JAIVXCELERATE ENERGY PRIVATE LIMITED

10.00 TPD Compressed Bio Gas (CBG) Plant

CEID CONSULTANTS & ENGINEERING PVT. LTD.

"Total Biogas Solution"

Corporate Office: - Unit No.118, Minimac Centre, Arcot Road, Valasaravakkam, Chennai, Tamil Nadu – 600087, India

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DISCLAIMER

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Summarizing, this document is prepared to delineate the future of Compressed Bio Gas (CBG) plants. It is extremely confidential report and cannot be shared without the prior written permission of CEID or JXEPL. The document consists of technical as well as the financial feasibility of project. The information provided is correct to the best knowledge of CEID and JXEPL.

Contents

Abbreviations Used

- CBG – Compressed Bio Gas
- CGD –City Gas Distribution
- CNG – Compressed Natural Gas
- CSTR – Continuous Stirred Tank Reactor
- Cum - Cubic Meter
- PNG - Piped Natural Gas
- PNGRB – Petroleum & Natural Gas Regulatory Board
- EOI – Expression of Interest
- MNRE – Ministry of Natural & Renewable Energy
- MTOE - Million Tonnes of Oil Equivalent
- MMSCMD - Million Standard Cubic Meters of Gas per day
- GOI – Government of India
- LPG - Liquefied Petroleum Gas
- MSW –Municipal Solid Waste
- MMT –Million Metric Tons
- NPV- Net Present Value
- IRR – Internal Rate of Return
- MIRR- Modified Internal Rate of Return
- GST –Goods & Services Tax
- TPD – Ton per day

Project at Glance

Name & Address of the Company	**M/s JAIVXCELERATE ENERGY PRIVATE LIMITED** Registered office add: A-42B- Shatabdi Nagar Aligarh, Uttar Pradesh -202001		
Name and address of EPC Contractor:	**M/s CEID CONSULTANTS & ENGINEERING PVT. LTD.** Corporate office add: Unit No.118, Minimac Centre, Arcot Road, Valasaravakkam, Chennai, Tamil Nadu Pin Code – 600087, India		
Location of the Project	Khasra no. 87 & 89, Khata no. 00021 & 00124, Village Sahar, Shikarpur, Bulandshahr, Uttar Pradesh- 203395		
Proposed Project Capacity	25000 cum Raw Biogas per day 10000 KG CBG per day		
Raw Material and quantity	**Sr. No.**	**Raw Material (TPD)**	**QTY**
	1.	Press mud	185
	2.	Poultry & other Biodegradable Waste	25
		Total	**210**
Working days / Year	350 days/year		
Gross Production of Raw Gas	25000 cum/day		
Bio CBG Production	10000 kg/day		
Bio Dry Fertilizer Production	37.00 Ton/Day		
Bio Liquid Fertilizer Production	63.00 KL/Day		
Project Cost	**Rs. 6812.75 Lakhs**		
Means of Finance			
Own Contribution	Rs. 2212.75 Lacs		
Loan from Bank/F. I	Rs. 4600 lacs		
MNRE Subsidy (CFA)	Rs 833.33 Lacs		
Subsidy from State Government	Rs. 750.00 Lacs		
Commercial Data			
Price of Raw Material	Rs. 700/- per Ton		
Sale Rate of CBG	Rs. 66/- per kg		
Sale Price of Dry Bio-Fertilizer	Rs. 5/- per Kg		
Sale Price of Liquid Bio-Fertilizer	Rs. 0.50/- per Liter		
Important Ratios			
Average DSCR	2.91		
IRR (%)	27.08%		
Pay Back	2.92 Years		

Executive Summary

Biogas is one of the clean sources of energy which can be obtained from different biodegradable organic materials and wastes such as agricultural residues, cattle-dung, and biomass from farms, gardens, kitchens, industry, poultry droppings and municipal wastes after anaerobic digestion in which microorganism breakdown biodegradable material in the absence of oxygen. Biogas is upgraded by removing carbon dioxide and hydrogen sulphide from methane in the gas mixture. This upgraded biogas after the process of compression is **known as compressed biogas (CBG)**. CBG has many uses and **application which can be categorized in to domestic, industrial, commercial, and automotive categories**.

As India being agricultural state, crop residues are one of the major sources of biomass in the state. Apart from agricultural residue, other major sources of biomass in the country are Municipality waste, Cow/animal dung, Press mud from sugar mills, Cooked food waste, Sugarcane bagasse, Poultry waste, Paper & card board industry waste and Food processing industry waste.

There is a tremendous future for biogas and bio- methane in the global energy, depending on the pace of technological innovation, energy policies, market dynamics, societal trends, and many more other factors. According to world energy outlook special report 2018 by international energy agency, total demand for global bio methane consumption in year 2018 is 3 million tones oil equivalent, which will grow to 45 million tones oil equivalent in year 2030 and 75 million tones oil equivalent in year 2040, if current policies are continued by different countries. **In case of India, from almost negligible demand for bio methane, consumption will grow to 6 MTOE in year 2030 and 15 MTOE in year 2040 in current policy scenario.**

Among the technologies available, CSTR is a commercially proven matured technology and has been identified for conversion of waste to CBG due to its reliability in Indian conditions for multiple feed stocks. As far as financials are concerned, total cost of the project including contingency and finance cost during construction period comes out **INR 6,812.75 Lakhs for setting up of 10.00 TPD CBG producing plant.**

Main statutory approvals required for the project are approvals from gram panchayat, Local Government, small industrial corporation, Petroleum and Explosives Safety Organization (PESO), State Pollution Board, Department of Forest& Wildlife etc. Pre-project activities include lease agreement for plant site, applying for Central financial assistant scheme, arrangement of finance from various sources and agreement with farmers, balers, aggregators, cooperative societies, biomass suppliers for continuous supply of biomass. The economic viability and sustainability of the plant will be high with long term agreements with biomass suppliers/aggregators for feedstock and with commercial & industrial units for selling of the products.

For overall comprehensive national CBG project scheme, Government should continue the existing central financial assistance scheme to the biogas plant in terms of one-time financial support.

Keeping in view supply of raw material, demand of the CBG, technical feasibility, financial indicators, and viability, **it is highly recommended to set up 210 MT per day waste material based 10.00 TPD CBG plant at Village Sahar, Shikarpur, Bulandshahr, Uttar Pradesh**.

Promoter's Profile

"**JAIVXCELERATE ENERGY PRIVATE LIMITED**" is a newly formed private limited company. The company have a vision to setup various renewable energy projects. The company aims to convert the biodegradable waste into energy, that's in turn used in various industrial and domestic applications.

M/S JAIVXCELERATE ENERGY PRIVATE LIMITED is a company registered under the Companies Act, 2013 (18 of 2013) having its registered office at **A-42B- Shatabdi Nagar Aligarh, Uttar Pradesh -202001**, and **CIN U35201UP2023PTC183646**with the aim to set up Renewable Energy Project.

Like any other project, in this case too, the integration & conveyance of capital & expertise is of supreme essentiality. Tangibly the capital can be add-on and measured but the intangible asset "Expertise" in the activity at the question has to be sensed prudently. The time has proved that, the basic yardstick to measure the expertise is nothing but the sum of strength & exposure of Principal Promoters and Man-Force own stream and as envisaged, the project proposes of following pillars as promoter: -

1. Mr. Divyansh Govil, Director

Mr. Govil is currently pursuing a degree in Computer Science, and he thrive in the world of technology and innovation. He is a dedicated and curious individual with a passion for learning and exploring new ideas. His proactive approach to challenges allows him to develop creative solutions and adapt to evolving situations. With a strong work ethic and effective communication skills, He is enjoying collaborating with others to achieve common goals. Through his experiences, he had developed a keen eye for detail and a commitment to continuous growth. He believe in embracing opportunities and making a positive impact in every endeavor he pursue.

2. Mr. Rishabh Sharma, Director

Mr. Sharma holds a B.Tech degree in Electronics and Communication Engineering from AKGEC. With a solid educational foundation, he would have honed skills in electronics and communication systems. Additionally, he bring two years of valuable work experience from TCS, where he have contributed to various projects and gained insights into the tech industry. This experience has polished his problem-solving abilities, teamwork, and adaptability. He was passionate about leveraging his knowledge to tackle challenges and drive innovation. His journey in both education and work has equipped him with a diverse skill set and a drive to excel in the dynamic world of technology.

The Company has plans to execute the 25000 cum per day CBG & Fertilizer Project in Uttar Pradesh, where the Biodegradable waste is available in abundance; ready market is available for consumption of its products such as CBG and Bio-Fertilizer. The Company also proposes to expand the project in second/third phase upon stabilization of its project in future.

Contractor's Profile

- **About CEID Consultants & Engineering Pvt. Ltd**

CEID is a vibrant project development company focused on identifying, prospecting, and promoting Biogas, Solar, Hydel, and Petrochemical based technologies to meet the growing demand for energy in India. With a mission to re-establish the ecological balance to target sustainable development by streamlining different energy sources.

Putting together the technical as well as non-technical team CCEPL members have extensive experience in large-scale energy and biogas development worldwide. CCEPL technical team brings industry expertise arising from over 25 years of experience in the international energy sector.

Technology Provider for
Ministry of Petroleum & Natural Gas, Govt. of India

"The MoU for providing the Technology was signed on 20th November 2020 between MoPNG and CEID Consultants Engg Pvt Ltd to establish Compressed Bio-Gas CBG) plants across India under the Sustainable Alternative Towards Affordable Transportation (SATAT) initiative, in the presence of Shri Dharmendra Pradhan, Former Union Minister of Petroleum and Natural Gas & Steel, Govt. of India"

"The MoU for establishing 19 Compressed Bio-Gas (CBG) plants across India was signed during INDIA ENERGY WEEK 2024 between IGL and CEID Consultants Engg Pvt Ltd. The biogas produced from these 19 plants shall be fed into IGL's City Gas Distribution network.

This MOU was signed in the presence of Mr. Praveen Mal Khanooja (IA &AS), Additional Secretary of the Ministry of Petroleum and Natural Gas (MoPNG), Mr. K.K Chatiwal, Managing Director of IGL, Mr. Pawan Kumar, Director (Commercial) of IGL senior officials and media persons.

Source:

https://www.sarkaritel.com/igl-signs-mous-for-setting-up-19-compressed-natural-gas-cbg-plants-with-technical-partners-at-india-energy-week-2024/

About CEID CONSULTANTS

We, at **CEID Consultants and Engineering Private Limited**, are proud to introduce ourselves as a pioneering company in the field of compressed bio gas & biodegradable waste management. We specialize in the design, engineering, manufacturing, supply, erection, testing, installation, and commissioning of projects related to biogas generation, purification, bottling & grid injection, and biogas-to-power conversion. Our management is driven by a vision and mission to meet India's growing energy demands through sustainable development, integrating various energy sources, and contributing to the restoration of ecological balance.

30+ Plants Commissioned

40+ Ongoing Projects

110+ TONNES OF CBG PER DAY — Producing From Commissioned Plants

400+ TONNES OF CBG PER DAY — Production Goal till 2026

CORE SERVICES

- EPC for CBG Plants
- Comprehensive O&M Services
- Project Financing
- Feasibility Studies
- Consulting Services
- Biogas Generation & Purification
- Grid Injection & Bottling
- Biogas-to-Power Conversion
- Equipment Design & Manufacturing
- Feedstock Sourcing, Pretreatment & Management

www.ceidconsultants.com info@ceidbiogas.com

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CENTRE FOR ENTREPRENEURSHIP & INDUSTRIES DEVELOPMENT
Haath Vishwas Ka...

CBG PLANTS
Commissioned before SATAT

India's First CBG Plant

Country's first eco-friendly biogas plant set up near Abohar

RAJ SADOSH

ABOHAR, SEPTEMBER 12

The country's first 600 cubic-meter compressed biogas bottling plant (non-conventional energy source) has been set up at village Kala Tibba near here. Punjab Energy Development Agency (PEDA) Director Balaur Singh informed that the Ministry of New and Renewable Energy (MNRE) and PEDA had joined hands to promote eco-friendly gas production by launching the green gas projects in the state.

The plant, first of its kind, at village Kala Tibba would produce gas by utilising cattle dung, poultry waste and kitchen waste. A survey had indicated that hundreds of cattle owners in the rural area had been dumping dung on the road sides or peripheries causing pollution besides damaging the roads.

Such dumps had created a lot of nuisance in the rainy season. The government had decided to offer carbon credit worth Rs 600 for the green gas plant. The benefit may run into lakhs of rupees annually.

Biogas is an economical, renewable and an eco-friendly fuel. Biogas is produced in an anaerobic digester i.e. a Gobar gas plant. Biogas in its natural self consists of Moisture, Carbon dioxide, Hydrogen sulfide and Methane gas.

Methane has a high calorific value in its pure stage. Due to the presence of impurities Biogas becomes a very low calorific value fuel and hence finds a very limited application even though it is cheap and easily available.

Asserting that biogas would cost less than the LPG, Balaur Singh said, "The entire quantity of biogas filled in the cylinder would be exhausted while liquefied gas at the bottom remains unused in the LPG cylinders. The production would also help in overcoming shortage of the LPG faced by commercial houses. The government had decided to offer 50 perc ent subsidy to promote green gas production.

The Ministry of New and Renewable Energy has planned to promote installation of 15 compressed biogas bottling plants in different states with a capacity of 11,200 cubic meters per day. The states to be covered as of now include Punjab, Haryana, Rajasthan, Gujarat, Karnataka, Bihar, Chhattisgarh and Maharashtra.

The MNRE had approved another green gas project with 1000 cubic-meter capacity at village Nijawat Kokrian in the Muktsar district, the same is likely to be completed by end of the year.

The Punjab Agricultural University has set up biogas development training centre to impart technical knowledge to the interested entrepreneurs.

The bio slurry discharged by the green gas plants can be used as liquid fertiliser that would promote organic farming. So far two farmers Pradeep Dawra of village Giddernanwali and Amar Kumar of Malout have shown interest in liquid fertiliser marketing, sources added.

India's first 600 cubic meter biogas bottling plant has been set up near Abohar. Photo: Raj Sadosh

The plant would produce gas by utilising cattle dung, poultry & kitchen waste

M/S ANAND ENERGY
FAZILKA (PUNJAB)

The Tribune
D.O.P.: 13.09.2011

M/s Panchkula Farms Pvt. Ltd.
PANCHKULA (HARYANA)

M/s Arc Bio Fuel Pvt. Ltd.
BARNALA (PUNJAB)

M/s Shri Dayoday Urja Evam Jaivik Khad Pvt. Ltd.
BHOPAL (MP)

M/s Shashi Energy
FATEHABAD (HARYANA)

M/s Amit & Sumit Dairy Farm
JHAJJAR (HARYANA)

M/s Singla Bio Energy
SRIGANGANAGAR (RAJASTHAN)

M/s SASK Energy
SRI MUKTSAR SAHIB (PUNJAB)

M/s Nepal Energy Development Company
CHITWAN (NEPAL)

Our FOUNDERS

Mr. Prince Gandhi

Director & CEO, CEID Consultants & Engineering Pvt. Ltd.

With over 24 years of extensive experience, Mr. Gandhi has played a pivotal role in establishing more than 400 industrial units across diverse sectors such as agro-industry, food processing, renewable energy, and more. He holds an MBA from Pune University.

In 2011, Mr. Gandhi successfully established India's first BioCNG Bottling & Fertilizer Plant at Abohar, which continues to operate effectively. He also pioneered Punjab's first and only Guar Gum production plant in 2008 under the name M/s Super Fine Agro Industries, which remains a thriving venture.

Further enhancing his legacy, Mr. Gandhi led the commissioning of Asia's largest Multi-Feed BioCNG Bottling & Fertilizer Plant in Nadiad (Gujarat) in 2018, under the banner of M/s Govardhannathji Energies. With a capacity of 21,000 cum/day, this project was inaugurated by the Hon'ble Prime Minister of India, Shri Narendra Modi.

As the Director and CEO of CEID Consultants & Engineering Pvt. Ltd., Mr. Gandhi currently oversees all operations, including technical, financial, management, and marketing activities, ensuring the company's continued success and innovation in the biogas and renewable energy sectors. His leadership and strategic vision have been instrumental in CEID's growth and industry recognition.

Mr. Rajaram Prajapati

Director & CTO, CEID Consultants & Engineering Pvt. Ltd.

With over 16 years of comprehensive experience in the biogas sector, Mr. Prajapati is a seasoned leader who brings deep expertise in factory production, project coordination, and plant machinery design. As the Director and Chief Technical Officer (CTO) at CEID, he plays a crucial role in overseeing the technical and operational excellence of all ongoing projects.

Mr. Prajapati is responsible for establishing effective coordination between team members, engineers, and various project sites, ensuring smooth operations across the board. His key responsibilities include the preparation of detailed drawings, designs, and specifications for plant machinery, as well as overseeing the installation and commissioning of projects to ensure efficient plant performance.

Notably, Mr. Prajapati led the establishment of India's first BioCNG Bottling & Fertilizer Plant in Abohar, Punjab, in 2011, under M/s Anand Energy. With a capacity of 600 cum/day, this pioneering project continues to operate successfully. Furthermore, he was instrumental in the development of Asia's largest Multi-Feed BioCNG Bottling & Fertilizer Plant in Nadiad, Gujarat, in 2018, under M/s Govardhannathji Energies, with a substantial capacity of 21,000 cum/day.

His extensive technical knowledge and leadership in the biogas industry have been vital to CEID's growth and the successful execution of large-scale, innovative projects across India and internationally.

Management Team

Mr. Madan Lal Gandhi, Director

Mr. Gandhi has a vast experience of 40 years as project Head in various industries. Mr. Gandhi holds an M.A Degree and responsible for all Operation, financial and Marketing activities in CEID.

Mrs. Sanjna Gandhi, Director

Mrs. Gandhi having more than 15 years' experience of Finance & Management. She is Post graduate in commerce and working with CEID since 2006 and currently responsible for all financial activities in all CEID Projects

Mr. B.Velmurugan, Executive Director – R&D

Mr. Velmurugan has done Master of Technology (M.Tech) in Chemical Engineering (Specialization in Petroleum Refining and Petrochemicals) and having more than 20 years of experience in biogas field. He is presently working with CEID as an Executive Director in Research & Development wing.

He started his career in Central Leather Research Institute, Chennai in 2003. He had also worked with Sardar Patel Renewable Energy Research Institute, Gujarat as "Principal Scientist" He has experience in the field of bio-methanation plants, "Enzymatic hydrolysis of biomass", bio-coal other agri-biomasses, He also had obtained patents to his name for "Enzymatic hydrolysis of biomass" and "Bio-gas production from enzymatic hydrolysate of rice straw".

Mr. R. Hemaselvan, Executive Director

Mr. Hemaselvan has done graduation in physics with MBA in International Business Management from Madras University. He started his career in Management Consultancy and Auditing in 2004 and have done lead auditor certification in ISO 9001, ISO 14001 with six sigma green belt. From 2010 till date he is in the business of consultancy on Solid waste management, project execution on all types of biogas plants, waste to energy projects like biogas bottling, biogas to electricity etc. He is presently with CEID as Executive Director taking care of Project Execution across South India and also handles pan India Business Development. He has 13 years of experience in the field of Biogas, Biogas Bottling, Biogas to Power.

Our Key MILESTONES

Setting Industry Benchmarks

In 2018, prior to SATAT's launch, CEID commissioned Asia's largest multi-feed Bio-CNG plant (21,000 cum/day, 8 TPD) at Govardhannathji Energies LLP, Gujarat. Using advanced PLC SCADA, it became India's first to inject gas into MDP pipeline via a tripartite agreement with Gujarat Gas Ltd.

MoU with IGL

At India Energy Week 2024, CEID Consultants & Engineering Pvt. Ltd. signed an MoU with Indraprastha Gas Ltd. (IGL) to develop 19 CBG plants across 4 North Indian states, with the biogas to be injected into IGL's City Gas Distribution network.

LEPC partner with IOCL's R&D

After successfully commissioning two CBG plants for IOCL in Jaipur and Gorakhpur, CEID Consultants & Engineering Pvt. Ltd. is proud to have been selected as the LEPC partner by IOCL's R&D team. This partnership aims to establish CBG plants utilizing proprietary technology developed by them.

Our Key MILESTONES

MoPNG Approved Technology Provider

CEID, recognized by MoPNG as an approved technology provider for CBG plants, signed an MoU on 20th Nov 2020 under the SATAT initiative to establish CBG plants across India, in the presence of Union Minister Shri Dharmendra Pradhan.

Strategic Partnership with GAIL

CEID is the sole company in India's CBG sector with a 10% equity stake held by GAIL, reflecting CEID's credibility, technological advancement, innovation, and the trust it has earned in the industry.

GAIL (India) Limited

Greater Chennai Corporation (GCC) Project

CEID established a 140 TPD MSW-based CBG plant in Chennai, part of an 850 TPD project comprising 6 plants, with the remaining 5 under construction. The first plant was inaugurated by Hon'ble CM of Tamil Nadu, Shri M.K. Stalin, on 22nd November 2022.

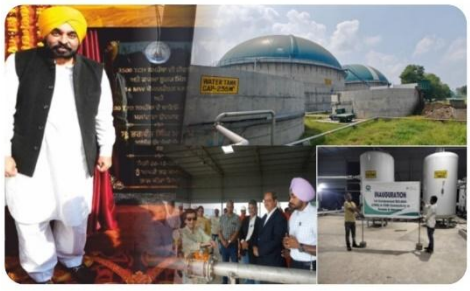
Our Key MILESTONES

GAIL Project in Ranchi

CEID recently completed GAIL's first MSW-based CBG plant in Ranchi, processing 150 tonnes of MSW. The plant was inaugurated by Prime Minister Shri Narendra Modi on 2nd October 2024, it marks a global first, with 1.5 years spent leveling rocky terrain to establish the CBG plant.

IOCL Projects

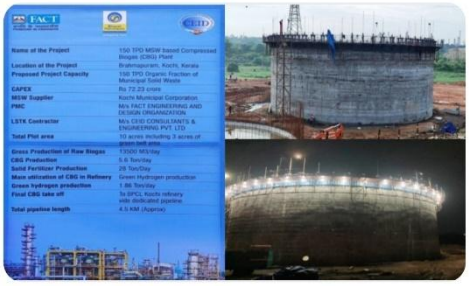
CEID built IOCL's first & second CBG plants, including a cow dung-based plant in Jaipur and a paddy straw-based plant in Gorakhpur, both successfully commissioned. The Gorakhpur plant was inaugurated by the Hon'ble Chief Minister of Uttar Pradesh.



Punjab SUGARFED Projects

CEID commissioned a 100 TPD press mud-based CBG plant at Batala and is constructing another at Bhogpur for Co-operative Sugar Mills, marking the first such projects by a Sugar Federation in India. Gas is injected into Gujarat Gas Ltd. pipelines, making it the first pipeline-injected plant in Haryana and Punjab. Trial commissioning was completed on 13th Sep 2024, and the Batala plant was inaugurated by Punjab CM Shri Bhagwant Mann on 6th Dec 2024.

Our Key MILESTONES



BPCL Project at Kochi

CEID was recently awarded a 150 TPD MSW-based CBG plant project by Bharat Petroleum Corporation Ltd. at Brahmapuram, Kochi, its first CBG plant. This will be India's first plant to generate hydrogen from CBG.

In-House Capabilities:

CEID designs and manufactures CBG plant equipment and is an approved vendor for IOCL, GAIL, and BPCL. It specializes in multi-feed and single-feed technologies, customized pre-treatment systems, advanced segregation units, and zero-waste feeding systems for optimal output.

Municipal Corporation of Delhi (MCD) Projects

CEID has been awarded three CBG projects totaling 700 TPD, utilizing cattle dung and vegetable mandi waste in Delhi. One plant is operational, while two others are currently under construction.

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CEID
Haath Vishwas Ka...

