas motors/engines. The product gas can be sold, further refined and shifted to hydrogen and/or ethanol or, of course, produce electricity with gas engines which is all part of waste to energy system and our turn-key service.

The Technology

INTRODUCTION

The Input material comprises of the following:

- Multi-feedstock capability.
- Input material does not need to be of constant quality and can be changed without making plant adjustments, any time and as often as desired.
- Dry & Wet segregation not needed, Only Inert removal needed.
- Overall, Segregation, Drying, Shredding are included as part of our turn-key plant, and are automatically done.

We turn classical gasification upside down. Conventional biogas plants turn the entire input material into a product gas typically by means of pyrolyzing the biomass into char and gasifying this by using air. This poor quality gas may be used to create energy through its heat (steam turbines), or by other means.
The Rochem Green process, by comparison, uses Pyrolysis to create a first stage product gas and char. The char is further combusted to create the heat for the process (making the plant more

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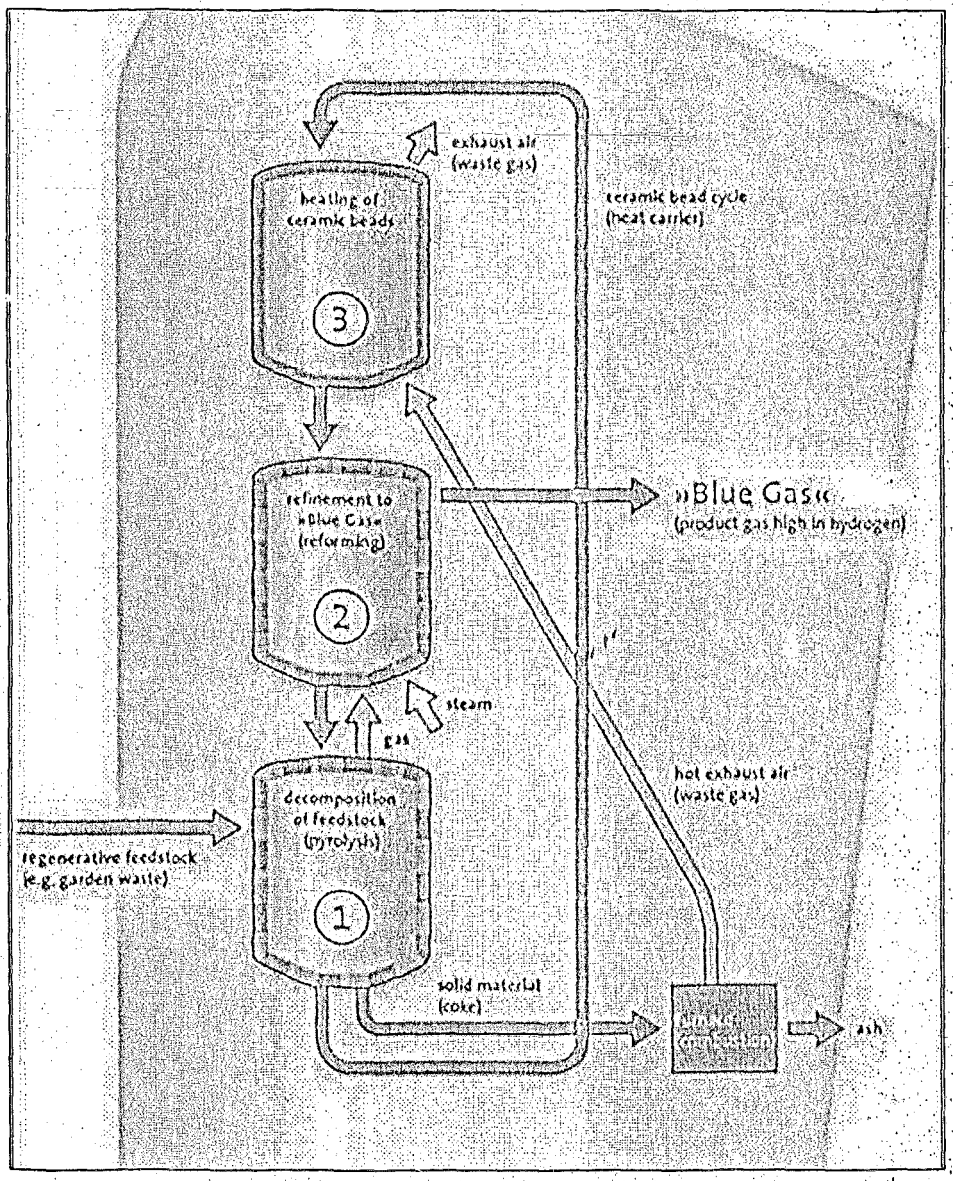
self-sustaining), while the gas is reformed with steam input and further refined to produce a high quality gas product.
The CBT consists of three (3) main vessels. The pyrolyser at the bottom, the steam reformer in the middle and the pre-heater at the top.



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Pyrolyser

- In its first stage the Rochem Green Tower separates the input material by pyrolyzing it into approximately 20% char and 80% Pyrolysis gas.
- The char is combusted into a flue gas in order to produce the necessary process heat.

Steam Reformer

- The remaining 80% moves up into the steam reformer. Here the Pyrolysis gas is cracked and reformed into a high quality product gas, consisting mainly of hydrogen and carbon.
- Steam is generated by passing the hot product gas through a waste heat recovery boiler before it is then quenched and cleaned.

Staged Reforming

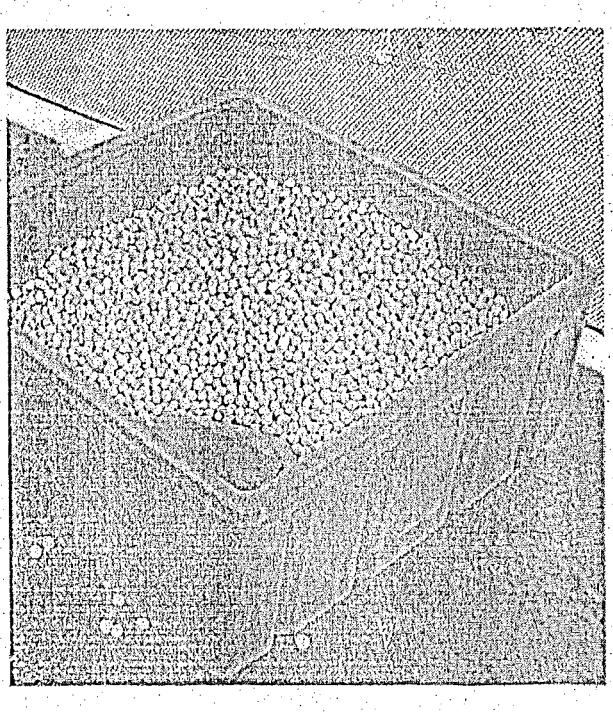
- The steam reformer is a simple homogenous purely gas phased reaction.
- It is spatially separated from the pyrolyser - therefore STAGED REFORMING.

High Quality Product Gas

- Unlike with common biomass gasification processes the product gas generated in the Blue Tower is very high in quality because it is unaffected by the flue gas from the char combustion.
- Common biogas plants achieve a product gas with approximately 30-50% calorific value efficiency, whereas the Blue Tower's product gas achieves around 80% efficiency.

Heat Carrier

A key feature of the Blue Tower is the use of a circulating bulk material as the heat carrying medium. This has the added benefit of ensuring that the heat carrying surfaces are always clean. This makes it easily possible to use biomass input material which in other systems causes slagging, fouling and corrosion.



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Heat Process

- The heat is transferred from the char combustion flue gas to the inert bulk heat carrier inside a simple moving bed reactor.
- During this process (circulating to the top) the heat carrier first gives off its heat in the reformer and then the pyrolyser.
- The advantage of using a heat carrier circuit and a motor flue gas circuit is that the different waste heats can be collected and used to supply the collected heat where it is needed.

Drum Sieve Separator

The CBS incorporates a DS Separator that acts like a sieve beneath the Pyrolyser, when the mixture of Heat Carriers (in this case Alumina Balls) and char is released therein. The DS Separator sieves the char into the char hopper whereas the Heat carrying media is stored in the hopper for recirculation in the heat carrier bunker.

Intelligent Process

- Only Simple Equipment Needed
- The pyrolyser and the reformer occur in separate gravity driven moving bed reactors. No further equipment is mounted inside.
- The heat carrying medium is moved by mechanical drive and gravity.
- At the end the Blue Tower generates electricity out of garbage or other waste material like a power station does out of coal or natural gas.

Input to Output Efficiency

This highly depends on the input material. A very broad estimate for separated dried household waste is 1 ton of input generating 0.7 - 1.2 MW net electric output. The calorific value of the Blue Tower product gas is approx. 12.2 - 15 MJ/Nm^3.
In order to determine the exact value a detailed analysis of the input material must be submitted.

The primary product of the Rochem Green Tower is a high-quality gas that consists of a high percentage of hydrogen and other calorific value-rich gases. Diluting gases, such as nitrogen - as may exist in air gasification - do not occur with Blue Tower's steam gasification. There are three main applications of the product gas:

- As fuel gas in a gas motor for high efficiency electric power production
- For hydrogen production
- For ethanol production
- As a raw material for synthesis gases, as a replacement or blender for natural gas.

Process Description

The following is the process description from bringing in the MSW to its conversion into a high value syngas. It is as follows:

- Delivery and Preconditioning
  The feedstock (in this case, MSW) is delivered by trucks (client scope). It is unloaded by dint of hydraulic tipping mechanism into the CBS premises unit after weighing in a weigh bridge. After this, the MSW is taken into the preconditioning unit, wherein it is shredded and sun dried to remove the excess moisture.

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- Pyrolysis

The key to obtaining a high quality syngas is by heating it by efficient heat carriers in the absence of oxygen for effective decomposition of organic wastes. The organic waste is distributed by a screw conveyor into the connecting pipelines leading upto the pyrolyser. During this process, the pyrolyser bed is already heated to a high temperature to ensure that pyrolysis starts on the introduction of organic wastes. The decomposition can happen within a range of 40 - 80% syngas (depending upon the requirements) the pyrolysed gas moves up from the bed towards the reformer.

- Reformer

Post Pyrolysis, slightly overheated steam from the boiler is fed at the bottom of the pyrolyser bed. It mixes with the gas in a direction towards the reformer. In the reformer, the gas meets the heat carriers with a far higher temperature. The mixture of gas and steam reacts - water gas shift reaction. This causes the product gas to be generated, comprising mainly of H_2 (about 40%), 25% CO_2 and 20% CO (By Volume). Please note that these figures are indicative and will vary with the input material. The warming of the product gas and the consumed heat of reaction will cool the heat carrier in the reformer. A percentage of the product gas is combusted to provide for the heat in the reformer.

- Product Gas Cleaning

After leaving the reformer, the raw product gas has an energy equivalent to around 75% of the input. However, it contains dust and minor traces of tar. Hence, it is taken through a series of equipments like scrubbers to rid it of the undesirable components. At the same time, acidic components can be neutralized.

- Flue Gas Cleaning

After the raw flue gas has passed the preheater, the flue gas is taken to the preheater to preheat the air for combustion in the furnace, thereby increasing the efficiency of the system.

- Flare

The purpose of the flare is to combust all gases coming from the product gas path which cannot be utilized otherwise. It is active in the following cases:

- Rinsing the system from inertization
- Starting the system until stable gas production is established, and the CHP can be started
- Shutting down the system

The flare is usually designed to combust all product gas.

- Steam Generator

The steam generator is integrated in the CB and aids in the water gas shift reaction that is responsible for generating the final product gas to be taken for cleaning and final use.

- Component Description

The following are some of the additional details about the component list:

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1. Heat Carrier Bunker - A Cylinder with ½ round dish bottom. It incorporates Ceramic Insulation and its MoC is SS 310.
2. Double Clap Valve - The double clap valve is a flap type, pneumatic cylinder operated mechanism, with a MoC of SS 309.
3. Biomass Bunker - A rectangular shell with cone at bottom with MoC as SA 516.
4. Screw Conveyor - The screw conveyor is tube type with MoC - SS 304.
5. Pyrolyser - The Pyrolyser is a cylinder with a cone at the bottom. Its MoC is SS 310 and requires a ceramic insulation.
6. Drum Sieve Separator - The Drum Sieve Separator is a horizontal perforated cylinder with screws and an MoC of SA 516.
7. Reformer - The reformer is a heat intensive device that is horizontal and dished at both ends. Its MoC is B-SB 729. Owing to its high heat content, the Reformer is insulated with Ceramic and its design/material code is ASTM ASME B-SB 729 (Incilloy 800).
8. Flare - The flare is a standalone system with a N_2 seal.
9. Cooling Tower - The cooling tower is rectangular with a basin and a fan. Its MoC is FRP.
10. Ball Storage Bunker - The Ball storage bunker is a rectangular shell with a jacket for cooling purpose. Its MoC is SA 516.
11. Char Storage Bunker - The char storage bunker, alike the ball bunker is a rectangular shell with a jacket for cooling purpose. It has a similar MoC.
12. Ball Bunker - The ball bunker is a rectangular shell with cone at the bottom to supplement the Heat Carrier Bunker with additional balls so as to ensure the continuity of operations. Its MoC is SA 516.
13. Boiler - The boiler is a vertically mounted, electrically heated unit. The material of construction is SA 516 and follows ASME code.
14. Gas Cooler - It is a cylinder with jackets for water cooling. Its MoC is SS 310.

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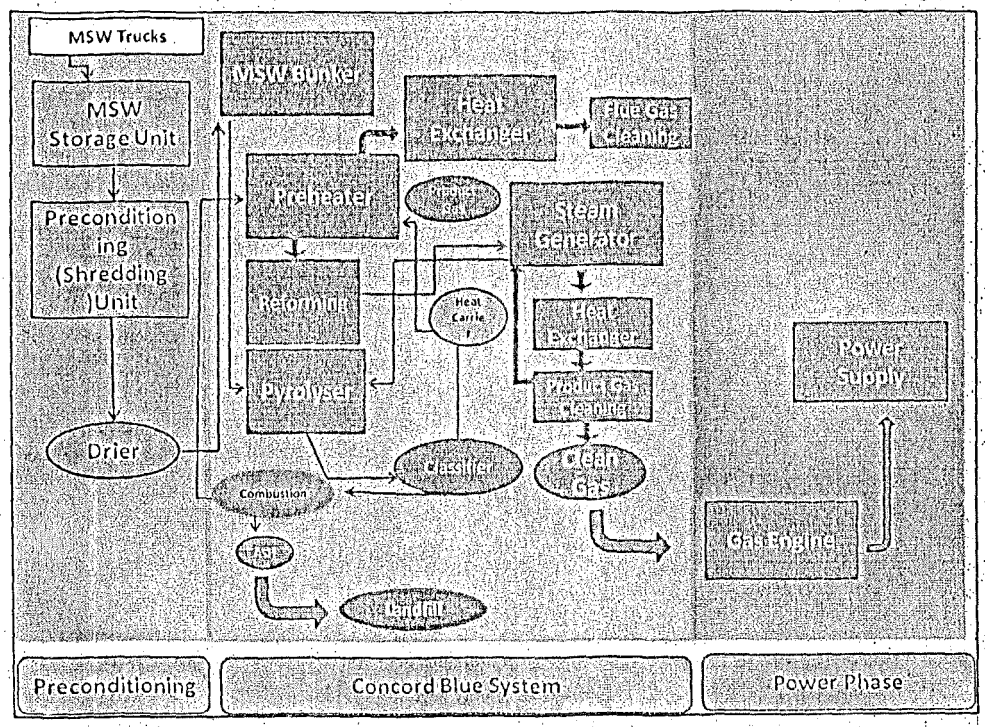
Process Flow Diagram

The following diagram is indicative of the process flow for the CB system:



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Design of components

Design Methodology and Parameters

Our project design is based on the following parameters:

- Waste Analysis - Current Composition
- Waste Quantity
- Waste Disposal Goals (Peak Hours/Off Peak hours); Syngas Char ratio;
- Client's timeframe
- Plant restrictions as regards:
  - Building/Construction
  - Emissions - Noise, Pollution, smell
  - Capacity
  - Required Land/space
  - Height of plant
- Suitability of waste composition
- Requisite outlet availability viz:
  - Gas
  - Water
  - Energy (to start the plant)
  - Electric Grid
- Client Stakeholders
- Project Sustainability

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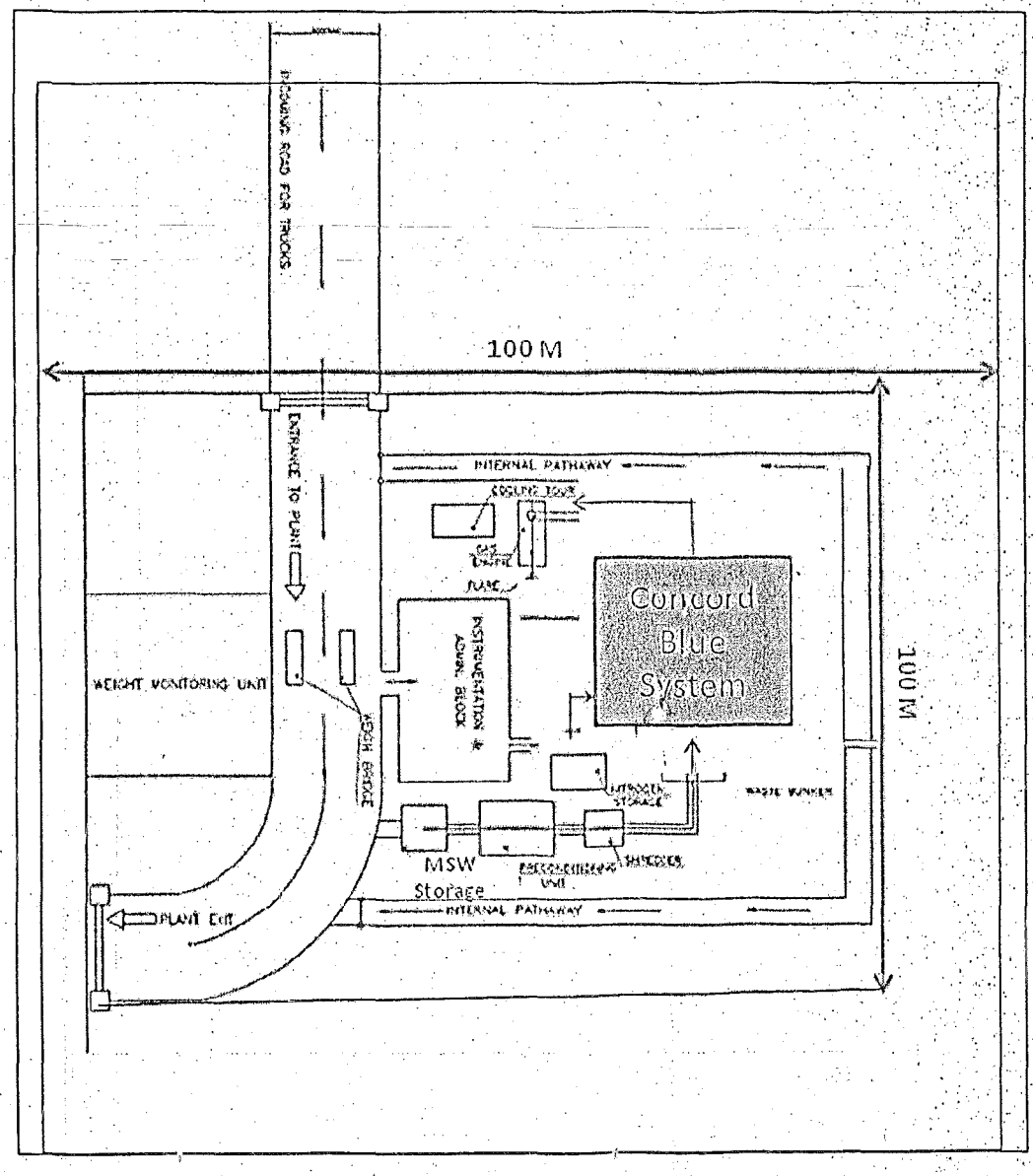
Plant Layout

The following is a proposed plant layout for our CB system.



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Benefits to PMC

- Low carbon footprint enabling PMC to qualify for Carbon credits as a revenue source
- A revenue source for PMC from sale of power after transfer of the plant
- No fossil fuels are used
- High Plant flexibility enabling a steady output irrespective of variations in the quality of the input material
- Self-Perpetuating - no additional fuel source is required for operation
- Extremely low rejects back to the Landfill resulting in lowest maintenance cost of rejects as well as one of the highest land reclamation propositions as compared to other technologies
- Operational in all seasons
- Job creation by continuous operating & maintenance;
- Very low emissions

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4. Section 4: Project Governance

- Roles and responsibilities (Rochem Green and Client)

The following table describes the roles and responsibilities of the Key personnel from Rochem Green and the Client:

Role	Responsibility
Basic Plant Data	• The client has to furnish all data pertaining to quantity and chemical composition of the input material to the plant
Basic Engineering	• Rochem Green would conduct the basic engineering
Drawing	• Rochem Green would draft the drawings. The client would be the final approving authority
Site Preparation	• The client would be responsible for preparing the site as per the approved drawings
Procuring of components	• All parts within the Rochem Green offered systemwould be in our scope.
Erection and Commissioning	• Rochem Green's responsibility;
Training	• Rochem Green's scope

Steering Committee

The following diagram shows the overall steering committee from both the client as well as Rochem Green's perspective:

- Change management

All changes, after the Project initiation, will be routed through a Change Control Board (CCB) initiated by Rochem Green. The Project Manager and PMC's Manager will be part of the CCB. After the Project kick off, changes can impact the scope, design, schedule and deliverables.

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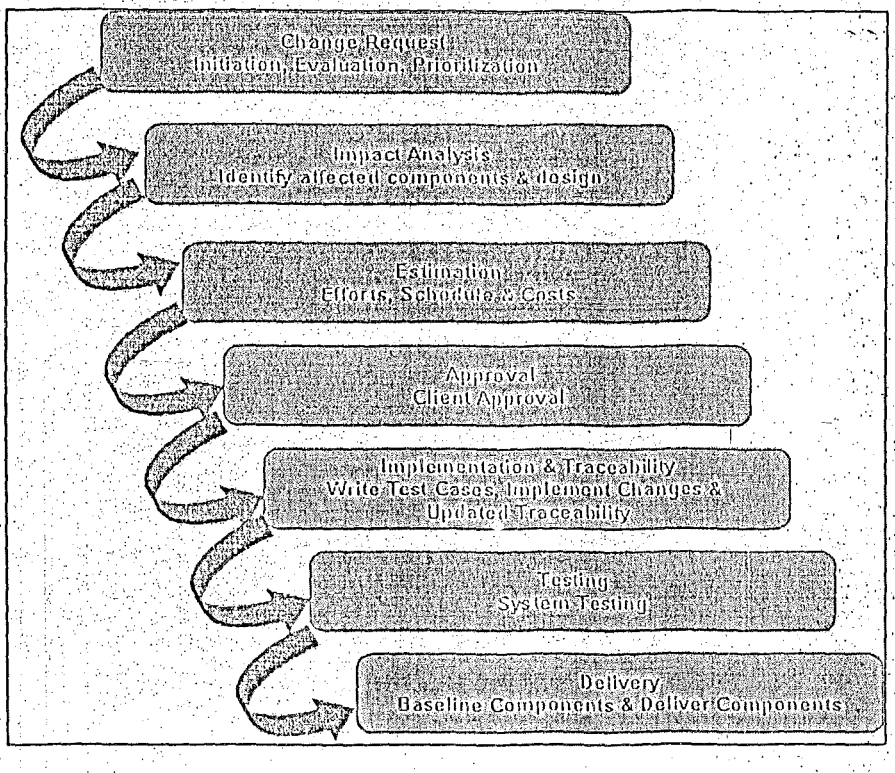

Impact Analysis and Estimation

- The requests for change will be recorded in a Change Control Register (CCR) with a unique change request number.
- Changes on base-lined items will be determined by the PM.
- Based on the description of the change, the impact analysis will be carried out by the team identified by the PM.
- The impact of the changes will be analyzed, the list of impacted work products identified, and recorded in Change Control Register (CCR).
- Impact of changes on schedule, effort and risk will be determined and summarized in the impact analysis section of CCR. The relevant sections of the project plan will be updated.