CBG PLANTS
Commissioned after SATAT

CBG Plants on DIFFERENT FEEDSTOCKS

MEPL Bioenergy LLP
Location: Batala, Punjab
Feedstock: Pressmud
CBG Production Capacity: 6.4 TPD

Mittal Enterprises
Location: Hapur, Uttar Pradesh
Feedstock: Press mud, Spent wash
CBG Production Capacity: 5.6 TPD

IOCL CBG PLANT
Location: Gorakhpur, Uttar Pradesh
Feedstock: Paddy Straw
CBG Production Capacity: 20 TPD

WI GREEN ENERGY LLP (WAVE GROUP)
Location: Amroha, UP
Feedstock: Pressmud , Spent Wash
CBG Production Capacity: 10 TPD

Demeter Agro Energies Pvt Ltd
Location: Kaithal, Haryana
Feedstock: Pressmud , Spent Wash
CBG Production Capacity: 10 TPD

IOCL CBG Plant
Location: Jaipur, Rajasthan
Feedstock: Cow Dung
CBG Production Capacity: 5 TPD

GAIL CBG PLANT
Location: Ranchi, Jharkhand
Feedstock: MSW
CBG Production Capacity: 5 TPD

SPARK BIOGAS Pvt. Ltd.
Location: Gr. Chennai, Tamil Nadu
Feedstock: MSW
CBG Production Capacity: 5.6 TPD

- **Visit of Delegation from The World Bank, USA, Ministry of New & Renewable Energy (MNRE), Govt. of India, New Delhi and Ministry of Population & Environment, Govt. of Nepal, Kathmandu visited our plant in Panchkula, Haryana (India)**

- **Mr. Tomoyuki Yamashita** (First from Right), P.E., Senior EnergySpecialist, Energy & Extractives, The World Bank, USA

- **Mr. V.K. Jain** (in Center), Advisor, Ministry of New & RenewableEnergy (MNRE) Govt. of India, New Delhi

- **Mr. Prince Gandhi** (Left), Chief Operating Officer, CEID Consultants & Engineering Private Limited (CCEPL), Abohar, Punjab

Nepal's First Biogas Pipeline Plant successfully installed by CEID and inaugurated by Honorable Prime Minister of Nepal, Sh. KP Oli

Tenders awarded to CEID by various Govt Department/ Corporation

S. No.	Project Details	Tender Authority
1	Bio-Gas Plant for Treating 150 TPD MSW into Generation Bio-CNG in Brahmapuram, Kochi	Bharat Petroleum Corporation Limited (BPCL)
2	Bio-Gas Plant for Treating 135 TPD Cowdung into Generation Bio-CNG in Barsana, U. P	Indian Oil Corporation Limited (IOCL)
3	Bio-Gas Plant for Treating 200 TPD Paddy Straw into Generation Bio-CNG in Gorakhpur, U. P	Indian Oil Corporation Limited (IOCL)
4	Bio-Gas Plant for Treating 150 TPD Municipal Solid Waste into Generation Bio-CNG in Ranchi, Jharkhand.	GAIL India Ltd
5	Bio-Gas Plant for Treating 100 Cattle Dung into Generation Bio-CNG & Bio-Fertilizer in Jaipur, Rajasthan	Indian Oil Corporation Limited (IOCL)
6	**4 nos** Project for 700 TPD Solid Waste Management for Treating Bio-Degradable Waste (Cattle Dung, Fruit & Vegetable Market Waste, MSW) into Generation Bio-CNG	Municipal Corporation, Delhi
7	Bio-Gas Plant for 140 Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer at **Madhavaran -1(KDR),** Chennai, Tamil Nadu	Greater Chennai Corporation
8	Bio-Gas Plant for 140 Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer at **Madhavaran -2(KDR),** Chennai, Tamil Nadu	Greater Chennai Corporation
9	Bio-Gas Plant for 140 Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer at **Sholinganallur**, Chennai, Tamil Nadu	Greater Chennai Corporation
10	Bio-Gas Plant for 140 Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer at **Pallikaranai -1**, Chennai, Tamil Nadu	Greater Chennai Corporation
11	Bio-Gas Plant for 140 Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer at **Koyambedu,** Chennai, Tamil Nadu	Greater Chennai Corporation
12	Bio-Gas Plant for 140 Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer at **Pallikaranai -2**, Chennai, Tamil Nadu	Greater Chennai Corporation
13	Installation, Operation and Maintenance of a Bio-CNG Plant from **100 TPD Pressmud** at Batala Co-operative Sugar Mills Limited on BOT basis	Sugarfed Punjab
14	Installation, Operation and Maintenance of a Bio-CNG Plant from **100 TPD Pressmud** Bhogpur Co-operative Sugar Mills Limited on BOT basis	Sugarfed Punjab

Commissioned and Successfully Running Units of BioCNG Bottling/ Power Generation

S. No.	Plant Name & Address	Plant Capacity (cum/day)
1	Bio-Gas Plant for Treating Paddy Straw into Generation Bio-CNG & Bio-Fertilizer in Gorakhpur, U.P Awarded by Indian Oil Corporation Limited (IOCL) – 20 TPD BioCNG Commissioned in January 2024 and handling Operation & Maintenance since commissioning	56000
2	M/s Govardhannathji Energies, Vill – Nadiad, Distt – Kheda (Gujarat)	21000
3	M/s MEPL Bioenergy LLP, Batala Co-operative Sugar Mills Awarded by Sugarfed Punjab – 6.4 TPD BioCNG	16000
4	M/s Mor Bioenergy Pvt Ltd, Tehsil – Safion, Distt – Jind (Haryana)	14500
5	M/s Shri Hari Bio CNG & Fertilizer LLP, Gujarat	14000
6	M/s Turquoise Bio Natural Energy Private Limited, District: Bharuch, State: Gujarat	14000
7	M/s Mittal Enterprises, Hapur, Uttar Pradesh	14000
8	M/s Spark Biogas Pvt Ltd, Madhavaram, Chennai	14000
9	Indian Oil Corporation Limited, Jaipur, Rajasthan	10000
10	M/s Braj Dham Power Pvt. Ltd., (Sewage Treatment Plant), Jaipur(Rajasthan)	8000
11	M/s Mahashank Energy LLP, Kanchipuram, Tamil Nadu	7000
12	M/s SLR Energy, Cuddalore, Tamil Nadu	7000
13	M/s JPS Agrotechs & Farms, Rohtak, Haryana	6000
14	M/S Sanjh deep Gas Energy, Village/P.O Mehma Sarjan, Tehsil & District- Bathinda (Punjab)	5000
15	M/s Bathinda Ceramics Pvt. Ltd., Village- Jodhpur Romana, Dabwali Road, Bathinda(Punjab)	5000
16	M/s Arc Bio Fuel Pvt Ltd., Vill – Kothe Saran, Tehsil & Distt- Barnala (Punjab)	5000

17	M/s Panchkula Farms Pvt Ltd., Vill – Jaspur, Tehsil Barwala, Distt-Panchkula (Haryana)	4000
18	M/s Shri Dayoday Urja Evam Jaivik Khad Pvt Ltd., Bhopal, Madhya Pradesh	3000
19	M/s R2S Bio-Products Pvt Ltd., Rohtak, Haryana	3000
20	M/s Milestone Infrastructure, Biogas Bottling & Bio-Compost Division, Baroda, Gujarat	2000
21	M/s Swaraj Farms & Stores, Vill – Jatwar, Tehsil Naraiangarh, Distt-Ambala (Haryana)	1500
22	M/s Sarovar Agro Farms & Biogas Pvt. Ltd., Vill – Jatwar, Tehsil Naraiangarh, Distt- Ambala (Haryana)	1500
23	M/s Gau Samridhi Energy Pvt. Ltd., Siwani, Haryana	1000
24	M/S SASK Energy, Village Najabat Kukrian, P.O Lubaniawali, Tehsil & District- Sri Muktsar Sahib (Punjab)	1000
25	M/S Singla Bio Energy, Village Siaghawali, Tehsil- Sadulsehar, District- Sri Ganganagar (Rajasthan)	1000
26	M/S Amit & Sumit Dairy Farm, Village- Jahajgarh, Tehsil- Beri, District- Jhajjar(Haryana)	700
27	M/S Shashi Energy,Tehsil-Tohana, District- Fatehabad (Haryana)	600
28	M/S Anand Energy, Tehsil-Abohar, District -Fazilka (Punjab)	600
29	M/s Nepal Energy Development Company Pvt. Ltd., Chitwan, Nepal	200
30	M/s Nepal Energy Development Company Pvt. Ltd., Birat Nagar, Nepal	100

Under Installation Units of BioCNG Bottling/ Power Generation

S. No.	Project Name & Address	Plant Capacity (Cum/Day)
1.	Bio-Gas Plant for 840 Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer in various parts of Chennai, Tamil Nadu Awarded by Greater Chennai Corporation – 35 TPD BioCNG	84000
2.	M/s Demeter Biofuel Energies Private Limited, Ambala, Haryana - 15 TPD CBG	37500
3.	M/s Synergy Teletech Pvt. Ltd., Saharanpur, UP - 13 TPD CBG	34000
4.	M/s Samridh Bio Energy & Organics, Moradabad, UP – 12 TPD CBG	30000
5.	M/s Demeter Agro Energies Private Limited, Kaithal, Haryana - 10 TPD CBG	25000
6.	M/s WI Green Energy LLP (Wave Group), Amroha, UP - 10 TPD CBG	25000
7.	M/s BABA DEEP SINGH GREEN POWER Pvt Ltd, Meerut, UP - 10 TPD CBG	25000
8.	M/s Samridh Bioenergy and Organics, Moradabad, UP- 10 TPD BioCNG	25000
9.	M/s Panj Aab Bio Fuel and Bio-Fertilizers Pvt. Ltd Ludhiana, Punjab - 10 TPD CBG	25000
10.	M/s Jaivxcelerate Energy Private Limited, Bulandshahr, UP – 10 TPD BioCNG	25000
11.	M/s Shobhit Green Energy LLP, Meerut, UP - 9.6 TPD CBG	24000
12.	M/s Degna Bioenergy Pvt. Ltd., Hapur, UP - 9.6 TPD CBG	24000
13.	M/s LR Bio Bargur Pvt. Ltd., Krishnagiri, Tamil Nadu - 9.6 TPD CBG	24000
14.	Municipal Corporation Delhi, Ghogha Dairy Bawana Industrial Area, New Delhi - 8.4 TPD BioCNG	21000
15.	M/s Rajput BioCNG Manure Pvt Ltd, Amroha, UP - 7 TPD CBG	17500
16.	M/s Rajput BioCNG Manure Pvt Ltd, Rampur, UP - 7 TPD CBG	17500
17.	Installation, Operation and Maintenance of a Bio- CNG Plant from 100 TPD PressMud Bhogpur Co-operative Sugar Mills Limited on BOT basis Awarded by Sugarfed Punjab – 5.6 TPD BioCNG	16000
18.	M/s Girivar Energy & Bio Fertilizers LLP, Gujarat Biogas to LNG Production Project – 5.6 TPD CBG	16000
19.	M/s Renew Bioenergy Pvt Ltd, Ludhiana, Punjab Awarded by Punjab Energy Development Agency, (SNA to MNRE) on Build, Operate, Own basis, 5.6 TPD CBG	16000
20.	M/s Renew Bioenergy Pvt Ltd, Amritsar, Punjab warded by Punjab Energy Development Agency, (SNA to MNRE) on Build, Operate, Own basis, 5.6 TPD CBG	16000
21.	M/s Agrowaste Gas Pvt Ltd. Roorkee, Uttarakhand – 6.4 TPD BioCNG	16000
22.	M/s ADD Bio Renergy (OPC) Pvt. Ltd., Erode, Tamil Nadu – 6.4 TPD BioCNG	16000

23.	M/s Shri Ram Biogas, Muzaffarnagar, UP – 6.4 TPD BioCNG	16000
24.	Municipal Corporation Delhi, Goyla Dairy, Nazafgarh, New Delhi - 5 TPD BioCNG	14000
25.	Municipal Corporation Delhi, Nangli Dairy, Nazafgarh, New Delhi - 5 TPD BioCNG	14000
26.	Bio-Gas Plant for Treating Municipal Solid Waste into Generation Bio-CNG & Bio-Fertilizer in Ranchi, Jharkhand Awarded by GAIL India Ltd– 5 TPD BioCNG	12500
27.	M/s Jaivik Vikalp Urja LLP, Moradabad, UP – 3 TPD BioCNG	7500
28.	M/s Buland Bio Gas, Bulandshahr, UP – 3 TPD BioCNG	7500
29.	M/s Renefuels Energy Solutions LLP, Muzaffarnagar, UP – 2.8 TPD BioCNG	7000
30.	Tender for "Design, Supply, Installation, testing & commissioning of Bio Gas Based Co Generation Engine and Bio-methanation Plant along with the comprehensive Operation & Maintenance work initially for five years at permanent campus of Nalanda University (NU), Nalanda, Rajgir, Bihar	5000

Chapter-1: Introduction

Oil crisis of 1973 started the process of exploring options for using renewable energy in place of conventional sources of energy. Rising oil prices, supply- demand gap for energy in meeting the demand of growing economies, urbanization and attention on greenhouse gas emissions spurred the renewable energy utilization. Technological improvements, better quality control, standardization and increased number of suppliers/ manufacturers/vendors in technologies such as wind turbines, biomass-based power generation, biomass gasification, small and micro-hydro, Bio-fuel and solar photovoltaic aided the growth of renewable. In-spite of focus on renewable, usage of biomass as a renewable fuel lagged due to high cost of logistics involved resulting in continuation of their burning in fields.

This is resulting in hazardous effects on Health, Environmental, Soil Nutrition and National security. Hon'ble Supreme Court of India and National Green Tribunal has been issuing orders to various stake holders to control this practice which is going on despite legal restrictions being put in place by State and Central Governments.

In 2020, even while economies down under the weight of Covid-19 lockdowns, renewable sources of energy such as wind, solar, biofuels continued to grow rapidly. Clean energy technology is becoming a major new area for investment and generation. India is among the fastest growing economy in the world and its energy consumption is slated to increase rapidly. According to the Ministry of Petroleum and Natural Gas (MoPNG) estimates, India has a total reserve of 763 Million Metric Ton (MMT) of crude oil and 1,488 Billion Cubic Meter (BCM) of natural gas. The country currently imports nearly 77% of its crude oil requirements and about 50% of natural gas requirement, leading the Government of India to set a target of reducing this import in the coming years. Hon'ble Prime Minister has given the following four pillars of vision of India's energy future – energy access, energy efficiency, energy sustainability and energy security.

Waste / Bio-mass sources like agricultural residue, cattle dung, sugarcane press mud, municipal solid waste and sewage treatment plant waste, etc. can be used to produce clean sources of energy, with multiple potential benefits for sustainable development. Compressed Biogas (CBG) has calorific value and other properties similar to Compressed Natural Gas (CNG) and hence can be utilized as green renewable automotive

fuel. Thus, it can replace CNG in automotive, industrial and commercial areas, given the abundance biomass availability within the country.

Biogas and CBG are having many applications and they originate from a range of organic feedstocks whose potential is underutilized till now. The production and use of these gases brings many benefits like reduced emissions, improved waste management and greater resource efficiency. Production of Biogas and CBG are providing a way for participation of rural communities and industries into the transformation of the energy sector in India.

Conversion of agricultural residue, cattle dung and municipal solid waste (MSW) into CBG in a commercial scale is expected to have many benefits: -

- Reduction of import of natural gas, crude & other energy sources.
- Utilization of agricultural residue, cattle dung, MSW and other organic wastes for the production of CBG to achieve reduction in emissions and pollution.
- Fulfilment of National commitments in achieving climate change goals.
- Providing a buffer against energy security concerns and crude/gas price fluctuations.
- Contribution towards Swachh Bharat Mission through responsible waste management
- Providing additional source of revenue to the farmers and rural employment
- Betterment of the rural economy

Biogas is produced, when bio-degradable organic materials such as agricultural residues, cattle-dung, biomass from farms, gardens, kitchens, industry, poultry droppings and municipals wastes are subjected to a scientific process, called Anaerobic Digestion. Anaerobic digestion includes a series of biological processes in which micro-organisms breakdown biodegradable material in the absence of oxygen. Initially, Biogas Plants were developed for digesting cattle dung. However, over a period of time, technology has been developed for the bio-methanation of various types of biomass materials and organic wastes.

The gas produced after the series of processes is a clean, flammable and pollution-free fuel. The biogas produced as a result of anaerobic digestion process mainly consists of Methane (CH4) and Carbon Dioxide (CO2), with small quantities of Hydrogen Sulfide (H2S), Ammonia and moisture. CH4 content in the biogas is usable as fuel and after purification its calorific value is equivalent to Compressed Natural Gas (CNG), and thus can replace CNG use in automobile, power generation, heating, and other commercial purposes.

Comparison of Calorific Value of different fuels

Sr. No	Fuel	Kcal per cubic meter
1	Biogas	5500
2	Natural Gas	9350
3	CBG	9600
4	LPG	25350

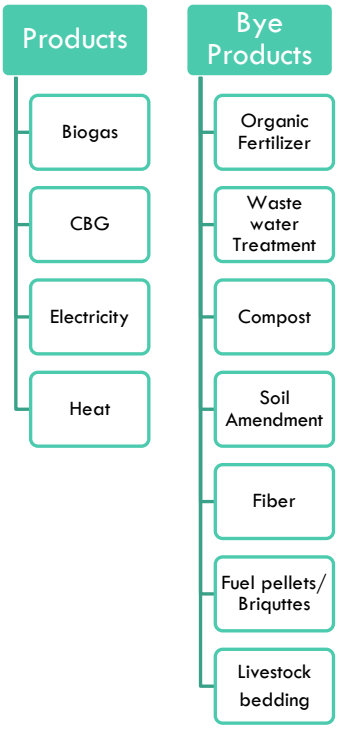
Biogas contains about 55-65 % of methane, 35-45 % of carbon dioxide and traces of other gases, such as Hydrogen Sulphide, Nitrogen and Ammonia. The process of removal of the impurities from biogas is known as purification and removal of all impurities in the biogas particularly CO2, H2S and ammonia results in percentage increase in the content of CH4 that enhances the quality of biogas resulting in higher calorific value. After purification, the gas is compressed with the help of a compression system for using it in automobile, power industries, etc. The purified and compressed biogas has calorific value equivalent to natural gas and termed as CBG. CBG is the purified form of biogas after removal of all impurities and contains more than 90% pure CH4 and is similar to the commercially available CNG in terms of chemical composition but with higher energy potential. In terms of chemical composition, CNG and CBG are similar, except that CNG contains higher alkanes. In addition, CBG favourably compares with Liquefied Petroleum Gas (LPG). In general, CBG has the potential to directly replace CNG and LPG.

Comparison of Biogas & CBG

Composition	Biogas	CBG
Methane	55%- 65%	>90%
Carbon dioxide	30%-40%	< 4%
Hydrogen Sulfide	0.1% -4%	< 16ppm
Ammonia	0.1%	0%
Nitrogen	3%	<0.5%
Oxygen	0.1%-2%	<0.5%
Moisture	1%-2%	0%

The digested slurry produced from biogas plants as a by-product is a better source of nutrient enriched organic manure for use in agriculture. It not only helps in improving the crop yield

but also maintain soil health. This may be commercially used for producing organic fertilizer, compost and/ or biomass briquettes.



Products & By-products in a Biogas Plant

The commercial use of CBG in India shall meet IS 16087:2016 specifications of BIS standards, as mentioned in the below table.

BIS specification for CBG

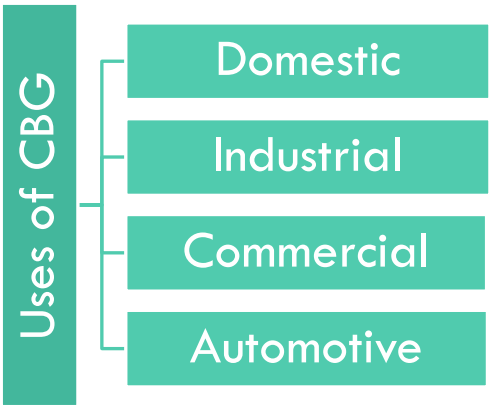
Characteristics	Requirement
CH4 in %, minimum	90%
CO2 in %, maximum	4%
(CO2+N2+O2) in %, maximum	10%
O2 in %, maximum	0.5%
Total Sulphur (incl. H2S) in mg/m3, maximum	20 mg/m3
Moisture in mg/m3, maximum	5 mg/m3

Also, as per the specifications, CBG shall be free from liquids over the entire range of temperature and pressure encountered in storage and dispensing system, free from particulate matter such as dirt, dust, etc. Apart from this, CBG delivered shall be odorized similar to a level found in local distribution (IS 15319). As per this standard, an intensely smelling organic chemical or combination of chemicals is added to natural gas at low concentration which is capable of imparting a characteristic and distinctive (usually

disagreeable) warning odour, so gas leaks can be detected at concentrations below their lower flammability limit.

Uses & Application of CBG:

CBG has many applications and these applications can be categorized in to the following four categories



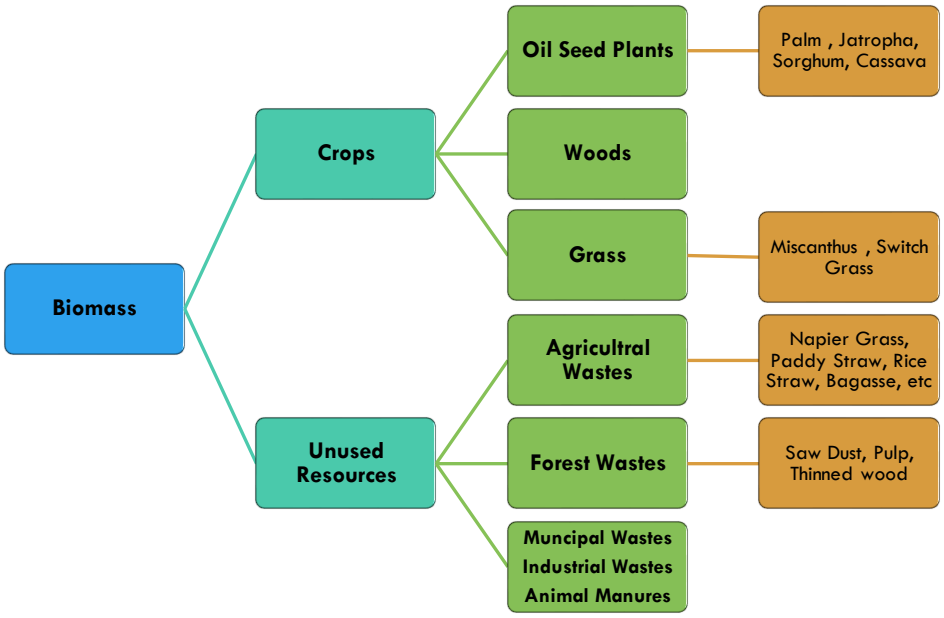
Uses & application of CBG

Chapter-2: Feed/ Biomass Assessment

Raw Material for the plant is an important factor in the successful running of a plant. Continuous & uninterrupted supply of raw material can be ensured only by proper feed assessment & Management.

India is predominantly an agrarian country and 60 to 70% of its population is dependent on agriculture. Agriculture activity generates a large quantity of agricultural wastes which is increasing with growing population. These residues have various usages like animal feed, thatching for rural homes, residential cooking fuel and industrial fuel.

Sources of Biomass



Different Sources of Biomass

The terrestrial biomass feedstock can be generally categorized into two categories. The first category comprises of corn grain, sugarcane, soya bean, oil seed, etc. The second category of terrestrial biomass feed stocks, the cellulosic biomass, are non-starch, non-edible and non-food feed stocks and their use does not have any adverse impacts on food supply. Cellulosic biomass feed stocks can be obtained from different sources, such as agricultural residues (such as Napier Grass. paddy straw, wheat straw, etc.) forest residues (such as branches, foliage, roots, wood dust & pulp waste etc.) and energy crops (such as Miscanthus,

switchgrass reed canary grass, coppice etc.). Currently, most bio-fuels are made from second category of feed stocks due to lower production cost and mature technology.

Apart from this, other sources for production of bioenergy includes bio-degradable waste such as food and kitchen waste (e.g. from households, restaurants, hotels, schools, hospitals), municipal sewage waste, yard & park waste, manure & animal dung and residues from food processing industries can also be used for generation of energy.

Major Sources of Biomass in India

Main Sector	Sub Sector	Sources
Agriculture	By - products and residues	• Napier Grass • Paddy Straw • Sugarcane stalk • Corn Cob • Barley Straw, etc
	Other indirect sources	• Cow Dung/ Animal Dung • Poultry Waste, etc
Organic waste		• Municipal solid waste (MSW) • Cooked food Waste • Milk Processing Industry Waste • Sugar Mills Industry Waste • Food Processing Industry Waste • Paper & Card Board Industry Waste • Leather Industry Waste • Press Mud • Fruit & Vegetable Waste • Sugarcane Bagasse, etc

This plant is proposed to be set-up in the vicinity of the Land owned by the Company is located at Village Sahar, Shikarpur, Bulandshahr, Uttar Pradesh- 203395. Since, the client's land and unit is one of the biggest organization in that area and as per the assurances / guarantees given by nearby sugarcane Industry and Sugarcane Farms as per the past records of their yield, we are assured of getting the required amount of raw material as required by the Plant.

Daily 210 tons of Biodegradable waste such as Press mud, Poultry and other such waste will be added. The proposed scheme will ensure a stable microbial reaction and a smooth functioning of the digester performance. Quantity of the addition will be adjusted as per the availability, Total Solid (TS) content and storage requirements of the project.

The promoters have approx. **4 acres** of land for setting up the project at Village Sahar, Shikarpur, Bulandshahr, Uttar Pradesh. The Company may expand the project at later stage. The area has a large Agricultural belt and thus the Biodegradable waste can be used as a raw material for the Plant.

Proposed Project Location : Village Sahar, Shikarpur, Bulandshahr, Uttar Pradesh

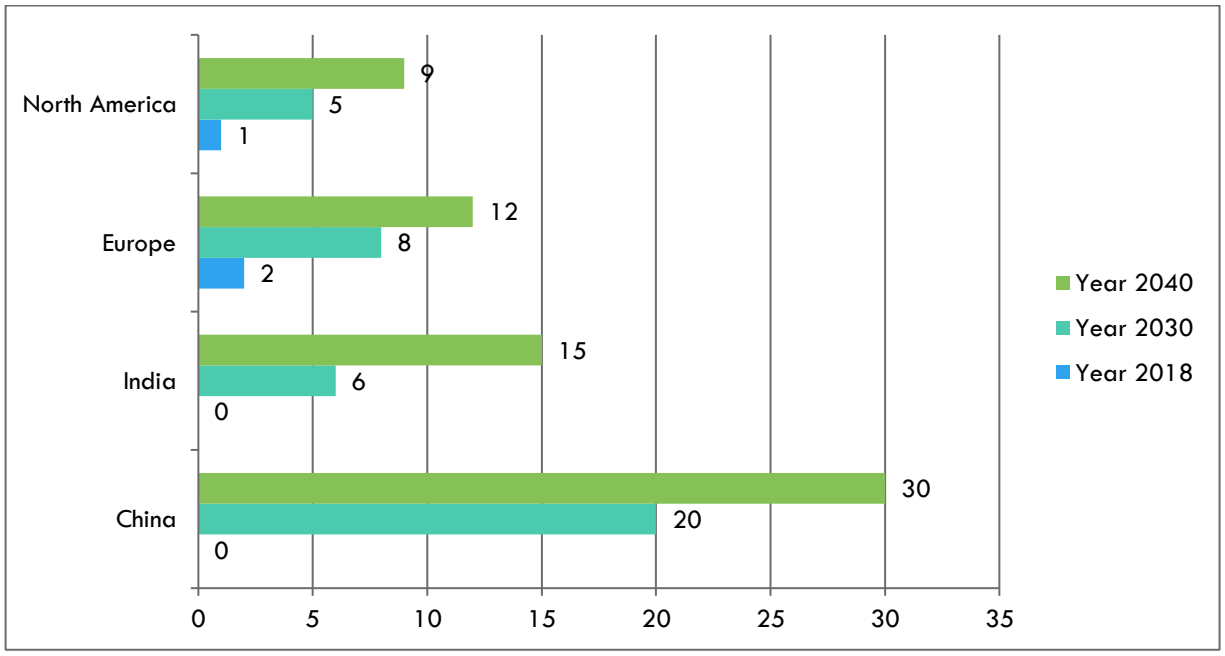
Coordinates: 28°06'27.4"N 78°07'14.1"E

Chapter-3: Market and Commercial Assessment

Demand of CBG

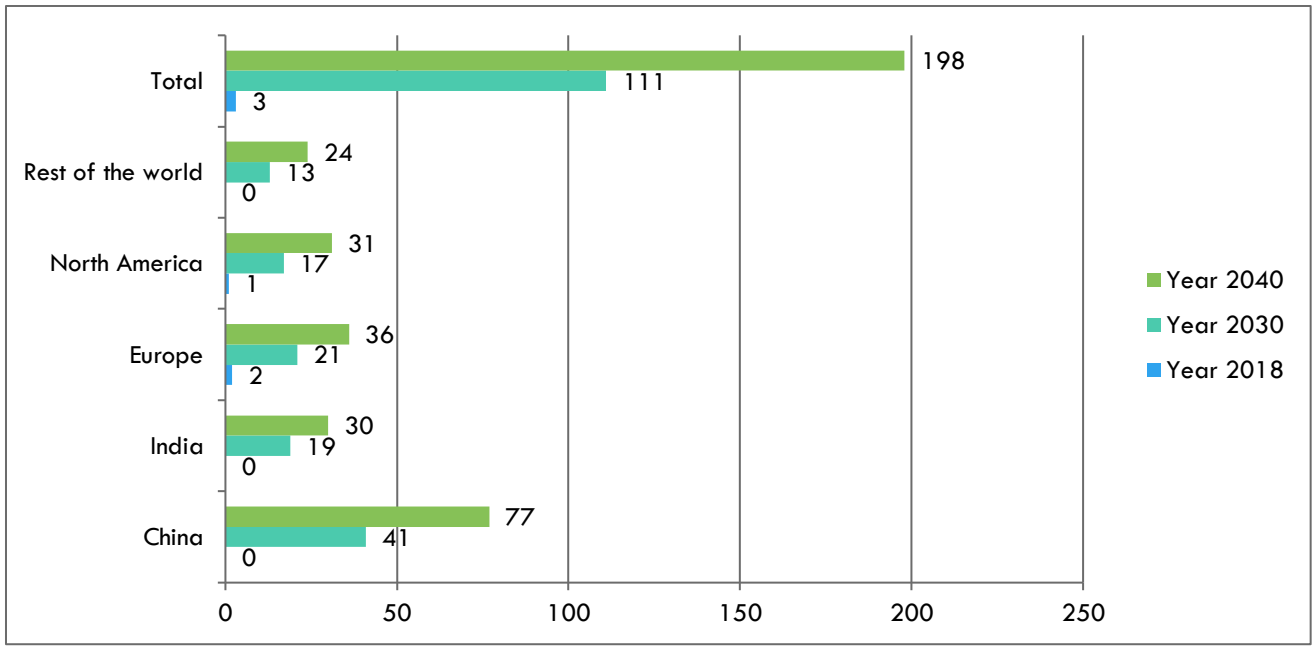
The future of biogas and bio-methane cannot be separated from the wider context of the global energy system. There is a tremendous future for biogas and bio- methane in the global energy, depending on the pace of technological innovation, energy policies, market dynamics, societal trends, and many more other factors.

According to world energy outlook special report 2018 by international energy agency, total demand for global bio methane consumption in year 2018 is 3 MTOE, which will grow to 45 MTOE in year 2030 and 75 MTOE in year 2040, if current policies are continued by different countries. But it will rise at much faster rate if sustainable polices are adopted by the nations and demand will grow to 111 MTOE in year 2030 and 198 MTOE in year 2040 in that case.



Demand Outlook for global bio methane consumption by region in the Current Policies Scenario (in MTOE)

In case of India from almost negligible to demand for bio methane consumption will grow to 6 MTOE in year 2030 and 15 MTOE in year 2040 in current policy scenario. While in case of sustainable policy scenario, Indian demand will grow to 19 MTOE in year 2030 and 30 MTOE in year 2040. So, there is huge demand potential in the coming years not only at the world level, but also in India.



Demand Outlook for global bio methane consumption by region in Sustainable Development Scenario (in MTOE)

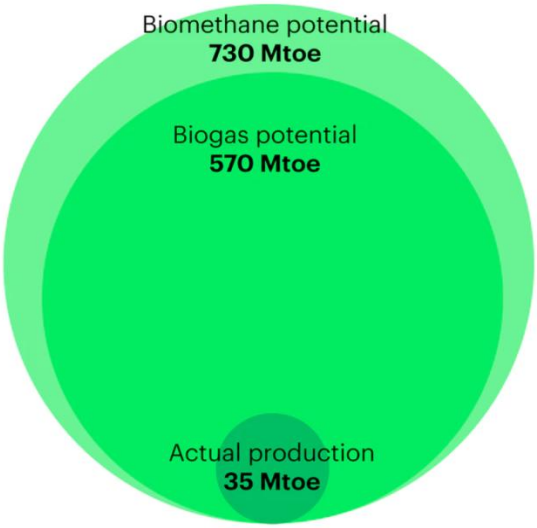
Since Government of India under the provisions of Petroleum and Natural Gas regulatory body Act 2008 has started authorizing entities to lay, build, operate and expand city or local natural gas distribution network in year 2008 in different districts of various states of India, the demand for CBG gas in India has increased manifold. The government of India has so far conducted 10 rounds of bidding process for authorizing different entities to authorize them for city gas distribution networks, establishment of CNG stations and laying of gas pipelines in the allotted region/area. The government has so far allotted 228 geographical locations covering 71 percent of population and around 53 percent of area of the country. The companies have been given year wise target and the total targets assigned are needed to be completed by them with in the time frame, the last of which will be completing in year 2026. In the last two rounds of biddings in year 2018, the government has made agreements for 136 geographical locations out of total 228 geographical locations allotted so far. So, government is also keen in building infrastructure in the whole country for city gas distribution and CNG stations. This is going to be game changer for demand for CBG in the country as once the infrastructure will be ready for CBG in the country, the demand is going to increase manifold. Number of geographical locations allotted, coverage of population and area in different bidding process are given in the table below: -

Image - A Dabha at Roadside using CBG

Image - CBG transported in Cascades for distribution

Assessment of commercial viability based on existing / potential market demand and supply of CBG.

Expected Demand for CBG is likely to grow faster as usage of CBG will increase in all spheres of application through distribution of PNG Connections, establishment of CNG stations, awareness, and cost competitiveness in Commercial and Industrial Sector. As per International Energy Agency, potential for bio -methane and biogas in year 2018 are 730 MTOE and 570 MTOE respectively, while actual production is merely 35 MTOE worldwide.



Biogas and bio methane production in 2018 against sustainable potential

(World potential production of Biogas Source: International Energy Agency Special Report 2018)

As far as India is concern, not many biogas plants are there to produce biogas. Plant sizes are also very small, keeping in mind potential demand for CBG.

Looking at future potential for demand through PNG connections, a population of 130 crores resides in the country, which translates in to 26 crores households (assuming 5 persons per household). One household can consume 0.350 kg of CBG per day, which translates in to 91000 tonnes per day of consumption. Similarly for assessing potential demand from automotive sector, Number of registered vehicles in year 2019 in the country was 29.58 crores. Similarly, if awareness of commercial and industrial sector about CBG increases, demand from commercial and industrial sectors cannot be even imagine.

Chapter-4: Technical Feasibility

Location of the plant is the most important thing in establishment of a biogas plant. There are certain factors which should be considered while choosing the location of the plant, which are given as follows-

- Availability of raw material
- Near to railway station & airport
- Near to major cities/towns
- Near to end products market
- Availability of infrastructure like roads, schools, hospital, etc.
- Availability of electrical sub-station / HT lines
- Availability of drinking / fire / cooling water
- Availability of skilled / un-skilled workers

4.1 Technology / technical arrangements:

CSTR Technology is proven and available for Indian conditions using multi feed stocks. Indigenously developed CSTR technology can also be used for the conversion of paddy straw to CBG.

Biogas is produced through anaerobic decomposition from waste/biomass sources like agriculture residue, fruits and vegetable waste, cattle dung etc. When organic matter is degraded by microorganisms and enzymes under anaerobic conditions, raw biogas is produced. Pre-treatment of the biomass may be necessary to make the organic fraction available for the microorganisms or to secure hygienic standards in the case of feedstock, which may be critical from the epidemiological and photo hygienic standpoint. Pre-treatment can be carried out mechanically, thermally, chemically or biologically to enhance anaerobic digestion of organic waste.

Anaerobic technology is critically dependent on the development and use of anaerobic bio reactors. In recent years, several novel reactor designs have been developed, allowing for a significantly higher rate of reaction per unit volume of reactor. Different anaerobic processes, such as batch, continuous one-stage, and continuous two-stage systems, with a

variety of methanizers like, continuously stirred tank reactor (CSTR), tubular reactor, Anaerobic Sequencing Batch Reactor (ASBR), Up flow Anaerobic Sludge Blanket (UASB) and anaerobic filters have been applied to increase the yield of biogas.

To use biogas as vehicle fuel, purification and upgradation is necessary to reduce contamination and increase the calorific value of the gas. Various biogas upgradation and purification methods are available, based on one of three mechanisms; absorption, adsorption and membrane separation. Methods like Water Scrubbing, Pressure Swing Adsorption (PSA), and Membrane Separation, are now commercially available.

4.2. Basis of selection of technology

The design of the plant is hereby proposed for the anaerobic digestion of biodegradable waste material.

Normally, the selection of suitable digester kind is relying on the properties of the main feed stock used, specifically total solid. Feed stocks with high amount of total solid and slurry are generally treated in CSTRs; whereas, soluble organic wastes are mainly digested in up-flow anaerobic sludge blanket (UASB) reactors, anaerobic filters, and fluidized bed reactors.

The two generally utilized reactor kinds are: continuous stirred-tank reactors (CSTR, using biogas recirculation for mixing or mechanical agitation or effluent), and plug-flow reactors (PFR, where the reactor content is shoved along a horizontal reactor). In dry digestion processes, PFRs are usually utilized to treat substrates with high solid content, whereas CSTRs are applied in wet digestion systems. The choice of wet or dry digestion technology relies on the total solid content (TS) of the material treated.

- Continuously stirred tank reactor (CSTR) is preferred technology due to its maturity in operation in Indian conditions and a proven technology for multi feed stocks. CSTR are continuous reactors and are mainly used for large-scale production whereas PFR are not established in Indian conditions for large-scale CBG production.
- CSTR are advantageous by providing improved controllability and mixing. It is much easier to adjust e.g., an optimal temperature or concentration profile in such a multistage CSTR.
- The reactor analysis for each reactor in series is identical to a single CSTR.

4.2.1. Merits / demerits vis-à-vis other technologies

The primary reactor technologies are classified as:

1. Batch,
2. Semi-batch,
3. Continuous stirred tank, and
4. Plug flow.

1. Batch reactors: The reactor is characterized by no addition of reactant or removal of product during the reaction. Any reaction being carried out with this constraint, regardless of any other reactor characteristic, is considered batch.

The assumptions for batch operation are:

(1) The contents of the tank are well mixed,

(2) Reaction does not occur to any appreciable degree until filling and start-up procedures are complete, and

(3) The reaction stops when quenched or emptied.

The reactor can be operated with either a homogeneous or heterogeneous reaction mixture for almost any type of reaction. The design parameters for a batch reactor can be as simple as concentration and time for isothermal systems.

Applications: Initially, when concentrations are at their highest, the corresponding rates of reaction are also high. This gives the greatest amount of conversion in the shortest time. The integral reactor design form makes the batch reactor attractive for higher-order reactions. Batch is also good for reactions in series (if the reaction can be quickly quenched), where large amounts of an intermediate can be produced quickly before it has time to react away to a by-product. The batch reactor is extremely flexible compared with continuous reactor configurations. For example, temperature can easily be made a function of reaction time. Once the reactor is put into service, operational alternatives are still available. The tank can be operated half-full without affecting product quality, or the reaction time can be modified easily. Both of these changes may cause heat and mass transfer problems in fixed-volume continuous equipment. This flexibility is worthwhile for products that are made in various grades, have seasonal demand, or have subjective specifications such as the taste of beer. Batch reactors are used extensively in industries where only small quantities of product are

made. For small amounts, the economy of scale hurts flow reactors, which typically have a higher initial investment for controls and plumbing.

Advantages-Disadvantages: The primary advantages of the batch reactor are simplicity of design, which allows for tremendous flexibility, and integration of the performance equation over time. The simplicity of design, usually a stirred tank, makes operation and monitoring easy for the majority of reactions. One of the traditional disadvantages of the batch reactor has been the labor required between runs for emptying and filling the tank. With recent advances in computer control, this disadvantage no longer exists. If the advantages of batch are significant, the capital expense of computer control is essentially negligible. Due to computer control, the batch reactor should no longer be looked upon as something to be avoided. The major disadvantage of batch reaction now is the hold-up time between batches. Although the actual reaction time necessary to process a given amount of feed may be substantially less than for a time-averaged reactor such as a CSTR, when the hold-up time is added, the total process time may be greater. Other disadvantages of the batch reactor are dependent on the particular type of reaction being considered, such as whether the reaction is in parallel or series.

2. Semi-batch reactors: The semi-batch reactor is a cross between an ordinary batch reactor and a continuous-stirred tank reactor. The reactor has continuous input of reactant through the course of the batch run with no output stream. Another possibility for semi-batch operation is continuous withdrawal of product with no addition of reactant. Physically, the semi-batch reactor looks similar to a batch reactor or a CSTR.

The assumptions for semi-batch operation are:
(1) The contents of the tank are well mixed, and
(2) There are no inlet or outlet effects caused by the continuous stream.
The semi-batch reactor is one of the primary ideal reactor types since it cannot be accurately described as either a continuous or a batch reactor. A semi-batch reactor is usually classified as a type of transient reactor. The major design parameters for a semi-batch reactor are similar to a batch reactor with the addition of flow into or out of the tank.

Applications: The advantage of this reactor, with feed only, is for the control of heat of extremely exothermic reactions. By inputting the feed gradually during the course of the

reaction, the concentration of feed in the reactor can be kept lower than in normal batch operation. Also, the temperature of the feed stream, when cooler than the reaction mixture, has a quenching effect. Some of the heat released during the reaction is used to heat the feed material, thereby reducing the required capacity of the heating coils.

Advantages-Disadvantages: The temperature-controlling features of this reaction scheme dominate selection and use of the reactor. However, the semi-batch reactor does have some of the advantages of batch reactors: temperature programming with time and variable reaction time control. The temperature conditions and the batch nature of this reactor are the primary operational difficulties and make the reactor impractical for most reactions, even for computer-controlled systems.

3. Continuous-stirred tank reactors: The continuous-stirred tank reactor (CSTR) has continuous input and output of material. The CSTR is well mixed with no dead zones or bypasses in ideal operation. It may or may not include baffling.
The assumptions made for the ideal CSTR are Composition and temperature are uniform everywhere in the tank, The effluent composition is the same as that in the tank, and the tank operates at steady state.

We traditionally think of the CSTR as having the appearance of a mixing tank. This need not be the case. The above assumptions can be met even in a long tube if the mixing characteristics indicate high dispersion levels in the reactor. This is particularly true of gassed liquids where the bubbling in the column mixes the liquid.

The continuous-stirred tank reactor is one of the two primary types of ideal flow reactors. It is also referred to as a mixed-flow reactor, back-mix reactor, or constant-flow stirred-tank reactor. The CSTR is not an integral reactor. Since the same concentration exists everywhere, and the reactor is operating at steady state, there is only one reaction rate at the average concentration in the tank. Since this concentration is low because of the conversion in the tank, the value for the reaction rate is also low.

Applications: The CSTR is particularly useful for reaction schemes that require low concentration, such as selectivity between multiple reactions or substrate inhibition in a chemostat. The reactor also has applications for heterogeneous systems where high mixing

gives high contact time between phases. Liquid-liquid CSTRs are used for the saponification of fats and for suspension and emulsion polymerizations.

Advantages-Disadvantages: The advantages for CSTRs include
Steady state operation,

- Back mixing of heat generated by exothermic reactions, which increases the reaction rate and subsequent reactor performance,
- Avoidance of reactor hot spots for highly exothermic reactions, making temperature easier to control,
- Favoring lower-order reactions in parallel reaction schemes,
- Economical operation when large volumes require high contact time, and
- Enhancement of heat transfer by mixing.

Disadvantages of CSTR are that larger reactor volumes are usually required, compared with other reactor schemes, and that energy for agitation is required in the tank, increasing operating costs.

4. Plug flow reactors: This reactor has continuous input and output of material through a tube. Assumptions made for the plug flow reactor (PFR) are

- Material passes through the reactor in incremental slices (each slice is perfectly mixed radially but has no forward or backward mixing between slices)
- Composition and conversion vary with residence time and can be correlated with reactor volume or reactor length, and
- The reactor operates at steady state. The PFR can be imagined as a tube, but not all tubular reactors respond as PFRs.

The parameters for PFRs include space time, concentration, volumetric flow rate, and volume. This reactor follows an integral reaction expression identical to the batch reactor except that space time has been substituted for reaction time. In the plug flow reactor, concentration can be envisioned as having a profile down the reactor. Conversion and concentration can be directly related to the reactor length, which in turn corresponds to reactor volume.

Applications: For normal reaction kinetics the plug flow reactor is smaller than the continuous-stirred tank reactor under similar conditions. This gives the PFR an advantage over CSTR for most reactions. These conditions are best met for short residence times where

velocity profiles in the tubes can be maintained in the turbulent flow regime. In an empty tube this requires high flow rates; for packed columns the flow rates need not be as high.

Advantages-Disadvantages: The advantages of a PFR include

- Steady state operation,
- Minimum back mixing of product so that concentration remains higher than in a CSTR for normal reaction kinetics,
- Minimum reactor volume in comparison with CSTR (since each incremental slice of the reactor looks like an individual CSTR, we can operate at an infinite number of points along the rate curve),
- Application of heat transfer in only those sections of the reactor where it is needed (allowing for temperature profiles to be generated down the reactor), and
- No requirement for agitation and baffling.

The plug flow reactor is more complex than the continuous-stirred tank alternative with regard to operating conditions. There are a few other disadvantages associated with the PFR. For the kinetics where rate increases with conversion, an isothermal plug flow reactor has lower product composition than a CSTR. For highly viscous reactants, problems can develop due to high-pressure drop through the tubes and unusual flow profiles.

For processing dilute organic slurry with a total solid content of maximum 10–15%, the wet systems are designed. Substrates consist of total solid higher than 15% will be co-digested with co-substrates of lower total solid content, or usually diluted with re-circulated or fresh process water. In contrast, in solid-state fermentation processes, also called dry digestion, the substrates used have high solid content (25–40% TS), thus an essentially different technical approach regarding the waste handling and treatment is needed. Due to the high viscosity in the dry digestion systems, heat and nutrient transfer is not as efficient as it is in wet processes, therefore mixing is very important to prevent local overloading and acidification. Despite that, conventional mechanical mixers are not appropriate for solid-state processes; instead, recirculation of the waste or re-injection of the produced biogas is often used in these types of reactors to solve the mixing problems. The productivity of biogas will be higher in PFR compared to CSTR due to higher solid content used in the feed stock.

4.3 Biogas upgrading technologies:

Biogas is a mixture of several compounds containing CH4 (giving its calorific value) and non-combustible carbon dioxide (CO2). In order to increase its calorific value, improve biogas combustion and decrease corrosion problem, CH4 concentration must be increased and impurities must be removed. It is knowing that CH4 is a clean fuel, the combustion being without any soot particles or other pollutants. Apart from CO2, biogas also contains small quantity of hydrogen sulphide (H2S). When water is present, H2S is dissolved and the aqueous solution is highly corrosive, making the biogas unusable. When the biogas is burned, H2S is oxidized to sulfur oxides which react with water and formic acid (H2SO3). This acid is also corrosive and attacks the metallic surfaces of gas pipeline. The non-flammable CO2 in biogas not only reduces its calorific value, but also corrodes pipelines when water is present.

The biogas calorific value is upgraded, when CO2 is removed from the biogas. Removal of CO2, H2S and impurities from biogas is commonly named upgrading. Biogas upgrading improves gas quality, which must be composed of more than 90% CH4 to become acceptable for more advanced utilization, especially heat efficiency. For the separation of other components, such as H2S, a pre-cleaning step is required previously to the CO2 separation process from CH4.

A few technologies are available on the market for biogas upgrading. The main unit operations are absorption, adsorption, and membrane separation.

1. Pressure Swing Adsorption (PSA)

Adsorption systems consist of the transfer of a solute in a gaseous stream to the surface of an adsorbent material. With PSA systems, some undesirable gases such as CO2, oxygen (O2) and nitrogen (N2) are separated by adsorption on zeolites or activated carbon mainly, at different pressure. The adsorption material also adsorbs H2S, but unlike the adsorption of CO2, it is irreversible. For this reason, this technique makes the biogas obtained free of H2S. In order not to destroy the adsorption material, the H2S is eliminated in a previous independent stage.

In PSA, CH4 loses are usually about 2–4%. However, the core of the system lies in the choice of a good adsorbent material, both for the selectivity to be higher to CO2, and to be able

to remove other contaminants simultaneously. Due to the small pore diameter, they present, adsorbents such as cationic zeolites, silicates, alumina's or activated carbon are widely used commercially and the technology that surrounds them is very advanced.

For biogas cleaning, the desirable properties that the adsorbent should have been the following: basic contact surface (equilibrium-base adsorbents); pore diameter of the adsorbent suitable for the particle diameter of CO2, but not for that of CH4; the material must be easily desorbed or regenerated, with low energy consumption.

2. High pressure water scrubbing (HPWS)

HPWS is a technique capable of simultaneously absorbing CO2 and H2S, giving as a product a gas enriched in CH4. The key to the process is since both CO2 and H2S are more soluble compared to CH4, N2 or O2. To use this cleaning technique, it is therefore necessary to know the solubility of the major components of the gas in H2O. This technique is usually carried out in packed bed columns, optimizing the operating conditions to achieve high levels of CO2 elimination, which normally leads to greater energy expenditure.

By means of this technique, a bio-methane with a purity of more than 98% can be obtained with a minimum supervision of the operation and a single passage through the column, which is increased in cases of recirculation. The key advantages of this technique are that it is a simple technology, widely used in industry and relatively inexpensive. In addition, washing with H2O has few losses of CH4 (less than 2% losses) due to the large difference between the solubility of CO2 and CH4. The main disadvantage of H2O absorption is that it is less efficient than other processes in terms of energy. When using water scrubbing, few resources are consumed. Of course, the most important is the H2O that needs to be replaced to prevent the accumulation of unwanted compounds from biogas, as well as to avoid the decrease in pH caused by the oxidation of H2S. The volume of H2O required varies according to the different sizes and operating conditions, but an average consumption of 0.5–5 m3/day can be established. In addition, oil is also required for the compressors (their quantity depends on the type of compressor) and small volumes of antifoam agents.