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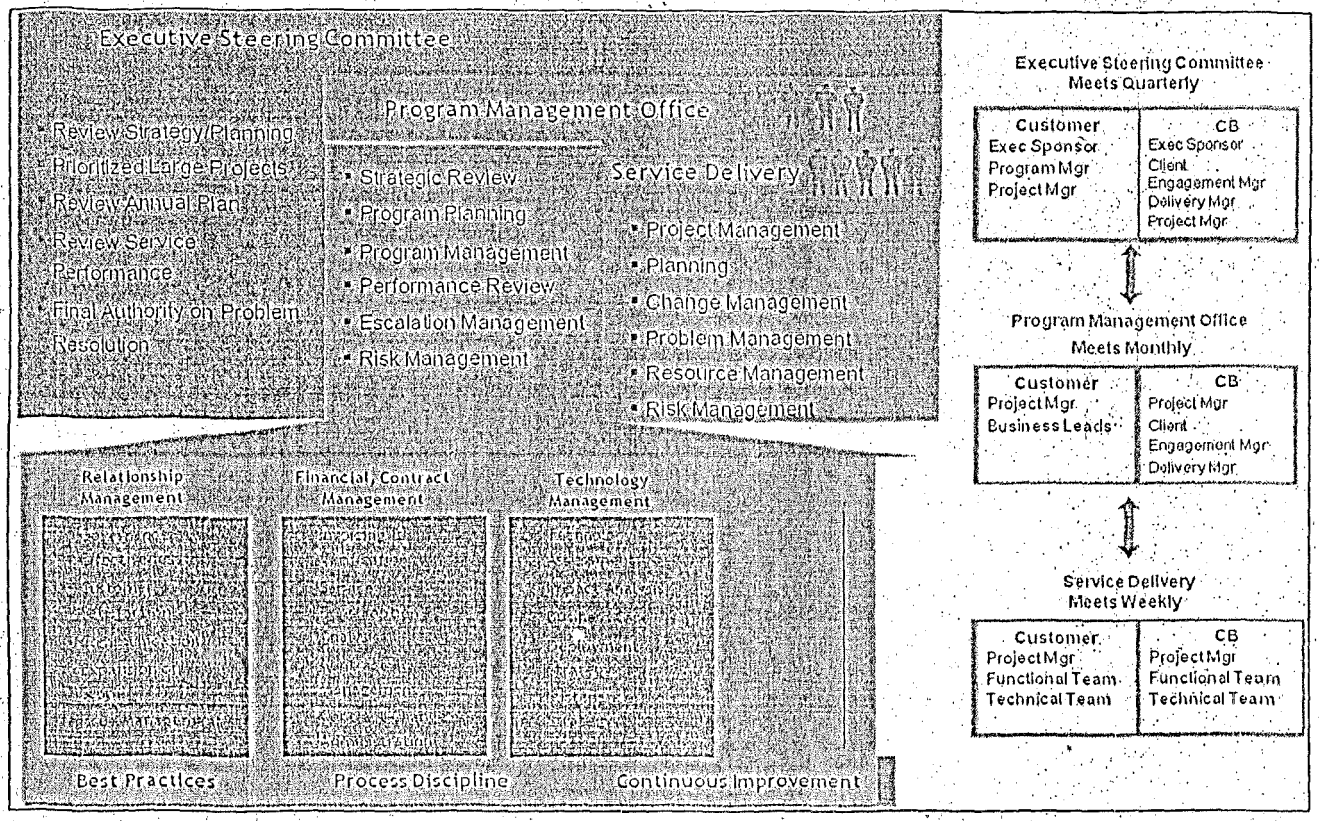

- PMC resources required by Rochem Green

  Rochem Green would need PMC's resources in procuring all requisite permits and clearances and also for facilitation of local boarding and lodging. Also, we would need a Project Manager appointed by PMC for periodic briefing on the progress of the project as well as resolving any and all issues rising from therein.

- Communication protocols

  - Project communication plan

Effective communication with all key stakeholders is critical for the success of any engagement. Effective communication also ensures visibility of the delivery and allays the fears of loss of control for the customer.

The Rochem Green team prepares a communication management plan at the start of a project. This is a comprehensive plan containing information about the project, stakeholders, and the execution team. This plan also defines the information collection, storage, and distribution systems. Based on the type of engagement, communication levels, channels and the frequency the communication channels are decided. Some of the channels of project communication are listed below:

- Project communication plan
- Status reports
- Performance reports

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- Management reviews

Rochem Green's project team would interact with its counterpart at PMC in order to gather technical requirements, as well as seek technical clarifications. Rochem Green's Account Manager and Project Manager will participate in conference calls with PMC's Project Managers on a periodic basis, and update the status, as well as share concerns, if any. In addition, periodic management reviews between the senior management of Rochem Green and PMC would be scheduled. These reviews focus at the engagement level, PMC's satisfaction levels and progress of the various key initiatives.

Templates

Rochem Green teams will use the following templates for Communication Management which is available in our quality system,. Some of the key templates are listed below:

- Communication management plan
- Account status report
- Customer feedback
- Customer satisfaction survey
- Project data and metrics report
- Project monitoring report
- Project performance report

Scope Chart

The following is the detailed scope chart for this project as envisaged by the MoU group. The same can be frozen during the discussion phase.

CST - Customer
CB - Rochem Green

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DESCRIPTION		ENGINEERING		SUPPLY	FABRI-CATION	E&C	REMARKS
		TECH. SPECN / DATA SHEET	DRAW-INGS				
Raw water transfer pump for make-up		CB	CB	CB	CB	CB	
Raw water transfer pump for cooling tower make-up		CB	CB	CB	CB	CB	
Multigrade sand filter (For boiler makeup and cooling tower makeup)		CB	CB	CB	CB	CB	
Softener (For cooling tower makeup)		CB					If required
Clarifier		CB					If required
DM water storage tank (M.S)		CB	CB	CB	CB	CB	
LT MCC for the drives pertaining to water treatment plant under vendor scope		CB	CB	CB	CB	CB	
Interconnecting LT power and control cables for the drives supplied by vendors		CB	CB	CB	CB	CB	
Drinking water facilities		CST	CST	CST	CST	CST	
Portable water system		CST	CST	CST	CST	CST	
Plant intake water pump house, intake water pumps and borewell for service water		CST	CST	CST	CST	CST	
FEED STOCK FEEDING SYSTEM			CB	CB	CB	CB	

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Bunker with supporting structure from operating floor		CB					
Supporting steel structures for bunker roof & side cladding		CB	CB	CB	CB	CB	
Fuel Inlet hopper to CBS plant		CB	CB	CB	CB	CB	
FUEL FEEDERS Screw feeder with variable frequency drive & gearbox		CB	CB	CB	CB	CB	
Couplings / hardware		CB	CB	CB	CB	CB	
SUPPORTING STRUCTURE Supporting structure from operating platform	02-01	CB	CB	CB	CB	CB	
Operating platform (RCC)	02-03	CB	CB	CB	CB	CB	
Staircases, ladders upto operating floor	02-03	CB	CB	CB	CB	CB	
Handrails for operating floor	02-03	CB	CB	CB	CB	CB	
Platform above operating floor (MS)	02-03	CB	CB	CB	CB	CB	

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Staircases, ladders above operating floor.	02-03	CB	CB	CB	CB	CB	
Foundation bolts for CB supplied equipments	01-03	CB	CB	CB	CB	CB	
Complete steel supports for ducting		CB	CB	CB	CB	CB	
GI sheets for roof and side cladding for boiler upto drum operating floor on three side (except on bunker side) and at firing floor level for 3 m height from firing floor for 2 sides.		CB	CB	CB	CB	CB	
Bypass Valve		CB	CB	CB	CB	CB	
1.1. CONTROL SYSTEM PLC based SCADA system with three nos. of operation station		CB	CB	CB	CB	CB	
Cables from junction box to control system		CB	CB	CB	CB	CB	
Uninterrupted power supply system (UPS)		CB	CB	CB	CB	CB	
ELECTRICALS All Motors		CB	CB	CB	CB	CB	
440 V LT MCC & its auxiliaries		CB	CB	CB	CB	CB	

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Local push button stations for the motors supplied by CB		CB	CB	CB	CB	CB	
Interconnecting LT power & control cables including cable trays from LT MCC to drives supplied by CB		CB	CB	CB	CB	CB	
Earthing of electrical equipments supplied by CBS above ground level		CB	CB	CB	CB	CB	
Earthing pit		CB	CB	CB	CB	CB	
Lightning protection system & installation		CB	CB	CB	CB	CB	
REFRACTORY Refractory and refractory holding materials		CB	CB	CB	CB	CB	
Casing for refractory		CB	CB	CB	CB	CB	
Insulation and cladding		CB	CB	CB	CB	CB	
SPARES Commissioning spares		CB	CB	CB	CB	CB	
O&M spares		CB	CB	CB	CB	CB	
Tools & tackles		CB	CB	CB	CB	CB	
Auxiliary control panel		CB	CB	CB	CB	CB	
LPG GAS ASSISTED START-UP FIRING							

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SYSTEM		CB	CB	CB	CB	CB	
Burner & Control System complete with piping		CB	CB	CB	CB	CB	
Gas storage & Supply		CB	CB	CB	CB	CB	
ASH DISCHARGE SYSTEM BED ASH Bed ash drain pipe		CB	CB	CB	CB	CB	
Slide gate		CB	CB	CB	CB	CB	
BED ASH HANDLING SYSTEM		CB	CB	CB	CB	CB	Manual handling system envisaged.
PAINTING Primer painting for CB components		CB	CB	CB	CB	CB	
FINAL PAINTING FOR CB SUPPLIED COMPONENTS		CB	CB	CB	CB	CB	Un-insulated surfaces

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ELECTRICALS HT busduct (11 KV) connecting alternator terminal and generator transformer	70-01	CB	CB	CB	CB	CB	
DG set alongwith auxiliaries and panels.	70-24	CB	CB	CB	CB	CB	
Local push button station for plant auxiliary drives	70-25	CB	CB	CB	CB	CB	
MECHANICAL AUXILIARIES One no. H.O.T Crane as specified.	31-01	CB	CB	CB	CB	CB	
Two x 100% (One working + One standby) air compressor for service air requirement	28-02	CB	CB	CB	CB	CB	
Fire detection system	32-02	CB	CB	CB	CB	CB	Fire detection at boiler and TG house and cable spreader room
Exhaust fan	33-02						

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		CB	CB	CB	CB	CB	
Weigh Bridge	31-07	CB	CB	CB	CB	CB	
Pump required for Hydro test		CB	CB	CB	CB	CB	
CIVIL WORKS All civil works related to CBS plant installation,		CB	CB	CB	CB	CB	
RCC Raw Water Reservoir		CB	CB	CB	CB	CB	
Cooling Tower basin, cooling tower RCC structure,(If required) CoolingTower Switchgear room, C.W. Pump House, C.W. Pump & Misc. Pumps		CB	CB	CB	CB	CB	
Compressor House.		CB	CB	CB	CB	CB	
Boundary Wall, Gates, Fencing and Plant Roads.		CB	CB	CB	CB	CB	
Plumbing & Drainage (storm water, sanitary, sewerage & industrial effluent) System, Guard Pond.		CB	CB	CB	CB	CB	

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Fire water reservoir and pump house.		CST	CST	CST	CST	CST	
Permanent Store, Workshop, Weighbridge, Gate House complex, Security room & Time office, Admin. Building, Fire Station, Water Tank, First Aid Centre, temporary site office for Owner, open shed for storing materials and other auxiliary facilities etc.		CB	CB	CB	CB	CB	
One no. RCC Clarified Water Storage Tank and Pump House, WTP Control Lab room etc.		CST	CST	CST	CST	CST	If required
Various settling pits / basins.		CST	CST	CST	CST	CST	
Trenches / Pipe & Cable Bridge.		CB	CB	CB	CB	CB	
Topographical Survey, as required & Site Grading work as per site & layout requirements.		CB	CB	CB	CB	CB	
Soil investigation work on all work areas/fronts if required		CB	CB	CB	CB	CB	
All temporary work such as construction of site office and construction of stores, residential accommodation for Contractor's labour,		CB	CB	CB	CB	CB	
All electrical grounding system.		CB	CB	CB	CB	CB	

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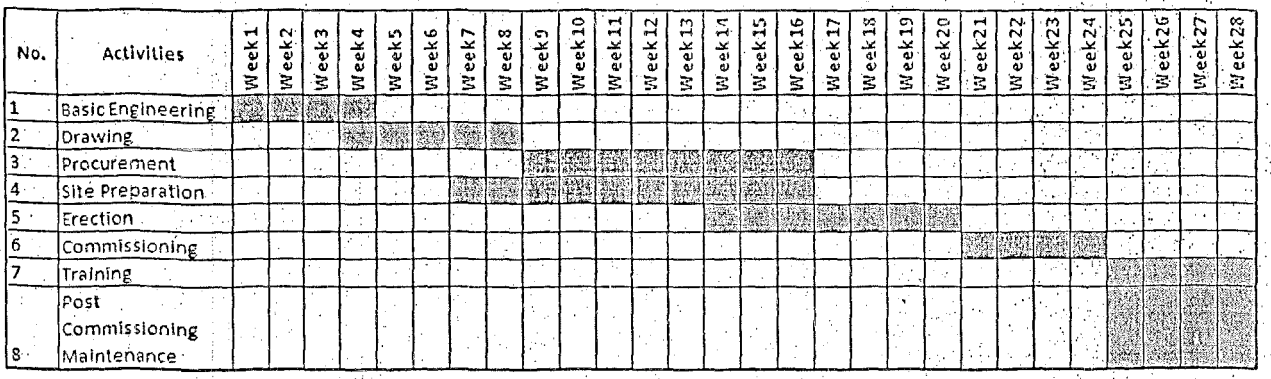
Covered FEED STOCK storage yard		CB	CB	CB	CB	CB	
Access roads & Interconnecting roads inside the plant area		CB	CB	CB	CB	CB	

Time/Work Schedule

The following figure details the timeline for the activities for installation and commissioning of the CBS:



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Activity Phases

The following table gives the phase wise activities as well as deliverables for successful completion of the project:

Phase	Key Activities/Steps	Deliverables
Data Collection	• The Rochem Green team would have to conduct detailed surveys/interviews to gather specific data regarding the conditions prevailing at PMC	• Ensure that complete data regarding the biomedical waste quantity, chemical composition, topography, resource availability, legal policies and permits are obtained
Engineering	• Detailed engineering and drawing preparation based on inputs received during the data collection phase	• Engineering drawings to be furnished
Procurement	• Post approval, all engineered components have to be sent for fabrication and OTS (Off the Shelf Products) to be requisitioned for	• All fabrications completed and other requisite components to be shipped off to site
Site Preparation	• Drawings to be handed over from phase 2 to the client with necessary instructions for site preparation	• The site has to be ready for erection and commissioning of the Rochem Green System
Erection and Commissioning	• Ensure proper project management methodology is followed to implement the erection and commissioning of the Rochem Green Tower	• The plant should be commissioned and be prepared to be handed over to PMC's operators

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Change management

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Problem resolution and escalation process

The purpose of the Issue Management process is to ensure that all project issues are documented, tracked and resolved. Issues are items identified during a Project that may impact the scope, timing, and the ultimate success of the Project.

The detailed responsibilities and activities in this regard are indicated in the table below:

Activity	Responsibility	Activity Description
Issue Identification	All Team Members	• Identify issues or barriers to progress. • Verify if the issue has not been previously identified and documented.
Issue Documentation	All Team Members	• Enter issue into the Issue Log, filling in as much information as possible. • Discuss questions regarding issue categorization with Project Manager.
Issue Resolution	Responsible Team Member	For each assigned issue: • Research alternatives and discuss with stakeholders directly impacted by the issue's outcome. • Evaluate pros and cons of each alternative; develop a well-supported recommendation. • Document activities and recommended resolution in the Issues Log. • Mark the issue as "Resolved" in the Issue Log.
Issue Reviewing and Tracking	Track Leads	• Review issue resolution status in the Issues Log. • Track outstanding issues and ensure that the assigned team member is making progress in resolving the issue. • Discuss new issues and issue resolution status during weekly team lead meetings. • Include high priority open issues on the status report.
Issue Escalation	Project Managers	• Escalate issues that have not been resolved within a specified time frame or those that require the Steering Committee's attention.

Escalation Process:
On engagement initiation, Rochem Green will discuss and agree with PMC on the structure for escalation of issues from either side. The reported escalation will be immediately logged along with the responsibility assignment and expected resolution date. The assignee will seek more details if needed to better understand the issue from appropriate stakeholders from both PMC and Rochem Green. An action plan on corrective and preventive measures would be communicated to PMC within

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agreed timelines. PMC can revert with comments/suggestions regarding the same and Rochem Green will track it down to closure with regular updates sent to PMC and Rochem Green management.

Rochem Green may also conduct an elaborate Root Cause Analysis (RCA) for key escalations.

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5. Section 5: Impact of the Project

The project will have the following impact:

Environmental

- Provide an environmentally friendly & economically viable hospital waste disposal solution;
- Meet Environmental and State permitting & emission regulations;
- Increased reclamation of land made available to PMC;
- Qualify for Carbon Credits;
- Reduce the discharge of toxic compounds in the atmosphere thereby preserving the fauna of the surroundings. Also, it will ensure that the high level of toxic gases discharged into the system by inefficient disposal systems would be diminished, thereby leading to not only improved atmosphere but also better climates and more pleasant temperature.
- The impact of carcinogens would reduce.
- High risk prone individuals like pregnant women and children would be especially safe.

Social

- Create Jobs
  - The installation of the plant would require resources, consisting of 50% low skilled workers, 25% semi-skilled and 25% skilled.
  - Involve Local Unions & Manufacturing
  - CB plans to cooperate with the local unions. The scope required will cover all installation and construction jobs, piping and electrical manufacturing and installation.

Business

- Provide a secure and easily calculable investment opportunity with a high Return on Investment of over 15% per year.
- Provision of a warranty and performance guarantee to the Client and other investors.
- Biochar

  For non hazardous waste as an addition to producing energy we can also produce up to 50% bio char. *"Biochar is a fine-grained charcoal high in organic carbon and largely resistant to decomposition. It is produced from pyrolysis of plant and waste feedstocks. As a soil amendment, biochar creates a recalcitrant soil carbon pool that is carbon negative, serving as a net withdrawal of atmospheric carbon dioxide stored in highly recalcitrant soil carbon stocks. The enhanced nutrient retention capacity of biochar amended soil not only reduces the total fertilizer requirements but also the climate and environmental impact of croplands. Char-amended soils have shown 50 - 80 percent reductions in nitrous oxide emissions and reduced runoff of phosphorus into surface waters and leaching of nitrogen into groundwater. As a soil amendment, biochar significantly increases the efficiency of and reduces the need for traditional chemical fertilizers, while greatly enhancing crop yields. Renewable oils and gases co-produced in the pyrolysis process can be used as fuel or fuel feedstocks. Biochar thus offers promise for its soil productivity and climate benefits."* Source: *ttp://www.biocharinternational. org/aboutbiochar/informationaboutbiochar.html*

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6. Section 6: Project Quality

Our project adheres to the accepted industry norms with our vendors conforming to International Standards like ISO in their product quality. We will strive to achieve emissions below the EPA specified ranges and produce Syngas of the highest quality suitable for the client.

Our Quality Objectives:

- To achieve uninterrupted plant operation (Optimum Reliability);
- To meet rated output;
- To comply with local and international emission standards;
- To deliver the optimum value Product gas and/or Bio char to the client as per requisite demand;

Quality Processes

Subsequent to freezing the plant capacity (dependant on the organic waste inflow), the requisite engineering is delved upon which generates the P&I diagrams as well as flow sheets for the process. These are reviewed and validated at multiple levels of the management to ensure the accuracy of the same. On final approval from the CTO (the Chief Technical Officer), the design is completed following relevant ASME codes.
Rochem Green has developed a stringent process to appraise its vendors and our current pool of suppliers represent a highly quality conscious group which adhere to the highest norms as defined by the standards of the corresponding product.
Post manufacturing, we carry out a stage inspection at the vendor's premises to check for any anomalies and the records are logged in our inspection template. The bought out items are checked against applicable standards and we only adhere to the best in the industry.
The structures are designed by reputed structural engineers conforming to various design codes/standards like ISO 800 - 1973 (working stress).

At Rochem Green, we cross train our staff at various disciplines, encompassing technical and managerial functions to ensure an all round development of the individual. It also provides an alternate line of resources should the assigned personnel be unavailable for any reasons.

We would like to reiterate our respect for the environment, a key reason for us to be in business and would like to ensure the growth, profitability, leadership, social responsibility, environmental, safety of the society and its inhabitants at large by sound quality policies in order to assure the success of this company.

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7. Section 7: Project Inputs

Design Basis

Sr. No.	Description	UOM	Value	
1	Input Capacity	tonnes per day	700	
2	Uptime	Hours/Year	7500	
		Days/Year	365	
3	Electrical Capacity	MWel	10	
4	Inerts	% of Feed	10	
5	Ash	% of Feed	10	
6	Standby Generator Capacity	KVA	600	
7	Connected MSEB load	KVA	600	Considered 1/3rd of operating Load
	ELECTRICAL LOAD			
			kW (connected)	load factor
8	Drier	3nos	400	0.75
9	Shredder	1 set	400	0.65
10	Segregation & Sorting	1 set	180	0.6
11	Engine Auxilaries	1 set	300	0.7
12	CBS	3nos	750	0.7
13	Utilities	1 set	100	0.8
14	Lighting	1 set	50	0.5
		Total	2180	

Process Flow

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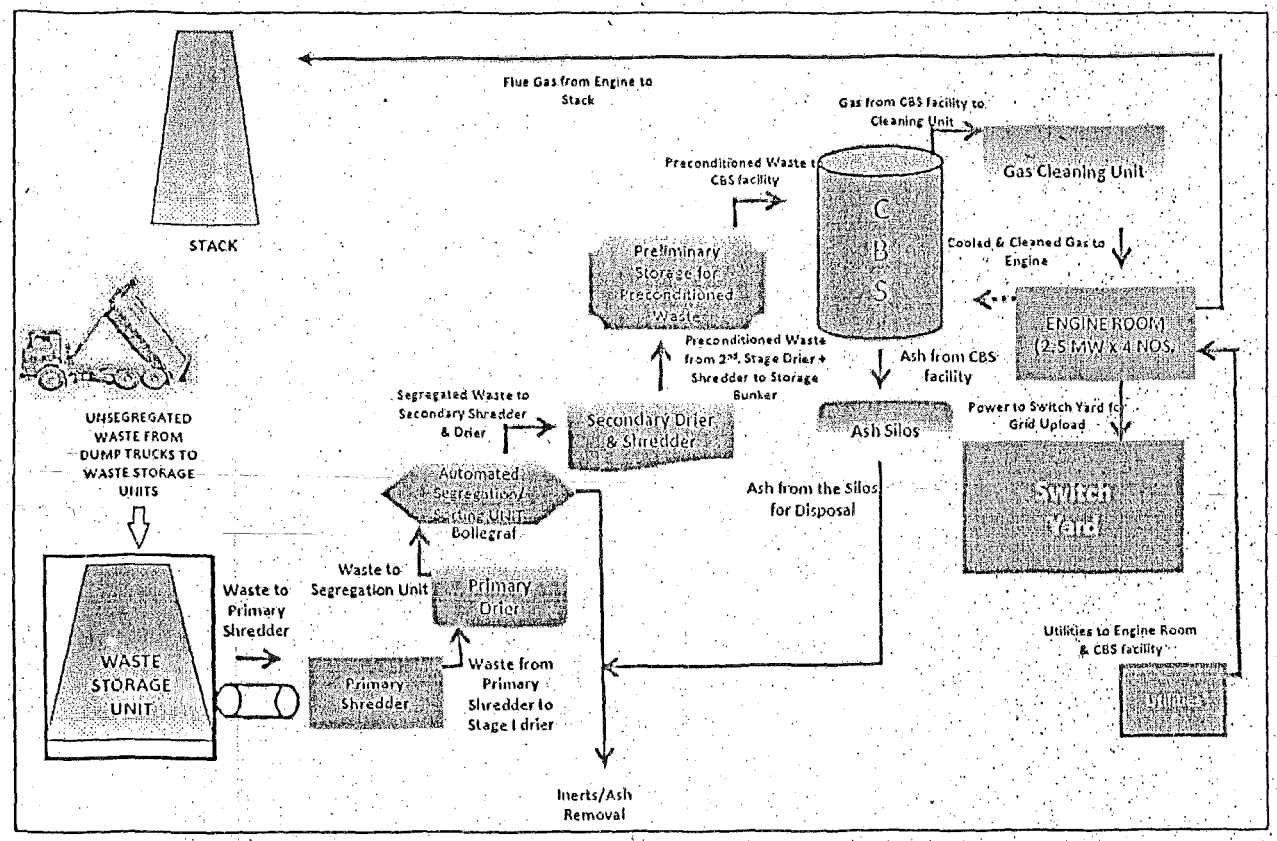

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PROCESS DESCRIPTION

Summary of Operation

1. The solid waste (feed) is conveyed to the storage shed by the waste tipping trucks (or any other suitable conveyance);
2. The Trucks are weighed on Weigh bridges which transmits the data (weight of the waste) to the control room which monitors the quantum of waste brought into the Concord Blue facility daily.
3. The waste is stored in enclosed sheds to ensure that there is no putresance emitted from within them;
4. The feed is tipped on the tipping floor from wherein it is stored in storage bays (7 nos.). The Storage unit has a capacity for accommodating 1000 tonnes of waste. From herein, the front loader conveys it to the primary shredder where the initial sizing of the material is achieved. From herein, it goes to the primary drier for initial moisture removal.
5. The waste from the primary drier is conveyed to the fully automated segregation unit wherein inerts, viz. metals, glass *et al.* are separated. Subsequently, it goes to the secondary shredder where the shredded waste (about 3 cms. In dia.) is conveyed to the secondary drier unit.
6. The secondary drier unit comprises of two driers operating in parallel along with its associated components which removes the moisture to the requisite level.
7. The waste from the secondary drier which has been preconditioned (i.e. shredded, segregated & dried) is conveyed to a preliminary feed storage bunker
8. The pre-conditioned feed from the preliminary storage is subsequently loaded in the feed bunker.
9. The waste (feed for the Concord Blue System) is conveyed by appropriate conveyers from the Feed Bunker to the reactor chambers within the Concord Blue Towers (1 X 3 Nos.) to generate hydrogen intensive syngas.
10. The gas is taken to the cooling and scrubbing unit and the scrubbed and cooled gas is taken to the engine room for power generation.
11. The Engine room comprises of 4 numbers of gas engines, each of 2.5 MWel generating capacity.
12. The Syngas is processed in the Gas engines to produce 10 MW of electrical power.
13. The Electrical power is evacuated by dint of a switch yard and is uploaded to the Grid with transformers to step it to the appropriate voltage of 22 KV.
14. The ash from the CBS facility is collected in ash silos and is sold to appropriate buyers (cement block manufacturers) and/or disposed alongside the inerts generated from segregation of the waste.
15. The Recyclables obtained from initial sorting/segregation is sold as scrap to appropriate dealers.

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Turnkey Packages

Turnkey packages		Delivery Schedule		
Sr. No. Item	Vendor	phase 1 - 2.5 MW	phase 2 - 5 MW	phase 3 - 2.5 MW
1 Gas Gensets	MWM Germany	Dec-10	Feb-11	Apr-11
2 BOP - Gas Gensets Auxilaries and Accessories	Green Power International	Dec-10	Feb-11	Apr-11
3 Shredders	M&J, Wiema	Nov-10		
4 Segregation	Bollegraaf	Dec-10		Feb-11
5 Dryers	Arrow head Separation Systems Pvt. Ltd.	Dec-10	Jan-11	Mar-11
6 CBS Gasifier + Utilities	Concord Blue	Nov-10	Jan-11	Apr-11
7 Power Evacuation Equipment & Controls	Voltage -Infra Pvt. Ltd.	Dec-10	Feb-11	Apr-11

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Section 8: Commercials

Commercial Highlights

The business model for a viable waste-to-energy solution typically includes:

- A committed amount of waste input material;
- A variation of gate/tipping fee or associated cost avoidance;
- A committed avenue for the sale of the high quality / high value output products: electricity, product gas, biochar, hydrogen or ethanol.

Our Commercial Highlights are outlined below:

1. CONCORD BLUE SYSTEM FOR PMC

Rochem Green would like to propose a 30 Yr. Agreement in line with the requirements of PMC, for treatment and disposition of MSW under a Build-Own-Operate-Transfer Further to this, Land to be provided free of cost by PMC and waste to be delivered to site free of cost by PMC. The scope of work would include:

- Preparation of detailed project design for 700 TPD Mixed Solid Waste as per the norms Maharashtra State Pollution Control Board (MPCB) & MSW rule 2000.
- Coordinate & obtain approvals/consent for the project from all relevant authorities including MPCB / CPCB.
- Reclaimed the land from the existing dumping area
- Construction of 700 TPD mixed Solid Waste plant at the land fill site provided by Pune Municipal Corporation within period of 12 months including monsoon.
- Construction of project related activities such as compound wall, weighing platform, internal roads, water lines, drainage lines, storm water drain, watchman quarter etc.
- Technology adherence to MPCB / CPCB guidelines & MSW rules 2000.
- Operation & maintenance for 30 years after completion of the project.

The detailed Technical Proposal is included as a separate attachment that enumerates in detail, the proposed technology as well as the waste disposition methodology.

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A tipping fee of Rs. 300/MT would be charged to PMC as a cost of avoidance of disposal. This would amount to approximately Rs. 765 lacs/annum based on the total MSW made available each year, and would be payable on a monthly basis.

Output

- The proposed technology by Rochem Green encompasses the following output:
  - High value Syngas resulting into Electricity ;
  - Carbon credits as the atmosphere is rendered Carbon negative;

  As mentioned in the tender, the above mentioned outputs would be property of Rochem Green for commercial Sale.

- Rochem Green reserves the right of generation and further commercial usage/sale of the electricity produced - 75000 KWhr. /annum. Rochem Green is free to enter into PPA with any party it may deem fit to generate revenue from sale of electricity during the 10 year period.

- The CBS prides itself on reducing the carbon footprint in its area of operation. Hence, it qualifies for obtaining Carbon credits. The same would be made available to PMC on a shared basis with 50% of credit ratings & associated revenue going to PMC while Rochem Green would retain 50% of the ratings.

- We propose to transfer the Blue Tower to the PMC post expiry of the contract.

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The following table summarizes the aforementioned details:

CBS B.O.O.T/B.O.T		
Description	Unit of Measurement	Value
PMC Load	Tonnes per Day	700
Period before Transfer	Years	30
Tipping Fees	Rs./Tonne/day	300
Total Tipping fees per annum	INR (Crores/annum)	7.6
Total Tipping Fees to be paid by PMC for entire Period	INR (Crores)	228
Transfer Price to PMC	INR (Crores)	N/A
Revenue to PMC from generation of Electricity and Carbon Credits after Transfer	INR (In crores/year)	21

SUPERVISION OF INSTALLATION & COMMISSIONING
Included

Delivery Terms

Delivery Period: The complete turnkey project can be implemented within 10-12 months on site.

Validity: This offer is valid only if order is placed by November 30, 2009.

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SUMMARY OF THE SOLUTION:

Rochem Green Energy Pvt. Ltd. would receive the unsegregated MSW from Pune Municipal Corporation and precondition for removal of moisture, metals and inerts (inerts would include only construction and demolition debris). Also, tl preconditioning would include drying and shredding of the waste. This pre-conditioned waste is fed to the patented syste provided by Rochem Green, which processes it to produce an energy intensive hydrogen rich syngas that is supplied to tl reciprocating gas engines after requisite pre-treatment for cleaning to produce green power.

The Steps are enumerated below:-

Step 1 = WASTE PRECONDITIONING

Includes = Shredding, Segregation Sorting, Drying.

Step 2 = REFORMER

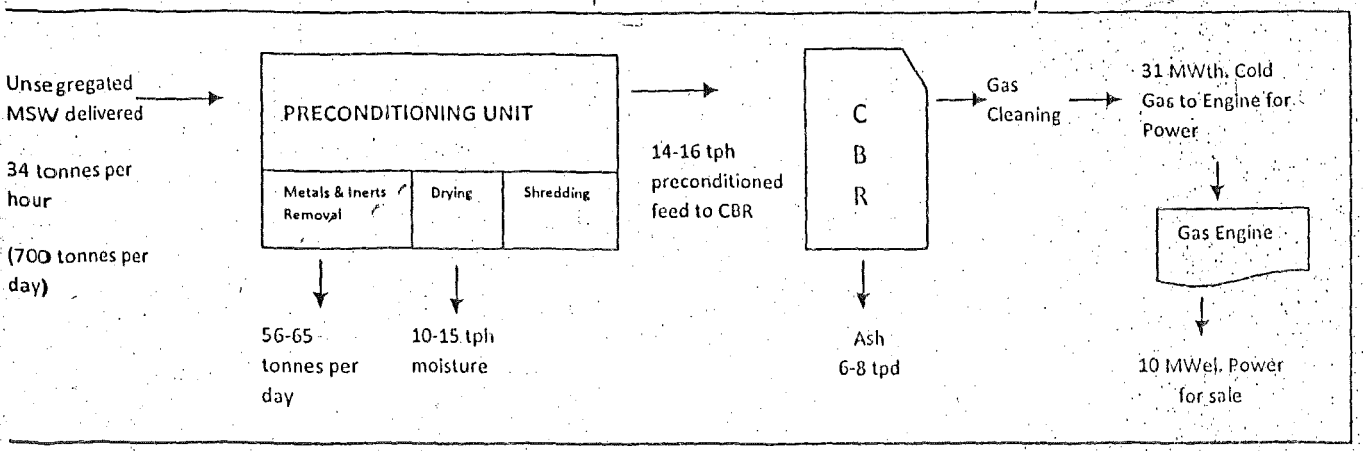
Step 3 = RECIPROCATING GAS ENGINE GENERATOR

Step 4 = EMISSION CONTROLS

Broad Input / Output

- Input – Unsegregated Municipal Solid Waste – 700 tonnes per day (2,55,500 tonnes per annum);
- Receipt of waste – 365 days a year;
- Plant Uptime (Defined as the amount of time for production of electricity) – 7500 hours/annum;
- Amount of Electricity Produced – 10.0 MWel (Net sellable electric power);
- Rejects from the system:
  - Inerts & Recyclables - A function of the feed – estimated at APPROX 15% of the received waste
  - Ash - A function of the feed – estimated at APPROX 6 TONS/DAY (subject to actual feed analysis)
- Space required - 10,000 square meters;

The following image gives the overall flow of mass/energy for the system:



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The proposed solution is an integration of the following segments that is further detailed in subsequent sections:

Segment A – Receipt and Preconditioning of Waste

- The facility would receive unsegregated MSW that is delivered by Pune Municipal Corporation;
- This MSW would be pre-conditioned as follows:
  - It would be segregated and sorted for Metals;
    - Ferrous Metals – Magnetic Separators;
    - Non Ferrous – Eddy Current Separators;
  - Miscellaneous – Trommel Screens;
- Drying – The Waste is expected at 35-50% moisture (AVGgross). It would be dried to 15% moisture level by utiliz the waste heat emanating from the system
- Shredding – The waste would be shredded to about <3 cms. Dia. To ensure a smooth flow within the process System.
- The recyclable material as obtained from the segregation and sorting unit is sold to appropriate third party buyers;

Segment B – Gasification of Waste

- The preconditioned waste is conveyed to the Biomass bunker from wherein it is fed to the Thermolyser.
- High temperature resistant heat carrier media is let into the Thermolyser (reactor chamber) by control va wherein it mixes with the feed. The atmosphere inside the Thermolyser is completely inertized by nitrogen addi and steam blanketing, and this ensures that there is no addition of air/oxygen in the reaction. This ensures r dilution of the resultant gases and also makes it energy intensive.
- The heat carrier media owing to its size (12-15 mm dia.) offers the maximum surface area, thereby maximizing heat exchange efficiency, and this result in the fed feed to undergo a phase change to gas, and leaves behind a s reside – biochar.
- The Biochar alongside the heat carrier media are let into a drum sieve separator, wherein they are taken apa different silos. The media is conveyed in enclosed elevators to the Heat Carrier Bunker. The char is combusted char combustor to supply the process heat.
- The gas generated in the Thermolyser is then taken to a Reformer wherein it is further heated to a hi temperature in the presence of steam to effect a steam reformation. This ensures that the hydrocarbons associ with tar formations are eliminated (they break into short chain hydrocarbons which when condensed does produce tar) and the water-gas shift reaction occurs that makes the syngas hydrogen intensive.
- The Syngas is then taken for cleaning and cooling and subsequently conveyed to the engine for power productior

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Segment C – Gas Cleaning and Power production

- The resultant syngas from the reformer is cooled and the sensible heat is transferred to the process to optimize heat balance.
- Further it is cleaned by filtering & scrubbing for pollutants and is subsequently conveyed to the engine.
- The engine is a reciprocating type internal combustion mechanism which processes this clean syngas to prodi power (38-40% electrical efficiency);
- The flue gas emanating from the engine and the char combustor is treated for the following:
  - NOx – Mode of Treatment – SCR
  - CO - Mode of Treatment - Oxidative Catalysts
  - HAP - Mode of treatment – Scrubbers
- The final exhaust is treated as stated above to adhere to the regulatory emission standards.
- The final rejects from the system are as under:
  - Ash – from the char combustor – 6-8 tpd;
  - Construction and Demolition Debris – Estimated at 56-65- tpd;

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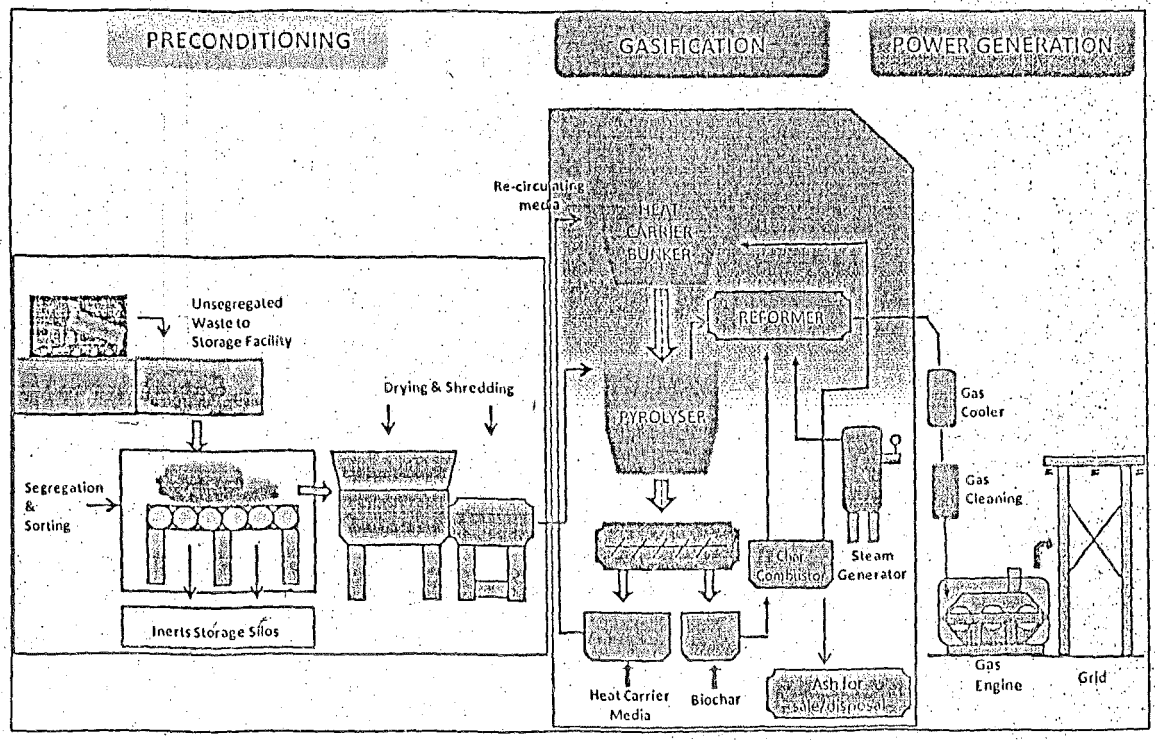
Summary of the Technologies

Conventional gasification plants typically turn input biomass material into a product (also called producer ga syngas or synthesis gas) by means of pyrolyzing it into biochar and gasifying the material by introducing air (as a oxygen source). The low energy syngas that results is then used to create energy through heat via steam turbines.

In contrast, the system offered by Rochem Green uses a multi-stage process, beginning with Pyrolysis of the sol organic waste to create a product gas. The product gas is subsequently passed through a reformation stage wit steam addition that results into a tar free, high calorific hydrogen intensive syngas which can be utilized to produ power via a gas engine or steam by dint of a boiler.

The System is a pure Steam Thermolysis technology that enhances the quality of its gas by inhibiting any dilutic with oxygen (the gas never comes in contact with the atmosphere). We employ high temperature resistant he carrier media which maximizes the available surface area and hence, also the heat transfer between the media a the solid waste. The high temperature heat carrier media mixes with the solid waste in a completely inertiz atmosphere (blanketed by Nitrogen or any suitable inertizing agent) to thermally effect a phase change of the so waste to gas and generate high quality char as a by-product. The gas is subsequently reformed in the presence steam which causes the water gas-shift reaction thereby resulting into a hydrogen intensive high calorific val syngas which is taken to a gas engine post cooling and pre-treatment to produce power at maximum efficiency.



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SUMMARY OF OPERATION FOR THE PROPOSED PLANT

1. The solid waste (feed) is conveyed to the storage shed by the waste tipping trucks (or any other suita conveyance);
2. The Trucks are weighed on Weigh bridges which transmits the data (weight of the waste) to the control ro which monitors the quantum of waste brought into the processing facility daily.
3. The waste is stored in enclosed sheds to ensure that there is no putresance emitted from within them;
4. The feed is tipped on the tipping floor from wherein it is stored in storage bays. From herein, the front loa conveys it to the primary shredder where the initial sizing of the material is achieved. From herein, it goes the drier for initial moisture removal.
5. Post drying, the waste is conveyed to the fully automated segregation unit wherein inerts, viz. metals, glass *al.* are separated. Subsequently, it goes to the secondary shredder where the shredded waste (about 3 cms dia.) is conveyed to the secondary drier unit.
6. The drier unit comprises of a drier operating in parallel along with its associated components which remo the moisture to the requisite level.
7. The waste from the drier which has been preconditioned (i.e. shredded, segregated & dried) is conveyed t preliminary feed storage bunker
8. The pre-conditioned feed from the preliminary storage is subsequently loaded in the feed bunker.
9. The waste (feed for the processing System) is conveyed by appropriate conveyers from the Feed Bunker to reactor chambers within the processing Towers to generate hydrogen intensive syngas.
10. The gas is taken to the cooling and scrubbing unit and the scrubbed and cooled gas is taken to the engine ro for power generation.
11. The Engine room comprises of reciprocating gas engines, each of 3.0 MWel generating capacity.
12. The Syngas is processed in the Gas engines to produce 10.0 MW of net electrical power at 11 kv.
13. The Electrical power is evacuated by dint of a switch yard and is uploaded to the Grid with transformers step it to the appropriate voltage.
14. The ash from the CBS facility is collected in ash silos and is disposed alongside the inerts generated fr segregation of the waste.
15. The Recyclables obtained from initial sorting/segregation is sold/disposed as scrap to appropriate dealers.
16. The excess gas, or the gas generated when there's an engine shutdown is flared off.

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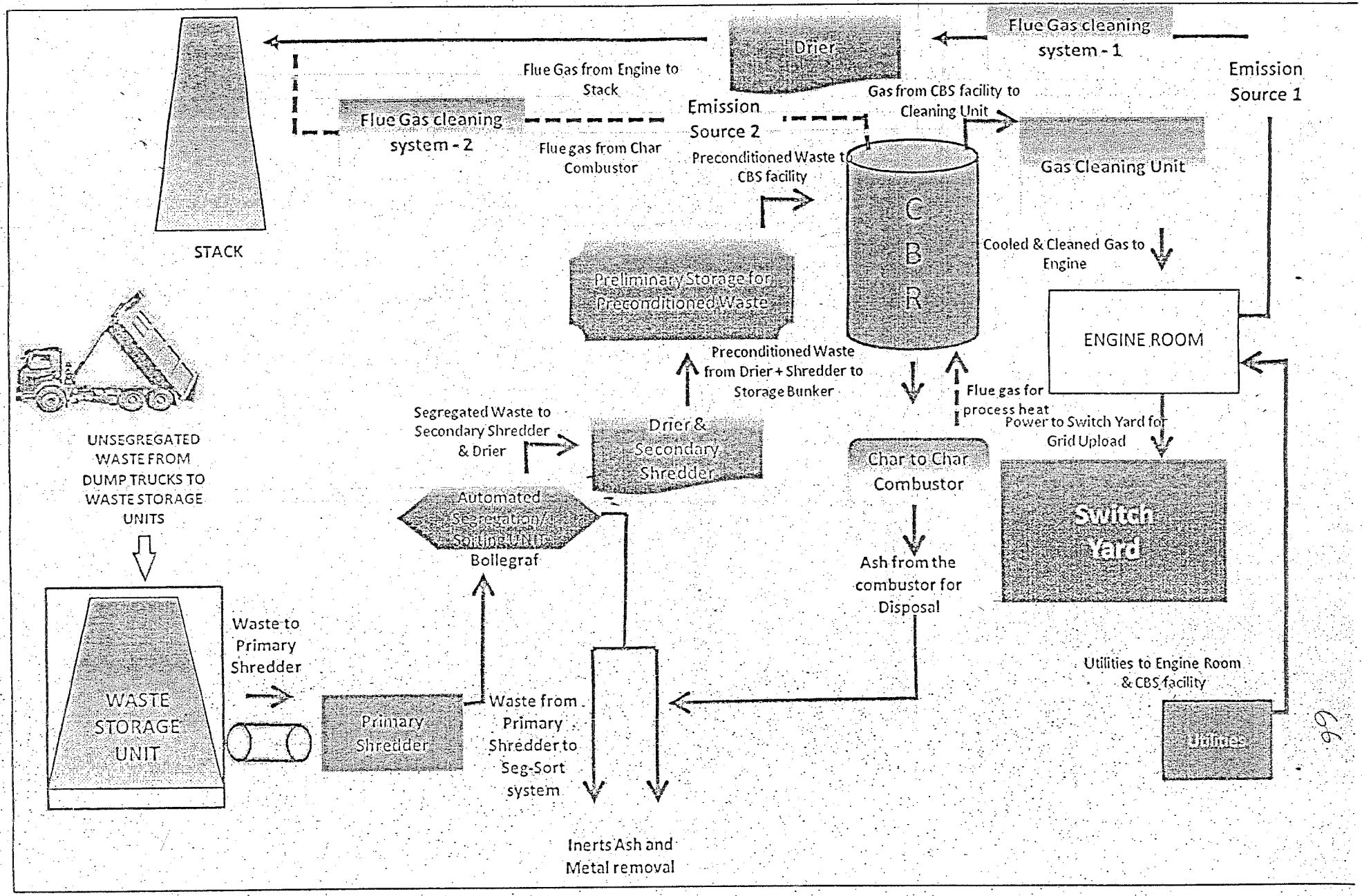
Process Flow



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The following details the operational procedure from feed analysis to final power generation:

FEED ANALYSIS

The proposition is a completely customized solution catering to the specific requirements of the MSW in the Inc scenario. Every plant is designed as per the waste quality and quantity and hence, we carry out a detailed analysis of waste type to ascertain the design considerations and fashion an optimized solution to meet the rated parameters.

We, at Rochem work with some of the leading waste analysis laboratories of the world like SGS labs (www.sgs.com ensure that we obtain the most accurate data as regards the waste analysis as this would prove pivotal to the output t the plant would subsequently be designed for.

PROXIMATE ANALYSIS	
COMPONENTS	PROTOCOL
MOISTURE (%) adb	ASTM D 3173 – 03
ASH (%) adb	ASTM D 3174– 04
VOLATILE MATTER (%) adb	ASTM D 3175 – 07
FIXED CARBON (%) adb	100 – (Moisture+Ash+VM)
GROSS CALORIFIC VALUE (KJ/KG) db	ASTM D 5865 – 07
ULTIMATE ANALYSIS	
COMPONENTS	PROTOCOL
Carbon as C	ASTM D 5373 – 2002
Hydrogen as H	ASTM D 5373 – 2002
Nitrogen as N	ASTM D 5373 – 2002
Ash Content	ASTM D 5373 – 2002
Sulphur as S	ASTM D 5373 – 2002
Oxygen as O (Balance)	
Chlorine as Cl	

**Depending on the type of waste, analysis of specific components is conducted;*

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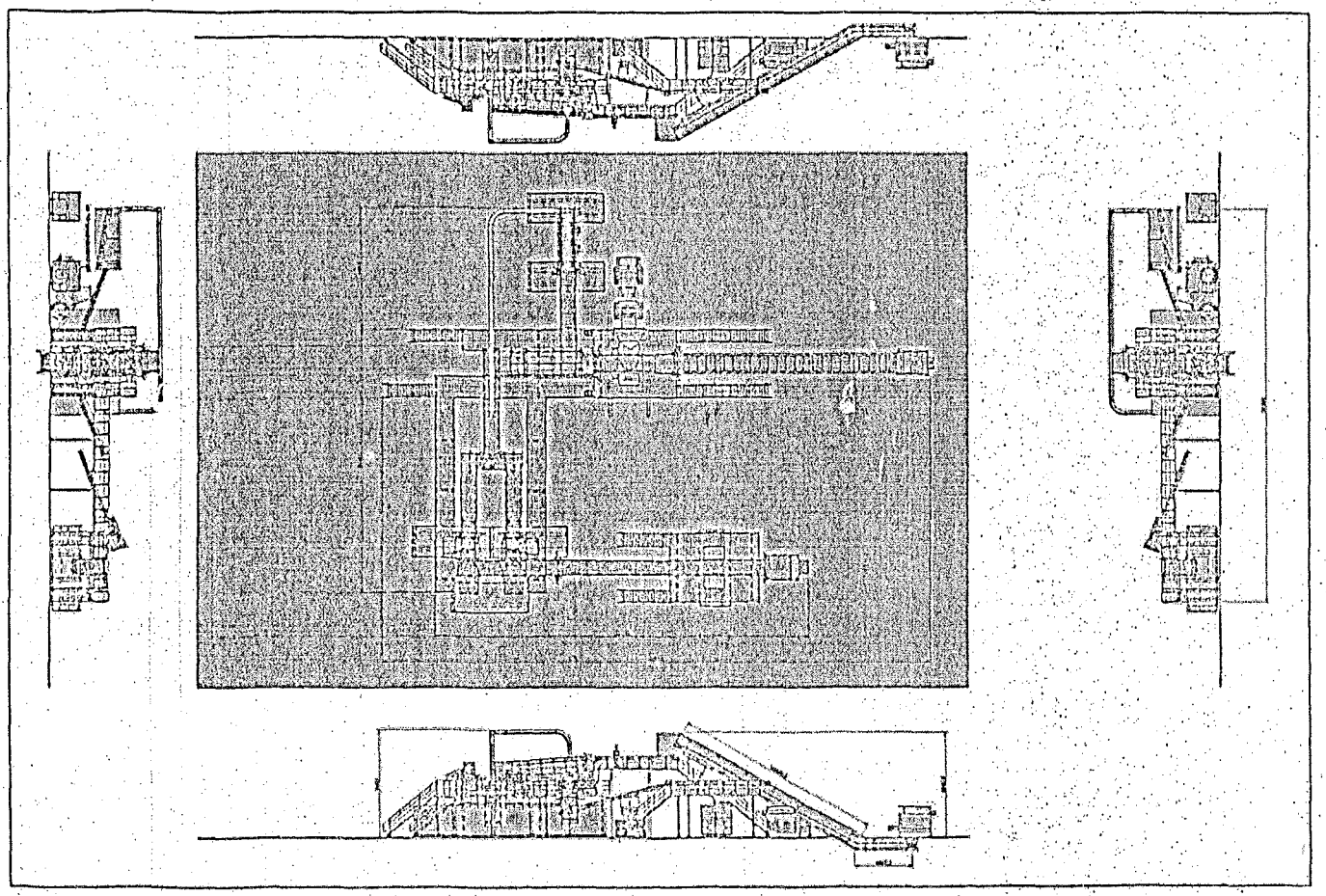
Preconditioning Unit

BASIC DATA

- Total amount of Metals + Inerts – 10-15% of gross feed.
- The feed is expected to be removed at a 95% efficiency, thereby making the total feed removal rate at 56-65 tonnes per day;
- Automated Segregation and Sorting Unit supplier – Bollegraf, Netherlands.