3. Membrane separation (MS)

Membranes for biogas recovery are made of materials permeable to CO2, H2O or NH3. Part of the H2S and O2 pass through the membranes, while the N2 and CH4 pass in a very low proportion, what makes separation possible. This permeability is based on differences in concentration, pressure, temperature and electric charges of different compounds that create a driving force.

For separation with membranes; there are wet and dry techniques. Dry techniques are based on the fact that certain substances pass more easily through membranes than others. The rate of passage of each substance depends on the difference in partial pressure of each substance on either side of the membrane. The partial pressure is dependent on the permeability, which is a function of the chemical solubility of the substance in the membrane. To achieve a good separation of CO2 the membrane must be selective for this compound and the difference in permeability between CO2 and CH4 must be high. Membranes for this type of operation are hollow fibre module type in order to achieve the greatest possible surface area. These hollow fibres can be made of different polymers, which have a permeability of 20 to 60 times higher for CO2 and H2S than for CH4. To prevent corrosion, H2S is removed before passing the biogas through the membrane. It may also be necessary to separate the H2O drops, since these reduce the efficiency of the membranes. Separation is achieved at high pressure, usually between 25 and 40 bar. CH4 remains on the side of the high pressure, while CO2 passes through the membrane. This decreases the compression needed by the gas when it is distributed to the natural gas network or vehicle fuel.

The energy consumption for a specific application depends on several parameters such as the CH4 losses, the CH4 purity of the biomethane produced, the installed membrane area, and the pressure applied to the membrane. If a high concentration of CH4 is required, a larger membrane area and/or higher pressure will be required. Also, if higher CH4 losses are allowed, less biogas can be recirculated, so the compressor's energy consumption will decrease. Finally, the area of the membrane determines the pressure that will be applied to valorize a certain volume of biogas. If the membrane is larger, a lower pressure may be used because the gas flow is smaller. The membranes most used commercially are composed of polymers that come from organic materials such as polycarbonate or cellulose acetate. A previous removal of H2S from biogas is necessary to not affect negatively to membrane

performance. As well, drops or aerosol that biogas could contain should be eliminated from raw biogas. This last removal is done usually by a previous membrane filter.

Advantages and disadvantages of general techniques for biogas upgrading

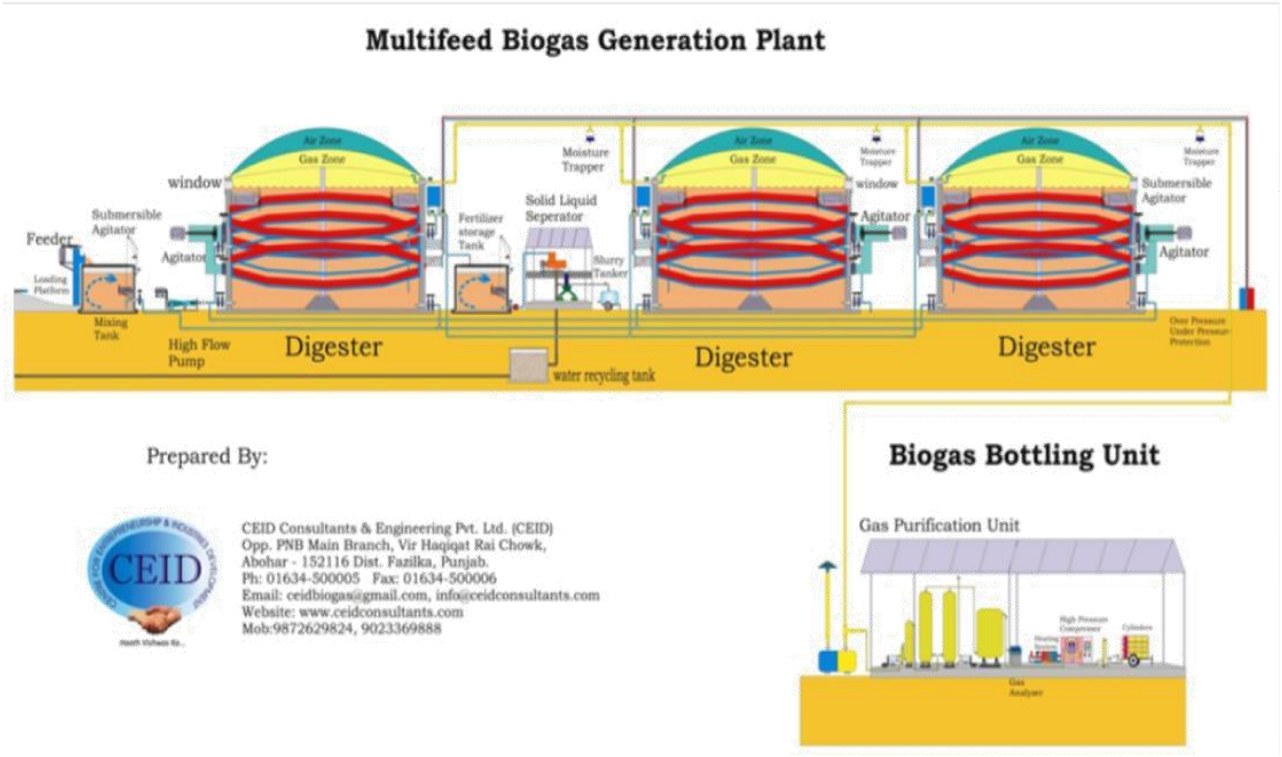
Technique	Advantages	Disadvantages
PSA systems	• Low energy consumption • Compactness • Very common in low scale industries.	• Chemicals needed and needs to be changed twice a year • Medium-high CH4 composition is obtained (>96%) compared with very high purities (>99%) • Less efficiency than others techniques (2–4%methane losses) • Pre-treatment to remove water and H2S is required • Strict control of the process • High electricity consumption (0,25 kWh/Nm3)
Water scrubbing	• Chemicals not needed • Easy to use and cheap • Very High CH4 composition is obtained (>99%) • CH4 losses are very low • Low electricity consumption (<0,25 kWh/Nm3) • Able to remove NH3 and H2S • Flexible in capacity • The most applied in industries	• Dried stage after scrubbing is needed
Membrane Separation	• Simple construction and operation • Requires little maintenance • Modular configuration • No heat and no chemical products are required • High reliability • Small gas flows can be treated without high costs increase	• Pre-treatment is needed to remove H2S • Low selectivity of the membrane • Several stages are required to achieve a high purity of CH4 • Medium/high losses of CH4 (<10%) • Not suitable for a biogas with pollutants not determined, such as landfill gas or wastewater biogas • High cost of membranes • Not widespread in industry

Comparison and evaluation of the costs of different biogas upgrading technologies

Parameter	PSA	Water scrubbing	Membrane technology
Typical methane content in biomethane [vol%]	95.0–99.0	95.0–99.0	95.0–99.0
Methane recovery [%]	98.0	99.90	80–99.5
Typical delivery pressure [bar(g)]	4–7	4–8	4–7
Electric energy demand [kWh_{el} m^3 biomethane]	0.46	0.46	0.25–0.43
Desulphurization requirements	Yes	Process dependent	Yes
Consumables demand	Activated carbon (non-hazardous)	Antifouling agent, drying agent	-
Number of reference plants	High	High	Low
Typical investment costs [€/(m^3 h^{-1}) biomethane]			
For 100 m^3 h^{-1}biomethane	10 400	10 100	7300–7600
For 250 m^3 h^{-1}biomethane	5400	5500	4700–4900
For 500 m^3 h^{-1}biomethane	3700	3500	3500–3700
Typical operational costs [ct/(m^3 h^{-1}) biomethane]			
For 100 m^3 h^{-1}biomethane	12.8	14.0	10.8–15.8
For 250 m^3 h^{-1}biomethane	10.1	10.3	7.7–11.6
For 500 m^3 h^{-1}biomethane	9.2	9.1	6.5–10.1

4.4 Production Process:

The state-of-the-art Process methodology & disruptive technology involved in the project followed by advanced anaerobic digestion, stripping (purification) of Biogas, purify to attain Bio Methane (BioCNG) and along with valuable bi-products like Bio Compost, Nutrient rich Slurry etc., which are very important from not only their environmental credentials but also add in considerable for the economic viability of the project.



The uniqueness lies in controlling process parameters to get the best yields especially in the first few days of feeding when acidogenesis and acetogenesis are dominant. The continuous process will be controlled with both online & lab scale monitoring techniques and adjustment of various parameters. Design feed rate cycles will be maintained through automated controls to get going the efficient and stable production of biogas of right quantity & quality with optimum HRT (Hydraulic retention time).

The Plant will run 350 days per year, using sophisticated and proven Anaerobic Digestion CSTR technology for generation of Raw Biogas and Water Scrubbing system for Biogas Purification. Anaerobic digestion is a renewable energy generation process in which microorganisms break down biodegradable material in the absence of oxygen. Anaerobic digestion technology was developed long back in India and commercialized in India,

Europe and is technically considered a low-risk, high-output technology. The Bio-fertilizer and Biogas generation technology considered for this project is already proven in India and other parts of the world. CEID did a detail study of the best equipment and the best suppliers of the equipment which are currently being used for the project.

Raw Material storage

Biodegradable will be procured on daily supply basis from the nearby regions or stored as per requirement and availability. Daily 210 MT of Bio-degradable waste will be added. The proposed project will ensure a stable microbial reaction and a smooth functioning of the digester performance. Quantity of the addition will be adjusted as per the availability, TS content and storage requirements of the project.

"Photograph of Raw Material Storage Zone for illustration Purpose"

Raw Material Unloading & Feed Preparation

Production Process

Complex polymers are broken down to soluble products by Enzymes produced by fermentative Bacteria which ferment the substrate to short- chain fatty Acids, Hydrogen and Carbon Dioxide. Fatty Acids longer than acetate are metabolized to acetate by obligate Hydrogen producing Acetogenic Bacteria. The major products after digestion of the substrate by these two groups are Hydrogen, Carbon Dioxide and Acetate. Hydrogen and Carbon Dioxide can be converted to acetate by Hydrogen-Oxidizing acetogens or

methane by Carbon-Dioxide-reducing, hydrogen-oxidizing methanogens. Acetate is also converted to methane by aceticlastic methanogens. Microbial diversity in Biogas digesters is as great as that of rumen wherein seventeen fermentative bacterial species have been reported to play important role for production of Biogas. Furthermore, it is the nature of the substrate that determines the type and extent of the fermentative bacteria present in the digester. Poultry waste-fed digesters showed higher proteolytic population.

"Photographs of Raw Material Feeding Tank for illustration Purpose"

FEEDING

The mixture of bio degradable waste will be put into a Feed preparation pit. The submersible Agitator, which will mix the different feed stock and bring it to unpacked, fluffy and consistency. From time to time, it releases small quantities of feedstock into an open mouth pump. This open mouth pump joins an additional quantity of liquid with the biomass and pushes it forward.

The liquid itself comes in the beginning of the daily preparation period from a Fertilizer pit or sometimes directly from digester. The mixture of feedstock and effluent will be pumped into the digester.

The Fertilizer pit and the Feed preparation pit will be fully mixed by high quality submersible agitators. Whilst its way from the Feed prep pit to the digester, the biomass passes through

an additional chopper to refine the whole mixture for better pumping, piping and mixing consistence. This way of maintaining an acceptable fluid viscosity even of high dry mater containing mixtures will also reduce the demand of electrical self- consumption of the plant.

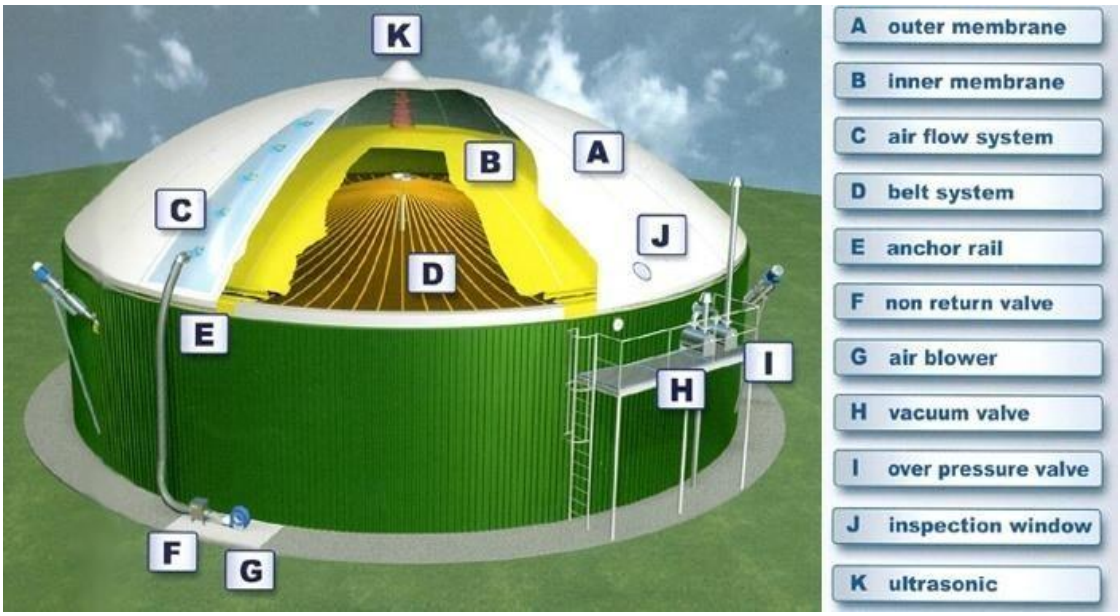
"Photographs of Various Bio-degradable waste being unloaded"

Biogas Generation and Storage

Anaerobic Digestion (advanced CSTR type digester)

The substrate will be used as feed for the anaerobic digestion (AD) process which will happen in the concrete digesters. In the digesters bacteria convert the substrate in a 4-step process to biogas. The raw biogas of this unit will be fed into next stage. The feeding of the anaerobic digester will work as a semi-automatic storage-flow-process, by which the bio mass is guided into the digester from the feed prep pit per day. Any process of pumping from, and to any containment will be monitored by level switches, which are connected to the PLC-System, and will supervise the pumping system.

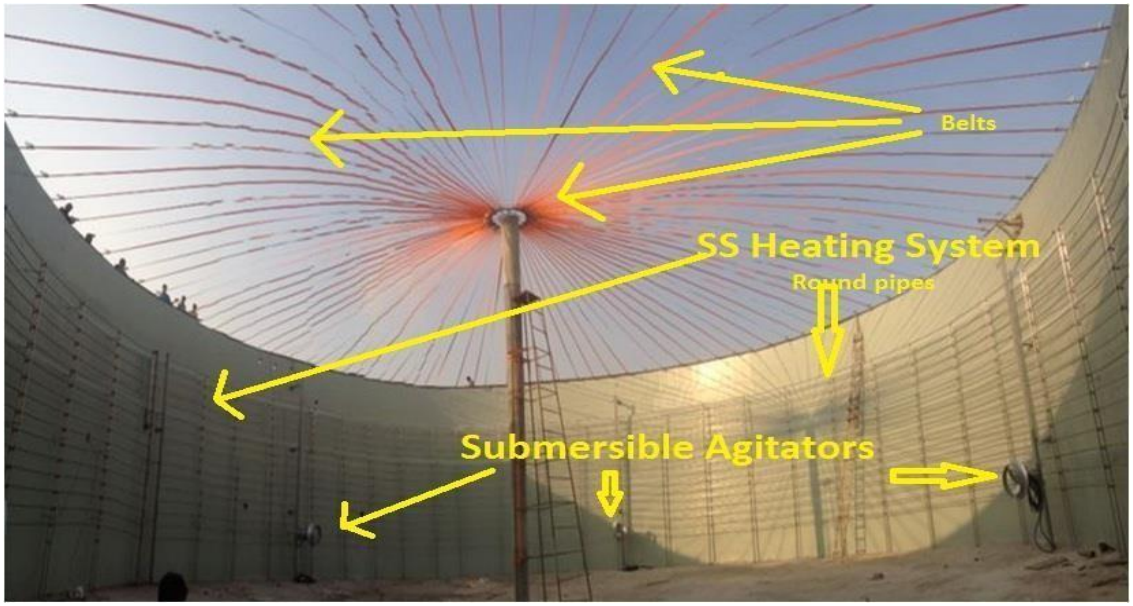
"Photographs of Various Bio-degradable waste being unloaded"



The Digesters will fully mix by high quality submersible agitator and will be operated in a mesophilic (38 °C ± 1°C) temperature range. This leads to a stable process and an economical optimized demand for process heat. So, a maximum gas yield which results in maximum greenhouse gas reduction will be guaranteed. The digesters are comprised of a standing cylindrical tank of reinforced concrete with a volume of over 25000 m3 including a freeboard head space for gas release. The Digesters will be covered with double membrane gas roof for storage of Raw Biogas. The solids that are fed into the Digestion System for decomposition or degradation of the Volatile Solids (VS) (Organic Dry Matter) present inside

the feed substrate (Bio mass). The degradation is done in the one digester. The plant will work on a storage-flow-process. Bio mass is guided into the single digester by the pumping system several times per day. Additionally, re-circulated slurry will be pumped into the digester. The treated sludge will be pumped to the liquid fertilizer tank when indicators show a certain level within the digester is reached.

As described above, the digesters will be fully mixed by high quality submersible agitators and will be operated in a Mesospheric temperature range. This combination leads to a stable process with good Hygienization results and a minimized effort as far as area requirements and digester volume are concerned. On the other hand, it aims at maximum gas yield which results in maximum greenhouse gas reduction.



"Photo of Digester – Inside View for Illustration Purpose"

Biogas Storage

The digester will be covered with Flexible Double Membrane Roof. Outer- membrane & inner-membrane Material: Euro-standard membrane, anti-UV, self-clean (PVDF coating), Anti-corrosion, anti-aging, acid proof, alkali proof and high strength.

- Double membrane roof will be fully controlled by PLC/ Control panel with additional benefits Electric control cabinet Display system
- Pressure/volume/control process display
- Function control system: LCC more than 20 functions
- Sensor system: pressure / volume sensor made of stainless steel, explosion proof

- Operation cabinet: Air boost blower, Non return valve Safety function design more than 8 ways,

The technology used is CSTR (continuously stirred reactors). The High Flow Agitators will be installed inside the digester to ensure extremely homogenous mixing of the slurry.

The digested feed material has VS content in it to produce a gas comprising of maximum methane CH4 and the rest containing of CO2 and H2S. This gas is called biogas. After digestion the feed material is taken for further storage. This technology ensures that the maximum biodegradable feedstock is degraded and maximum efficiency is attained out of the biogas generation plant. A total of 25000m3 gas will be recovered from the daily Bio mass (Bio-degradable waste) that is digested.
Summarizing, the plant will generate around 8750000 N Cum of raw biogas per year. The output of the project will generate 3500000 kg Compressed Biogas (CBG) per year.

"Photograph of Digesters with Double Membrane Biogas Holders installed on Top and Ground Mounted Biogas Holders (in Center) for illustration purpose"

4.5 Biogas Up-gradation process:

High Pressure Water Scrubbing Based Biogas Purification System

In biogas upgrading using water scrubbing technology, water is used to separate the carbon dioxide from biogas. The process is based on the difference in solubility of carbon dioxide and methane in water and process parameters such as pressure and temperature in the

water scrubber are chosen to maximize this difference in solubility. Today, most water scrubbers are operated at a pressure around 6-8 bar(a).

"Photo of Water Scrubber for illustration purpose"

Often, the process water is recirculated in the biogas upgrading plant, which requires a desorption of the carbon dioxide from the process water. Carbon dioxide is desorbed from water in an air stripper at ambient pressure and temperature. To recover as much as possible of the methane dissolved in the process water in the absorption column, the water is lead

through a flash column with lower pressure before desorption. The flashed gas is recirculated in the water scrubber and lead back to a point before compression and absorption. Waste gas treatment may be needed mostly to reduce the concentration of methane or H2S.

The waste gas, e.g., the stripper air, from a water scrubber contains traces of methane. The water scrubber is a robust technology for biogas upgrading, which is able to handle various impurities in the raw biogas. Compounds such as H2S, ammonia and certain VOC are dissolved in the process water and released with the stripper air. In many cases, post treatment of the stripper air is needed to fulfil environmental legislation. Alternatively, to remove e.g., H2S in the stripper air it may be interesting to consider removing it in the raw gas before the upgrading process.

The upgraded gas is saturated with water and needs to be dried to the required dew point. Compounds such as H2S, ammonia and VOC present in the raw biogas are usually removed by the water scrubber to a necessary extent and no further post treatment is needed.

For stable operation, the pH needs to be kept stable and a base is needed to increase the pH and to compensate the pH drop in the process water, which is a result of oxidation of mostly H2S in the raw biogas.

An antifoam agent may also be needed to improve mass transfer in the absorption column and increase the separation between carbon dioxide and methane. Growth of microorganisms in the columns in a water scrubber may be a problem. This is reduced in recent water scrubbers operating at a lower temperature and may be further minimized by the addition of biocides or treatment of the fresh water to the upgrading plant to minimize the amount of nutrients in the process water.

Biogas Compressing/Bottling/Pipeline

The Purified Biogas will be compressed, injected into pipeline at suitable pressure for the usage in transportation sector with the help of Biogas Compressor and accessories as shown in pictures below. The CBG (also known as BioCNG) will also be an excellent substitute to LPG/PNG in commercial sector as clean fuel for Transportation, Cooking, Heating and other released purposes.

"Photograph of Biogas Compressor for Illustration Purpose"

4.6 Organic Fertilizer:

Anaerobic digesters produce a material after the gas is created - a mixture of solids suspended in a very thick liquid solution. This solution is rich in nutrients such as ammonia, phosphorus and potassium, along with important trace elements. When treated as a part of the AD process, the solution is weed-, seed- and pathogen-free. A value-added by-product, the solution is a soil conditioner used as compost or an amendment to the soil. Post AD processing provides stable and odour free compost, which can be stored without the issues associated with raw waste. The compost will not attract flies, rodents or the attention of neighbours.

"Photograph of Solid Liquid Separator for illustration Purpose"

AD systems reduce the potential for surface and ground water contamination. These nutrients move into the digester's effluent, and then into the resulting compost product, thus reducing the potential for water pollution. As a result, compost generated as a by-product of AD contributes beneficial, stable, and balanced nutrients when applied to soil. In raw organic waste, the nutrients are in complex form so it is difficult for the soil microbes to act on it and convert it into crop/plant absorption form. But in the case of composted organic fertilizer from the Biogas plant, it is already broken into the simplest form so that the plant readily uses it without any further conversion.

"Photograph for Aero-tiller being used for Composting in Fertilizer Windrows"

The composition of biogas slurry (Composted organic fertilizer) comprises of moisture content, organic carbon, potassium, nitrogen, phosphorus etc. in the percentage of 40.21, 11.77, 0.33, 0.71 and 0.43 respectively with the C: N ratio of 17:1.

Advantages of Bio-fertilizer from Biogas plant over non-composted organic waste directly used for crops/plant:

- Reduced volume
- Odour less
- Reduced pathogens and weed seeds
- Reduced spontaneous emissions of CH4, NH3 and N2O on to the atmosphere

High quality compost allows farmers and other users to decrease their reliance upon Petro chemical sources of fertilizers and nutrients, at a significantly reduced cost.

4.7 Manpower requirement

Manpower estimates for proposed plant capacity is listed below.