The detail of the segregation and sorting unit is as follows:



AUTOMATED SEGREGATION & SORTING UNIT

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The segregation and sorting unit consists of the following operations :-

- Shredder
  - To reduce the feed size and make it suitable for further processing
- Segregation sorting system
  - Trommell
  - Fine screen
  - Air conveyance
  - Magnetic separator
  - Eddy current separator
  - Manual picking station at 4 locations for hand picking (quality control , etc as desired)
  - Secondary shredder for final size reduction.
- Drum Dryer
  - For final moisture control before processing of pre-conditioned waste

The recovery of the Biomass fraction from the MSW is carried out by automated mechanical segregation sorting equipment as shown in conceptual layout above.

The biomass recovery is based on the assumption that the general MSW components are as follows ;-

The intent is to remove – Glass, metal, inerts and misc contaminants.

The Proposed system consists of the following steps:-

- Tromell (75mm)
- Fine Screen (50 mm)
- Air conveyance
- Manual pick up conveyor
- Magnetic separator
- Eddy current separator

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The MSW as received is initially sent through a SHREDDER for size reduction down to 8 inch. Post shredding the waste which is received is passed though an automated Segregation and sorting system for removal of Metals (ferrous & non-ferrous), Glass, Debris and other recyclables and inert materials. The recyclables are sent forward to recyclers and the debris & inert form part of the total facility residual waste.

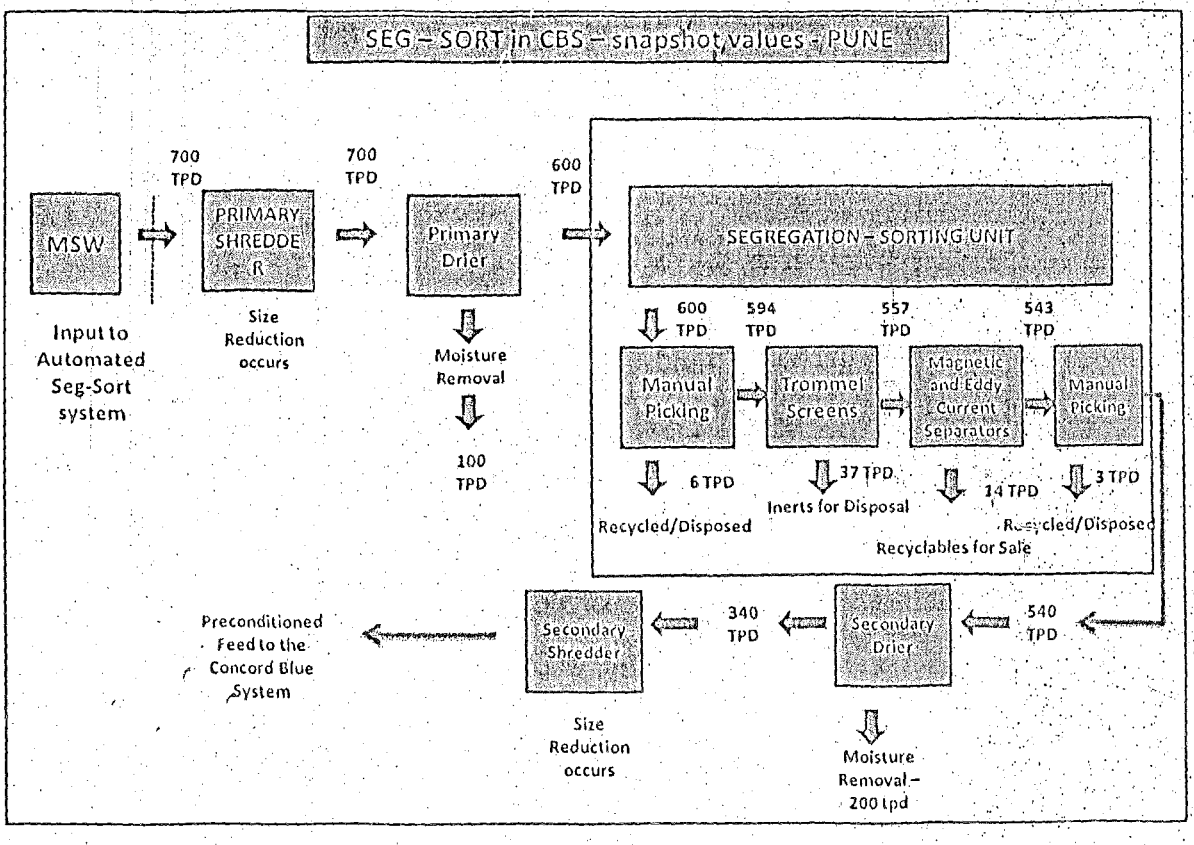
Accordingly, an Recyclables in the form of metal & glass are expected to be recovered and removed from site to recyclers at the rate of one truck load per day from the automated segregation & sorting system.

The next step is drying for excess moisture removal. This is achieved by means a ROTARY TUNNEL DRYER utilizing Waste heat (flue gas).

The Waste is dried from an initial moisture content of 50% to less than appox. 15% by removal of moisture to the tune of - 10 tons/hour.

The Flue gas shall be vented from the dryer through suitable designed Bag house system for PM emission control. The pre-conditioned MSW thus obtained shall be input ready feedstock for the CBR system and shall be conveyed to the CBR tower via enclosed Bucket elevator system. Here the feed is then pushed into the CBR Thermolysis section by ram feeder.

Details of Metals + inerts removal are outlined in the following images:



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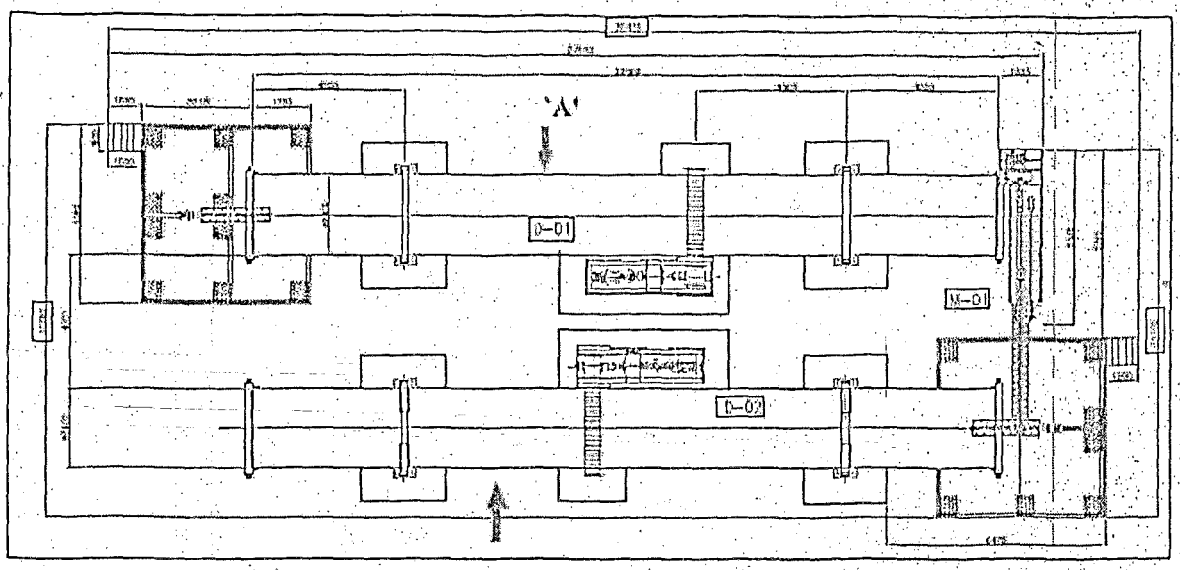
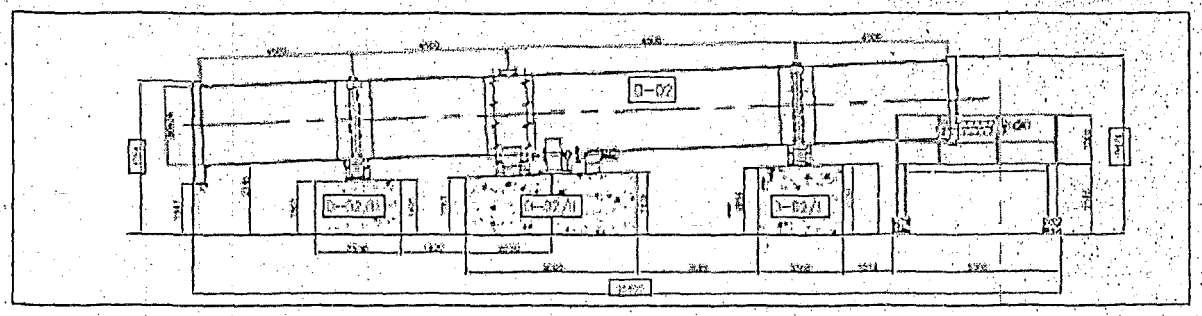
Dryer View



3 meters

12 meters



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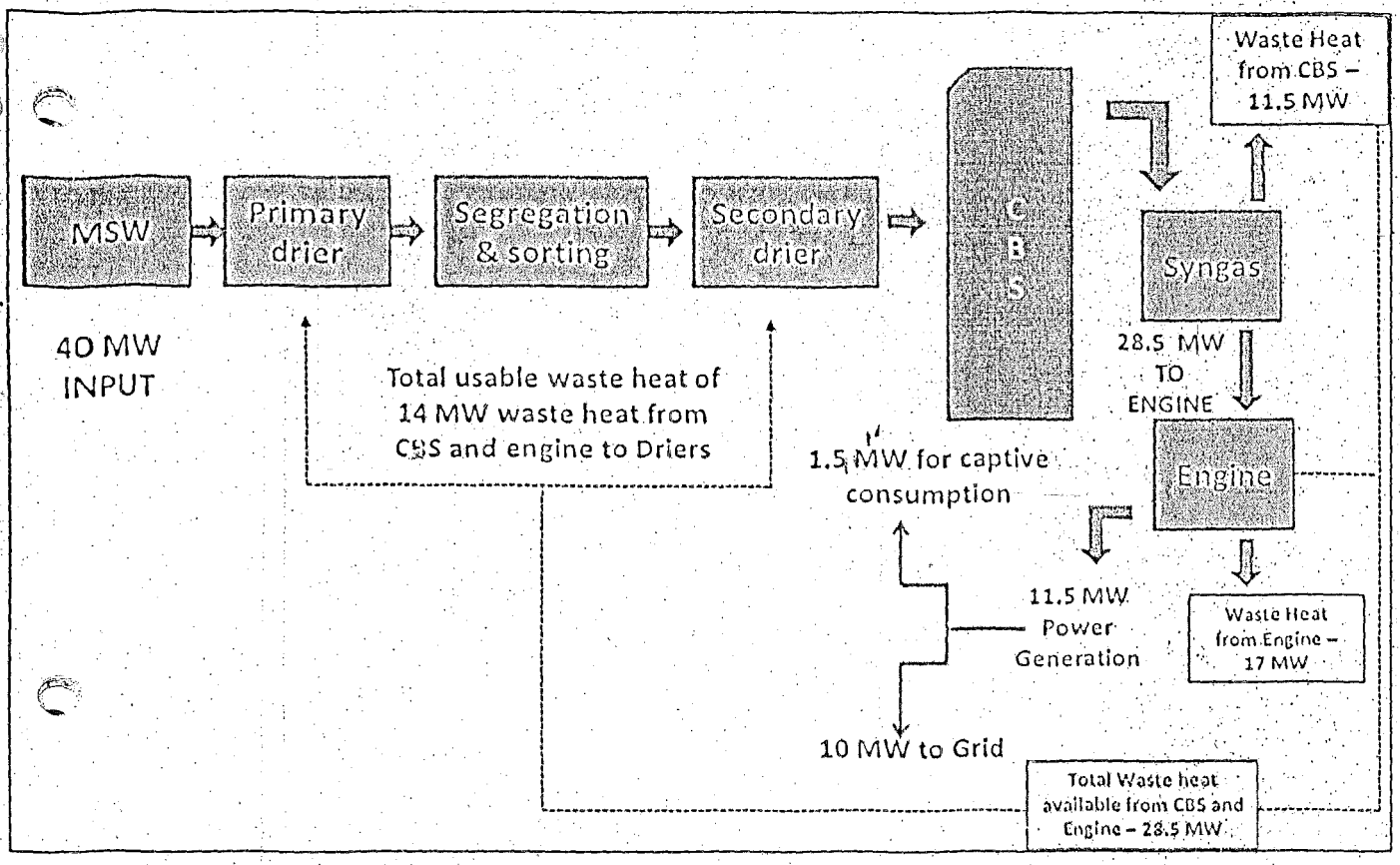
GASIFICATION UNIT

BASIC DATA

- Input to CBR – 340 tonnes per day of pre-conditioned feed;
- Energy of Input Feed – 43 MW gross;
- Thermal Plant Efficiency – 70%;
- Thermal Energy of Gas - 30 MWth.
- Gas engine electric efficiency - 40%;
- Total Power produced - 11.5 MWel;
- Captive Consumption - 1.5 MW (for all equipments)
- Net sellable power - 10.0 MWel;



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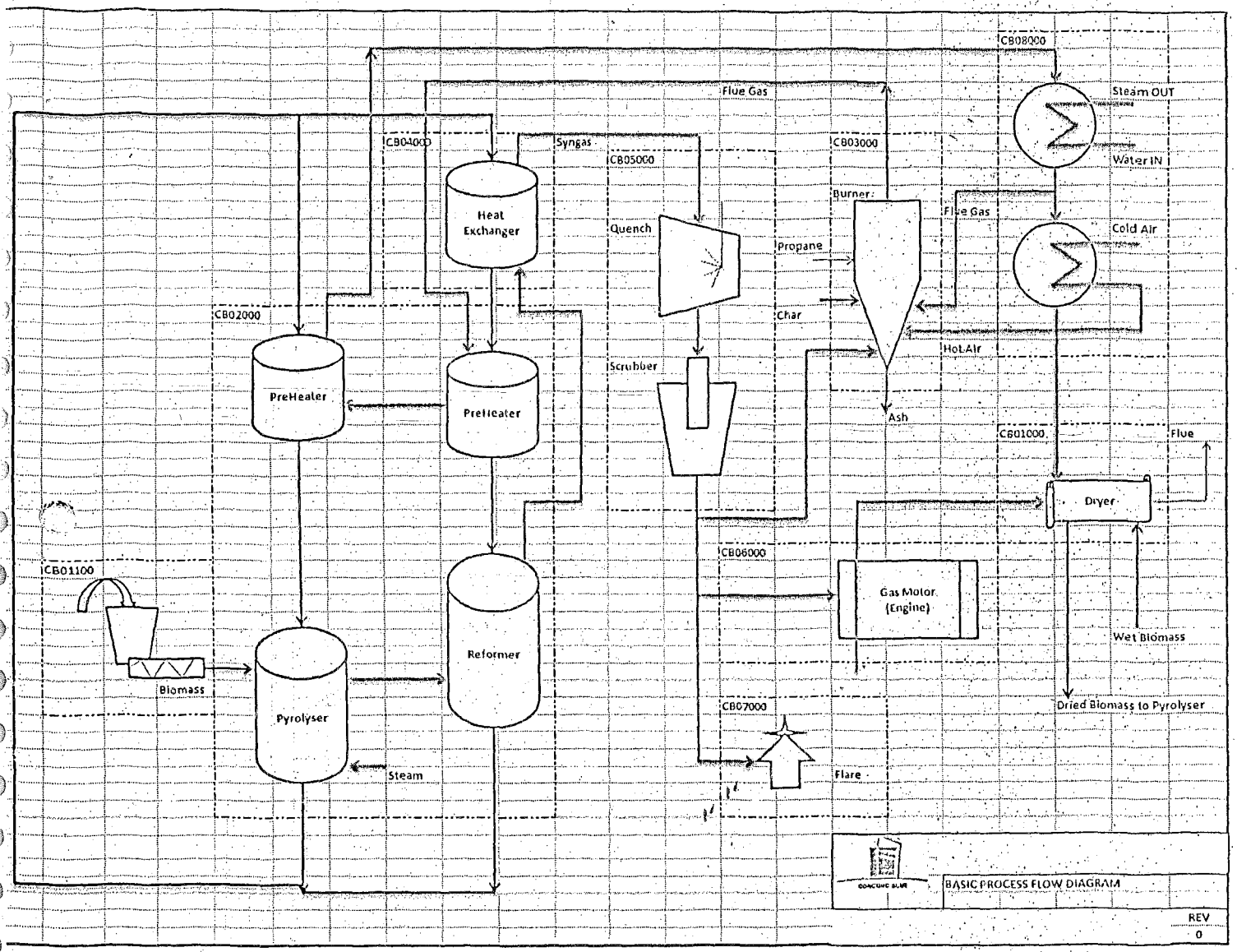

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THE WASTE PROCESSING REFORMER

The input ready material is fed to the THERMOLYSIS REFORMER for conversion of the volatile content to Fuel Gas. The CBR system is a complete Waste to Gas generation plant, housed on a Steel structure with most units fitted on the structure other than certain utilities.

The main processes undertaken in the process are as follows:-

- THERMOLYSIS
- CHAR DECARBONISATION
- WASTE HEAT RECOVERY
- ASH HANDLING

Step 1- THERMOLYSIS

The CBR reformer is a unique pure steam Reformer, wherein the waste is heated by direct contact with suitable heat transfer media (heat carriers – this is a completely inert material capable of withstanding the high operating temperatures and environment of the CBR system). The reaction is carried out in a Steam environment, which is completely devoid of air/oxygen. At a temperature between 600-800 °C the waste undergoes phase change from Solid phase to Gaseous phase by thermal phase change. Since the entire Thermolysis process is completely devoid of Oxygen or Air, there is NIL combustion of Waste, thus leading to only clean gas generation. The lack of air/oxygen ensures a clean Gas generation without the possibility of any harmful by-products of combustion reaction taking place. This is unlike the most partial oxidation systems which combine air/oxygen with waste in the same reactor.

The obtained Fuel Gas is then further heated upto 1200 °C. This process aids in the further refining and enrichment of the gas. This process of heating the fuel gas to such a high temperature with a residence time of over 2 seconds also ensures complete destruction of any toxic substances that may be generated.

The Reformed Gas obtained is cooled & quenched before being conveyed to the Cleanup and Generation section. Reformed Gas cooling is partially achieved by using the heat to reheat the Heat Carriers. As a result of the unique process conditions maintained in the Thermolysis plant, the Fuel Gas obtained is a mixture of CO, H2 and CH4, and has a calorific value exceeding 2500 Kcal/Kg. The total gas generated is approx 30.0 MW thermal energy in fuel gas at outlet.

The Heat Carriers (HC) imparts the heat to the process and is again maintained in continuous recirculation within the system. These are reheated in HC Heater at the top of the Thermolyser by utilizing Fuel Gas as fuel for a Hot Air Generator and Hot Gas from other process sections including Decarbonisation.

The entire Thermolysis CBR system is designed with the highest standards of safety. With operating pressures below 5 ps (200 mbar), a completely safe operating plant condition is maintained. Necessary safety systems such a Rupture discs Emergency Flare, Feed cutoff and other safety cut-outs and alarms ensure a very safe operating environment.

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Step 2- CHAR DECARBONISATION

The left over from the THERMOYSIS, which converts all the volatile fraction of the feedstock to Fuel Gas, is the fixed Carbon and Ash fraction. This is referred to as Char and is extracted from the bottom of the CBR Thermolyser.

Char obtained has the following properties:-

- Fixed Carbon = > 40%
- Ash = > 40%
- Volatiles = <10%

The Char is conveyed to a decarbonisation section. Here the carbon content is reduced to less than 2% carbon. This is achieved by means of contacting the Char with Air. The resulting decarbonisation reaction leads to an increase in the temperature of the Air stream utilized for the decarbonisation reaction upto 500-600 °C. This Hot air is then utilized within the process in the HC reheater to utilize this waste heat and cool the air prior to it being vented from the system. This hot air also goes through other sections, before being vented through suitable Scrubber & Bag house system for Emission control.

Step 3- WASTE HEAT RECOVERY

The entire facility and the CBR system are designed with the highest level of energy efficiency for minimum energy consumption and highest input to output ration.

The Waste heat in terms of Hot Air which is available from the Char Decarbonisation section is utilized in two ways:

- The hot air at 500 °C from the outlet of the Heat Carrier Re-heater is sent to a Waste Heat Recovery Boiler (Heat Recovery Steam generator – HRSG) to generate Steam for the CBR process Thermolyser at 120 psi (5 bar) pressure.
- The Hot air from the HRSG outlet is then led emission control section, where it is Cooled, Scrubbed and cleaned though suitable BAG House mechanism for PM control.

Step 4- ASH AHNDLING

The residue from Char Decarbonisation is Ash. The ash so obtained is cooled in a Water bath, and wet ash is then conveyed to an onsite ash storage bunker, which is equipped with an online bagging system. The Wet ash handling ensured control of PM is achieved throughout the ash handling system upto the point of bagging.

The generation of Ash based on the feed MSW is estimated at 6 tons per day.

The bagged Ash is disposed onsite on a weekly basis by trucking to suitable disposal facility.

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POWER GENERATION

BASIC DATA

- Vendor – MWM Germany
- Input to Gas Engine – 30 MWth.
- Rated Efficiency of Gas Engine – 40%;
- Electric Power Produced - 11.5 MWel;
- Net sellable Electric Power - 10 MWel;

The CBR generated "FUEL GAS" meets and exceeds the requirements of the Modern Gas Engine sets to enable Clean, High Efficiency Electrical Power Generation.

MWM GmbH in Mannheim, Germany, has been one of the world's leading system providers of highly efficient and environmentally-friendly complete plants for decentralized energy supply with gas and diesel engines. The company sta_ s for the reliable, uninterrupted provision of electricity, heat, and cooling at all times and at any location. The machine incorporated is a state-of-art, fuel-efficient gas engine from Germany.

Basic scope of supply Genset

• Modern stationary four-stroke Otto gas engine with lean mixture combustion; V configuration engine;

• Water-cooled with exhaust gas mixture turbocharging and intercooling; direction of rotation according to DIN 6265, counter clockwise (viewed on the flywheel side);

- Three-phase internal pole synchronous generator
- Manufacturer: Marelli/Equivalent

• Output – 11,000 V, 60 Hz.;

• Three-phase synchronous generator, brushless, self-induced, self-adjusting, with dampening cage for 30% inclined load and parallel operation, artificial star point, protection type IP 23, with tropical atmosphere and humidity protection insu_ation, degree of radio shielding "N", voltage target value setting ± 5%;

Genset assembly

- Specification TCG2032V16.
- Gas engine and generator are coupled elastically, mounted on the common support frame, for vibration insulated installation using feather elements on foundation at the customer's;

The gas Engine is designed to intake the 30 MWth Fuel Gas from CBR and produce a Gross output of 11.5 MW electrical at 40% efficiency.