Manpower requirement for proposed Plant

Designation	Shift 1	Shift 2	Total
Project Manager / Chief Engineer	1	0	1
Skilled Worker	2	1	3
Semi Skilled	2	2	4
Labour for Raw Material Feeding & Fertilizer Handling	4	3	7
Driver	1	1	2
Helper/Care taker	1	1	2
Watchman/ Security	1	2	3
Accounts / Admin Staff	2	0	2
Total	***14***	***10***	***24***

4.8 Detailed list of Plant Machinery, Civil & Other work

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
1	**PLANNING AND MANAGEMENT**				
1.01	Survey of Site		NA	NA	1
1.02	Portable Cabin and Container		NA	NA	1
1.03	Soil Bearing Test and its Report	As Per Institute /Company Standard	NA	NA	6
1.04	Structural drawing and its calculation	Civil Structural design according to soil test Report	NA	NA	1
1.05	Layout drawing	Based on Soil report	NA	NA	1
2	**CIVIL WORK**				
2.01	Excavation	According to Soil Bearing Report	N/A	N/A	3
2.02	Digester	RCC Digestor with Center Column	8500	M3	3
2.03	Mixing tank	RCC	235	M3	1
2.04	Fertilizer tank	RCC	235	M3	1
2.05	Water tank	RCC	235	M3	1
2.06	Unloading Pit	RCC	235	M2	1
2.07	Pumping Station	RCC	9	SQ MTR	1
2.08	foundation for Gas purification & Gas filling	RCC / PCC	625	SQ MTR	1
2.09	foundation for SLS	RCC / PCC	64	SQ. MTR	1
2.10	Intermediate Tank	RCC/PCC	6	SQ. MTR	1
2.11	**Foundation of other pumps and Machinery**				
	High Flow Agitators	RCC	6.25	SQ. MTR	12
	Roof Air Blower System	RCC	3.75	SQ. MTR	3
	Under Pressure Tank	RCC	0.5	SQ. MTR	3
	Fertilizer Slurry pump	RCC	6	SQ. MTR	1
	Water Slurry pump	RCC	0.9	SQ. MTR	1
	Heating system	RCC	9	SQ. MTR	3
	Valves	RCC	0.09	SQ. MTR	51
	Pipes	RCC	0.09	SQ. MTR	151
2.12	Other equipment foundations	RCC	20	SQ. MTR	1
2.13	Gas Generation Panel room	Brick Work (LxBxH)	48	SQ. MTR	1

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
2.14	Gas purification and Gas filling Panel Room	Brick Work (LxBxH)	42	SQ. MTR	1
2.15	Staff Room	Brick Work (LxBxH)	80	SQ. MTR	1
3	**SHED**				
3.01	Feeding pump	Resist the pump from outside environment	9	SQ. MTR	1
3.02	Solid Liquid Separator	Resist the SLS from outside environment	64	SQ. MTR	1
3.03	Gas purification and filling area	Resist the various machine and equipment in gas purification area from outside environment	625	SQ. MTR	1
3.04	Pumps and other equipment's	Resist the pump and other equipment's from outside environment	4	SQ. MTR	30
4	**ELECTRICAL EQUIPMENTS**				
4.01	Electrical Cables	as per specification of all motors , quipment's and programme • PVC Insulated • twisted – Polyster • Isolator - UV FRLS sheathed Cables	L/S	L/S	1
4.02	Sensors Cables	as per specification of all Sensors equipment's and programme PVC Insulated twisted - Polyster Isolator - Almylor Tape wrapped with Drain wire - UV FRLS sheathed Cables	L/S	L/S	1
4.03	Cable tray	**GI CABLE TRAY(73089090)** • SIZE :- 100 X 50 X 1.2 • HEAVY DUTY INDUSTRIAL GI CABLE TRAY 1.2 MM HEAVY THICKNESS WITH COUPLER & JOINTER **GI CABLE TRAY(73089090)** • SIZE :- 50 X 25 X 1.2 • HEAVY DUTY INDUSTRIAL GI CABLE TRAY 1.2 MM HEAVY THICKNESS WITH COUPLER & JOINTER	L/S	L/S	1
4.04	Earthling Rod	As per load dependent specification	L/S	L/S	1
4.05	Earthling Patti	As per load dependent specification	L/S	L/S	1
4.06	Lugs and other required material for wiring	As per load dependent specification	L/S	L/S	1

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
4.07	Electrical Panel of Generation site	Electrical Control Panel for Biogas Generation, With all Preventers, Ampere meter on every connection, Voltage Indicator , Programme Logistic Control (PLC) included Programme for all atomized operation connected with all sensors and SCADA for Report generation, timer based, programmable, expandable. Incl. Phase drop preventer, for protection of drives against fade out by phase drop, fluctuating voltage, reverse phase connection, overload, or dry run			1
5	**ELECTRONICS EQUIPMENTS AND SENSORS**				
5.01	Raw Biogas Flow meter	Thermal mass flow meter: Thermal sensor consists of two sensing elements-a velocity sensor and a temperature sensor that automatically corrects the changes in gas temperature. Flow rate: 381 to 8640 Nm3/hr, Power supply: 24 VDC. Accuracy: +/- 1%, Output: 4 -20 mA	397	M3/HR	3
5.02	Biogas Slurry Flow Meter	Electromagnetic Flow Meter: Flow rate: 32 to 320 m3/hr, Power supply: 24 VDC. Accuracy: +/- 1%, Output: 4 -20 mA	32 to 320	M3/HR	3
5.03	Sensor	Pressure Level transmitter	0 to 4	MTR	5
		Temperature transmitter	0 to 100	Deg C	7
		PH Sensor	0 to 10	PH	4
6	**MACHINERY , EQUIPMENTS WITH INSTALLATION WORK**				
6.01	Screw Feeder	Operated through PLC for feeding raw material to Mixing tank, with auto mechanism	NA	NA	2
6.02	Submersible Agitator	Submersible Mixers, 20HP , 3-phase-motor 415 V, 50 Hz, 1450 rpm, protection class IP68 / Insulation class F = 155° C ,Thermo control per phase as overheat protection, Cast iron/SS , Propeller speed 300 rpm, with Complete Lifting Arrangements	15	Kwh	9
6.03	High flow Agitators	Axial High Flow Agitators , 20HP, 3-phase-motor 400 V, 50 Hz, 1450 rpm, protection class IP68 / Insulation class F = 155° C ,Thermo control per phase as overheat	15	Kwh	12

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
		protection, Cast iron Body , SS Propeller speed 750 rpm,with Complete Fitting Arrangements Pulley belt Driven			
6.04	Air compressor	8 Kg Operating , 2 Stage Air compressor with200 Litter storage capacity ,	2	HP	1
6.05	Feeding pump	Feeding Pump, 100 m3 /hr capacity with suitable motor capacity	100	m3/Hr	1
6.06	Slurry pump	Horizontal Shaft Pump for Solid transfer to Solid Liquid Separator, 7.5Hp, 3-phase motor,400V,50 Hz, 1450 rpm,	60	m3/hr	4
6.07	Solid Liquid Separator	Digestate Slurry Separator with complete system up to bag filling and weighing scale under mounted machine	10	Tone/hr	3
6.08	Under pressure Tank	Pressure Sensor with SS 304 water seal safety tank with Level gauge	50	Ltr.	3
6.09	Over pressure Tank	Pressure Sensor with SS 304 water seal safety tank with Level gauge	50	Ltr.	3
6.10	Heating system	SS 304 , 1'' Pipeline , connected with SS 304 , 4"Manifold corrode resistance , with Stand at every 2 meter , SS rod grouted with chemical for stand support , Leak proof and test at 10 Bar	16	Rounds	3
		Gas Blower	50	m3/Hr	3
		Air Blower			3
		Water storage tank	500	Ltr.	3
		Water Pump	1	HP	3
		Electric Water Heater	750	Lit	3
6.11	Double membrane Roof (Top Mounted)	Outer-membrane, inner-membrane Material: Euro-standard membrane, anti-UV, self-clean(PVDF coating), Anti-corrosion, anti-aging, acid proof, alkali proof, high strength, Electric control cabinet Display system: pressure/volume /control process display , Function control system: LCC more than 20 functions; Sensor system: pressure / volume sensor made of stainless steel, explosion	3000	m3	3

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
		proof. Operation cabinet : Air boost blower , Non return valve : PVC DN50, Auto-decompression device: DN50, Observation window, Rubber pad for anchor, Hose and fasten ring, Signal wire & cable, Accessories and tools, Safety function design: more than 8 ways			
6.12	Nylon Rope Net	Mesh Rope 6 Mm Dia, Border Rope 12 Mm Dia, Intermediate Rope12 Mm Dia, Tie Cords12 Mm Dia, Mesh Size Diamond Mesh Of 4",Fabrication Hand Woven Diamond Mesh Net, No Of Tie Cords 1 Meter Long At Every 1 Meter Distance Of Circumference Border	706.50	sq. mtr	3
6.13	Spider Ring	SS 316 , 35 mm ROD , Machine Bended in 1Mtr. Dia in Spider form For Belt Support on Centre Pillar	50	Tone load	3
6.14	Nylon Belts	Lashing Belts with Powder coated Ratchets, with anti-corrosive painted D hook	5	Tone load	621
6.15	Sealant for Roof Angle	For Sealing joints, gaps between angle and wall	500	Kg	3
6.16	MS Angle	MS Angle Plate 100x100x8 mm, machine bended Dia of Digester, holed at 150 mm each with anti-corrosive paint	6	Mtr	102
6.17	Level box	SS 304 tank which open from top for setting the level Patti and having two 8" hole at centre of sub divided area	1.2*0.6*0.6	MTR	3
6.18	Moisture Trap	Transparent tube with SS ball valve	NA	NA	3
6.19	Degasification unit	1.5 m3 SS 304 Tank with water pump and related accessories	NA	NA	3
6.20	Inspection Window	250 mm Dia with wiper glass assembly • Base Plate: SS316 of 16mm Thick • Cover Plate: SS 304 of 12mm Thick • Glass: Borosilicate toughened Glass with wiper with 15mm Tk • Wiper: SS316 with Silicon or PTFE having 170mm DIA • Packing: Silicon Rubber • Visible View: 250mm • Fasteners: SS304	1	Pair	3

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
6.21	Sky Platform of Digester	7.5-meter-high Ladder with sky platform of 1 meter width, surrounding digester, Platform with Industrial Anti corrosive paint	1 MTR WIDTH		3
6.22	Bar screen	Unloading Pit	(2mtr*3mtr) with 0.15 mm hole	MTR	1
		Mixing tank	2*2*0.15	MTR	1
6.23	Bellow for feeding pump	For controlling the vibration of pump against pipeline	8	inch	2
6.24	Epoxy work	Providing micron coating for filling pore hole in Rcc of digester tank	1000	SQ MTR	3
6.25	Flare System	For burning of Unwanted Raw biogas in emergency use **With All Required Fittings:** 1. Flare Tip Assembly 2. Riser Pipe (SS304) 3. Control Panel (Weather Proof) 4. Ignition System 5. Thermocouple (K Type) 6. Flame Arrestor 7. Gas Skid Assly. (SS304) 8. Structure Assembly 9. Moisture Trap (SS 304)	1200	M3/HR	1
6.26	Others	Nuts & Bolts , Fischer chemical , Welding rod and Anchor fastener	N/A	N/A	1
7	**GATE VALVES, FLANGES & PIPING**				
7.01	Pneumatic Knife Gate Valve , SS 316 Plate with CI body	Mixing tank	8"	INCH	2
		Fertilizer tank (For SLS)	6"	INCH	3
		Overflow point (Digester)	8"	INCH	3
		Feeding Point (Digester)	6"	INCH	3
		Fertilizer to mixing tank recirculation (Mixing tank)	8"	INCH	1
7.02	Manual knife gate valve, ss 316 Plate with CI body	Fertilizer tank	6"	INCH	1
		Water tank	6"	INCH	1
		High flow agitators (Digester)	16"	INCH	24
		Overflow point (Digester)	8"	INCH	3
		Overflow inlet point (Fertilizer tank)	8"	INCH	1
		Pressure level sensor Point (Digester)	8"	INCH	3
7.03	Ball valve	Digester Sample point Ball valve (Digester)	2"	INCH	3
		Gas line (PP Ball valve) (Digester)	6"	INCH	3
7.04	Butterfly valve	For Gas outlet line	6"	INCH	3

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
7.05	Flanges	SS 304 Flanges	4"	INCH	50
		SS 304 Flanges	6"	INCH	153
		SS 304 Flanges	8"	INCH	75
		SS 304 Flanges	16"	INCH	23
7.06	Wall mounting Flanges	High flow agitators (Digester)	16"	INCH	30
		Feeding point (Digester)	6"	INCH	3
		Heating system inlet and outlet (Digester)	4	INCH	6
		Slurry Overflow point (Digester)	8	INCH	6
		Digester level sensor point (Digester)	8	INCH	3
		Sample point (Digester)	2	INCH	3
		Gas outlet point (Digester)	6	INCH	3
		Gas overflow or drain point (Digester)	6	INCH	3
		Submersible agitator wire (Digester)	2	INCH	6
		Digester window (Digester)	10	INCH	6
		Feeding pump suction point (Mixing Tank)	8	INCH	1
		Temperature Sensor (Mixing Tank)	1	INCH	1
		Solid liquid separator pump inlet (Fertilizer tank)	6	INCH	1
		Overflow Inlet point (Fertilizer tank)	8	INCH	1
		Slurry feeded pump inlet (Water Tank)	6	INCH	1
7.07	Pipeline	Feeding line • SS 304 • Schedule 10 • Thickness: 3 mm • Anti corrosion	6" (6mtr /length)	MTR	200
		Gas line • SS 304 • Schedule 10 • Thickness: 3 mm • Anti corrosion	6" (6mtr /length)	MTR	240
		High flow agitator suction and discharge line • SS 304 • Schedule 5 • Thickness: 3 mm • Anti corrosion	16" (6mtr /length)	MTR	60
		Overflow line • SS 304 • Schedule 10 • Thickness: 3 mm • Anti corrosion	8" (6mtr /length)	MTR	200
		Solid liquid Separator line with tanker filling line	4" (6mtr /length)	MTR	200

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	QTY
		• SS 304 • Schedule 10 • Thickness: 3 mm • Anti corrosion			
7.08	Other Pipeline fittings	Elbow , Tee , Reducers, Nipples and others required material	2",4",6",and 8"	L/S	1
8	**BIOGAS PURIFICATION & COMPRESSOR PACKAGE**				
8.01	Low Pressure Biogas Compressor (1 working + 1 Standby)	Low Pressure Reciprocating Compressor Including install and wiring	600	m3	2
8.02	Biogas Upgradation System	High Pressure Water Scrubbing based Biogas Purification Unit for removal of H2S, moisture and Co2, with inline standby equipment's	1200	m3/hr	1
8.03	High pressure Manifold	High pressure Pherol fittings manifold, 4 filling points (3-meter-long hose pipe)	4	Filling point	1
8.04	Gas Analyzer	Online Gas Analyzer with calibrated certificate CH4, Co2, H2S and Moisture	NA	NA	1
8.05	Odorant Unit	Odorant Unit	NA	NA	1
9	**CONSTRUCTION MANAGEMENT , LOGISTIC , START-UP , COMMISIONING OF PLANT**				
9.01	Miscellaneous	Crane , Loading /Unloading, Scaffolding, Installation, Travelling , Boarding,	N/A	N/A	1

Other Essentials:

S.NO.	WORK & MACHINERY	DESCRIPTION	CAPACITY	UNIT	Qty
1	**HIGH PRESSURE CYLINDERS CASCADE (Optional)**				
1.01	High Pressure Cylinders Cascade	PESO Approved CNG cylinders cascade with valve and fitting, Including trolley	3000	Litter. /clay	16
2	**FERTILIZER BAGGING AND STICHING SYSTEM**				
2.01	Screening and Bagging of Dried Fertilizer	As per requirements	NA	NA	1
2.02	Aero Trailer with Tractor	As per desired capacity	NA	NA	1
3	**SITE DEVELOPMENT AND VARIOUS ROOMS AND BUILDING FACILITY**				
3.01	Office buildings	It consists of Dining, Kitchen, Reception and other	150	SQ. MT	1
3.02	Security Room	As per requirements	15	SQ MT	1
3.03	Site Development				1
4	**INTERNAL ROADS**				
4.01	TAR/ Bitumen Road	surrounding the site boundary as per approved layout			
4.02	Windrows RCC	RCC Flooring for Windrows area as per approved Layout			
5	**WALL Fencing & GATES**				
5.01	Boundary Wall (2 mt High)	As per Requirement			
5.02	Entry/Exit gate	As per Requirement			
6	**BOREWELL AND FITTINGS**				
6.01	Bore Well	As per Requirement	L/S	L/S	1
6.02	Water Tank	As per Requirement	10000	LTR	1
6.03	Piping	As per Requirement	L/S	L/S	1
7	**LIGHTINING ESTIMATE**				
7.01	Street Light @ 6 mtr Distance	Along plant boundary/ Internal Road			80
7.02	High Mask Light	As per Requirement			1
7.03	Flame proof Light Purification	As per Requirement			10
8	**VEHICLES**				
8.01	Tractor	As per Requirement	L/S		2
8.02	Trolley	As per Requirement	L/S		2
8.03	Tanker	As per Requirement	L/S		2
8.04	Tractor Loader	As per Requirement	L/S		1
9	**ELECTRICITY CONNECTION AND CABLES**				
9.01	Transformer	As per Requirement			1
9.02	HT Line, Breaker, Capacitor, PF Panel and Power Cable upto PLC Scada control panel				1
10	**OTHER ESSENTIAL REQUIREMENTS**				
10.02	Lab	As per Requirement			1
10.03	CCTV Camera	As per Requirement			1
10.04	Weigh Bridge	As per Requirement			1

Chapter-5: Project Cost

The financials for this project are very attractive as well, with a handsome IRR% and Payback period.

On a normative approach the parameters have been generally taken as per latest market scenario and as per price circulars issued by IGL & IOCL and other Oil & gas Marketing Companies. The sale rate of CBG has been assumed as Rs 66 per kg. Market rates for input fuel and products have been considered without any escalations in view of emerging market for BioCNG. A conservative approach has been adopted in calculating the expenses & revenues. Simple accounting rules have been followed in calculating the IRR and Paybacks.

A total of 4 Acres of land has been proposed for the project which will also be used for onsite storage of Raw Material and Fertilizers. Taking a model case of about 25000 cum/Day of biogas generation, the typical financials are as follow. The salient financial data is summarized as under:-

Raw Material		
Raw Material	210	MT/day
Cost of Raw Material	700	INR/MT
Production		
Capacity (Raw Biogas)	25000	Cum/ day
Compressed Biogas (CBG)	10000	kg/day
Bio-Fertilizer (Dry)	37	MT/day
Bio-Fertilizer (Liquid)	63	kl/day
Sale Price of Both Products		
Sale Price of Compressed Biogas (CBG)	66.00	INR/kg
Sale Price of Bio-Fertilizer (Dry)	5.00	INR/kg
Sale Price of Bio-Fertilizer (Liquid)	0.50	INR/kg

Cost of the Project (Rs. in Lakhs)

Sr.	PARTICULARS	CAPEX Rs.Lakh
1	Land Cost & Site Development	100.00
2	Capex- Plant & Machinery inclusive of GST	4270.00
3	Capex- Building & Civil Work inclusive of GST	1830.00
4	Contingency on Capex	100.00
5	Preliminary Expenses	20.00
6	Interest During Construction Period	442.75
7	Margin for Working Capital	50.00
	TOTAL COST OF PROJECT	6812.75

MEANS OF FINANCE		
Sr.	PARTICULARS	MOF Rs.Lakh
1	Promoter' Contribution	2212.75
2	Term Loan	4600.00
	TOTAL MEANS OF FINANCE	6812.75
	Working Capital loan from Bank (First Year)	80.00
	Working Capital loan from Bank (second Year onwards)	98.00
	Capital Finance Assitatance(CFA) Rs 833.33 Lakhs from MNRE @ 3333 Rs./M3 Capacity + Rs. 750 Lakhs Subsidy from UPNEDA	1583.00

Other Assumptions		
Income Tax exemption - MAT applicable	For First Five Years	
Working Days	350	Per Year
Rate of Interest (for Term & W.C)	11.00	%
Loan repayment period (Excluding Moratorium Period)	10	Years
Moratorium Period (Excluding Loan repayment period)	18	Months
Other Expenses		
Maintenance, Consumable and other misc.	250000.00	INR/Month
Manpower	506000.00	INR/Month
Electricity Expenses	1500000.00	INR/Month

Chapter-6: Financial Analysis

Assumptions for financial calculations:

1. Cash flows has been calculated for 11 years although the Project Life has been found to be 20 years.
2. CBG Price has been assumed to be constant Rs 66,000 per ton (Excluding GST) over the period of Project Life.
3. Dry Fertilizer Price has been taken INR 5000 per ton and assumed to be fixed over life of the Project.
4. Slurry Fertilizer Price has been taken INR 500 per ton and assumed to be fixed over life of the Project.
5. Average Price of Raw Material has been taken INR 700 per ton and assumed to be fixed over life of the Project.
6. Staff Salary Cost assumed to be increasing 5 percent every year over the life of the project.
7. Maintenance Expenses assumed to be fixed every year over the life of the project.
8. Depreciation on Plant & Machinery has been taken at 10% on WDV value while on Civil Work has been taken at 5% rate.
9. MAT rate/ Income Tax Rate taken as18.54%/ 25.75% including of all surcharges and Cess.
10. For MIRR calculation, Weighted Average Cost of Capital (WACC) to be considered is 10%.
11. Project construction period has been taken as 12 months.
12. IDC has been calculated for 16 months (12 months Construction period+ 4 months Trial Run Period).
13. Moratorium period has been taken for 18 Months (12 months Construction period + 3 months Trial Run Period + First 3 months of Commercial production).
14. Loan Repayment period has been taken as 10 years excluding moratorium period of 18 Months.

Standard Working Calculations for proposed biogas project

JAVEX CBG Plant Capacity - 25000 cum per day (10TPD CBG) - WORKING						Rs. In Lakhs
Plant Capacity (cm/day)	25000	25000	25000	25000	25000	25000
Nos. of Days per annum	350.00	350.00	350.00	350.00	350.00	350.00
CBG Production per Day (Kg)	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00
CBG Production per Annum (MTPA)	3500.00	3500.00	3500.00	3500.00	3500.00	3500.00
Bio Fertilizer (MTPD)	37.00	37.00	37.00	37.00	37.00	37.00
Bio Fertilizer (MTPA)	12950.00	12950.00	12950.00	12950.00	12950.00	12950.00
Slury Fertilizer (MTPD)	63.00	63.00	63.00	63.00	63.00	63.00
Slury Fertilizer (MTPA)	22050.00	22050.00	22050.00	22050.00	22050.00	22050.00
Total Raw Material Feed MTPD	210.00	210.00	210.00	210.00	210.00	210.00
Raw Material Feed MTPA	73500.00	73500.00	73500.00	73500.00	73500.00	73500.00
Sale Rate - CBG (Rs/ton)	66000.00	66000.00	66000.00	66000.00	66000.00	66000.00
Sale Rate - Bio Fertilizer (Rs./KG)	5.00	5.00	5.00	5.00	5.00	5.00
Sale Rate - Slury Fertilizer (Rs./KG)	0.50	0.50	0.50	0.50	0.50	0.50
Average Cost of Raw Material (Rs./MT)	700.00	700.00	700.00	700.00	700.00	700.00
Initial Cost of RM	Rs. Lakh	0.00	0.00	0.00	0.00	0.00
Utilised Capacity (%)		80.00%	90.00%	90.00%	95.00%	95.00%
Months of Operations/Annum		12	12	12	12	12
Plant Capacity (cm/day)	25000	25000	25000	25000	25000	25000
Nos. of Days per annum	350.00	350.00	350.00	350.00	350.00	350.00
CBG Production per Day (Kg)	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00
CBG Production per Annum (MTPA)	3500.00	3500.00	3500.00	3500.00	3500.00	3500.00
Bio Fertilizer (MTPD)	37.00	37.00	37.00	37.00	37.00	37.00
Bio Fertilizer (MTPA)	12950.00	12950.00	12950.00	12950.00	12950.00	12950.00
Slury Fertilizer (MTPD)	63.00	63.00	63.00	63.00	63.00	63.00
Slury Fertilizer (MTPA)	22050.00	22050.00	22050.00	22050.00	22050.00	22050.00
Total Raw Material Feed MTPD	210.00	210.00	210.00	210.00	210.00	210.00
Raw Material Feed MTPA	73500.00	73500.00	73500.00	73500.00	73500.00	73500.00
Sale Rate - CBG (Rs/ton)	66000.00	66000.00	66000.00	66000.00	66000.00	66000.00
Sale Rate - Bio Fertilizer (Rs./KG)	5.00	5.00	5.00	5.00	5.00	5.00
Sale Rate - Slury Fertilizer (Rs./KG)	0.50	0.50	0.50	0.50	0.50	0.50
Average Cost of Raw Material (Rs./MT)	700.00	700.00	700.00	700.00	700.00	700.00
Initial Cost of RM	0.00	0.00	0.00	0.00	0.00	0.00
Utilised Capacity (%)	95.00%	95.00%	95.00%	95.00%	95.00%	95.00%
Months of Operations/Annum	12	12	12	12	12	12