The Engine is suitably fine tuned to ensure lowest Raw emissions. The engine is fitted with suitably designed SCR and Oxicat low emissions of NOX and CO.

Exhaust Gas from engine is available at > 700 °F. This is led to the dryer by suitable insulated ducting for the purpose of waste heat utilization for MSW drying. From the dryer the exhaust is then led to stack via a bag house for PM control.

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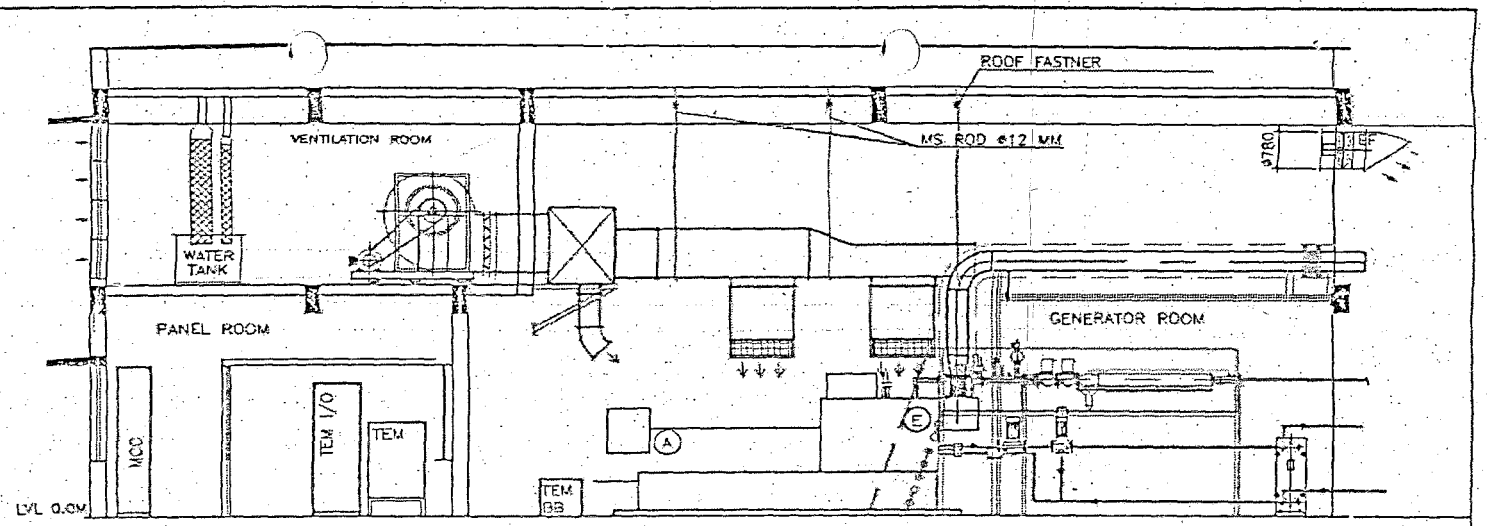
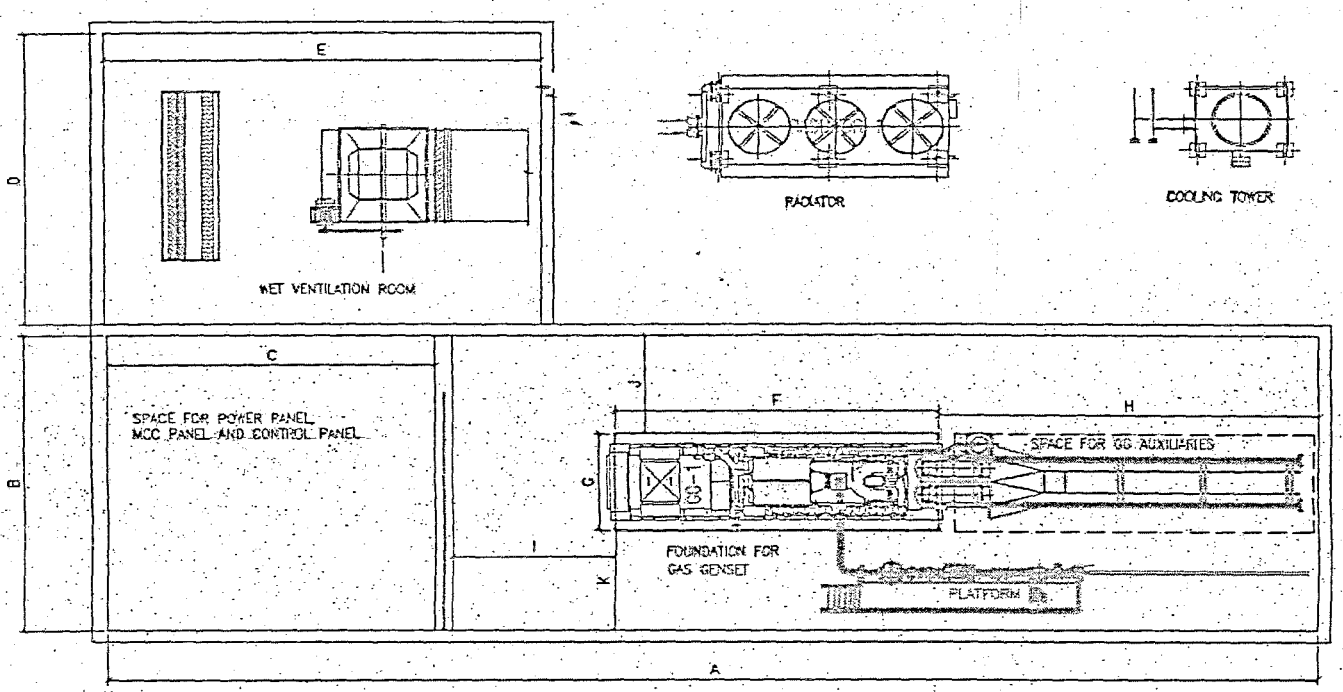


ELEVATION



PLAN

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UTILITIES

The entre facility is provided with the following utilities to support the plant operations at all times.

1. COOLING TOWER

For the purpose of engine cooling as well as Hot air cooling from CBR and decarbonisation step as well as Quench systems. The cooling tower utilized shall be an INDUCED DRAFT COUNTER FLOW of FRP construction designed with low drift loss of < 0.02 %.

2. AIR COMPRESSOR – 400 CFM

A suitably sized reciprocating Air compressor with tank, filter for dry air supply to instrument and control system is provided.

3. FUEL GAS FLARE

In case of any process interruptions of emergency conditions leading to activation of fail safe mechanism, the Fuel Gas produced shall be diverted to FLARE.

The Flare system is designed in compliance with latest relevant regulations to ensure > 99% destruction efficiency.

The flare shall also be utilized during startup and shutdown periods when Engine is not operational. Maximum 300 hours per year.

4. NITROGEN BANK – 100 m3/hour for the first 2 hours; 20 m3/hr. thereafter;

Nitrogen cylinder bank is maintained onsite, to supply N2 for the purpose of initial plant inertization, and operation purging of requisite process components to maintain air/oxygen free environment in the CBR Thermolyser.

5. STARTUP HOT AIR GENERATOR

A Hot Air Generator is provided to supply Hot Air for Heat Carrier heating during initial plant startup, and also to supply the dryer for startup while the engine is not operational and exhaust gas of engine is not available.

This is only utilized during startup periods and the operation of this device is limited to a maximum of 500 hrs per annum.

6. FUEL GAS QUENCH + SCRUBBER

The FUEL Gas from CBR system is led to a Quench for temperature reduction and then led to a 2 step scrubber process for cleanup which includes reduction of H2S, other Acid Gases and Tar polishing.

At the Quench a mixture of Biodiesel and Water is utilized to ensure polishing of any residual tars as maybe present in the Fuel Gas.

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The Scrubbing is conducted by means of suitable Scrubbing with:-

- H202 for H2S control
- NaOH for other Acid Gas control

Scrubbing is done in Packed Column Scrubber towers. This clean, low Sulfur FUEL Gas is obtained which is reliably and cleanly utilized as fuel for electricity generation in the Engine Generators.

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MATERIAL AND ENERGY BALANCE

Mass & Energy Balance

The following table gives the Mass and Energy balance for the gasification System;

Sr. No.	Description	UOM	Value	Remarks
1	Type of Feed	---	---	Municipal Solid Waste
2	Quantity	tonnes per annum	255,500.00	As received basis
3	Recyclables/Rejects	% of as received feed	12.00	Metals and Inerts
4	Moisture Content	% of as received feed	50.00	Gross
5	Waste feed energy	Kcal/kg	800-1000	As -received basis
6	No. of hours of power plant uptime	Hours/annum	7,500.00	Indicates the number of hours of electricity production
7	Waste feed to Plant	Tonnes per Hour	34.07	On an As received basis
10	Inerts and Metals Removal	Tonnes per day	56-65	Considered at 95% removal efficiency
11	Moisture Removal	tonnes per day	300.00	---
12	Moisture Removal Rate	Tonnes per Hour	15-Oct	---
13	Pre-conditioned input feed to	Tonnes per day	340.0	---
14	Calorific value of waste	kcal/kg	2,600.00	Input ready basis (Assumption)
15	Gross Input Energy to the plant	Mwgross	43	Input Energy of Preconditioned feed to the plant at 2600 kcal/kg
12	Thermal Energy of the Plant	MWthermal	30	Considered at a cold gas efficiency of 70% after accounting for losses and internal consumption
13	Electrical Energy Production	MWelec	11.5	Considered at an engine efficiency of 40%
14	Captive Electric Consumption	MWcaptive	1.5	Captive consumption for all equipments
15	Net Sellable Electric Power to the Grid	KWnet sellable	10	Net exportable power

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MSW WORKSHEET

WASTE ANALYSIS - CV

	as recd	dry + seg
H2O	50%	20%
C	16%	27%
H	3.00%	4.80%
N	0.07%	0.10%
S	0.06%	0.09%
O	16%	31%
Ash	14%	17%
Cl	0.60%	0.10%
Total	100%	100%
CV	5447.395	10082.95
kcal/kg	1301.337	2408.731

CBR2 operation

input	340	tpd
dry + seg	2600	kcal/kg
Gross IN	13	MW
Cold Gas eff	70%	
Gas Out	30	MW
Engine Efficiency	38%	
Elec Gross	11.38	MW
less plant load	13%	
	1.48	
Net Exportable	10	MW

input	700	tpd	
input	340	tpd	
	14	tph	
removal	361	tpd	% removal
	298	moisture	38
	63	inert	12
drying energy @ 60% dryer efficiency			
	12	MW	

Waste Heat CBR		13 MW
useable Heat	30%	4 MW
Waste Heat Engine		19 MW
useable Heat	45%	8 MW
total useable Heat		12.2 MW

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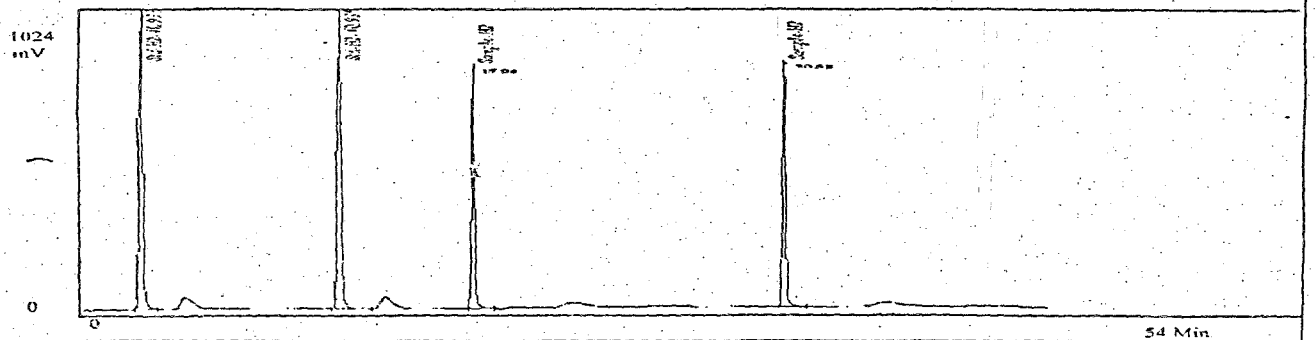
The following image gives the Gas Chromatography report for Hydrogen detection. Similar details for other components of the gas can be made available on request:

Report

Lab. Name : Chemtron Science Laboratories Pvt Ltd.
Client: Concord Blue
Analysis Date: 03-09-2010
Detector: TCD
Column: MS-13 X
Carrier: Argon
Operator: Nivrutti
Column Length: 6 ft
Carrier Flow Rt: 25 ml/min
Components: Hydrogen
Injection Vol.: 0.5 ml

Sample: Bio Mass Sample.
Data File: D:\Nivrutti\Concord Blue\H2-Sample 3-09-2010.csl



Number	Retention Time	Area	Area%	Height	Height%	Concentration	Component
1	2.62	11065.01	30.137	1028.77	27.885		Std-H2-40.93%
2	11.32	11066.07	30.14	1032.17	27.977		Std-H2-40.93%
3	17.08	7292.231	19.862	809.8133	21.95		Sample-H2
4	30.83	7292.0221	19.861	818.5572	22.187		Sample-H2

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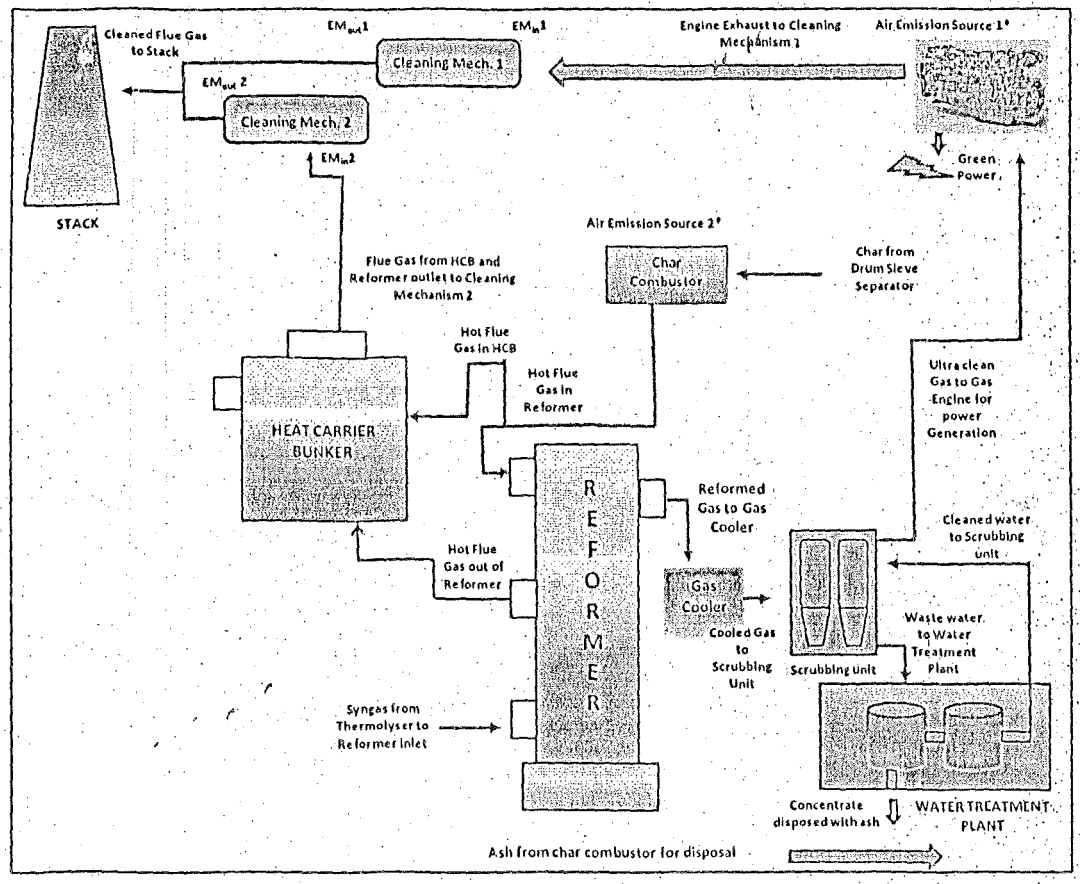
EMISSIONS

Efficient and clean emissions resulting from a state of the art treatment mechanism is one of the USPs of every Reforme The CBR produces ultra clean gas by converting most of the waste into gas which is treated with appropriate pollutic control mechanisms. The reformed gas is taken through a set of cleaning mechanism that ensures that the engine receiv clean gas which results into a clean exhaust. This exhaust is further treated with efficient engine combustion relat technologies and hence the major pollutants like NOx and CO are lowered to well below regulated norms by a combinatic of good engine control and management practices. Also, the flue gas resulting from combusting the syngas is treated f NOx and CO by SCR and Oxidative Catalysts respectively alongside requisite filters thereby ensuring that the emissions fro therein are also regulated to remain below the prevailing norms in the concerned geography.

Elements such as sulphur and Chlorine are preferentially converted into a part of the ash by the scrubbing syster wherein the contaminants that are not sequestered within the char are scrubbed in the scrubbing unit. The was water from the scrubbing unit along with the contaminants is then treated in a water treatment plant wherein tl contaminants are disposed off as a concentrate along with the ash.

There are 2 air emission sources from the CBR. These are:

- Emissions from the Engine (Air Emission Source 1)
- Emissions from the char combustor (the flue gas from therein is taken to the HCB and the Reformer and then to tl Flue Gas treatment Unit) (Air Emission Source 2)



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The main Air emissions generation points are as follows:-

- CBR HOT AIR GENERATOR – Fuel Gas fired
- CBR CHAR DECARBNISATION SYSTEM
- RECIPORCATING GAS ENGINE GENERATOR
- DRYER
- COOLING TOWER
- EMERGENCY FLARE
- TIPPING AREA

Process Emissions are controlled by installation of suitable control mechanisms at requisite locations, details are provid below.

CBR CHAR DECARBNISATION SYSTEM

Hot air after HRSG (steam generator) from this process is suitably passed through an Alkaline Scrubber system for Ac Gas controls, and then through a Bag House for PM control.

RECIPORCATING GAS ENGINE GENERATOR

The exhaust Gas from engine is lead to suitable sized SCR and *Oxicat* (Oxidative Catalysts) system for reduction in values NOX and CO to desired standards.

DRYER

The exhaust gas from Dryer is lead to Bag house for PM control.

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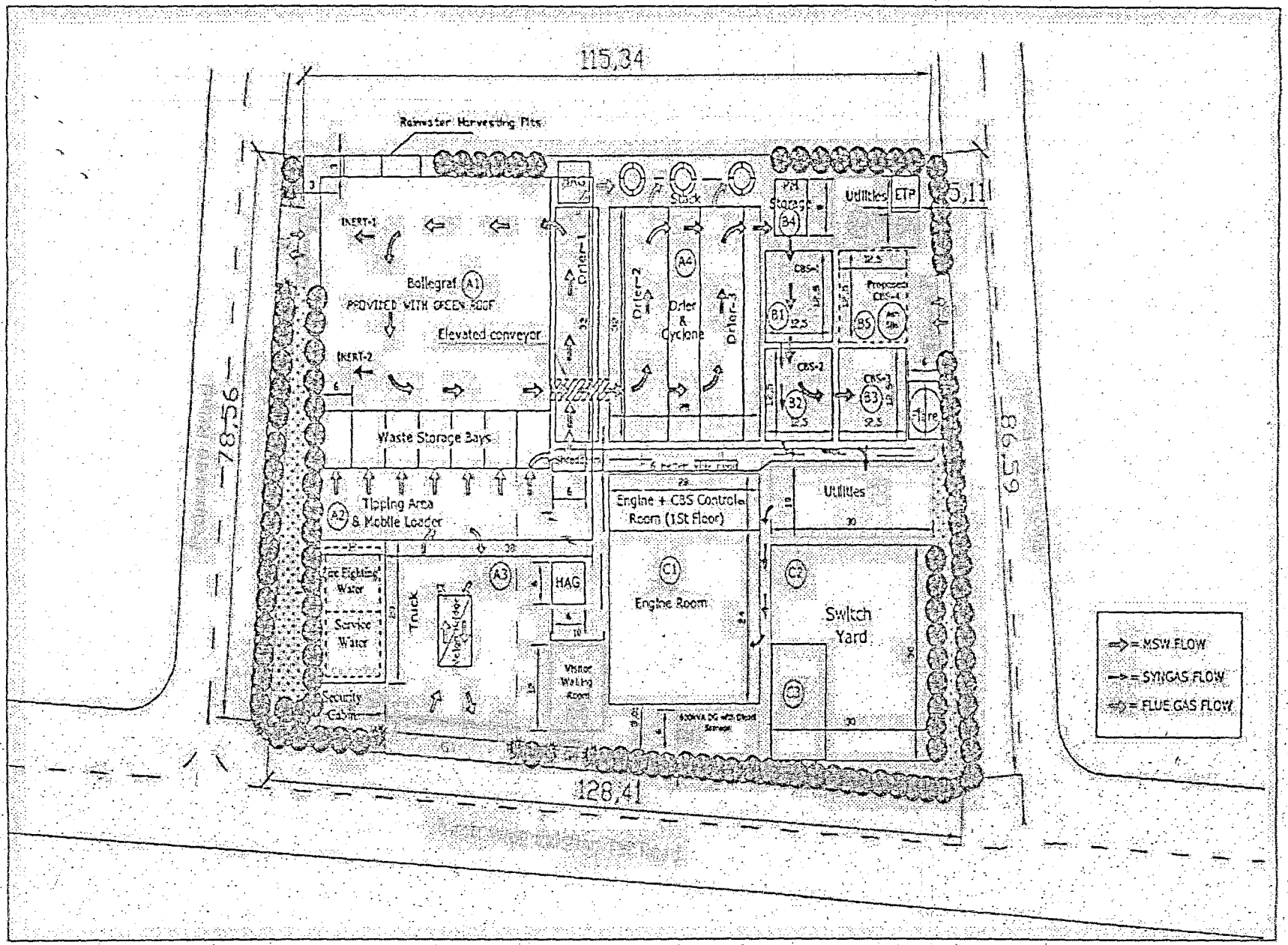
SITE REQUIREMENTS

The following image gives the layout for the proposed Waste to Energy facility. The details of the same are outlined subsequently:



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EA STATEMENT

#	Particulars	Area Sq. Mt.
1	Total plot Area	10,000
2	Area Under Roof	3338
3	Paved area	1400
4	Area Under Greening	2000
5	Open Space	2500
6	Built-up Area	5850

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aste Parameters:

- Total Waste Received – 700 tonnes per day
- Total number of hours in a year - 8760 hours; (Considering 365 days/year);
- Total plant uptime - 7500 hours (86% plant load factor);
- Total Storage required - 8760 – 7500 = 1260 hours per annum;

yout details

ease note that the layout is attached separately for your reference;

CTION A	PRE-CONDITIONING
CTION B	CBS GASIFIER
CTION C	POWER GENERATION
CTION D	SWITCH YARD

so mentioned are Equipments & their supplier

CTION A

B structure fully covered

- Segregation & Sorting Unit 1 set (Vendor – Bollegraph, Netherlands)
- Primary Shredder (Vendor - M&J)
- Primary Dryer System (Vendor - AHS)
- Front Loader (JCB)
- EOT Crane - 10 ton 1 unit
- Feed Conveyor to Dryer
- Ventilation system + Scrubber
- Fire detection & Suppression system
- Drainage Pit for tipping area + pump to ETP
- Misting system for Odour control
- Bobcat loader for inerts/sorter items

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- Misting system for Odour control
- Bobcat loader for inerts/sorter items

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:B structure fully covered

- 1 Underground Water Tank - Service + Fire Civil
- 1 Weigh Bridge
- 1 HAG
- 1 Fuel storage for HAG

CTION B

:B Shed

Fire detection & Suppression system

CBS feed conveyor

Duc[illegible]; works

>EN

- CBS tower
- CBS System (OEM)
- Ash Silo
- Ash receiving & discharge SILO for bagging 1
- feed storage

CTION C

ıgine Room

- RCC structure
- 4 Gas engine Gensets (Vendor - MWM)
- 2 Complete set of Auxiliaries related to engine set of BOP Green Power
- 3 MCC

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CTION D

vitch Yard Area

ɔen Area of given magnitude

RID CONNECTIVITY EQUIPMENTS

vitch yard - Panel & Control room

- RCC structure

:ility Area

- Natural Gas Connection
- 2 Fork Lift 1

ıilding - Security + MSW metering station RCC

ıilding - Visitor Centre + Conf room RCC

OTES

- All individual buildings to provide for the Panel, Control & Operator rooms
- All individual buildings to provide for Office block, Change rooms, toilets, etc

ɔmponent Heights:

- Processing Tower – 34 meters / 112 feet;
- Engine Room - 9 meters / 30 feet;
- Preconditioning Unit - 8 meters / 26 feet;
- Flare - 8 meters / 26 feet;
- Stack - 30 meters / 98 feet;

l other enclosed structures are to follow a standard of 6 meters height (or as outlined in the applicable building codes);