CALCULATION OF ACTUAL PRODUCTION-CBG and Bio-Fertilizers

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
1	Total Installed Input Capacity per Annum (In MT)	73500.00	73500.00	73500.00	73500.00	73500.00	73500.00
2	Utilized Capacity in Percentage (%)	80.00%	90.00%	90.00%	95.00%	95.00%	95.00%
3	Total Consumption of RM Feedstock (In MT)	58800.00	66150.00	66150.00	69825.00	69825.00	69825.00
4	Opening Stock of RM for RM Feedstock(In MT)	0.00	2520.00	2835.00	2835.00	2992.50	2992.50
5	Closing Stock of RM for RM Feedstock(In MT)	2520.00	2835.00	2835.00	2992.50	2992.50	2992.50
A	Actual Purchase of RM for RM Feedstock(In MT)	61320.00	66465.00	66150.00	69982.50	69825.00	69825.00
	OUTPUT						
6	Actual Output of CBG (In tons.)	2800.00	3150.00	3150.00	3325.00	3325.00	3325.00
7	Opening Stock of CBG (In tons.)	0.00	0.00	0.00	0.00	0.00	0.00
8	Closing Stock of CBG (In tons.)	0.00	0.00	0.00	0.00	0.00	0.00
B	Actual Sales Quantity of CBG (In tons.)	2800.00	3150.00	3150.00	3325.00	3325.00	3325.00
9	Actual Output of Fertilizer in Kg.	10360000.00	11655000.00	11655000.00	12302500.00	12302500.00	12302500.00
10	Opening Stock of Fertilizer in Kg.	0.00	444000.00	499500.00	499500.00	527250.00	527250.00
11	Closing Stock of Fertilizer in Kg.	444000.00	499500.00	499500.00	527250.00	527250.00	527250.00
C	Actual Sales Quantity of Fertilizer in Kg.	9916000.00	11599500.00	11655000.00	12274750.00	12302500.00	12302500.00
12	Actual Output of Slury Fertilizer in Kg.	17640000.00	19845000.00	19845000.00	20947500.00	20947500.00	20947500.00
13	Opening Stock of Slury Fertilizer in Kg.	0.00	756000.00	850500.00	850500.00	897750.00	897750.00
14	Closing Stock of Slury Fertilizer in Kg.	756000.00	850500.00	850500.00	897750.00	897750.00	897750.00
D	Actual Sales Quantity of Slury Fertilizer in Kg.	16884000.00	19750500.00	19845000.00	20900250.00	20947500.00	20947500.00

Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum	12	12	12	12	12
1	Total Installed Input Capacity per Annum (In MT)	73500.00	73500.00	73500.00	73500.00	73500.00
2	Utilized Capacity in Percentage (%)	95.00%	95.00%	95.00%	95.00%	95.00%
3	Total Consumption of RM Feedstock (In MT)	69825.00	69825.00	69825.00	69825.00	69825.00
4	Opening Stock of RM for RM Feedstock(In MT)	2992.50	2992.50	2992.50	2992.50	2992.50
5	Closing Stock of RM for RM Feedstock(In MT)	2992.50	2992.50	2992.50	2992.50	2992.50
A	Actual Purchase of RM for RM Feedstock(In MT)	69825.00	69825.00	69825.00	69825.00	69825.00
	OUTPUT					
6	Actual Output of CBG (In tons.)	3325.00	3325.00	3325.00	3325.00	3325.00
7	Opening Stock of CBG (In tons.)	0.00	0.00	0.00	0.00	0.00
8	Closing Stock of CBG (In tons.)	0.00	0.00	0.00	0.00	0.00
B	Actual Sales Quantity of CBG (In tons.)	3325.00	3325.00	3325.00	3325.00	3325.00
9	Actual Output of Fertilizer in Kg.	12302500.00	12302500.00	12302500.00	12302500.00	12302500.00
10	Opening Stock of Fertilizer in Kg.	527250.00	527250.00	527250.00	527250.00	527250.00
11	Closing Stock of Fertilizer in Kg.	527250.00	527250.00	527250.00	527250.00	527250.00
C	Actual Sales Quantity of Fertilizer in Kg.	12302500.00	12302500.00	12302500.00	12302500.00	12302500.00
12	Actual Output of Slury Fertilizer in Kg.	20947500.00	20947500.00	20947500.00	20947500.00	20947500.00
13	Opening Stock of Slury Fertilizer in Kg.	897750.00	897750.00	897750.00	897750.00	897750.00
14	Closing Stock of Slury Fertilizer in Kg.	897750.00	897750.00	897750.00	897750.00	897750.00
D	Actual Sales Quantity of Slury Fertilizer in Kg.	20947500.00	20947500.00	20947500.00	20947500.00	20947500.00

CALCULATION OF TURNOVER - CBG

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Actual Sales Quantity of CBG	2800.00	3150.00	3150.00	3325.00	3325.00	3325.00
2	Average Sales Price CBG	66000.00	66000.00	66000.00	66000.00	66000.00	66000.00
3	Income (Rs. in Lac) -CBG	1848.00	2079.00	2079.00	2194.50	2194.50	2194.50

Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
1	Actual Sales Quantity of CBG	3325.00	3325.00	3325.00	3325.00	3325.00
2	Average Sales Price CBG	66000.00	66000.00	66000.00	66000.00	66000.00
3	Income (Rs. in Lac) -CBG	2194.50	2194.50	2194.50	2194.50	2194.50

CALCULATION OF TURNOVER - Bio Fertilizer

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Actual Sales Quantity of Bio-Fertilizer Dry (in Kg.)	9916000.00	11599500.00	11655000.00	12274750.00	12302500.00	12302500.00
2	Average Sales Price Fertilizer (In Kg.)	5.00	5.00	5.00	5.00	5.00	5.00
3	Income (Rs. in Lac) -Fertilizer	495.80	579.98	582.75	613.74	615.13	615.13

Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
1	Actual Sales Quantity of Bio-Fertilizer Dry (in Kg.)	12302500.00	12302500.00	12302500.00	12302500.00	12302500.00
2	Average Sales Price Fertilizer (In Kg.)	5.00	5.00	5.00	5.00	5.00
3	Income (Rs. in Lac) -Fertilizer	615.13	615.13	615.13	615.13	615.13

CALCULATION OF TURNOVER - Slury Fertilizer

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Actual Sales Quantity of slury-Fertilizer (in Kg.)	16884000.00	19750500.00	19845000.00	20900250.00	20947500.00	20947500.00
2	Average Sales Price slury Fertilizer (In Kg.)	0.50	0.50	0.50	0.50	0.50	0.50
3	Income (Rs. in Lac) - slury Fertilizer	84.42	98.75	99.23	104.50	104.74	104.74
	TOTAL TURNOVER	2428.22	2757.73	2760.98	2912.74	2914.36	2914.36

Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
1	Actual Sales Quantity of slury-Fertilizer (in Kg.)	20947500.00	20947500.00	20947500.00	20947500.00	20947500.00
2	Average Sales Price slury Fertilizer (In Kg.)	0.50	0.50	0.50	0.50	0.50
3	Income (Rs. in Lac) - slury Fertilizer	104.74	104.74	104.74	104.74	104.74
	TOTAL TURNOVER	2914.36	2914.36	2914.36	2914.36	2914.36

CALCULATION OF cost of RAW MATERIAL Feedstock

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Actual Consumption of RM Feedstock per Annum	58800.00	66150.00	66150.00	69825.00	69825.00	69825.00
2	Average cost of RM per MT (including Segregation	700.00	700.00	700.00	700.00	700.00	700.00
3	Annual regular Cost of RM (Rs. Lakh)	411.60	463.05	463.05	488.78	488.78	488.78
4	Initial Cost of RM	0.00	0.00	0.00	0.00	0.00	0.00
5	Cost of RM Feedstock per Annum (Rs. in Lakh)	411.60	463.05	463.05	488.78	488.78	488.78

Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
1	Actual Consumption of RM Feedstock per Annum	69825.00	69825.00	69825.00	69825.00	69825.00
2	Average cost of RM per MT (including Segregation	700.00	700.00	700.00	700.00	700.00
3	Annual regular Cost of RM (Rs. Lakh)	488.78	488.78	488.78	488.78	488.78
4	Initial Cost of RM	0.00	0.00	0.00	0.00	0.00
5	Cost of RM Feedstock per Annum (Rs. in Lakh)	488.78	488.78	488.78	488.78	488.78

CALCULATION OF CLOSING STOCK OF RAW MATERIAL-Feedstock

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Closing Stock of RM for RM Feedstock(In MT)	2520.00	2835.00	2835.00	2992.50	2992.50	2992.50
2	Average cost of RM - per MT	700.00	700.00	700.00	700.00	700.00	700.00
3	Value of Closing Stock of RM -(Rs. in Lac)	17.64	19.85	19.85	20.95	20.95	20.95
Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11	
1	Closing Stock of RM for RM Feedstock(In MT)	2992.50	2992.50	2992.50	2992.50	2992.50	
2	Average cost of RM - per MT	700.00	700.00	700.00	700.00	700.00	
3	Value of Closing Stock of RM -(Rs. in Lac)	20.95	20.95	20.95	20.95	20.95	

CALCULATION OF CLOSING STOCK OF CBG

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Closing Stock of CBG (In tons.)	0.00	0.00	0.00	0.00	0.00	0.00
2	Average Sales Price CBG	66000.00	66000.00	66000.00	66000.00	66000.00	66000.00
3	Value of Closing Stock of FG -Methane (Rs. in Lac)	0.00	0.00	0.00	0.00	0.00	0.00
Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11	
1	Closing Stock of CBG (In tons.)	0.00	0.00	0.00	0.00	0.00	
2	Average Sales Price CBG	66000.00	66000.00	66000.00	66000.00	66000.00	
3	Value of Closing Stock of FG -Methane (Rs. in Lac)	0.00	0.00	0.00	0.00	0.00	

CALCULATION OF CLOSING STOCK OF Bio Fertilizer

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Closing Stock of Fertilizer in Kg.	444000.00	499500.00	499500.00	527250.00	527250.00	527250.00
2	Average Sales Price Fertilizer (In Kg.)	5.00	5.00	5.00	5.00	5.00	5.00
3	Value of Closing Stock of FG -Fertilizer (Rs. in Lac)	22.20	24.98	24.98	26.36	26.36	26.36
Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11	
1	Closing Stock of Fertilizer in Kg.	527250.00	527250.00	527250.00	527250.00	527250.00	
2	Average Sales Price Fertilizer (In Kg.)	5.00	5.00	5.00	5.00	5.00	
3	Value of Closing Stock of FG -Fertilizer (Rs. in Lac)	26.36	26.36	26.36	26.36	26.36	

CALCULATION OF CLOSING STOCK OF Slury Fertilizer

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Closing Stock of Slury Fertilizer in Kg.	756000.00	850500.00	850500.00	897750.00	897750.00	897750.00
2	Average Sales Price slury Fertilizer (In Kg.)	0.50	0.50	0.50	0.50	0.50	0.50
3	Value of Closing Stock of FG -Slury Fertilizer (Rs. in	3.78	4.25	4.25	4.49	4.49	4.49
	TOTAL CLOSING STOCK of FG	25.98	29.23	29.23	30.85	30.85	30.85
Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11	
1	Closing Stock of Slury Fertilizer in Kg.	897750.00	897750.00	897750.00	897750.00	897750.00	
2	Average Sales Price slury Fertilizer (In Kg.)	0.50	0.50	0.50	0.50	0.50	
3	Value of Closing Stock of FG -Slury Fertilizer (Rs. in	4.49	4.49	4.49	4.49	4.49	
	TOTAL CLOSING STOCK of FG	30.85	30.85	30.85	30.85	30.85	

CALCULATION OF SALARY & WAGES

Sr	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Capicity Utilisation	80.00%	90.00%	90.00%	95.00%	95.00%	95.00%
2	Months of Operations/Annum	12.00	12.00	12.00	12.00	12.00	12.00
3	YoY rise in Salary	0%	5%	5%	5%	5%	5%
4	Salary Cost (Rs. in Lac) '@60.72 Lakh/Annum Full	60.72	63.76	66.94	70.29	73.81	77.50
Sr	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11	
1	Capicity Utilisation	95.00%	95.00%	95.00%	95.00%	95.00%	
2	Months of Operations/Annum	12.00	12.00	12.00	12.00	12.00	
3	YoY rise in Salary	5%	5%	5%	5%	5%	
4	Salary Cost (Rs. in Lac) '@60.72 Lakh/Annum Full	81.37	85.44	89.71	94.20	98.91	

CALCULATION OF OFFICE, ADMINISTRATIVE & MARKETING EXPENSES

Sr	Particulars		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Capicity Utilisation		80.00%	90.00%	90.00%	95.00%	95.00%	95.00%
2	Months of Operations/Annum		12.00	12.00	12.00	12.00	12.00	12.00
3	YoY rise		0%	0%	0%	0%	0%	0%
4	Total Cost (Rs. in Lac) '@12 Lakh/Annum Full	12.00	9.60	10.80	10.80	11.40	11.40	11.40
Sr	Particulars		Year 7	Year 8	Year 9	Year 10	Year 11	
1	Capicity Utilisation		95.00%	95.00%	95.00%	95.00%	95.00%	
2	Months of Operations/Annum		12.00	12.00	12.00	12.00	12.00	
3	YoY rise		0%	0%	0%	0%	0%	
4	Total Cost (Rs. in Lac) '@12 Lakh/Annum Full	12.00	11.40	11.40	11.40	11.40	11.40	

CALCULATION OF MAINTAINANCE EXPENSES

Sr	Particulars		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Capicity Utilisation		80.00%	90.00%	90.00%	95.00%	95.00%	95.00%
2	Months of Operations/Annum		12.00	12.00	12.00	12.00	12.00	12.00
3	YoY rise		0%	0%	0%	0%	0%	0%
4	TOTAL Cost (Rs. in Lac) '		0.00	0.00	0.00	0.00	0.00	0.00
		30.00	24.00	27.00	27.00	28.50	28.50	28.50
Sr	Particulars		Year 7	Year 8	Year 9	Year 10	Year 11	
1	Capicity Utilisation		95.00%	95.00%	95.00%	95.00%	95.00%	
2	Months of Operations/Annum		12.00	12.00	12.00	12.00	12.00	
3	YoY rise		0%	0%	0%	0%	0%	
4	TOTAL Cost (Rs. in Lac) '		0.00	0.00	0.00	0.00	0.00	
		30.00	28.50	28.50	28.50	28.50	28.50	

CALCULATION OF POWER COST

Sr	Particulars		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Capicity Utilisation		80.00%	90.00%	90.00%	95.00%	95.00%	95.00%
2	Months of Operations/Annum		12.00	12.00	12.00	12.00	12.00	12.00
3	Power Cost(Rs. in Lac) '	180.00	144.00	162.00	162.00	171.00	171.00	171.00
			60.72	63.76	66.94	70.29	73.81	77.50
Sr	Particulars		Year 7	Year 8	Year 9	Year 10	Year 11	
1	Capicity Utilisation		95.00%	95.00%	95.00%	95.00%	95.00%	
2	Months of Operations/Annum		12.00	12.00	12.00	12.00	12.00	
3	Power Cost(Rs. in Lac) '	180.00	171.00	171.00	171.00	171.00	171.00	
			81.37	85.44	89.71	94.20	98.91	

Calculation of Depreciation for proposed Project (Rs. in Lakhs)

Sr.	Asset	Particulars	Dep.%	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1	Land	Opening Balance	0.00%	100.00	100.00	100.00	100.00	100.00	100.00
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00	0.00
		Gross Block		100.00	100.00	100.00	100.00	100.00	100.00
		Depreciation		0.00	0.00	0.00	0.00	0.00	0.00
		Closing Balance		100.00	100.00	100.00	100.00	100.00	100.00
2	Building and Civil Work	Opening Balance	5.00%	1830.00	1784.25	1717.34	1631.47	1549.90	1472.40
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00	0.00
		Gross Block		1830.00	1784.25	1717.34	1631.47	1549.90	1472.40
		Depreciation		45.75	66.91	85.87	81.57	77.49	73.62
		Closing Balance		1784.25	1717.34	1631.47	1549.90	1472.40	1398.78
3	Plant and Machineries & Civil Work	Opening Balance	10.00%	4270.00	3843.00	3458.70	3112.83	2801.55	2521.39
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00	0.00
		Gross Block		4270.00	3843.00	3458.70	3112.83	2801.55	2521.39
		Depreciation		427.00	384.30	345.87	311.28	280.15	252.14
		Closing Balance		3843.00	3458.70	3112.83	2801.55	2521.39	2269.25
4	Other Equipments	Opening Balance	10.00%	0.00	0.00	0.00	0.00	0.00	0.00
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00	0.00
		Gross Block		0.00	0.00	0.00	0.00	0.00	0.00
		Depreciation		0.00	0.00	0.00	0.00	0.00	0.00
		Closing Balance		0.00	0.00	0.00	0.00	0.00	0.00
	Total	Opening Balance		6200.00	5727.25	5276.04	4844.30	4451.45	4093.80
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00	0.00
		Gross Block		6200.00	5727.25	5276.04	4844.30	4451.45	4093.80
		Depreciation		472.75	451.21	431.74	392.86	357.65	325.76
		Closing Balance		5727.25	5276.04	4844.30	4451.45	4093.80	3768.04

Sr.	Asset	Particulars	Dep.%	Year 7	Year 8	Year 9	Year 10	Year 11
1	Land	Opening Balance	0.00%	100.00	100.00	100.00	100.00	100.00
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00
		Gross Block		100.00	100.00	100.00	100.00	100.00
		Depreciation		0.00	0.00	0.00	0.00	0.00
		Closing Balance		100.00	100.00	100.00	100.00	100.00
2	Building and Civil Work	Opening Balance	5.00%	1398.78	1328.85	1262.40	1199.28	1139.32
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00
		Gross Block		1398.78	1328.85	1262.40	1199.28	1139.32
		Depreciation		69.94	66.44	63.12	59.96	56.97
		Closing Balance		1328.85	1262.40	1199.28	1139.32	1082.35
3	Plant and Machineries & Civil Work	Opening Balance	10.00%	2269.25	2042.33	1838.09	1654.29	1488.86
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00
		Gross Block		2269.25	2042.33	1838.09	1654.29	1488.86
		Depreciation		226.93	204.23	183.81	165.43	148.89
		Closing Balance		2042.33	1838.09	1654.29	1488.86	1339.97
4	Other Equipments	Opening Balance	10.00%	0.00	0.00	0.00	0.00	0.00
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00
		Gross Block		0.00	0.00	0.00	0.00	0.00
		Depreciation		0.00	0.00	0.00	0.00	0.00
		Closing Balance		0.00	0.00	0.00	0.00	0.00
	Total	Opening Balance		3768.04	3471.17	3200.50	2953.57	2728.18
		Net Addition / Deletion		0.00	0.00	0.00	0.00	0.00
		Gross Block		3768.04	3471.17	3200.50	2953.57	2728.18
		Depreciation		296.86	270.68	246.93	225.39	205.85
		Closing Balance		3471.17	3200.50	2953.57	2728.18	2522.32

Computation of Income Tax						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Book Profit	838.92	1145.33	1376.84	1561.91	1623.18	1642.10
Add: Book Depriciation	472.75	451.21	431.74	392.86	357.65	325.76
Less: WDV Depriciation	472.75	451.21	431.74	392.86	357.65	325.76
Less: Set-off of previous loss	0	0	0	0	0	0
Profit / (loss) attributable to income tax	838.92	1145.33	1376.84	1561.91	1623.18	1642.10
Tax Payable (with MAT for first 5 years)	155.54	212.34	255.27	289.58	300.94	422.84
	Year 7	Year 8	Year 9	Year 10	Year 11	
Book Profit	1589.67	1641.28	1690.25	1736.79	1820.02	
Add: Book Depriciation	296.86	270.68	246.93	225.39	205.85	
Less: WDV Depriciation	296.86	270.68	246.93	225.39	205.85	
Less: Set-off of previous loss	0.00	0.00	0.00	0.00	0.00	
Profit / (loss) attributable to income tax	1589.67	1641.28	1690.25	1736.79	1820.02	
Tax Payable (with MAT for first 5 years)	409.34	422.63	435.24	447.22	468.66	

Projected Profit & Loss Account for proposed biogas plant

			Projected Profit and Loss Account					Rs.in Lakh
Sr.	Particulars		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum		12	12	12	12	12	12
A	Total Sales Income		2428.22	2757.73	2760.98	2912.74	2914.36	2914.36
C	Other Income (GST input average 15% including in Capex)	795.65	121.41	137.89	138.05	145.64	145.72	106.95
D	Total Income (A+B+C)		2549.63	2895.61	2899.02	3058.38	3060.08	3021.31
E	Raw Material Consumption		411.60	463.05	463.05	488.78	488.78	488.78
	Salary and Wages		60.72	63.76	66.94	70.29	73.81	77.50
	Power and Fuel Cost		144.00	162.00	162.00	171.00	171.00	171.00
	Transporation Cost		56.00	63.00	63.00	66.50	66.50	66.50
	Repairs and Maintenance Expenses		24.00	27.00	27.00	28.50	28.50	28.50
	Office & Adm Expenses		9.60	10.80	10.80	11.40	11.40	11.40
	Depreciation		472.75	451.21	431.74	392.86	357.65	325.76
	Cost of Production		1178.67	1240.82	1224.53	1229.32	1197.63	1169.43
F	Add : Opening Stock of WIP		0.00	0.00	0.00	0.00	0.00	0.00
	Less : Closing Stock of WIP		0.00	0.00	0.00	0.00	0.00	0.00
	Add : Opening Stock of Finished Goods		0.00	25.98	29.23	29.23	30.85	30.85
	Less : Closing Stock of Finished Goods		25.98	29.23	29.23	30.85	30.85	30.85
	Cost of Sales		1152.69	1237.57	1224.53	1227.70	1197.63	1169.43
G	Gross Profit		1396.94	1658.05	1674.49	1830.68	1862.45	1851.88
H	Admn. & Marketing Exp.		9.60	10.80	10.80	11.40	11.40	11.40
I	Interest Cost		502.15	455.64	240.58	211.09	181.60	152.10
	Interest of Term Loan		493.35	444.86	229.80	200.31	170.82	141.32
	Interest on Working Capital		8.80	10.78	10.78	10.78	10.78	10.78
	Interest on Unsecured Loans		0.00	0.00	0.00	0.00	0.00	0.00
J	Other Non Operating Income		0.00	0.00	0.00	0.00	0.00	0.00
	Net Profit on Sale of Misc. Stocks /		0.00	0.00	0.00	0.00	0.00	0.00
	Interest / Dividend Income		0.00	0.00	0.00	0.00	0.00	0.00
	Any Other Income		0.00	0.00	0.00	0.00	0.00	0.00
K	Other Non Operating Expenses		46.28	46.28	46.28	46.28	46.28	46.28
	Written Off Expenses		46.28	46.28	46.28	46.28	46.28	46.28
	Any Other Expenses		0.00	0.00	0.00	0.00	0.00	0.00
L	Profit Before Tax		838.92	1145.33	1376.84	1561.91	1623.18	1642.10
M	Provision For Taxation (MAT / Regular)		155.54	212.34	255.27	289.58	300.94	422.84
N	Profit After Tax		683.38	932.99	1121.57	1272.33	1322.24	1219.26

Projected Profit and Loss Account						(Rs. in Lakh
Sr.	Particulars		Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum		12	12	12	12	12
A	Total Sales Income		2914.36	2914.36	2914.36	2914.36	2914.36
C	Other Income (GST input average 15% including in Capex)	795.65					
D	Total Income (A+B+C)		2914.36	2914.36	2914.36	2914.36	2914.36
E	Raw Material Consumption		488.78	488.78	488.78	488.78	488.78
	Salary and Wages		81.37	85.44	89.71	94.20	98.91
	Power and Fuel Cost		171.00	171.00	171.00	171.00	171.00
	Transporation Cost		66.50	66.50	66.50	66.50	66.50
	Repairs and Maintenance Expenses		28.50	28.50	28.50	28.50	28.50
	Office & Adm Expenses		11.40	11.40	11.40	11.40	11.40
	Depreciation		296.86	270.68	246.93	225.39	205.85
	Cost of Production		1144.41	1122.29	1102.82	1085.76	1070.93
F	Add : Opening Stock of WIP		0.00	0.00	0.00	0.00	0.00
	Less : Closing Stock of WIP		0.00	0.00	0.00	0.00	0.00
	Add : Opening Stock of Finished Goods		30.85	30.85	30.85	30.85	30.85
	Less : Closing Stock of Finished Goods		30.85	30.85	30.85	30.85	30.85
	Cost of Sales		1144.41	1122.29	1102.82	1085.76	1070.93
G	Gross Profit		1769.95	1792.07	1811.55	1828.60	1843.43
H	Admn. & Marketing Exp.		11.40	11.40	11.40	11.40	11.40
I	Interest Cost		122.61	93.12	63.62	34.13	12.01
	Interest of Term Loan		111.83	82.34	52.84	23.35	1.23
	Interest on Working Capital		10.78	10.78	10.78	10.78	10.78
	Interest on Unsecured Loans		0.00	0.00	0.00	0.00	0.00
J	Other Non Operating Income		0.00	0.00	0.00	0.00	0.00
	Net Profit on Sale of Misc. Stocks /		0.00	0.00	0.00	0.00	0.00
	Interest / Dividend Income		0.00	0.00	0.00	0.00	0.00
	Any Other Income		0.00	0.00	0.00	0.00	0.00
K	Other Non Operating Expenses		46.28	46.28	46.28	46.28	0.00
	Written Off Expenses		46.28	46.28	46.28	46.28	0.00
	Any Other Expenses		0.00	0.00	0.00	0.00	0.00
L	Profit Before Tax		1589.67	1641.28	1690.25	1736.79	1820.02
M	Provision For Taxation (MAT / Regular)		409.34	422.63	435.24	447.22	468.66
N	Profit After Tax		1180.33	1218.65	1255.01	1289.57	1351.37

DSCR Calculation for proposed biogas plant

DSCR Calculation							
Sr.	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
	Sources for pay						
1	Profit After Tax	683.38	932.99	1121.57	1272.33	1322.24	1219.26
2	Depreciation	472.75	451.21	431.74	392.86	357.65	325.76
3	P & P Expenses W/off	46.28	46.28	46.28	46.28	46.28	46.28
4	Interest on Term Loan	493.35	444.86	229.80	200.31	170.82	141.32
5	Capital Subsidy	0.00	1583.00	0.00	0.00	0.00	0.00
A	**Total of sources**	**1695.76**	**3458.33**	**1829.38**	**1911.77**	**1896.98**	**1732.62**
	Obligations to pay						
1	Interest on Term Loan	493.35	444.86	229.80	200.31	170.82	141.32
2	Installment of Term Loan	345.00	2043.00	268.12	268.12	268.12	268.12
B	**Total of obligations**	**838.35**	**2487.86**	**497.92**	**468.43**	**438.94**	**409.44**
C	**DSCR (ANNUAL)**	2.02	1.39	3.67	4.08	4.32	4.23
D	**DSCR (OVERALL)**	**2.92**					

Sr.	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum	12	12	12	12	12
	Sources for pay					
1	Profit After Tax	1180.33	1218.65	1255.01	1289.57	1351.37
2	Depreciation	296.86	270.68	246.93	225.39	205.85
3	P & P Expenses W/off	46.28	46.28	46.28	46.28	0.00
4	Interest on Term Loan	111.83	82.34	52.84	23.35	1.23
5	Capital Subsidy	0.00	0.00	0.00	0.00	0.00
A	**Total of sources**	**1635.30**	**1617.94**	**1601.06**	**1584.59**	**1558.45**
	Obligations to pay			0.00	0.00	
1	Interest on Term Loan	111.83	82.34	52.84	23.35	1.23
2	Installment of Term Loan	268.12	268.12	268.12	268.12	67.03
B	**Total of obligations**	**379.95**	**350.46**	**320.96**	**291.47**	**68.26**
C	**DSCR (ANNUAL)**	4.30	4.62	4.99	5.44	22.83

Sensitivity Analysis for proposed Biogas plant – drop in sale rate by 5%

Sensitivity Analysis (drop in Sale Rate by 5%)							
Sr.	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
	PAT - Actual	683.38	932.99	1121.57	1272.33	1322.24	1219.26
5%	Total Sales	121.41	137.89	138.05	145.64	145.72	145.72
0	RM Cost	0.00	0.00	0.00	0.00	0.00	0.00
1	Profit After Tax	561.97	795.10	983.52	1126.70	1176.52	1073.54
2	Depreciation	472.75	451.21	431.74	392.86	357.65	325.76
3	P & P Expenses	46.28	46.28	46.28	46.28	46.28	46.28
4	Interest on Term Loan	493.35	444.86	229.80	200.31	170.82	141.32
5	Capital Subsidy	0.00	1583.00	0.00	0.00	0.00	0.00
A	Total of Sources	1574.34	3320.44	1691.34	1766.14	1751.26	1586.90
1	Interest on Term Loan	493.35	444.86	229.80	200.31	170.82	141.32
2	Installment of Term Loan	345.00	2043.00	268.12	268.12	268.12	268.12
B	Total of Obligations	838.35	2487.86	497.92	468.43	438.94	409.44
C	DSCR (ANNUAL)	1.88	1.33	3.40	3.77	3.99	3.88
D	DSCR (OVERALL)	2.71					

Sr.	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum	12	12	12	12	12
	PAT - Actual	1180.33	1218.65	1255.01	1289.57	1351.37
5%	Total Sales	145.72	145.72	145.72	145.72	145.72
0	RM Cost	0.00	0.00	0.00	0.00	0.00
1	Profit After Tax	1034.61	1072.93	1109.29	1143.85	1205.65
2	Depreciation	296.86	270.68	246.93	225.39	205.85
3	P & P Expenses	46.28	46.28	46.28	46.28	0.00
4	Interest on Term Loan	111.83	82.34	52.84	23.35	1.23
5	Capital Subsidy	0.00	0.00	0.00	0.00	0.00
A	Total of Sources	1489.58	1472.22	1455.34	1438.87	1412.73
					0.00	0.00
1	Interest on Term Loan	111.83	82.34	52.84	23.35	1.23
2	Installment of Term Loan	268.12	268.12	268.12	268.12	67.03
B	Total of Obligations	379.95	350.46	320.96	291.47	68.26
C	DSCR (ANNUAL)	3.92	4.20	4.53	4.94	20.70

Sensitivity Analysis for proposed Biogas plant – rise in RM Cost by 5%

Sensitivity Analysis (rise in RM Cost by 5%)							
Sr.	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
	PAT - Actual	683.38	795.10	983.52	1126.70	1176.52	1073.54
0%	Total Sales	0.00	0.00	0.00	0.00	0.00	0.00
5%	RM Cost	20.58	23.15	23.15	24.44	24.44	24.44
1	Profit After Tax	662.80	771.95	960.37	1102.26	1152.09	1049.11
2	Depreciation	472.75	451.21	431.74	392.86	357.65	325.76
3	P & P Expenses	46.28	46.28	46.28	46.28	46.28	46.28
4	Interest on Term Loan	493.35	444.86	229.80	200.31	170.82	141.32
5	Capital Subsidy	0.00	1583.00	0.00	0.00	0.00	0.00
A	Total of Sources	1675.18	3297.29	1668.18	1741.70	1726.83	1562.46
1	Interest on Term Loan	493.35	444.86	229.80	200.31	170.82	141.32
2	Installment of Term Loan	345.00	2043.00	268.12	268.12	268.12	268.12
B	Total of Obligations	838.35	2487.86	497.92	468.43	438.94	409.44
C	DSCR (ANNUAL)	2.00	1.33	3.35	3.72	3.93	3.82
D	DSCR (OVERALL)	2.69					

Sr.	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum	12	12	12	12	12
	PAT - Actual	1034.61	1072.93	1109.29	1143.85	1205.65
0%	Total Sales	0.00	0.00	0.00	0.00	0.00
5%	RM Cost	24.44	24.44	24.44	24.44	24.44
1	Profit After Tax	1010.17	1048.50	1084.85	1119.41	1181.21
2	Depreciation	296.86	270.68	246.93	225.39	205.85
3	P & P Expenses	46.28	46.28	46.28	46.28	0.00
4	Interest on Term Loan	111.83	82.34	52.84	23.35	1.23
5	Capital Subsidy	0.00	0.00	0.00	0.00	0.00
A	Total of Sources	1465.14	1447.78	1430.90	1414.43	1388.29
1	Interest on Term Loan	111.83	82.34	52.84	23.35	1.23
2	Installment of Term Loan	268.12	268.12	268.12	268.12	67.03
B	Total of Obligations	379.95	350.46	320.96	291.47	68.26
C	DSCR (ANNUAL)	3.86	4.13	4.46	4.85	20.34

Projected Balance Sheet for 300TPD Biogas Plant

Projected Balance Sheet							
Sr.	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
A	Current Liabilities	2123.00	366.12	366.12	366.12	366.12	366.12
	Short Term Borrowing From Bank	80.00	98.00	98.00	98.00	98.00	98.00
	-- From Applicant Bank	80.00	98.00	98.00	98.00	98.00	98.00
	-- From Other Bank	0.00	0.00	0.00	0.00	0.00	0.00
	Short Term Borrowing From Others	0.00	0.00	0.00	0.00	0.00	0.00
	Trade Creditors	0.00	0.00	0.00	0.00	0.00	0.00
	Advance Deposit from Customers	0.00	0.00	0.00	0.00	0.00	0.00
	Provision for Taxes	0.00	0.00	0.00	0.00	0.00	0.00
	Dividend Payable	0.00	0.00	0.00	0.00	0.00	0.00
	Other Statu.Liability Payable within 1 Year	0.00	0.00	0.00	0.00	0.00	0.00
	Term Loan Installments due within 1 Year	2043.00	268.12	268.12	268.12	268.12	268.12
	Other Current Liabilities	0.00	0.00	0.00	0.00	0.00	0.00
B	Total Term Liabilities	2212.00	1943.88	1675.76	1407.64	1139.52	871.39
	Debentures Not Maturing within One Year	0.00	0.00	0.00	0.00	0.00	0.00
	Pref. Shares Redeemable after One Year	0.00	0.00	0.00	0.00	0.00	0.00
	TL (Excld. Installment due within 1 Year)	2212.00	1943.88	1675.76	1407.64	1139.52	871.39
	Other Term Liabilities	0.00	0.00	0.00	0.00	0.00	0.00
	Trade Deposits (Repayable after 1 Year)	0.00	0.00	0.00	0.00	0.00	0.00
	Deposits from Family Members / Relatives	0.00	0.00	0.00	0.00	0.00	0.00
C	Total Outside Liabilities (A + B)	4335.00	2310.00	2041.88	1773.76	1505.64	1237.52
D	Net Worth	2896.13	5412.12	6533.69	7806.02	9128.27	10347.53
	Promoter Fund / Capital	2212.75	2212.75	2212.75	2212.75	2212.75	2212.75
	General Reserve	0.00	0.00	0.00	0.00	0.00	0.00
	Investment Allowance Reserve	0.00	0.00	0.00	0.00	0.00	0.00
	Capital Subsidy	0.00	1583.00	1583.00	1583.00	1583.00	1583.00
	Any Other Reserve and Surplus	0.00	0.00	0.00	0.00	0.00	0.00
	Other reserves	0.00	0.00	0.00	0.00	0.00	0.00
	Surplus / Deficit from Profit and Loss A/c	683.38	1616.37	2737.94	4010.27	5332.52	6551.78
E	TOTAL LIABILITIES (C + D)	7231.13	7722.12	8575.57	9579.78	10633.90	11585.04

Projected Balance Sheet							
Sr.	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
F	Total Current Assets	987.41	1975.88	3307.34	4750.68	6208.73	7531.91
	Cash and Bank Balance	184.18	196.27	284.67	384.48	431.09	532.36
	Investment	0.00	0.00	0.00	0.00	0.00	0.00
	-- Fixed Deposit with Bank	0.00	0.00	0.00	0.00	0.00	0.00
	-- Any Other type of Investment	0.00	0.00	0.00	0.00	0.00	0.00
	Receivables	104.07	118.19	118.33	124.83	124.90	124.90
	-- Domestic	104.07	118.19	118.33	124.83	124.90	124.90
	-- Export	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	43.62	49.07	49.07	51.80	51.80	51.80
	-- Raw Material	17.64	19.85	19.85	20.95	20.95	20.95
	- Indegeneous	17.64	19.85	19.85	20.95	20.95	20.95
	- Imported	0.00	0.00	0.00	0.00	0.00	0.00
	-- Packing Material	0.00	0.00	0.00	0.00	0.00	0.00
	-- Work in Progress	0.00	0.00	0.00	0.00	0.00	0.00
	-- FG	25.98	29.23	29.23	30.85	30.85	30.85
	-- Consumables and Spares	0.00	0.00	0.00	0.00	0.00	0.00
	Advance to Suppliers of Raw Material	100.00	100.00	100.00	100.00	100.00	100.00
	Advance Payment of Taxes	155.54	212.34	255.27	289.58	300.94	422.84
	Any Other Current Assets	400.00	1300.00	2500.00	3800.00	5200.00	6300.00
G	Fixed Assets						
	Opening Balance	6200.00	6200.00	6200.00	6200.00	6200.00	6200.00
	'(+)/(-): Net Addition / Deduction	0.00	0.00	0.00	0.00	0.00	0.00
	Gross Block at the end of Year	6200.00	6200.00	6200.00	6200.00	6200.00	6200.00
	Depreciation upto the Date	472.75	923.96	1355.70	1748.55	2106.20	2431.96
	Net Block at the End of Year	5727.25	5276.04	4844.30	4451.45	4093.80	3768.04
H	Other Non Current Assets	100.00	100.00	100.00	100.00	100.00	100.00
	Investments which are Non Current Assets	100.00	100.00	100.00	100.00	100.00	100.00
	-- Investment in Sunsidary	0.00	0.00	0.00	0.00	0.00	0.00
	-- Advance to Suppliers / Contractors	100.00	100.00	100.00	100.00	100.00	100.00
	-- Deferred Receivables	0.00	0.00	0.00	0.00	0.00	0.00
	Non Consumable Stores / Spares	0.00	0.00	0.00	0.00	0.00	0.00
	Other Non Current Assets	0.00	0.00	0.00	0.00	0.00	0.00
I	Intangible Assets	416.48	370.20	323.93	277.65	231.38	185.10
	Opening Balance	0.00	416.48	370.20	323.93	277.65	231.38
	Add : Addition during the Year	462.75	0.00	0.00	0.00	0.00	0.00
	Less : Written off during the Year	46.28	46.28	46.28	46.28	46.28	46.28
J	TOTAL ASSETS (F + G + H + I)	7231.13	7722.12	8575.57	9579.78	10633.90	11585.04
		0	0	0	0	0	0

Projected Balance Sheet						
Sr.	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum	12	12	12	12	12
A	Current Liabilities	366.12	366.12	366.12	165.03	98.00
	Short Term Borrowing From Bank	98.00	98.00	98.00	98.00	98.00
	-- From Applicant Bank	98.00	98.00	98.00	98.00	98.00
	-- From Other Bank	0.00	0.00	0.00	0.00	0.00
	Short Term Borrowing From Others	0.00	0.00	0.00	0.00	0.00
	Trade Creditors	0.00	0.00	0.00	0.00	0.00
	Advance Deposit from Customers	0.00	0.00	0.00	0.00	0.00
	Provision for Taxes	0.00	0.00	0.00	0.00	0.00
	Dividend Payable	0.00	0.00	0.00	0.00	0.00
	Other Statu.Liability Payable within 1 Year	0.00	0.00	0.00	0.00	0.00
	Term Loan Installments due within 1 Year	268.12	268.12	268.12	67.03	0.00
	Other Current Liabilities	0.00	0.00	0.00	0.00	0.00
B	Total Term Liabilities	603.27	335.15	67.03	0.00	0.00
	Debentures Not Maturing within One Year	0.00	0.00	0.00	0.00	0.00
	Pref. Shares Redeemable after One Year	0.00	0.00	0.00	0.00	0.00
	TL (Excld. Installment due within 1 Year)	603.27	335.15	67.03	0.00	0.00
	Other Term Liabilities	0.00	0.00	0.00	0.00	0.00
	Trade Deposits (Repayable after 1 Year)	0.00	0.00	0.00	0.00	0.00
	Deposits from Family Members / Relatives	0.00	0.00	0.00	0.00	0.00
C	Total Outside Liabilities (A + B)	969.39	701.27	433.15	165.03	98.00
D	Net Worth	11527.86	12746.51	14001.52	15291.09	16642.46
	Promoter Fund / Capital	2212.75	2212.75	2212.75	2212.75	2212.75
	General Reserve	0.00	0.00	0.00	0.00	0.00
	Investment Allowance Reserve	0.00	0.00	0.00	0.00	0.00
	Capital Subsidy	1583.00	1583.00	1583.00	1583.00	1583.00
	Any Other Reserve and Surplus	0.00	0.00	0.00	0.00	0.00
	Other reserves	0.00	0.00	0.00	0.00	0.00
	Surplus / Deficit from Profit and Loss A/c	7732.11	8950.76	10205.77	11495.34	12846.71
E	TOTAL LIABILITIES (C + D)	12497.25	13447.78	14434.67	15456.12	16740.46

Projected Balance Sheet						
Sr.	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum	12	12	12	12	12
F	Total Current Assets	8787.25	10054.73	11334.83	12627.94	14118.13
	Cash and Bank Balance	601.21	655.40	822.89	904.02	1072.78
	Investment	0.00	0.00	0.00	0.00	0.00
	-- Fixed Deposit with Bank	0.00	0.00	0.00	0.00	0.00
	-- Any Other type of Investment	0.00	0.00	0.00	0.00	0.00
	Receivables	124.90	124.90	124.90	124.90	124.90
	-- Domestic	124.90	124.90	124.90	124.90	124.90
	-- Export	0.00	0.00	0.00	0.00	0.00
	Inventory	51.80	51.80	51.80	51.80	51.80
	-- Raw Material	20.95	20.95	20.95	20.95	20.95
	- Indegeneous	20.95	20.95	20.95	20.95	20.95
	- Imported	0.00	0.00	0.00	0.00	0.00
	-- Packing Material	0.00	0.00	0.00	0.00	0.00
	-- Work in Progress	0.00	0.00	0.00	0.00	0.00
	-- FG	30.85	30.85	30.85	30.85	30.85
	-- Consumables and Spares	0.00	0.00	0.00	0.00	0.00
	Advance to Suppliers of Raw Material	100.00	100.00	100.00	100.00	100.00
	Advance Payment of Taxes	409.34	422.63	435.24	447.22	468.66
	Any Other Current Assets	7500.00	8700.00	9800.00	11000.00	12300.00
G	Fixed Assets					
	Opening Balance	6200.00	6200.00	6200.00	6200.00	6200.00
	'(+)/(-): Net Addition / Deduction	0.00	0.00	0.00	0.00	0.00
	Gross Block at the end of Year	6200.00	6200.00	6200.00	6200.00	6200.00
	Depreciation upto the Date	2728.83	2999.50	3246.43	3471.82	3677.68
	Net Block at the End of Year	3471.17	3200.50	2953.57	2728.18	2522.32
H	Other Non Current Assets	100.00	100.00	100.00	100.00	100.00
	Investments which are Non Current Assets	100.00	100.00	100.00	100.00	100.00
	-- Investment in Sunsidary	0.00	0.00	0.00	0.00	0.00
	-- Advance to Suppliers / Contractors	100.00	100.00	100.00	100.00	100.00
	-- Deferred Receivables	0.00	0.00	0.00	0.00	0.00
	Non Consumable Stores / Spares	0.00	0.00	0.00	0.00	0.00
	Other Non Current Assets	0.00	0.00	0.00	0.00	0.00
I	Intangible Assets	138.83	92.55	46.28	0.00	0.00
	Opening Balance	185.10	138.83	92.55	46.28	0.00
	Add : Addition during the Year	0.00	0.00	0.00	0.00	0.00
	Less : Written off during the Year	46.28	46.28	46.28	46.28	0.00
J	TOTAL ASSETS (F + G + H + I)	12497.25 0	13447.78 0	14434.67 0	15456.12 0	16740.46 0

Important Ratios for proposed Biogas plant

Important RATIOs						
Sr.	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
	PBT (in % to Sales)	32.90%	39.55%	47.49%	51.07%	53.04%	54.35%
	PAT (in % to Sales)	26.80%	32.22%	38.69%	41.60%	43.21%	40.36%
	PBDIT (Rs. Lakh)	1813.82	2052.18	2049.15	2165.86	2162.43	2119.97
	PBDIT (in % to Sales)	71.14%	70.87%	70.68%	70.82%	70.67%	70.17%
	Cash Profit (Rs. Lakh)	1202.41	1430.47	1599.58	1711.47	1726.17	1591.30
	Tangible Net Worth (D - I)	2479.66	5041.92	6209.76	7528.37	8896.89	10162.43
	Net WC (TL instal.due within 1 year as CL)	-1135.59	1609.76	2941.22	4384.56	5842.61	7165.78
	TOL/TNW (Non-Quasi)	1.75	0.46	0.33	0.24	0.17	0.12
	TOL/TNW (Quasi Capital)	1.75	0.46	0.33	0.24	0.17	0.12
	TTL/TNW	0.89	0.39	0.27	0.19	0.13	0.09
	DE Ratio	1.00	0.88	0.76	0.64	0.51	0.39
	Current Ratio (Including TL Due 1 yr as CL)	0.47	5.40	9.03	12.98	16.96	20.57
	Current Ratio (Excluding TL Due 1 yr as CL)	12.34	20.16	33.75	48.48	63.35	76.86
Sr.	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11	
	Months in an annum	12	12	12	12	12	
	PBT (in % to Sales)	54.55%	56.32%	58.00%	59.59%	62.45%	
	PAT (in % to Sales)	40.50%	41.82%	43.06%	44.25%	46.37%	
	PBDIT (Rs. Lakh)	2009.14	2005.07	2000.80	1996.32	2037.88	
	PBDIT (in % to Sales)	68.94%	68.80%	68.65%	68.50%	69.93%	
	Cash Profit (Rs. Lakh)	1523.47	1535.60	1548.21	1561.24	1557.22	
	Tangible Net Worth (D - I)	11389.03	12653.96	13955.25	15291.09	16642.46	
	Net WC (TL instal.due within 1 year as CL)	8421.13	9688.61	10968.71	12462.91	14020.13	
	TOL/TNW (Non-Quasi)	0.09	0.06	0.03	0.01	0.01	
	TOL/TNW (Quasi Capital)	0.09	0.06	0.03	0.01	0.01	
	TTL/TNW	0.05	0.03	0.00	0.00	0.00	
	DE Ratio	0.27	0.15	0.03	0.00	0.00	
	Current Ratio (Including TL Due 1 yr as CL)	24.00	27.46	30.96	76.52	144.06	
	Current Ratio (Excluding TL Due 1 yr as CL)	89.67	102.60	115.66	128.86	144.06	

Projected Cash Flow for proposed Biogas Plant

Projected CASH FLOW							
Sr.	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Months in an annum	12	12	12	12	12	12
A	Sources of Funds						
1	Cash Accruals (PBT + Interest)	1341.07	1600.97	1617.42	1773.00	1804.78	1794.21
	Profit Before Tax	838.92	1145.33	1376.84	1561.91	1623.18	1642.10
	Interest	502.15	455.64	240.58	211.09	181.60	152.10
2	Increase in Share Capital	2212.75	0.00	0.00	0.00	0.00	0.00
3	Depreciation	472.75	451.21	431.74	392.86	357.65	325.76
4	Increase in Long Term Borrowing	2212.00	(268.12)	(268.12)	(268.12)	(268.12)	(268.12)
5	Increase in Bank Borrowings (WC)	80.00	18.00	0.00	0.00	0.00	0.00
6	Increase in Unsecured Loans / Public Deposits	0.00	0.00	0.00	0.00	0.00	0.00
7	Government Subsidy	0.00	1583.00	0.00	0.00	0.00	0.00
8	Increase in Other Term Liabilities	0.00	0.00	0.00	0.00	0.00	0.00
9	Increase in Other Current Liabilities	2043.00	(1774.88)	0.00	0.00	0.00	0.00
	Total Sources (A)	8361.57	1610.18	1781.03	1897.74	1894.30	1851.85
B	Application of Funds						
1	Increase in Preli. & Pre Ope. Exp.	416.48	(46.28)	(46.28)	(46.28)	(46.28)	(46.28)
2	Increase in Capiatl Exenditure / Fixed Assets	6200.00	0.00	0.00	0.00	0.00	0.00
3	Increase in Current Assets						
	Inventories	43.62	5.45	0.00	2.73	0.00	0.00
	Receivables	104.07	14.12	0.14	6.50	0.07	0.00
	Other Current Assets	655.54	956.81	1242.92	1334.31	1411.36	1221.90
4	Interest	502.15	455.64	240.58	211.09	181.60	152.10
5	Taxation	155.54	212.34	255.27	289.58	300.94	422.84
6	Increase in Other Non Current Assets	100.00	0.00	0.00	0.00	0.00	0.00
	Totals Application of Funds (B)	8177.38	1598.09	1692.63	1797.94	1847.69	1750.57
C	Opening Balance of Cash and Bank	0.00	184.18	196.27	284.67	384.48	431.09
D	Net Surplus (A - B)	184.18	12.09	88.40	99.80	46.62	101.27
E	Closing Balance of Cash and Bank (C + D)	184.18	196.27	284.67	384.48	431.09	532.36

Projected CASH FLOW						
Sr.	Particulars	Year 7	Year 8	Year 9	Year 10	Year 11
	Months in an annum	12	12	12	12	12
A	Sources of Funds					
1	Cash Accruals (PBT + Interest)	1712.28	1734.40	1753.87	1770.92	1832.03
	Profit Before Tax	1589.67	1641.28	1690.25	1736.79	1820.02
	Interest	122.61	93.12	63.62	34.13	12.01
2	Increase in Share Capital	0.00	0.00	0.00	0.00	0.00
3	Depreciation	296.86	270.68	246.93	225.39	205.85
4	Increase in Long Term Borrowing	(268.12)	(268.12)	(268.12)	(67.03)	0.00
5	Increase in Bank Borrowings (WC)	0.00	0.00	0.00	0.00	0.00
6	Increase in Unsecured Loans / Public Deposits	0.00	0.00	0.00	0.00	0.00
7	Government Subsidy	0.00	0.00	0.00	0.00	0.00
8	Increase in Other Term Liabilities	0.00	0.00	0.00	0.00	0.00
9	Increase in Other Current Liabilities	0.00	0.00	0.00	(201.09)	(67.03)
	Total Sources (A)	1741.02	1736.95	1732.68	1728.19	1970.85
B	Application of Funds					
1	Increase in Preli. & Pre Ope. Exp.	(46.28)	(46.28)	(46.28)	(46.28)	0.00
2	Increase in Capiatl Exenditure / Fixed Assets	0.00	0.00	0.00	0.00	0.00
3	Increase in Current Assets					
	Inventories	0.00	0.00	0.00	0.00	0.00
	Receivables	0.00	0.00	0.00	0.00	0.00
	Other Current Assets	1186.50	1213.29	1112.61	1211.99	1321.43
4	Interest	122.61	93.12	63.62	34.13	12.01
5	Taxation	409.34	422.63	435.24	447.22	468.66
6	Increase in Other Non Current Assets	0.00	0.00	0.00	0.00	0.00
	Totals Application of Funds (B)	1672.17	1682.76	1565.20	1647.06	1802.09
C	Opening Balance of Cash and Bank	532.36	601.21	655.40	822.89	904.02
D	Net Surplus (A - B)	68.85	54.19	167.48	81.13	168.76
E	Closing Balance of Cash and Bank (C + D)	601.21	655.40	822.89	904.02	1072.78