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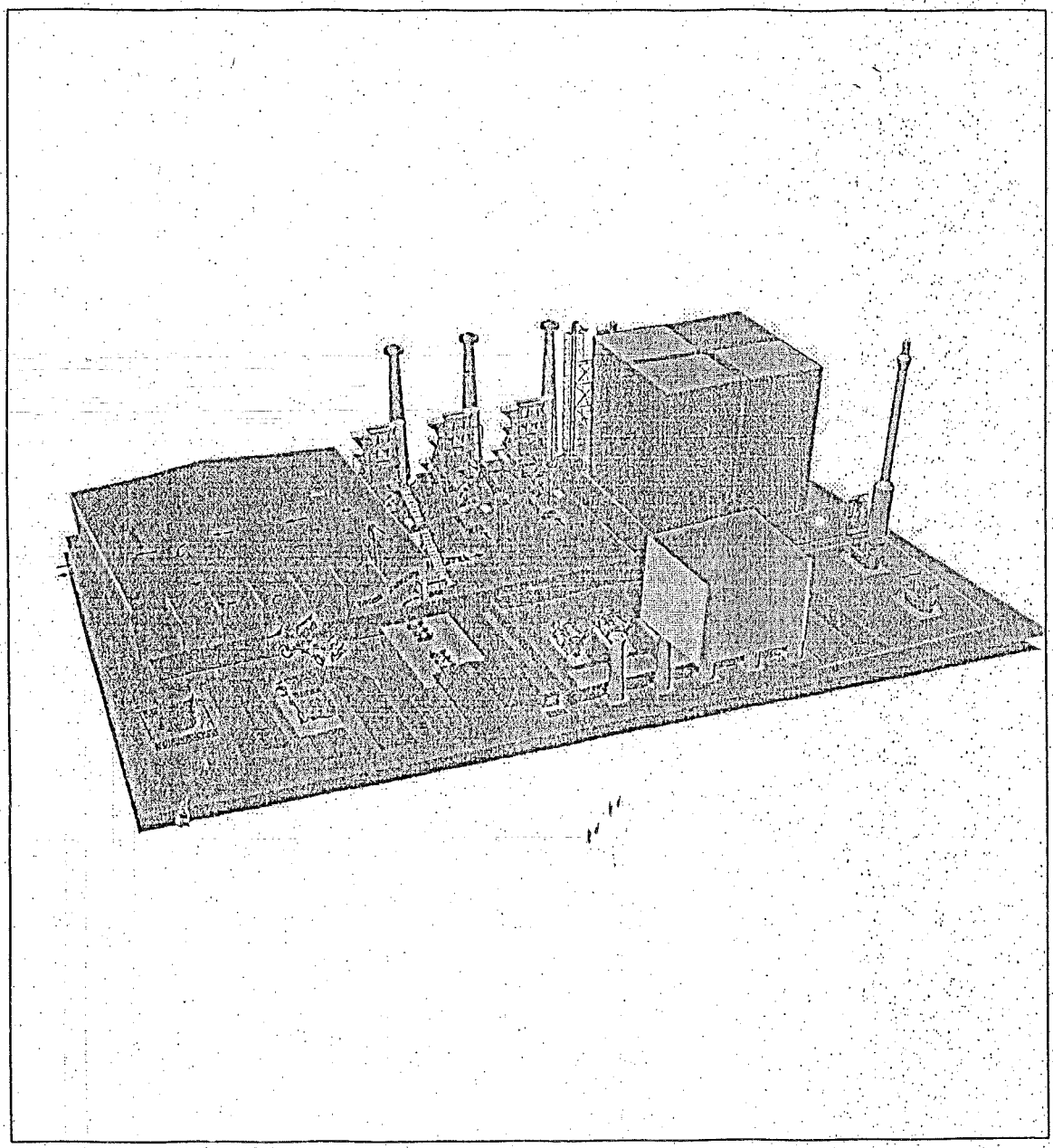
ıe following is a 3D generated image of the proposed layout (indicative)



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Form –I
[see rules 4(2) & 6(2)]
Application for obtaining authorization

To,

The Member Secretary
Maharashtra Pollution Control Board
3rd & 4th Floor, Kalpataru Point, Opp. Cineplanet
Sion (East) Mumbai

1.		Name of the municipal authority / Name of the agency appointed by the municipal authority.	:	Pune Municipal Corporation
2.		Correspondence address	:	Pune Municipal Corporation Shivajinagar, Pune – 411 005
		Telephone No	:	020-25501401
		Fax No.	:	020-25501103
3.		Officer authorized by the municipal authority	:	Mr. Suresh N. Jagtap Deputy. Commissioner, Solid Waste Management Div. Pune Municipal Corporation, Pune.

3 - A	3.1	Name of the Processing Facility		Aerobic Microbial Composting & Vermin Composting
	3.2	Capacity		1000 Mt/day
	3.2	Agency responsible for Carrying out Operation & Maintenance of the Processing and disposal facility.		M/s Hanjar Biotech Energies Pvt. Ltd. Kanjurmarg (W) Mumbai-400078. Represented by 1. Mr. Nazim Furniturewala 2. Mr. Sohail Ismail Furniturewala
4 – A		Authorization applied for (Please tick mark)	:	Agency already submitted application for authorization. Vide letter no. moh/211 dt. 30/5/2009.
5 - A		Detailed proposal of waste processing / disposal facility (to be attached) to include	:	Pl See Annexure – I
	5.1-A	Processing of Waste	:	
	i	Location of Site	:	Devachi Urli / Fursungi Pune
	ii	Name of Waste Processing Technology	:	Aerobic Microbial Composting & Vermin Composting

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		Technology		Vermin Composting
	iii	Details of Processing Technology	:	PI see Annexure – I
	iv	Quantity of waste to be processed per day	:	1000 – 1200 MT
	v	Site Clearance (from local authority)	:	PMC has already approached & discussed with these authorities for the clearances. Few of the authorities have given their clearances & few of them have not yet cleared.
	vi	Details of Agreement between Municipal Authority and Operating Agency	:	PI see Annexure – II (Copy of Agreement signed between PMC & M/s. Hanjar Biotech Engineers Pvt. Ltd., Mumbai.)
	vii	Utilization programmed for waste processed (Product utilization)	:	M/s. Hanjar Biotech Engineers Pvt. Ltd., Mumbai, has tied up with various agencies for sale the Compost / Vermi Compost produced per day.
	Viii	Methodology for disposal of waste processing rejects (quantity & quality)	:	Rejects generated are being sent to the Sanitary Landfill site, being maintained by M/s. Hanjar Biotech Engineers Pvt. Ltd., Mumbai, and is located next to the processing plant within the same premises. Rejects Generated – (i) Quantity – 150 to 250 MT/day
	ix	Measures to be taken for prevention & control of environmental pollution	:	Periodical monitoring of quality of ground water & air will be carried out.
	X	Investment on project & expected returns	:	Rs. 17.40 Crores.
	Xi	Measures to be taken for safety of workers working in the plant	:	As per MSW 2000 Rules.

3 - B	3.1	Name of the Processing Facility		Vermi Composting
	3.2	Capacity		200 Mt/day
	3.2	Agency responsible for Carrying out Operation & Maintenance of the Processing and disposal facility.		M/s. Ajinkya Bio-fertilizers Pvt. Ltd. Mayuresh Apartment, Phatak baug, navi peth, Pune - 30 Represented by Mr. Satish Dharne

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4 – B		Authorization applied for (Please tick mark).	:	a) Setting up & Operation of waste Processing facility. – By M/s. Ajinkya Bio-fertilizers Pvt. Ltd. Pune. b) Setting up & operation of Disposal facility – Products by M/s. Ajinkya Bio-fertilizers Pvt. Ltd. Pune and Rejects by PMC.
5 - B		Detailed proposal of waste processing / disposal facility (to be attached) to include	:	PI See Annexure – III
	5.1-B	**Processing of Waste**	:	
	i	Location of Site	:	Hadapsar MSW Ramp, Hadapsar, Pune.
	ii	Name of Waste Processing Technology	:	Mechanical Vermi Composting Plant
	iii	Details of Processing Technology	:	PI see Annexure – III
	iv	Quantity of waste to be processed per day	:	200 Mt./day
	v	Site Clearance (from local authority)	:	PMC has already approached & discussed with these authorities for the clearances. Few of the authorities have given their clearances & few of them have not yet cleared.
	vi	Details of Agreement between Municipal Authority and Operating Agency	:	PI see Annexure – IV (Copy of Agreement signed between PMC & M/s. Ajinkya Bio-Fertilizers Pvt. Ltd., Pune.)
	vii	Utilization programmed for waste processed (Product utilization)	:	M/s. Ajinkya Bio-fertilizers Pvt. Ltd., Pune have tied up with various agencies for sale the Compost / Vermin Compost produced per day.
	Viii	Methodology for disposal of waste processing rejects (quantity & quality)	:	Only segregated waste has been processed in this plant.
	ix	Measures to be taken for prevention & control of environmental pollution	:	Periodical monitoring of quality of ground water & air will be carried out.
	X	Investment on project & expected returns	:	Rs. 15.30 Crores.
	Xi	Measures to be taken for safety of	:	As per MSW 2000 Rules.

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		workers working in the plant		

3 - C	3.1	**Name of the Processing Facility**		**Mechanical Vermin Composting**
	3.2	Capacity		100 Mt/day
	3.2	Agency responsible for Carrying out Operation & Maintenance of the Processing and disposal facility.		**M/s. Disha Waste Management Pvt. Ltd., sr. no. 161/21+22 rajgad, talmajla Hadapsar , Pune - 28** Represented by Mr. Vikas Rohidas Tupe
4 – C		Authorization applied for (Please tick mark)	:	c) Setting up & Operation of waste Processing facility. – By M/s. Disha Waste Management Pvt. Ltd., sr. no. 161/21+22 rajgad, talmajla Hadapsar , Pune - 28. d) Setting up & operation of Disposal facility – Products by M/s. Disha Waste Management Pvt. Ltd., sr. no. 161/21+22 rajgad, talmajla Hadapsar , Pune - 28. Pune and Rejects by PMC.
5 - C		Detailed proposal of waste processing / disposal facility (to be attached) to include	:	PI See Annexure – V
	5.1-C	**Processing of Waste**	:	
	i	Location of Site	:	Hadapsar Industrial Estate (II), Final Plot No. 87 Ramtekdi Hadapsar Pune.
	ii	Name of Waste Processing Technology	:	Mechanical Vermi Composting Plant
	iii	Details of Processing Technology	:	PI see Annexure – V
	iv	Quantity of waste to be processed per day	:	100 Mt./day
	v	Site Clearance (from local authority)	:	PMC has already approached & discussed with these authorities for the clearances. Few of the authorities have given their clearances & few of them have not yet cleared.
	vi	Details of Agreement between Municipal Authority and Operating	:	PI see Annexure – VI (Copy of Agreement signed between PMC

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		Agency		& M/s. Disha Waste Management Pvt. Ltd., sr. no. 161/21+22 rajgad, talmajla Hadapsar , Pune - 28.)
	vii	Utilization programmed for waste processed (Product utilization)	:	M/s. Disha Waste Management Pvt. Ltd., sr. no. 161/21+22 rajgad, talmajla Hadapsar , Pune - 28. have tied up with various agencies for sale the Compost / Vermi Compost produced per day.
	Viii	Methodology for disposal of waste processing rejects (quantity & quality)	:	Rejects generated are being collected and transported by PMC to the Sanitary Landfill site, located at Devachi Urli / Fursungi site.
	ix	Measures to be taken for prevention & control of environmental pollution	:	Periodical monitoring of quality of ground water & air will be carried out.
	X	Investment on project & expected returns	:	Rs. 7.65 Crores.
	Xi	Measures to be taken for safety of workers working in the plant	:	As per MSW 2000 Rules.

3 - D	3.1	**Name of the Processing Facility**		**Biomethanation Plant** (old 2009-11)
	3.2	Capacity		a) 10 Nos. X 5 TPD - 50 TPD b) 1 No. X 3 TPD - 03 TPD Total 11 Plants - 53 TPD
	3.2	Agency responsible for Carrying out Operation & Maintenance of the Processing and disposal facility.		There are 6 different Technology. Providers involved in setting up 11 Nos. of Biomethanation plants. Details may be refereed at Annexure - VII
4 – D		Authorization applied for (Please tick mark)	:	PMC already application for authorization. Vide letter No. SWMO / 1219, dated 6/11/2009.
5 - D		Detailed proposal of waste processing / disposal facility (to be attached) to include	:	PI See Annexure – VIII
	5.1- D	**Processing of Waste**	:	

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	i	Location of Site	:	At different locations (as per Annex. – VII) Within PMC area.
	ii	Name of Waste Processing Technology	:	Biomethanation
	iii	Details of Processing Technology	:	Pl see Annexure – VIII
	iv	Quantity of waste to be processed per day	:	53 Mt./day (Pl see Annex – VII)
	v	Site Clearance (from local authority)	:	PMC has already approached & discussed with these authorities for the clearances. Few of the authorities have given their clearances & few of them have not yet cleared.
	vi	Details of Agreement between Municipal Authority and Operating Agency	:	Pl see Annexure – IX (Copy of Agreement signed between PMC & Technology Providers (as per annex-VII)
	vii	Utilization programmed for waste processed (Product utilization)	:	Biogas generated is being utilized for electricity generation which in turn utilized for illuminating the street lights. . Digested solids (manure) generated is being utilized as a compost in PMC's public gardens. Leachate generated – 30% is being recalculated in the process to maintain F/M ration in the system and rest is connected to the sewerage system for further treatment at STP.
	viii	Methodology for disposal of waste processing rejects (quantity & quality)	:	Only wet waste is being delivered at site for processing and PMC has separate collection mechanism for the same. Therefore, no rejects are generated from the process.
	ix	Measures to be taken for prevention & control of environmental pollution	:	Periodical monitoring of quality of ground water & air will be carried out.
	x	Investment on project & expected returns	:	Capital Cost - Rs. 4.92 Crores. O&M Cost – Rs. 0.48 Crores per year Annual Returns – Rs. 0.42 crores.
	xi	Measures to be taken for safety of workers working in the plant	:	As per MSW 2000 Rules.

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3 – E	3.1	**Name of the Processing Facility**		**Waste to energy Project.**
	3.2	Capacity		700 Mt/day
	3.2	Agency responsible for Carrying out Operation & Maintenance of the Processing and disposal facility.		M/s Rochem Seperation System (Pvt.) Ltd. Represented by 1. Mr. Goel Prayas 2. Mr. Dr. Modak
4 – E		Authorization applied for (Please tick mark)	:	Agency already submitted application for authorization. Vide letter no. mswo/700 dt. 25/8/2010.
5 – E		Detailed proposal of waste processing / disposal facility (to be attached) to include	:	PI See Annexure – X
	5.1-E	**Processing of Waste**	:	
	i	Location of Site	:	PI See Annexure – X
	ii	Name of Waste Processing Technology	:	
	iii	Details of Processing Technology	:	
	iv	Quantity of waste to be processed per day	:	
	v	Site Clearance (from local authority)	:	
	vi	Details of Agreement between Municipal Authority and Operating Agency	:	
	vii	Utilization programmed for waste processed (Product utilization)	:	
	Viii	Methodology for disposal of waste processing rejects (quantity & quality)	:	
	ix	Measures to be taken for prevention & control of environmental pollution	:	PI See Annexure – X
	X	Investment on project & expected returns	:	
	Xi	Measures to be taken for safety of workers working in the plant	:	

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	5.2	Disposal of Waste	:	
	i	Number of sites identified	:	ONE (At Devachi Urli / Fursungi) Scientific sanitary landfill.
	ii	Layout maps of the site	:	Attached
	iii	Quantity of waste to be disposed per day	:	Total 150 to 250 MT Inert material/ rejects has disposed at landfill site.
	iv	Nature & composition of waste	:	Only inert/rejects attached
	v	Details of methodology or criteria followed for site selection	:	As per MSW 2000 Rules
	vi	Details of existing site under operation	:	At Devachi Uruli/Fursungi land located next to the processing plant within the same premises & maintained by M/s Hanjer Biotech Ltd.
	vii	Methodology & operational details of land filling	:	Annexure - I
	viii	Measures taken to check environmental pollution	:	Periodical checks of Air & underground water etc. by monitoring committee.

Date 30/10/10.

30/10/10

Deputy Municipal Commissioner

Solid Waste Management

Pune Municipal Corporation

3F

Biomethanization

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Out Ward No . MSW 01/700
Date :- 25th June 2010

(PMC Copy from Rochem)

e Member Secretary,
aharashtra Pollution Control Board,
ear Sion, Circle, Mumbai.

ib: Application for Authorization for MSW processing activity **for Public urpose under MSW 2000 Rules.**

r,

ne Government is already aware that the MSW problem of about 100MT/day Pune has almost reached to a level of crisis. Since October 2008 May 2010 the people from Urli Devachi & Fursungi villages have severely gitated against the open dumping of MSW at the dumping site. The complete oppage of MSW by the villagers had created a crisis & health hazard in une city area. On account of the same your office had issued a Show Cause otice dt.2.05.2009 to PMC for non-compliance with MSW Rules 2000.

rder to resolve the matter PMC has:

1. Altogether stopped open dumping of MSW since 1st June 2010.
2. Decided to set up processing units to take care of entire quantity of MSW being generated now & in future over next two years.
3. Establish many biogas units all over the city to process the MSW. (The same has been achieved.)
4. Award a contract for complete disposal of 700MT/day MSW, on BOOT basis adopting "Gasification Technology", which will not only convert mixed un-segregated MSW into SYNGAS first and then to electrical power. This option needed only 2.5Acres of land, merely 48hours conversion time and had no pollution related side effects. The **Operator** appointed for the scheme is M/s Rochem Separations Systems (I). P. Ltd.

s may be seen in the enclosed Application (Form-1 and Pre-feasibility eport) there are other advantages as

5. The plot is at Final Plot No. 86, T.P.S.-2, Hadapsar Industrial Estate, which is established since four decades and is notified in Pune Development Plan for municipal purpose.
6. We have selected this site for suitability from environmental and social aspects.
7. There will be no leachate as to cause any ground-water pollution.

भावक विभाग (मुख्यालय)
महाराष्ट्र प्रदूषण नियंत्रण मंडळ,
कल्पतरु पॉइंट, ... सायन सर्कल जवळ,
सिनेमा ... (पूर्व)
मुंबई ...
फोन.-२४०१०४३७/२४०२०७८१

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Date: 26th August 2010

To
The Member Secretary,
Maharashtra Pollution Control Board,
Kalpataru Point, 3rd Floor,
Opp. Cineplanet, Near Sion Circle,
Sion (E), Mumbai 400 042.

Your Reference: No. B5139 dt. 10.08.2010.
Our Reference: No. SWMO/808 dt. 09.08.2010.
Sub: Application for Authorization for MSW Processing activity (for Public Purpose) under MSW Rule 2000.

- This is further to our above referred previous submission dt. 09.08.2010.
- Please refer point No.(A) page No. 3 of No. SWMO/808 dt. 09.08.2010 (submission referred above).
- Submitted for kind perusal, consideration & records,
- Pune Municipal Corporation

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08. We have approached the District Site Selection... (S.S.C.) under Pune District Collector for seeking clearances fro various agencies. Your Sub- Regional Office at Pune & fe other agencies have already cleared the site in their report to th District Collector. As it is this plot is away from any forest lan water bodies, monuments, national park; wetland; place important from cultural, historical or religious interest, air-pc etc. and as such fits in land-use pattern.

09. There will be no solid waste problem post-operation in th scheme.

10. The Operator M/s Rochem has undertaken responsibility & ca for air pollution control on the basis of conditions as may be la in the Environmental Clearance and in the MPCB consent.

Since Pune city is the seventh largest city in India and is developing a very fast rate, the MSW generation is also proportionately increasing at very fast rate. In order to also take care of the incremental quantity of MSW future PMC has given consideration to a technology doing faster disposal MSW.

We respectfully request you to kindly go through this submission and give needful guidance. As our experience will also be beneficial to other Municip Corporations to come forward to improve the State's environment, and w also enable PMC to fulfil the compliance of MSW Rules 2000. Hence v keenly request you to kindly consider the matter from the point of view of th scheme being for Public Purpose & kindly grant prior Authorization und MSW 2000 Rules with top priority that it deserves.

Thanking you,

For Pune Municipal Corporation,

Shri. Suresh Jagtap

(Deputy Municipal Commissioner)

Dy. Municipal Commissioner
(Solid Waste Management)
Pune Municipal Corporation

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PUNE MUNICIPAL CORPORATION

APPLICATION
FOR
AUTHORIZATION BY MPCB OF
PROJECT FOR
ULTIMATE DISPOSAL OF
700MT/day MUNICIPAL SOLID WASTE (MSW)

AUTHORITY: Pune Municipal Corporation
e-Governance, to serve citizens better

OPERATOR: ROCHEM SEPARATIONS SYSTEMS (i) P. LTD, MUMBAI (INDIA)

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INDEX

No	DESCRIPTION	PAGE NO.
1	Application from MSW Authority PMC (Pune Municipal Corporation)	3
2	Application from Operator (Rochem Separation)	5
3	MPCB Regional Office Site Clearance	17
4	Form 1	7
	List of Item Nos. & Appendices in Form 1	10
5	5.1.(iii)A -Details of processing technology	11
6	5.1.(v)B-- Site clearance (from local authority)	16
7	5.1.(vi)C--Details of agreement between municipal authority and operating agency	18
8	5.1.(vii)D--Utilization program for waste processed (Product utilization)	20
9	5.1.(viii)E--Methodology for disposal of waste processing rejects (quantity and quality)	21
10	5.1.(ix)F--Measures to be taken for prevention and control of environmental pollution	23
11	5.1.(x)G--Investment on Project and expected returns	28
12	5.1.(xi)H--Measures to be taken for safety of workers working in the plant	29
13	5.2.(ii)I--Layout maps of site	30
14	5.2. (iii)J--Quantity of waste to be disposed per day	31
15	5.2. (iv)J--Nature and composition of waste	31
16	5.2. (vii)K--Methodology and operational details of land filling	32
17	5.2.(viii)L--Measures taken to check environmental pollution	35

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320.

Office of the Dy. Commissioner
Solid Waste Management
Pune Municipal Corporation
Out Ward No . MSW 0/ 700
Date :- 25th ~~June~~ Aug 2010

To
The Member Secretary,
Maharashtra Pollution Control Board,
Near Sion, Circle, Mumbai.

Sub: Application for Authorization for MSW processing activity **for Public Purpose under MSW 2000 Rules.**

Sir,

The Government is already aware that the MSW problem of about 1400MT/day Pune has almost reached to a level of crisis. Since October 2008 to May 2010 the people from Urli Devachi & Fursungi villages have severely agitated against the open dumping of MSW at the dumping site. The complete stoppage of MSW by the villagers had created a crisis & health hazard in Pune city area. On account of the same your office had issued a Show Cause Notice dt.2.05.2009 to PMC for non-compliance with MSW Rules 2000.
In order to resolve the matter PMC has,

1. Altogether stopped open dumping of MSW since 1st June 2010.
2. Decided to set up processing units to take care of entire quantity of MSW being generated now & in future over next two years.
3. Establish many biogas units all over the city to process the MSW. (The same has been achieved.)
4. Award a contract for complete disposal of 700MT/day MSW, on BOOT basis adopting "Gasification Technology", which will not only convert mixed un-segregated MSW into SYNGAS first and then to electrical power. This option needed only 2.5Acres of land, merely 48hours conversion time and had no pollution related side effects. The **Operator** appointed for the scheme is M/s Rochem Separations Systems (I). P. Ltd.

As may be seen in the enclosed Application (Form-1 and Pre-feasibility report) there are other advantages as

7. The plot is at Final Plot No. 86, T.P.S.-2, Hadapsar Industrial Estate, which is established since four decades and is notified in Pune Development Plan for municipal purpose.
8. We have selected this site for suitability from environmental and social aspects.
9. There will be no leachate as to cause any ground-water pollution.

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(324)

10. We have approached the District Site Selection Committee under Pune District Collector for seeking clearances from various agencies. Your Sub- Regional Office at Pune & few other agencies have already cleared the site in their report to the District Collector. As it is this plot is away from any forest land, water bodies, monuments, national park, wetland; places important from cultural, historical or religious interest, air-port etc. and as such fits in land-use pattern.
11. There will be no solid waste problem post-operation in the scheme.
12. The Operator M/s Rochem has undertaken responsibility & care for air pollution control on the basis of conditions as may be laid in the Environmental Clearance and in the MPCB consent.

Since Pune city is the seventh largest city in India and is developing at a very fast rate, the MSW generation is also proportionately increasing at a very fast rate. In order to also take care of the incremental quantity of MSW in future PMC has given consideration to a technology doing faster disposal of MSW.

We respectfully request you to kindly go through this submission and give us needful guidance. As our experience will also be beneficial to other Municipal Corporations to come forward to improve the State's environment, and will also enable PMC to fulfil the compliance of MSW Rules 2000. Hence we keenly request you to kindly consider the matter from the point of view of the scheme being for Public Purpose & kindly grant prior Authorization under MSW 2000 Rules with top priority that it deserves.

Thanking you,

For Pune Municipal Corporation,

Shri. Suresh Jagtap

(Deputy Municipal Commissioner)

Dy. Municipal Commissioner
(Solid Waste Management)
Pune Municipal Corporation

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32

ROCHEM
SEPARATION SYSTEMS

Rochem Separation Systems (India)
Pvt. Ltd.
101, Dheeraj Arma, Anant Kanekar Marg
Bandra (East)
Mumbai – 400 051, India
Tel. : + 91 22 6704 9000, 6704 9001
Fax : +91 22 6704 9010
E-Mail : rochem@rochemindia.com;

22 August 2010

To
The Member Secretary,
Maharashtra Pollution Control Board (MPCB),
Kalpataru Centre, Near Sion Circle, Sion, Mumbai

Sub: **Authorization under MSW Rules 2000 for Processing Facility of MSW for Public Purpose**
Ref.: Pune Municipal Corporation (PMC) Project for disposal of 700MT/day MSW

Dear Sir,

On behalf of Pune Municipal Corporation (PMC), we are Operator of the reference project.

PMC has identified a suitable method known as "Gasification Technology", offered by us, which segregates shreds and then converts the waste into usable quality gas. It is offered by us on BOOT basis for 30 years to PMC.

Thus under MSW Rules, the Project Authority will be Pune Municipal corporation (PMC) & the Operator will be M/s Rochem Separations Systems (I) P. Ltd., Mumbai.

This option needs less land, less conversion time and less pollution related side effects. As may be seen in the enclosed Application (Form-1) there are other advantages as

1. The plot is in the Hadapsar Industrial Estate, which is established since four decades and is s notified in Pune agglomeration Regional Development Plan.
2. We have selected this site environmentally and socially.
3. There will be no leachate as to cause any ground-water pollution.

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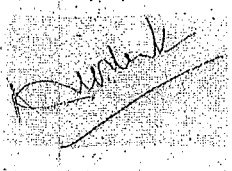
4. The plot is away from any forest land, water bodies, monuments, national park, wetland, places important from cultural, historical or religious interest, air-port and fits in land-use pattern.
5. There will be no solid waste problem post-operation.
6. The **Operator** (**Rochem**) shall take Responsible Care for air pollution control on the basis of conditions as may be laid in the Environmental Clearance and in the MPCB Authorization.
7. PMC informs that the site is visited & inspected by MPCB sub-regional office in June 2010 & have endorsed the site suggested by PMC in the capacity of Member of Collector's Site Selection Committee. (copy obtained by PMC is enclosed herewith [overleaf] for ready reference.)

We keenly request you to kindly view this project as being done for Public Purpose in order to bring about ultimate welfare of the population of Pune.

We request you to go through this submission and give a needful guidance. We request you to kindly consider the grant of Authorization under MSW Rules 2000 with a priority that it deserves.

Thanking you,
Yours faithfully,
For Rochem Separations Systems (I) P. Ltd.,



Dr. Harshvardhan Modak

(Authorized Signatory)

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Form – I

Application for Obtaining Authorization.

To,
The Member Secretary,

MPCB, Mumbai 400 022

1.	Name of the municipal authority/Name of the agency appointed by the municipal authority	:	(1)**Authority**: Municipal Commissioner, Pune Municipal Corporation, Pune (2) **Operating Agency**: M/s Rochem Separation Systems (I) Pvt Ltd. 101, Dheeraj Arma, Anant Kanekar Marg; Bandra East, Mumbai 400 015
2.	Correspondence address Telephone No. Fax No.	:	M/s Rochem Separation Systems (I) Pvt Ltd. 101, Dheeraj Arma, Anant Kanekar Marg; Bandra East, Mumbai 400 015 Phone; (022) 67049000 Fax: (022) 6704 9010 e-mail tejashri@vsnl.com
3.	Nodal Officer & designation(Officer authorized by the municipal authority or agency responsible for operation of processing or disposal facility)	:	**Authority**: Pune Municipal Corporation, Pune (1) **Shri. Suresh Jagtap**, (Mobile: +9689931414) Designation: Deputy Commissioner. **Agency**: M/s Rochem Separation Systems (I) Pvt Ltd. (2) **Dr. H M Modak** (Mobile +9370146655)
4.	Authorization applied for	:	(a) Setting up & operation of waste

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	(Please tick mark)		processing facility : YES (b)Setting up & operation of disposal facility: YES
5.	Detailed proposal of waste processing/disposal facility (to be attached) to include	:	As Follows
5.1	**Processing of Waste** i. Location of site ii. Name of waste processing technology iii. Details of processing technology iv. Quanitty of waste to be processed per day v. Site clearance (from local authority) vi. Details of agreement between municipal authority and operating agency vii. Utilization programme for waste processed (Product utilization) viii. Methodology for disposal of waste processing rejects (quantity and quality) ix. Measures to be taken for prevention and control of environmental pollution x. Investment on Project and expected returns xi. Measures to be taken for safety of workers working in the plant	:	i. Plot No.86, Hadapsar Industrial Estate, T. P. S.- 2, Pune ii. Concord Blue System iii. Please vide Appendix "A" iv. 700 MT/DAY v. Please ref. PMC resolution in Appendix B vi. Please vide Appendix C vii. Please vide Appendix D viii. Please vide Appendix E ix. Please vide Appendix F x. Rs. Ninety Crores only @ Expected Returns of 15% Please vide Appendix "G" xi. Please vide Appendix "H"
5.2	**Disposal of Waste** i. Number of sites identified	:	i. One

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ii.	Layout maps of site	ii.	Please vide Appendix "I"
iii.	Quantity of waste to be disposed per day	iii.	Please vide Appendix "J"
iv.	Nature and composition of waste	iv.	Please vide Appendix "J"
v.	Details of methodology or criteria followed for site selection	v.	Site allotted by PMC (own industrial land in notified area, surrounded by industries & adequate for purpose)
vi.	Details of existing site under operation	vi.	This is new site for MSW treatment.
vii.	Methodology and operational details of land filling	vii.	This is not a land-fill operation. Vide App "K"
viii.	Measures taken to check environmental pollution	viii.	Please refer Appendix "L"

Date 12 August 2010

Dr. H. M. MODAK

Signature of Nodal Officer of Operator

--0--

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List of Appendices

#	Appendix	Item	Regarding
1.	A	5.1.(iii)	Details of processing technology
2.	B	5.1.(v)	Site clearance (from local authority)
3.	C	5.1.(vi)	Details of agreement between municipal authority and operating agency
4.	D	5.1.(vii)	Utilization programme for waste processed (Product utilization)
5.	E	5.1.(viii)	Methodology for disposal of waste processing rejects (quantity and quality)
6.	F	5.1.(ix)	Measures to be taken for prevention and control of environmental pollution
7.	G	5.1.(x)	Investment on Project and expected returns
8.	H	5.1.(xi)	Measures to be taken for safety of workers working in the plant
9.	I	5.2.(ii)	Layout maps of site
10.	J	5.2. (iii)	Quantity of waste to be disposed per day
11.	J	5.2. (iv)	Nature and composition of waste
12.	K	5.2. (vii)	Methodology and operational details of land filling
13.	L	5.2.(viii)	Measures taken to check environmental pollution

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Appendix	Item	Regarding
A	5.1.(iii)	Details of processing technology

Manufacturing Process:

The Rochem group's Concord Blue (CB) gasification technology is significant in its approach. MSW processing is done without using Oxygen in the reactor. This ensures that the volatiles that are pyrolysed do not contain any toxic gases (like dioxin etc.) that are generally emitted from other sources. Several reports of researchers have shown that pyrolysis in such circumstances lead to inhibition of dioxin creation. This has been evidenced from many test reports of the stack emission of the pyrolysed gas in CB technology.

Rochem Group has developed this proposal for a MSW management for PMC based on the input data from PMC, the general assumptions using our own knowledge, information drawn from multiple entities & the economic practicality and market data in India.

- Rochem Group will process 700 tons per day of MSW as input material per year.
- The input MSW is assumed to have 40 % moisture and 10% inert material like stones, soil, dust etc. The inert material will be removed in pre-processing. Balance MSW will be dried in Dryer to 15 to 20% moisture content; using the waste heat generated from in the subsequent process. This material will pass through a sieve and shredder system to prepare the MSW into input ready material for system input,
- This feed segregation for inert material and drying are integral parts of the complete turnkey package offered.
- This pre-processed MSW will be fed into the gasifier plant from a small, covered storage bunker.
- The fully automated system will include a fully enclosed conveyor system so that no moisture can be added during delivery to the CB plant.
- The MSW fed into Pyrolyser comes into contact with ceramic balls, which are pre-heated to 800deg C & are used as heat transfer material. Since they have a very large surface area, the heat transfer is more efficient.
- The majority of organic portion of MSW gets volatilized due to high temperature exposure. The inorganic portion along with some organic portion gets converted into a substance called Biochar & is delivered out of the system at the bottom.
- Biochar has high calorific value of the order of 5000 kcal/kg & hence is used in the furnace section of CB system to provide requisite heat for the

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processing. Thus once the cycle of MSW processing is commenced, no external heat is required for the CB MSW processing.

- The Biochar is incinerated in furnace section of the CB system & the heat generated in the same in terms of flue gases of furnace are fed to the upper most reactor of the CB system, where the ceramic balls are again heated to high temperature. The ceramic balls are recycled by mechanical elevator from uppermost reactor to Reformer to Pyrolyser & back to uppermost reactor.
- The volatiles (mentioned above) generated from organic portion of the MSW gets transferred into Reformer. Steam (prepared in the subsequent steps in the CB process) is fed here to reform the organic volatile gases & degrade them into hydrogen (45%), Carbon monoxide (35%) & balance methane, carbon dioxide & water vapour.
- This gaseous mixture is called SYN gas, since it is used for synthesis of many other valuable organic chemicals. However in this case, it is used as fuel to run the gas engines to generate electricity.
- The SYN gas is cooled in waste heat recovery boiler to produce steam used in the earlier steps of MSW drying & volatile reforming.
- The cooled gas is scrubbed by alkaline water to remove the acidic gases (like sulphur dioxide & hydrochloric acid gas) & suspended particulate matter (SPM). The scrubbing water is treated by a separate RO unit to extract pure water & submit the RO rejects into MSW.
- The clean gas is used as fuel in gas engines to produce electricity. The exhaust of gas engines is useful another source for waste heat recovery.
- A flare system is kept as standby safety equipment to destroy the excess SYN gas whenever needed.
- This entire process from input of pre-processed MSW up to gas engines hardly requires 45 minutes to complete.
- Hence it allows the MSW received today to get destroyed tomorrow after accounting for time required for segregation of inert material & drying.

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330

Material Balance of the CB MSW processing for PMC

No	Description	Input MT/DAY	Output Qty	Comment
1	MSW	700	–	As received
2	Inert Material (10% of input)	70	–	Landfill disposal
3	Moisture (40% of input)	280	–	To be removed by drying
4	Segregated MSW after inert removal	630	70	Sent to landfill
5	Pre-dried MSW material keeping 20% moisture intact	490	140	Vented into atmosphere
6	Biochar	98	–	Used as internal fuel
7	Ash from Biochar burning (40% of Char)	–	40	Used for brick making
8	Electricity		11MW/hr	Available for use
9	Captive consumption (10%)	1MW/hr	–	Internal use

The flow sheet can be visualized as on next page –

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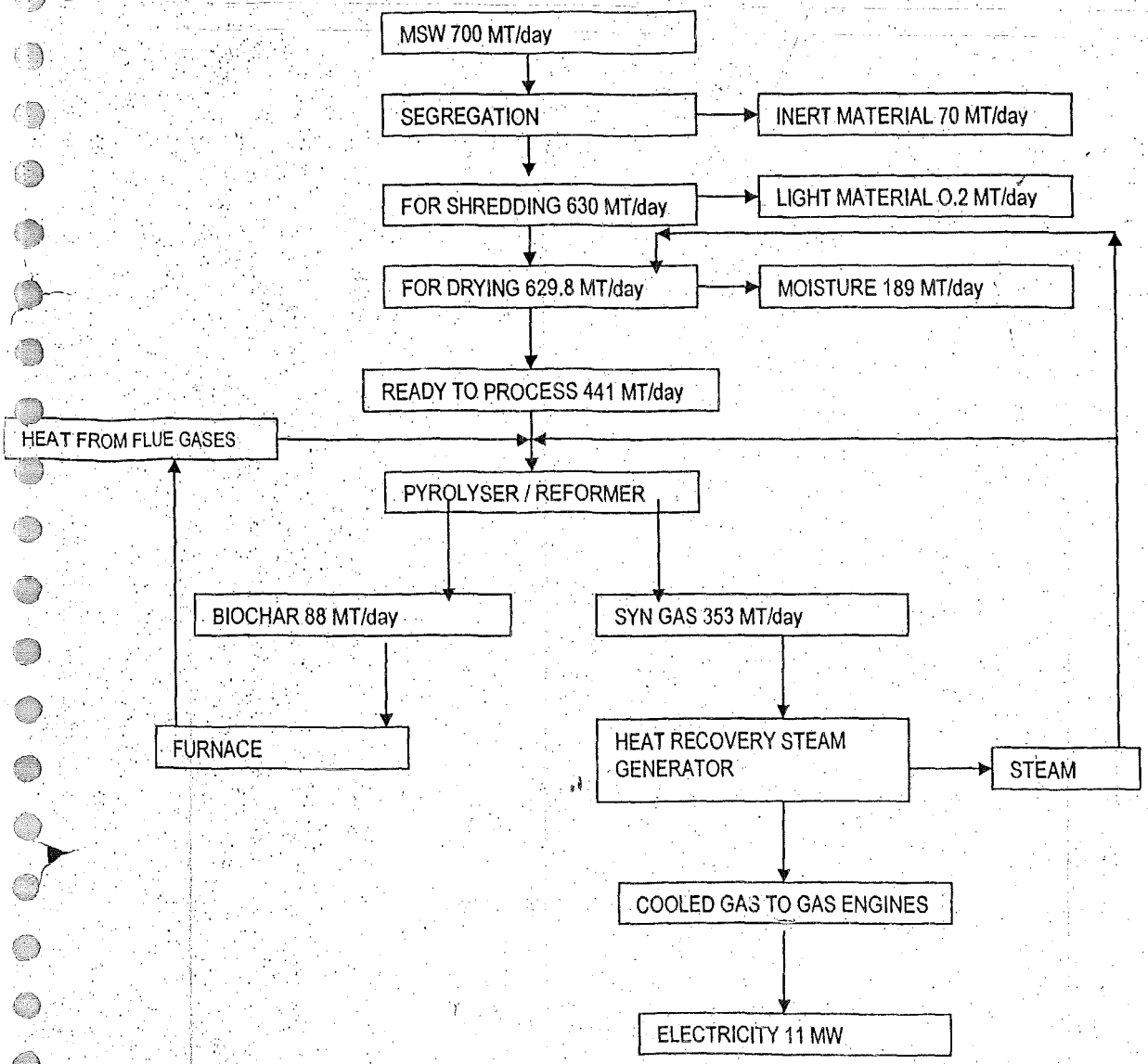
330

PMC MSW PROCESSING FLOW CHART



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Environmental Significance:

S. #	Unit Operation /Process	Peculiarities	Environmental Significance
1	Incoming Raw Materials	Selected by PMC, nearest area. Quick transport. Quick use.	Prompt use prevents deterioration, odor and nuisance escaping out, Ease of keeping Statistics. Inspection is done at procurement stage itself, which reduces the fear of discards or low quality product at the end.
			Inspection is done again once procured and when it reaches site, which further reduces the fear of discards or low quality product at the end.
2	Transport & Transfer	Smoother roads, covered trucks, covered bucket elevator, careful unloading, EOT crane and fork-lifters pressed in service.	This is a point of loss of valuable material in the form of dust. The dust is a load on environment, which is saved here. Manual handling avoided. Hooks avoided. Safety is seen.
3	Weigh batcher	Ensures further quality. Opportunity of inspection is made	This is a timely inspection, where rectification is possible that in turn will reduce the possible discards and rejects
4	Segregation and shredder	Two stage refining helps. Opportunity of inspection is made	This is the main raw material. This is a timely inspection, where rectification is possible that in turn will reduce the possible discards and rejects. Two stage also helps in reducing power need.
5	Pre-heater, and two heat exchangers	This is done with an emphasis as production step.	This is the conservation of heat energy.
6	Human resource	Training imparted, Documentation designed, Indicator chart, hourly reading charts provided	Best operational control and retrieval of information results in better checks.

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380

Appendix	Item	Regarding
B	5.1.(v)	Site clearance (from local authority taken by PMC themselves)

Kindly see below the scan of the original MPCB Regional Office to District Site Clearance Committee:

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389

महाराष्ट्र प्रदूषण नियंत्रण मंडळ
उप-प्रादेशिक कार्यालय, पुणे-१

फो.न. ०२० - २५८१६४५१
फॅक्स.नं.०२० - २५८११७०१

२ मजला जोग सेंटर
पुणे - मुंबई रोड, वाकडेवाडी
पुणे-४११००३

जा क्र/उप्र/ता/२०५४/१० दि: ३०/०६/२०१०

प्रति,
मा. जिल्हाधिकारी,
जिल्हाधिकारी कार्यालय,
पुणे.

विषय:- पुणे महानगरपालिकेच्या हद्दीतील हडपसर टी.पी.एस.२, फायनल प्लॉट ८६ येथील मनपाचे जागेवर प्रतिदिन ७०० मे.टन. क्षमतेचा प्रकल्प उभारणेकामी करीता मा. जिल्हा सनियंत्रण समिती मार्फत जागा पाहणी करुन प्रक्रिया प्रकल्पासाठी जागा निवड समिती मार्फत ना-हरकत प्रमाणपत्र मिळणेबाबत.

संदर्भ:- पमह/कावि/१३२८/१०, दि. ०२.०६.२०१०.

महोदय,

उपरोक्त संदर्भीय विषयानुसार सदरहू जागे बाबत कागदपत्रे व नकाशे प्राप्त झाले व त्या नुसार पुणे महानगरपालिकेच्या ताब्यातील हडपसर इंडस्ट्रियल इस्टेट टी.पी.एस.२, फायनल प्लॉट ८६ या जागेस भेट देवून पहाणी करण्यात आली. भेटीचा अहवाल खालील प्रमाणे आहे.

१) सदरहू जागा पुणे महानगरपालिकेच्या ताब्यातील आहे.
२) सदरहू जागा औद्योगिक वसाहतीत आहे.
३) विज निर्मिती प्रकल्पामुळे भू-वापरात विसंगती निर्माण होत नाही.
४) ही औद्योगिक वसाहत महानगरपालिकेच्या हद्दीत असल्यामुळे महानगरपालिकेचा शुध्द पाणी पुरवठा उपलब्ध आहे व त्यामुळे भू-जल वापरावे लागणार नाही.
५) औद्योगिक परिसरात सांडपाणी वाहुन नेण्यासाठी बंद पाईपची सोय असल्याने परिसरात घरगुती वा औद्योगिक जल प्रदूषणाचा प्रादूर्भाव होण्याचा संभव दिसत नाही.
६) प्रदूषीत हवेचे निराकरण करण्यासाठी त्याचे विलयन पाण्यात करावे लागते. असे औद्योगिक सांडपाणी निर्माण होवून हवा शुध्द होते. हे सांडपाणी बंद पाईपद्वारे वाहून नेण्याची सोय औद्योगिक वसाहतीत आहे.
७) या उद्योगास कच्चा माल म्हणून घनकचरा लागत असल्याने घनकचरा निर्मितीची समस्या जानवन्याचे कारण दिसत नाही.

वरील सर्व पर्यावरण बाबींचा विचार केला असता संबंधीत जागेच्या निवडीबाबत आक्षेप घेण्याचे दिसत नाही असे या कार्यालयाचे मत आहे. आपण जो निर्णय घ्याल तो या कार्यालयास कळवावा जेणे करुन या उद्योगावर लक्ष ठेवण्यास मंडळास सोपे जाईल.

(व. पा. शिरुरे)
उप-प्रादेशिक अधिकारी
म.प्र.नि.मंडळ, पुणे-१

Sub-Regional Office Pune-I M.P.C. Board

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382

Appendix	Item	Regarding
C	5.1.(vi)	Details of agreement between municipal authority and operating agency

Kindly see below the scan of the original resolution by Pune Municipal Corporation

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(३४३)

विषय क्रमांक:- ३/८५ ठराव क्रमांक:- २८ खाते - महा.आयुक्त

INWARD MAIL
DATE 07.2. NO. 2715
FILE NO.
MD SM PM A/C ST

संदर्भ :- १) मा.महा.आयुक्त यांचे क्र. मआ/उआ(घनकचरा)/७२ दि. १०/५/२०१० चे पत्र.
२) स्थायी समिती ठराव क्र. २०८, दि. १९/५/२०१०.

मा.महा.आयुक्त यांनी दिलेली कारणे व केलेली शिफारस विचारात घेऊन तसेच स्थायी समितीची शिफारस विचारात घेवून -

७०० मे.टन प्रतिदिन क्षमतेचा कचऱ्यापासून वीज निर्मितीचा व कचरा निर्मुलनाचा प्रकल्प मे.रोकेम सेपरेशन सिस्टम्स (इंडिया) प्रा.लि. यांचेकडून पुणे महानगरपालिकेच्या हडपसर टि.पी.एस.दोन मधील फायनल प्लॉट क्र. ८६ येथील २.५ एकर मनपाचे जागेवर बी.ओ.टी. तत्वावर प्रकल्प उभारणे व पुढील ३० वर्षाकरिता र.रुपये ३००/- प्रति टन प्रतिदिन या दराने टिपींग फी मनपाकडून देणे व प्रकल्पाची देखभाल व दुरुस्ती करणे व प्रकल्प चालविणे व त्यानुसार त्यांचेशी करार करणेसाठी खालील बाबीस मान्यता देण्यात येत आहे.

१. बी.ओ.टी. अंतर्गत प्राप्त प्रस्तावांपैकी मे. रोकेम सेपरेशन सिस्टीम्स (इंडिया) प्रा.लि. यांचा प्रस्ताव हा सर्वात कमी जागेवरील असल्याने त्यांना पुणे महानगरपालिकेची हडपसर टी.पी.एस.-२ मधील प्लॉट क्र.८६ येथील महानगरपालिका मालकीची सुमारे १०,००० चौ.मी. जागा देणेस व त्या जागेवर मे. रोकेम सेपरेशन सिस्टीम्स (इंडिया) प्रा.लि. यांचेकडून प्रतिदिन ७०० मे.टन मिक्स कचऱ्यावरील प्रक्रिया प्रकल्प उभारणीस मान्यता मिळणेस.

२. सदर प्रकल्पाची देखभाल दुरुस्ती ही ३० वर्षासाठी मे. रोकेम सेपरेशन सिस्टीम्स प्रा.लि. यांना देणेस व त्यासाठी र.रु. ३००/- (अक्षरी तीनशे रु.फक्त) प्रति टन टिपींग फी अदा करणेस.

३. प्रकल्प उभारणी व चालविण्यासाठी आवश्यक त्या सर्व मान्यता संबंधित ॲथोरिटी कडून मे.रोकेम सेपरेशन सिस्टीम्स (इंडिया) प्रा.लि. यांनी पुणे मनपाच्या वतीने घेणेस.

४. पुणे महानगरपालिका मालकीच्या जागेपोटी र.रु.१/- प्रति चौ.मी.प्रतिवर्ष प्रमाणे भूईभाडे आकारणी करणेस.

५. मे.रोकेम सेपरेशन सिस्टीम (इंडिया) प्रा.लि. यांचेकडून परफॉरमन्स गॅरंटी म्हणून प्रकल्प उभारणी व त्यापुढील प्रकल्प कार्यान्वीत झाल्यानंतरचे १ वर्ष कालावधीकरिता २ कोटी रुपयाची बँक गॅरंटी स्विकारणेस.

६. मे. रोकेम सेपरेशन सिस्टीम (इंडिया) प्रा.लि. यांचेकडुन सदर प्रकल्पापोटी मिळणा-या सी.ई.आर. मध्ये ५० % हिस्सा मनपाकडे स्विकारणेस.

७. काही अपरिहार्य कारणास्तव प्रस्तावित केलेल्या जागेवर प्रकल्प उभारणीसाठी अडचणी उद्भवल्यास प्रस्तूत प्रकल्पासाठी जागा बदल करणेचे अधिकार ; पर्यायी उपलब्ध जागेनुसार त्या क्षमतेचा प्रकल्प राबविणे आणि आवश्यकता म्हणून एकूण ७०० मे.टन क्षमतेचा प्रकल्प एकापेक्षा अधिक जागेवर उभारणी करण्याचे अधिकार ; प्रकरणी आवश्यक तो करारनामा करणेस व त्यातील कलमे ठरविण्याचा अधिकार मा. महापालिका आयुक्त यांना प्रदान करणेस.

उप आयुक्त (घनकचरा व्यव.)

नगरसचिव,
पुणे महानगरपालिका

उप आयुक्त
घन कचरा व्यवस्थापन कार्यालय
पुणे महानगरपालिका
आवक क्र. एच./एस इन्स्यु.एस.एस.
७९९ दि. २६/५/१०

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Appendix	Item	Regarding
D	5.1.(vii)	Utilization programme for waste processed (Product utilization)

The waste is utilized after conversion fully.

A unique advantage of the CB plant is that there is an economics of selling the following:

- High quality, high energy value "Syngas": Can be used not only in gas powered electric generating motors, but also as a replacement or blender for natural gas.
- Hydrogen: Is currently used in a multitude of industrial and manufacturing applications and holds great potential in automotive hydrogen fuel cell technology..
- Electricity: Turnkey system creates electricity via proprietary Syngas firing gas-motors, for which the State is in deficit.
- Bio Char: Is currently used in fertilizer and as a soil amendment, as well as its environmental value as a sequestered carbon.
- Material Balance of the CB MSW processing for PMC can be summarized as

No	Description	Input MT/DAY	Comment
1	Biochar	98	Used as internal fuel, or fertilizer.
2	Ash from Biochar burning (40% of Char)	40	Used for brick making / soil modifier
3	Electricity	11MW/hr	Available for use/ sale

- Another advantage is possibility of getting carbon credit.
- A unique advantage of the CB plant is that the desired input and output can be changed as required, depending on the market economics of selling the above products.

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Appendix	Item	Regarding
E	5.1.(viii)	Methodology for disposal of waste processing rejects (quantity and quality)

The waste processing rejects will be in solid, liquid and gaseous form and disposed.

A. Water regime.

- Boiler condensate water is recycled to the maximum extent. The boiler blow-down is sober and will be used for greening with some PCT (Physico-Chemical Treatment).
- Cooling water is recycled by employing a cooling tower to the maximum extent. The purging is sober and will be used for greening with some PCT (Physico-Chemical Treatment).
- Scrubbing water is neutralized, settled, clarified and recycled to the maximum. For this modern Reverse Osmosis will be employed and permeate will be recycled with no further question of disposal. The concentrate will be disposed as solid waste with PMC.

B. Solid Waste.

(1) The rejects discards inert coming out of PMC-supplied MSW. This is inert and about 70 MT/DAY. After segregation and pre- or post-shredding this is to be disposed by land-fill by PMC. Thus this is sent back to their facilities and we shall not be engaged in this.

(2) Our treatment method will convert some part of the MSW into a substance (called as Biochar) having high calorific value. This will be used as fuel in the combustion furnace. It will give useful heat energy and residue ash. This ash is in demand at many places like roads, building blocks, as fertilizer, as cement substitute etc. Hence it will regularly go out. However, in order to assist the purchasers, we may keep some transportation means handy for such disposal.

(3) The gas produced by us while treating the MSW by our method is to be cleaned before use in gas-engine to make electrical power. This cleaning involves scrubbing. It will capture gases and SPM. Scrubbed water will be neutralized with lime and passed through Reverse Osmosis. This permeate will go back for reuse, but the concentrate will require disposal. This will be by way of land-fill and will be sent back to PMC along with sub-stream (1) stated above.

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C. Air Pollutants

This process is not "incineration" in its true sense. It is first a pyrolysis where two streams will get separated, one being a bio-char is explained above. The remaining will produce a gaseous mixture which in turn drives an engine and generate electrical power. These will be passed through bag filter and scrubber with free air released through stack.

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----------(Continued overleaf)

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(380)

Appendix	Item	Regarding
F	5.1.(ix)	Measures to be taken for prevention and control of environmental pollution

Measures are fully designed for prevention and control of pollution.

Water:

Source: PMC treated water 205m3/day

Water budget – (Fig. in m3/day)

#	Use Station	Input (m3/day)	Loss/ Consumption	Effluent	Fate
1	Domestic	20	4	16	PMC sewer
2	Cooling	20	20	--	Recycled
3	Scrubbing	65	5	60	Treatment
4	Process	100	5	95	Treatment
	Total	205	34	171	

In order to minimize the water use,

- Boiler condensate water is recycled to the maximum extent and only make-up requirement is taken every day.
- Cooling water is recycled by employing a cooling tower to the maximum extent and only make-up requirement is taken every day.
- Scrubbing water is neutralized, settled, clarified and recycled by RO and only make-up requirement is taken every day.
- Domestic wastewater is sent to existing PMC sewerage line every day.

Air Pollution

The causes can be identified as

#	Source	Pollutants	In-plant measures	Control measures
1	Incoming yard	SPM, Odor	Smooth roads, less waiting, quick handling, mechanical tackles	
2	Shredding	RSPM, Odor	Closed building	Suction, ducting, bag filter, scrubber
3	Dryer	RSPM, Odor, moisture, HC	Closed unit	Suction, ducting, bag filter, scrubber
4	Transfer	RSPM, moisture, HC	Closed conveyer	
5	Flue Gas	SPM Acidic gases	Bag filters & scrubbing & oxidative	High stack discharge

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			catalysts.	
6	Gas engine exhaust	High temperature gas	Heat recovery unit & selective catalytic reduction.	Connection to high stack
7	SYN gas	Acidic gases from pyrolysis	Cooling, Scrubbing	Close circuit feeding to gas engines

This process is akin to "incineration" , goes through the route of pyrolysis; where two streams will get separated, one being a bio-char (which is useful as fuel to burn in the combustion furnace producing heat energy) and the remaining will produce a gaseous mixture which in turn drives an engine and generate electrical power. Thus the emissions are not hazardous. These will be passed through bag filter, catalytic scrubbers as needed and scrubber with free air released through stack, which is 30 meters high.

Solid waste

Daily about 700 tonnes of MSW will be coming in to this site from PMC. This will be taken for further treatment expeditiously and the awaiting period will be very short. However, during this period we shall be carefully doing the **Management of Municipal Solid Wastes.**

S.no	Parameters	Compliance criteria
1.	**In coming Transportation of municipal solid wastes**	Vehicles used for incoming transportation of wastes shall be covered. This will be mostly done by PMC as per our MoU. However, we might employ a few trucks to tide over any difficulties of stoppage of process due to 'no feed' The Waste will not be visible, nor exposed to open environment, nor spreading odor, nor will there be scattering. The following criteria shall be met, namely:- i. The temporary storage facilities awaiting further process of segregation and shredding, set up by the operator appointed by the municipal authorities shall be daily attended for clearing of wastes, and none will start overflowing; ii. Transportation vehicles shall be so plied that multiple handling of wastes, prior to further processing step of segregation and shredding, is avoided.

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38e

2.	**Collection of municipal solid wastes**	1. Littering of municipal solid waste that has entered in the premises of this site shall be avoided. For this the following steps shall be taken by this Operator appointed by the municipal authority, namely :- i. Organizing collection of municipal solid wastes through central community bin as specified by PMC limited only to occasions when municipal conveyance is having any bottle-neck bringing the material to our site. ii. PMC has earmarked some special areas like (a) slums (b) hotels, restaurants, (c) office complexes and commercial areas; (d) slaughter houses, meat and fish markets, (e) fruits and vegetable markets, (f) Bio-medical wastes (g) industrial wastes, (h) Horticultural (i) construction or demolition wastes or debris, (i) big townships and (j) wastes at dairies. It is predecided as to which of it will be lifted for our site either by PMC or occasionally by us. iii. Waste (garbage, dry leaves) shall not be burnt in open anywhere within the premises. iv. Stray animals shall not be allowed to move around waste storage facilities. 2. The municipal authority shall notify waste conveyance schedule to our site to facilitate prompt handling at our end. 3. It shall be the responsibility of PMC to ensure delivery of wastes in accordance with the collection and segregation system as pre-decided..
3.	**Initial Segregation of municipal solid wastes**	In order to encourage and promote reuse by way of heat recovery, power recovery, ash recovery PMC will give us segregated materials, free of debris. The finer combing, screening will be done by us carefully without generating nuisance within the premises.
4.	**Storage of municipal solid wastes**	This Operator appointed by the PMC Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and unsanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely :- i. Storage facilities shall be created and established

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		by taking into account quantities of waste brought to site pre-determined at 700 MT/DAY . An unloading facility shall be so placed that it is quick, safe and user-friendly. ii. Storage facilities to be set up by the Operator agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable. iii. There will be four types of storages namely when the material is brought and unloaded, when it is sent for segregation-shredding, the shredded useful material sent to MSW bunkers and rejected material about 10 % or 70 MT/DAY awaiting taken away by PMC to their land-fill site. iii. All these 4 types of Storage facilities shall have 'easy to operate' design for handling, transfer and transportation of waste. Color code will be given to them. iv. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.
5.	**Processing of municipal solid wastes**	Municipal authorities have appointed this Operating agency for their suitable technology combination to make use of wastes so as to minimize burden on landfill. Criteria adopted is stated in details separately. Mixed waste containing recoverable resources shall follow the route of recycling. Concord Blue System of pyrolysis-combustion with energy recovery (heat and power) is used for processing wastes in specific cases. Municipal authority and the operator of this facility wishing to use this state-of-the-art technology shall approach the Central Pollution Control Board if necessary.
6.	**Disposal of municipal solid wastes**	There will be for disposal following sub-streams, namely (a) Rejects and discarded MSW as received and unloaded, not suitable to us as raw material, (b) part of shredded refuse, not suitable to us as raw material, (c) the ash produced by our process at the end after combustion step, (d) the SPM captured at the shredding unit through

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		bag filters; all these four in solid form. All these four will be carted to PMC for landfill which may amount to about 80-90 MT/DAY. There will be another stream which will convert the production gases into liquid wastewater after scrubbing. With pre-treatment as settling and neutralization will be sent to PMC sewers. This is about 10 cum/day. There will be another useful product by way of steam (for internal use), waste heat (partly for internal use), and generated power.

Please also refer Appendix "L" for additional Measures taken to check environmental pollution

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Appendix	Item	Regarding
G	5.1.(x)	Investment on Project and expected returns

#	Particulars	Capital Investment Rs. Cr.	Operating/ maintaining cost / year Rs. Cr
1	Land	Allotted by PMC	Nil
2	Building	5	0.5
3	Plant and machinery	85	9.0
4	Total	90	9.5

The expected returns are from sale of ash, bio-char, electrical power, as 15% on the investment.

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Appendix	Item	Regarding
H	5.1.(xi)	Measures to be taken for safety of workers working in the plant

- Workforce: There will be 60 workers, for whom a safety & occupational health plan, with a disciplined approach will be devised.
- Safety Policy: Management has a definite plan to make a Safety Policy & it shall implement it to bring it in place. It shall be in compliance with state factory rules.
- First aid trained person: As a part of the above policy enthusiastic workers will be identified & trained with first aid techniques & management will ensure to have at least one such worker in every shift.
- Fire fighting person: As a part of the above policy enthusiastic workers will be identified & trained with fire fighting techniques & management will ensure to have at least one such worker in every shift in every shift.
- Competent persons: Management will ensure that it will identify the most competent people for above tasks.
- Provisions of other Acts: Management also has resolved that it shall comply with provisions of other acts as may be required.
- Fire fighting system: The management shall identify needs for the fire fighting system & shall commission the most suitable one as per the norms.
- Disaster Management Plan (DMP) & on –site emergency plan : As soon as possible, taking into consideration opinions of experts in the matter, the management will be take action to prepare & implement DMP & Emergency plan.
- Personal protection equipment: The management will ensure that the workers will be suitably equipped with personal protection equipment as needed.
- Consulting physician: A competent & experienced medical doctor will be retained to attend the factory.

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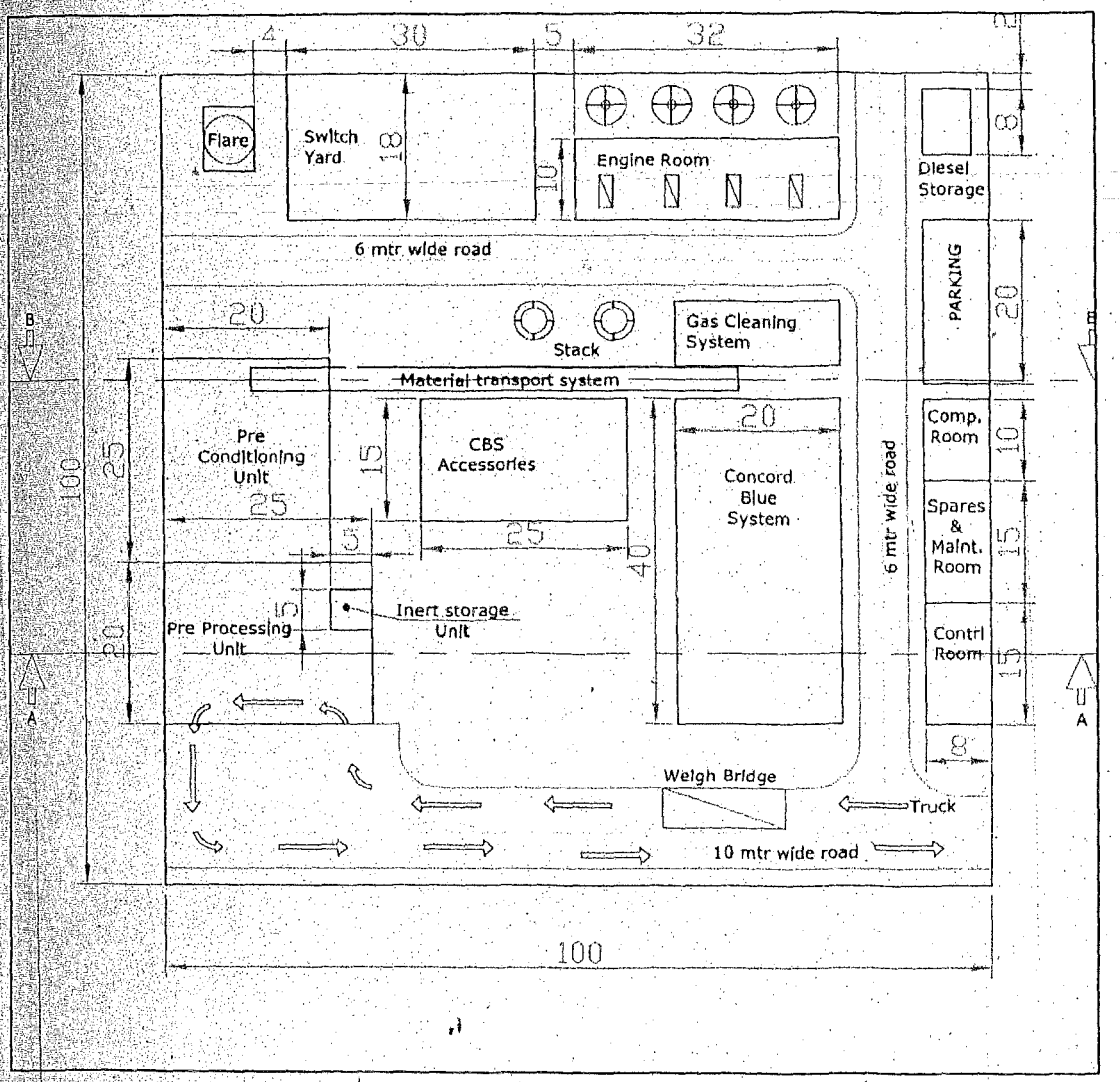
Appendix	Item	Regarding
I	5.2.(ii)	Layout maps of site



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Appendix	Item	Regarding
J	5.2. (iii)	Quantity of waste to be disposed per day
J	5.2. (iv)	Nature and composition of waste

Water:

#	Use Station	M3/day	Fate	Remark
1	Domestic	16	PMC sewer	Normal sewage
2	Process	95	Greening	Sober
3	Cooling	--	Greening	Sober
4	Scrubbing	60	Recycle	Recyclable

Solid Waste

#	Use Station	Quantity	Fate	Remark
1	Inert Reject	70 MT/DAY	PMC land-fill	Inert
2	Bio-char	98 MT/DAY	Self-use or sales	Like coal
3	Ash	40 MT/DAY	Sales	Recyclable
4	RO Concentrate	0.1 MT/DAY	Added back to MSW	Recyclable

Air Pollutants

#	Use Station	Quantity	Fate
1	Shredder fugitives	0.1 MT/DAY	Capture to Recycle
2	Scrubber water RO Concentrate	0.1 MT/DAY	Recycle into MSW

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Appendix	Item	Regarding
K	5.2.(vii)	Methodology and operational details of land filling (In fact temporary Land Storage TLS).

This site is allotted by PMC to this Operating agency. Here we manage the MSW by a novel method known as Concord Blue system. Therefore, we are not involved in land-fill way of MSW disposal. However, here we come across some residues and those are required to be disposed, namely

(1) The rejects discards inert coming out of PMC-supplied MSW. This is inert and about 70 MT/DAY. After segregation and pre- or post-shredding this is to be disposed by land-fill by PMC. Thus this is sent back to their facilities and we shall not be engaged in this. However, we may provide a 24- hour waiting storage here as stop-gap arrangement. This may generally remain dry, but may be used occasionally. For this temporary storage, we shall take the full responsible care as one should normally take for a scientific land-fill site.

(2) Our treatment method will convert some part of the MSW into a substance (called as Biochar) having high calorific value. This will be used as fuel in the combustion furnace. It will give useful heat energy and residue ash. This ash is in demand at many places like roads, building blocks, as fertilizer, as cement substitute etc. Hence it will regularly go out. However, on occasions it will be required to be stored. Thus a two-day storage is proposed. For this temporary storage, we shall take the full responsible care as one should normally take for a scientific land-fill site.

(3) The gas produced by us while treating the MSW by our method is to be cleaned before use in gas-engine to make electrical power. This cleaning involves scrubbing. It will capture gases and SPM. Scrubbed water will be neutralized and passed through Reverse Osmosis. This permeate will go back for reuse, but the concentrate will require disposal. This will be by way of land-fill and will be sent back to PMC along with sub-stream (1) stated above.

For this temporary land-storage [TLS] we take following precautions.

Site Selection

1. This site is allotted by PMC to us and we have shown them our layout. The layout is approved by them. On the layout itself we have shown the TLS.
2. Selection of TLS is based on examination of environmental issues.
3. TLS is planned and designed with proper documentation of a phased construction plan as well as a closure plan.
4. TLS site supports the nearby wastes processing facility, which in fact is planned as an integral part of it.

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5. The TLS site every five years shall be improved in accordance of the specifications given in this Schedule.
6. Biomedical wastes and hazardous wastes shall not come to this TLS.
7. The TLS site shall be large enough to last for 2 days, as it is meant for only temporary storage in emergency on occasions.
8. The parent site is allotted by PMC and this TLS is its small part. PMC has allotted this plot with a consideration that it is away from habitation clusters, forest areas, water bodies monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.
9. A buffer zone of no-development shall be maintained around TLS site and is so shown in the layout drawings submitted by us as Master Plan to PMC's environment and Town Planning Department.
10. TLS is away from airport including airbase.

Facilities at the Site

11. TLS site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.
12. TLS site shall be well protected to prevent entry of unauthorized persons and stray animals.
13. Approach and other internal roads for free movement of vehicles and other machinery shall exist at the TLS site.
14. TLS site shall have wastes inspection facility to monitor wastes brought in for temporary storage awaiting outward transportation, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipments.
15. Provisions to estimate quantity of waste brought at TLS site, fire protection equipments and other facilities as may be required shall be provided.
16. Utilities such as drinking water (preferably bathing facilities for workers) and lighting arrangements for easy TLS operations when carried out in night hours shall be provided.
17. Safety provisions including health inspections of workers at TLS site shall be periodically made.

Specifications for land filling

18. Wastes subjected to TLS shall be here only temporarily for a few hours or a day awaiting lifting. Hence compaction in thin layers is not required. This is not a high rainfall area.
19. Wastes shall be covered immediately or at the end of each working day. As this is merely a TLS, covering will be by plastic/ tarpaulin and not by any regular minimum 10 cm of soil, inert debris or construction material. Lifting will be immediate as soon as transport truck of PMC arrives for taking this away to their regular land-fill site.
20. Prior to the commencement of monsoon season, extra efforts will be taken for prompt transfer employing special vehicles of our own (if PMC trucks

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are not available). Proper drainage by way of garland drain shall be constructed to divert run-off and run-on away from the TLS cell.

21. TLS being of a temporary storage, (and usually dry and empty) there is no question of its completion, final cover, infiltration and erosion.

Closure and post-care

This is a TLS, meant only for stop-gap truck awaiting tenure, usually dry and empty, only occasionally filled; there is no closure or abandoning it. As such question of closure and post-closure care does not arise. However when after 30 years the BOOT arrangement with PMC will be over, the further care PMC will take.

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Appendix	Item	Regarding
L	5.2.(vii)	Measures taken to check environmental pollution

Pollution prevention

This process is based on a state-of-art method and do not expect any pollution from here, we still shall take measures to prevent pollution problems and for this the following provisions shall be made, namely :-

a. Diversion of storm water drains to minimize leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions;
b. Construction of a non-permeable lining system at the base and walls of waste temporary storage area. For TLS receiving residues are not expected to be of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) as this is segregated and sent to us by PMC selectively. Liner specifications shall be a composite barrier of high density polyethylene (HDPE) geomembrane, or equivalent, overlying of soil (clay or amended soil) having permeability coefficient not greater than 1×10^{-7} cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer;
c. Provisions for management of leachate collection and treatment shall be made. The treated leachate shall be seen to meet the standards specified in Schedule- IV;
d. Prevention of run-off from landfill area entering any stream, river, lake or pond.

Water Quality Monitoring

This site is allotted to us by PMC and hence have considered baseline data of ground water quality in the area The ground water quality within 50 meters of the periphery of landfill site shall be periodically monitored to ensure that the ground water is not contaminated beyond acceptable limit. Such monitoring shall be carried out annually at post-monsoon period.

PMC supplies water to the residents of this area and there is no dependence on groundwater in and around this site for drinking purpose. The following parameters for drinking water quality shall apply for monitoring purpose, namely :- Arsenic, Cadmium, Chromium, Copper, Cyanide, Lead, Mercury, Nickel, Nitrate as NO_3, PH, Iron, Total hardness (as aCO_3), Chlorides,

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Dissolved solids, Phenolic compounds (as C_6H_5OH), Zinc, and Sulphate (as SO_4) and shall be compared with **IS 10500: 1991**

Ambient Air Quality Monitoring

This process is based on a state-of-art method and do not expect any pollution from here, by any long detention, chemical reaction and resultant uncontrolled gaseous pollution from here. Thus it is easy for us to observe that there will be minimum odor generation, off-site migration of gases and mal-effect on vegetation.

The methane gas generation, acidic fumes or dioxins will not take place.

As this process is based on a state-of-art method of gas generation in this facility, its thermal applications, power generation, or burning (flared) is taken full care. Passive venting is not expected. Ambient air quality at the site and at the vicinity shall be monitored for **Parameters** As Sulphur dioxide, Suspended Particulate Matter, Methane, Ammonia, and Carbon monoxide to check meet the standards.

The ambient air quality monitoring shall be carried out voluntarily annually in winter.

This process is not "incineration" in its true sense. It is first a pyrolysis where two streams will get separated, one being a bio-char (which is useful as fuel to burn in the combustion furnace producing heat energy) and the remaining will produce a gaseous mixture which in turn drives an engine and generate electrical power. Thus the emissions are not hazardous. These will be passed through bag filter and scrubber with free air released through stack.

A. Operating Standards

(1) The incineration pyrolysis efficiency (like Combustion Efficiency) shall be at least 99.00%.

(2) The combustion efficiency in gas engines is 99%.

1. Emission Standards

The actual emission will be better than the following standards.

Parameters	Concentration mg/Nm^3 at (12% CO_2 correction)
(1) Particulate matter	150
(2) Nitrogen Oxides	450
(3) HCl	50

(4) Minimum stack height shall be 30 metres above ground.

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(5) Volatile organic compounds in ash shall not be more than 0.01%.

Note:

1. Suitably designed pollution control devices shall be installed with the Pyrolysis-Reformer to achieve the above emission limits.
2. Wastes shall not be chemically treated with any chlorinated disinfectants
3. Chlorinated plastics shall not be included.
4. Metals (toxic or otherwise) are excluded during segregation process itself and ash automatically shall be limited within the regulatory quantities as specified in the Hazardous Wastes (Management and Handling) Rules, 1989 as amended from time to time.
5. PMC MSW itself is being used as a fuel and has low sulphur. No auxiliary fuel like LDO, LSHS or Diesel shall be needed.

Plantation at Site

A vegetative cover shall be generally provided over the complete site in accordance with the and following specifications, namely :-

(a) Selection of locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be allowed to grow;

(b) The plants grown be such that their roots do not penetrate more than 30 cms for such trees that are near the TLS.

(c) Selected plants shall have ability to thrive on low-nutrient soil with minimum nutrient addition;

(d) Plantation to be made in sufficient density to minimize soil erosion.

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For Rochem Separations Systems (I) P. Ltd.,

Dr. Harshvardhan Modak

(Authorized Signatory)

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