Calculation of Term Loan Repayment & Working Capital for proposed Biogas Plant

Term Loan Amount	:	**4600.00**	**Rs. Lakh**	**Total Capital Grant Amount**	**1583.00 Rs Lakh**
Rate of Interest	:	**11.00%**			
Construction Period	:	**12 Months**			
IDC Period	:	**15 Months - (12 months Construction Period + 3 months Trial Run Period)**			
Commercial Production Starts on	:	**Year 1**			
Moratorium Period	:	**18 Months - 12 Months Construction Period + 3 monthsTrial Run Period + 3 months**			
Repayment period	:	**120 months**			

Years	Months	Opening Balance	No of Installment	Amount of Installment (Principal)	Closing Balance	Interest Amount	Amount of Installment (Principal and Interest)
Year 1	April	0.00	0	0.00	0.00	0.00	0.00
	May	0.00	0	0.00	0.00	0.00	0.00
	June	0.00	0	0.00	0.00	0.00	0.00
	July	0.00	0	0.00	0.00	0.00	0.00
	August	0.00	0	0.00	0.00	0.00	0.00
	Sept	0.00	0	0.00	0.00	0.00	0.00
	Oct	0.00	0	0.00	0.00	0.00	0.00
	Nov	0.00	0	0.00	0.00	0.00	0.00
	Dec	0.00	0	0.00	0.00	0.00	0.00
	Jan	500.00	0	0.00	500.00	4.58	0.00
	Feb	1000.00	0	0.00	1000.00	9.17	0.00
	March	1500.00	0	0.00	1500.00	13.75	0.00
				0.00		**27.50**	**0.00**
Year 2	April	2000.00	0	0.00	2000.00	18.33	0.00
	May	2400.00	0	0.00	2400.00	22.00	0.00
	June	2800.00	0	0.00	2800.00	25.67	0.00
	July	3200.00	0	0.00	3200.00	29.33	0.00
	August	3600.00	0	0.00	3600.00	33.00	0.00
	Sept	4000.00	0	0.00	4000.00	36.67	0.00
	Oct	4400.00	0	0.00	4400.00	40.33	0.00
	Nov	4500.00	0	0.00	4500.00	41.25	0.00
	Dec	4600.00	0	0.00	4600.00	42.17	0.00
	Jan	4600.00	0	0.00	4600.00	42.17	42.17
	Feb	4600.00	0	0.00	4600.00	42.17	42.17
	March	4600.00	0	0.00	4600.00	42.17	42.17
				0.00	**IDC**	**442.75**	**126.50**
Year 3	April	4600.00	0	0.00	4600.00	42.17	42.17
	May	4600.00	0	0.00	4600.00	42.17	42.17
	June	4600.00	0	0.00	4600.00	42.17	42.17
	July	4600.00	1	38.33	4561.67	42.17	80.50
	August	4561.67	2	38.33	4523.33	41.82	80.15
	Sept	4523.33	3	38.33	4485.00	41.46	79.80
	Oct	4485.00	4	38.33	4446.67	41.11	79.45
	Nov	4446.67	5	38.33	4408.33	40.76	79.09
	Dec	4408.33	6	38.33	4370.00	40.41	78.74
	Jan	4370.00	7	38.33	4331.67	40.06	78.39
	Feb	4331.67	8	38.33	4293.33	39.71	78.04
	March	4293.33	9	38.33	4255.00	39.36	77.69
				345.00		**493.35**	**838.35**

Years	Months	Opening Balance	No of Installment	Amount of Installment (Principal)	Closing Balance	Interest Amount	Amount of Installment (Principal and Interest)
Year 4	April	4255.00	10	38.33	4216.67	39.00	77.34
	May	4216.67	11	38.33	4178.33	38.65	76.99
	June	4178.33	12	38.33	4140.00	38.30	76.63
	July	4140.00	13	38.33	4101.67	37.95	76.28
	August	4101.67	14	38.33	4063.33	37.60	75.93
	Sept	4063.33	15	38.33	4025.00	37.25	75.58
	Oct	4025.00	16	38.33	3986.67	36.90	75.23
	Nov	3986.67	17	38.33	3948.33	36.54	74.88
	Dec	3948.33	18	38.33	3910.00	36.19	74.53
	Jan	3910.00	19	38.33	3871.67	35.84	74.18
	Feb	3871.67	20	38.33	3833.33	35.49	73.82
	March	3833.33	21	1621.33	2212.00	35.14	1656.47
				2043.00		444.86	2487.86
Year 5	April	2212.00	22	22.34	2189.66	20.28	42.62
	May	2189.66	23	22.34	2167.31	20.07	42.42
	June	2167.31	24	22.34	2144.97	19.87	42.21
	July	2144.97	25	22.34	2122.63	19.66	42.01
	August	2122.63	26	22.34	2100.28	19.46	41.80
	Sept	2100.28	27	22.34	2077.94	19.25	41.60
	Oct	2077.94	28	22.34	2055.60	19.05	41.39
	Nov	2055.60	29	22.34	2033.25	18.84	41.19
	Dec	2033.25	30	22.34	2010.91	18.64	40.98
	Jan	2010.91	31	22.34	1988.57	18.43	40.78
	Feb	1988.57	32	22.34	1966.22	18.23	40.57
	March	1966.22	33	22.34	1943.88	18.02	40.37
				268.12		229.80	497.92
Year 6	April	1943.88	34	22.34	1921.54	17.82	40.16
	May	1921.54	35	22.34	1899.19	17.61	39.96
	June	1899.19	36	22.34	1876.85	17.41	39.75
	July	1876.85	37	22.34	1854.51	17.20	39.55
	August	1854.51	38	22.34	1832.16	17.00	39.34
	Sept	1832.16	39	22.34	1809.82	16.79	39.14
	Oct	1809.82	40	22.34	1787.47	16.59	38.93
	Nov	1787.47	41	22.34	1765.13	16.39	38.73
	Dec	1765.13	42	22.34	1742.79	16.18	38.52
	Jan	1742.79	43	22.34	1720.44	15.98	38.32
	Feb	1720.44	44	22.34	1698.10	15.77	38.11
	March	1698.10	45	22.34	1675.76	15.57	37.91
				268.12		200.31	468.43

Years	Months	Opening Balance	No of Installment	Amount of Installment (Principal)	Closing Balance	Interest Amount	Amount of Installment (Principal and Interest)
Year 7	April	1675.76	46	22.34	1653.41	15.36	37.70
	May	1653.41	47	22.34	1631.07	15.16	37.50
	June	1631.07	48	22.34	1608.73	14.95	37.29
	July	1608.73	49	22.34	1586.38	14.75	37.09
	August	1586.38	50	22.34	1564.04	14.54	36.89
	Sept	1564.04	51	22.34	1541.70	14.34	36.68
	Oct	1541.70	52	22.34	1519.35	14.13	36.48
	Nov	1519.35	53	22.34	1497.01	13.93	36.27
	Dec	1497.01	54	22.34	1474.67	13.72	36.07
	Jan	1474.67	55	22.34	1452.32	13.52	35.86
	Feb	1452.32	56	22.34	1429.98	13.31	35.66
	March	1429.98	57	22.34	1407.64	13.11	35.45
				268.12		170.82	438.94
Year 8	April	1407.64	58	22.34	1385.29	12.90	35.25
	May	1385.29	59	22.34	1362.95	12.70	35.04
	June	1362.95	60	22.34	1340.61	12.49	34.84
	July	1340.61	61	22.34	1318.26	12.29	34.63
	August	1318.26	62	22.34	1295.92	12.08	34.43
	Sept	1295.92	63	22.34	1273.58	11.88	34.22
	Oct	1273.58	64	22.34	1251.23	11.67	34.02
	Nov	1251.23	65	22.34	1228.89	11.47	33.81
	Dec	1228.89	66	22.34	1206.55	11.26	33.61
	Jan	1206.55	67	22.34	1184.20	11.06	33.40
	Feb	1184.20	68	22.34	1161.86	10.86	33.20
	March	1161.86	69	22.34	1139.52	10.65	32.99
				268.12		141.32	409.44
Year 9	April	1139.52	70	22.34	1117.17	10.45	32.79
	May	1117.17	71	22.34	1094.83	10.24	32.58
	June	1094.83	72	22.34	1072.48	10.04	32.38
	July	1072.48	73	22.34	1050.14	9.83	32.17
	August	1050.14	74	22.34	1027.80	9.63	31.97
	Sept	1027.80	75	22.34	1005.45	9.42	31.76
	Oct	1005.45	76	22.34	983.11	9.22	31.56
	Nov	983.11	77	22.34	960.77	9.01	31.36
	Dec	960.77	78	22.34	938.42	8.81	31.15
	Jan	938.42	79	22.34	916.08	8.60	30.95
	Feb	916.08	80	22.34	893.74	8.40	30.74
	March	893.74	81	22.34	871.39	8.19	30.54
				268.12		111.83	379.95

Years	Months	Opening Balance	No of Installment	Amount of Installment (Principal)	Closing Balance	Interest Amount	Amount of Installment (Principal and Interest)
Year 10	April	871.39	82	22.34	849.05	7.99	30.33
	May	849.05	83	22.34	826.71	7.78	30.13
	June	826.71	84	22.34	804.36	7.58	29.92
	July	804.36	85	22.34	782.02	7.37	29.72
	August	782.02	86	22.34	759.68	7.17	29.51
	Sept	759.68	87	22.34	737.33	6.96	29.31
	Oct	737.33	88	22.34	714.99	6.76	29.10
	Nov	714.99	89	22.34	692.65	6.55	28.90
	Dec	692.65	90	22.34	670.30	6.35	28.69
	Jan	670.30	91	22.34	647.96	6.14	28.49
	Feb	647.96	92	22.34	625.62	5.94	28.28
	March	625.62	93	22.34	603.27	5.73	28.08
				268.12		82.34	350.46
Year 11	April	603.27	94	22.34	580.93	5.53	27.87
	May	580.93	95	22.34	558.59	5.33	27.67
	June	558.59	96	22.34	536.24	5.12	27.46
	July	536.24	97	22.34	513.90	4.92	27.26
	August	513.90	98	22.34	491.56	4.71	27.05
	Sept	491.56	99	22.34	469.21	4.51	26.85
	Oct	469.21	100	22.34	446.87	4.30	26.64
	Nov	446.87	101	22.34	424.53	4.10	26.44
	Dec	424.53	102	22.34	402.18	3.89	26.23
	Jan	402.18	103	22.34	379.84	3.69	26.03
	Feb	379.84	104	22.34	357.49	3.48	25.83
	March	357.49	105	22.34	335.15	3.28	25.62
				268.12		52.84	320.96
Year 12	April	335.15	106	22.34	312.81	3.07	25.42
	May	312.81	107	22.34	290.46	2.87	25.21
	June	290.46	108	22.34	268.12	2.66	25.01
	July	268.12	109	22.34	245.78	2.46	24.80
	August	245.78	110	22.34	223.43	2.25	24.60
	Sept	223.43	111	22.34	201.09	2.05	24.39
	Oct	201.09	112	22.34	178.75	1.84	24.19
	Nov	178.75	113	22.34	156.40	1.64	23.98
	Dec	156.40	114	22.34	134.06	1.43	23.78
	Jan	134.06	115	22.34	111.72	1.23	23.57
	Feb	111.72	116	22.34	89.37	1.02	23.37
	March	89.37	117	22.34	67.03	0.82	23.16
				268.12		23.35	291.47
Year 13	April	67.03	106	22.34	44.69	0.61	22.96
	May	44.69	107	22.34	22.34	0.41	22.75
	June	22.34	108	22.34	0.00	0.20	22.55
				67.03		1.23	68.26

TL Int. & Repayment Summary	Year 1 & Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
TL Repayment	0.00	345.00	2043.00	268.12	268.12	268.12
Term Loan Interest	0.00	345.00	444.86	229.80	200.31	170.82
Working Capital (CC)	0.00	80.00	98.00	98.00	98.00	98.00
TL Repayment	268.12	268.12	268.12	268.12	268.12	67.03
Term Loan Interest	141.32	111.83	82.34	52.84	23.35	1.23
Working Capital (CC)	98.00	98.00	98.00	98.00	98.00	98.00

Working Capital		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
RM Stock	15 days	17.64	19.85	19.85	20.95	20.95	20.95
FG-Fertilizer	15 days	22.20	24.98	24.98	26.36	26.36	26.36
FG- Slury	15 days	3.78	4.25	4.25	4.49	4.49	4.49
FG-CBG	0 Days	0.00	0.00	0.00	0.00	0.00	0.00
Debtors	15 days	104.07	118.19	118.33	124.83	124.90	124.90
Sub Total		147.69	167.26	167.40	176.63	176.70	176.70
Less : Creditors	15 days	18.40	19.94	19.85	20.99	20.95	20.95
Net CA		129.29	147.32	147.56	155.64	155.75	155.75
WC as per 75% of Net CA	0.75	111.00	125.00	126.00	132.00	133.00	133.00
WC as required		130.00	148.00	148.00	148.00	148.00	148.00
WC (finally from bank)		80.00	98.00	98.00	98.00	98.00	98.00
Margin		50.00	50.00	50.00	50.00	50.00	50.00
CC Interest Rate		11.00%	11.00%	11.00%	11.00%	11.00%	11.00%
CC Interest Rs.		8.80	10.78	10.78	10.78	10.78	10.78

Working Capital		Year 7	Year 8	Year 9	Year 10	Year 11
RM Stock	15 days	20.95	20.95	20.95	20.95	20.95
FG-Fertilizer	15 days	26.36	26.36	26.36	26.36	26.36
FG- Slury	15 days	4.49	4.49	4.49	4.49	4.49
FG-CBG	0 Days	0.00	0.00	0.00	0.00	0.00
Debtors	15 days	124.90	124.90	124.90	124.90	124.90
Sub Total		176.70	176.70	176.70	176.70	176.70
Less : Creditors	15 days	20.95	20.95	20.95	20.95	20.95
Net CA		155.75	155.75	155.75	155.75	155.75
WC as per 75% of Net CA	0.75	133.00	133.00	133.00	133.00	133.00
WC as required		148.00	148.00	148.00	148.00	148.00
WC (finally from bank)		98.00	98.00	98.00	98.00	98.00
Margin		50.00	50.00	50.00	50.00	50.00
CC Interest Rate		11.00%	11.00%	11.00%	11.00%	11.00%
CC Interest Rs.		10.78	10.78	10.78	10.78	10.78

TL Int. & Repayment Summary	Year 1 & Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
TL Opening Balance	0.00	4600.00	4255.00	2212.00	1943.88	1675.76
TL Disbursement	4600.00	0.00	0.00	0.00	0.00	0.00
TL Repayment	0.00	345.00	2043.00	268.12	268.12	268.12
TL Closing Balance	4600.00	4255.00	2212.00	1943.88	1675.76	1407.64
TL Interest (for IDC)	442.75	0.00	0.00	0.00	0.00	0.00
TL Interest (for P&L A/c)	0.00	493.35	444.86	229.80	200.31	170.82
TL Interest (Total)	442.75	493.35	444.86	229.80	200.31	170.82
		4255.00	2212.00	1943.88	1675.76	1407.64

TL Int. & Repayment Summary	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
TL Opening Balance	1407.64	1139.52	871.39	603.27	335.15	67.03
TL Disbursement	0.00	0.00	0.00	0.00	0.00	0.00
TL Repayment	268.12	268.12	268.12	268.12	268.12	67.03
TL Closing Balance	1139.52	871.39	603.27	335.15	67.03	0.00
TL Interest (for IDC)	0.00	0.00	0.00	0.00	0.00	0.00
TL Interest (for P&L A/c)	141.32	111.83	82.34	52.84	23.35	1.23
TL Interest (Total)	141.32	111.83	82.34	52.84	23.35	1.23
	1139.52	871.39	603.27	335.15	67.03	0.00

Calculation of Break-even point for proposed Biogas Plant

Particulars		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Months in an annum		12	12	12	12	12	12
Variable Cost Items							
Raw Material Consumption	100%	411.60	463.05	463.05	488.78	488.78	488.78
Salary & Wages	100%	60.72	63.76	66.94	70.29	73.81	77.50
Power and Fuel Cost	95%	136.80	153.90	153.90	162.45	162.45	162.45
Transportation Cost	100%	56.00	63.00	63.00	66.50	66.50	66.50
Repairs and Maintenance Expenses	80%	19.20	21.60	21.60	22.80	22.80	22.80
Depreciation	0%	0.00	0.00	0.00	0.00	0.00	0.00
Office Administrative Expenses	50%	4.80	5.40	5.40	5.70	5.70	5.70
Interest Cost	0%	0.00	0.00	0.00	0.00	0.00	0.00
Other Non Operating Expenses	0%	0.00	0.00	0.00	0.00	0.00	0.00
Provision For Taxation	100%	155.54	212.34	255.27	289.58	300.94	422.84
Total Variable Cost (VC)		844.66	983.05	1029.16	1106.09	1120.97	1246.56
Fixed Cost Items							
Raw Material Consumption	0%	0.00	0.00	0.00	0.00	0.00	0.00
Salary & Wages	0%	0.00	0.00	0.00	0.00	0.00	0.00
Power and Fuel Cost	5%	7.20	8.10	8.10	8.55	8.55	8.55
Repairs and Maintenance Expenses	20%	4.80	5.40	5.40	5.70	5.70	5.70
Depreciation	100%	472.75	451.21	431.74	392.86	357.65	325.76
Office Administrative Expenses	50%	4.80	5.40	5.40	5.70	5.70	5.70
Interest Cost	100%	502.15	455.64	240.58	211.09	181.60	152.10
Other Non Operating Expenses	100%	46.28	46.28	46.28	46.28	46.28	46.28
Provision For Taxation	0%	0.00	0.00	0.00	0.00	0.00	0.00
Total Fixed Cost (FC)		1037.98	972.02	737.49	670.17	605.47	544.09
	Average						
Sales		2428.22	2757.73	2760.98	2912.74	2914.36	2914.36
Contribution (Sales - VC)		1583.56	1774.68	1731.82	1806.64	1793.39	1667.80
PV Ratio		65.22%	64.35%	62.72%	62.03%	61.54%	57.23%
BEP Sales		1591.62	1510.46	1175.76	1080.47	983.92	950.75
Cash BEP Sales		795.75	737.40	413.68	372.49	327.52	300.65
BEP Sales as % of Total Sales	34.46%	65.55%	54.77%	42.59%	37.09%	33.76%	32.62%
Cash BEP Sales as % of Total Sales	12.23%	32.77%	26.74%	14.98%	12.79%	11.24%	10.32%

Particulars		Year 7	Year 8	Year 9	Year 10	Year 11
Months in an annum		12	12	12	12	12
Variable Cost Items						
Raw Material Consumption	100%	488.78	488.78	488.78	488.78	488.78
Salary & Wages	100%	81.37	85.44	89.71	94.20	98.91
Power and Fuel Cost	95%	162.45	162.45	162.45	162.45	162.45
Transportation Cost	100%	66.50	66.50	66.50	66.50	66.50
Repairs and Maintenance Expenses	80%	22.80	22.80	22.80	22.80	22.80
Depreciation	0%	0.00	0.00	0.00	0.00	0.00
Office Administrative Expenses	50%	5.70	5.70	5.70	5.70	5.70
Interest Cost	0%	0.00	0.00	0.00	0.00	0.00
Other Non Operating Expenses	0%	0.00	0.00	0.00	0.00	0.00
Provision For Taxation	100%	409.34	422.63	435.24	447.22	468.66
Total Variable Cost (VC)		1236.94	1254.29	1271.18	1287.65	1313.79
Fixed Cost Items						
Raw Material Consumption	0%	0.00	0.00	0.00	0.00	0.00
Salary & Wages	0%	0.00	0.00	0.00	0.00	0.00
Power and Fuel Cost	5%	8.55	8.55	8.55	8.55	8.55
Repairs and Maintenance Expenses	20%	5.70	5.70	5.70	5.70	5.70
Depreciation	100%	296.86	270.68	246.93	225.39	205.85
Office Administrative Expenses	50%	5.70	5.70	5.70	5.70	5.70
Interest Cost	100%	122.61	93.12	63.62	34.13	12.01
Other Non Operating Expenses	100%	46.28	46.28	46.28	46.28	0.00
Provision For Taxation	0%	0.00	0.00	0.00	0.00	0.00
Total Fixed Cost (FC)		485.70	430.02	376.78	325.75	237.81
	Average					
Sales		2914.36	2914.36	2914.36	2914.36	2914.36
Contribution (Sales - VC)		1677.43	1660.07	1643.19	1626.72	1600.58
PV Ratio		57.56%	56.96%	56.38%	55.82%	54.92%
BEP Sales		843.85	754.92	668.25	583.60	433.01
Cash BEP Sales		247.68	198.49	148.22	96.89	58.19
BEP Sales as % of Total Sales	34.46%	28.95%	25.90%	22.93%	20.02%	14.86%
Cash BEP Sales as % of Total Sales	12.23%	8.50%	6.81%	5.09%	3.32%	2.00%

Calculation of IRR & Payback for proposed Biogas Project

Calculation of IRR and Payback Period						Rs. in Lakhs
Sr No	Years	Months	Outflow	Inflow	Net Outflow / Inflow	Cumulative Inflow
0	0		6812.75	0.00	-6812.75	-6812.75
1	Year 1	12	0.00	1695.76	1695.76	-5116.99
2	Year 2	12	0.00	3458.33	3458.33	-1658.66
3	Year 3	12	0.00	1829.38	1829.38	170.72
4	Year 4	12	0.00	1911.77	1911.77	2082.50
5	Year 5	12	0.00	1896.98	1896.98	3979.48
6	Year 6	12	0.00	1732.62	1732.62	5712.10
7	Year 7	12	0.00	1635.30	1635.30	7347.40
8	Year 8	12	0.00	1617.94	1617.94	8965.33
9	Year 9	12	0.00	1601.06	1601.06	10566.39
10	Year 10	12	0.00	1584.59	1584.59	12150.98
11	Year 11	12	0.00	1558.45	1558.45	13709.42
IRR (for 10 Years)						27.08%
MIRR (Modified IRR with assumption of 'PV or WACC at 10%						16.60%

Calculation of Pay Back Period			
Year	Cash inflow	Cumulative Cash inflow	Fraction
Year 0	-6,812.75	-6,812.75	-
Year 1	1,695.76	-5,116.99	-
Year 2	3,458.33	-1,658.66	-
Year 3	1,829.38	170.72	0.91
Year 4	1,911.77	2,082.50	0.09
Year 5	1,896.98	3,979.48	1.10
Year 6	1,732.62	5,712.10	2.30
Year 7	1,635.30	7,347.40	3.49
Year 8	1,617.94	8,965.33	4.54
Year 9	1,601.06	10,566.39	5.60
Year 10	1,584.59	12,150.98	6.67
Year 11	1,558.45	13,709.42	7.80
Full Years			2.00
Partial Years			0.91
Pay Back Period (In Years)			2.91

Chapter-7: Sensitivity Analysis

The project is a Renewable Energy Project and is exposed to many risk factors associated with such projects but these can be taken care of by the promoters and a pragmatic risk is sharing in the form of subsidy from MNRE is requested.

Equipment Risk:

The major critical equipment is comprised of the agitators, gas storage, feeder, piping, gas-cleaning and processing unit which will be operating in strong atmosphere and prone to failures All the critical equipment will be designed with chemically resistant metals, procured with adequate performance guarantees / sufficient warranties and installed under the expert supervision.

Construction Risk:

Construction Risk is the major part of the Project which includes civil work of digesters. To minimize the construction risk, the entire work will be monitored and supervised by experts. and, by civil and structure experience Engineers.

Technology Risk:

Project of such Size and Scale has already been executed and are being executed in India by the EPC Contractor. Anaerobic Digestion technology, which this project utilizes, has been used widely in India, Europe and around the world for many years

The design and cost of the project may change slightly at the time of preparing final DPR/implementation stage for adopting latest technology and on issue of firm orders

Chapter-8: Statutory Compliances

List of Consents / Approvals / Statutory Compliances etc., applicable for installation, commissioning, and operation of the proposed CBG plant are as follows:

- NOC from Gram Panchayat/Village Sarpanch
- Approval from Department of Local Government for
  (a) Change of Land Use
  (b) Building Plan Approval
  (c) Water Connection
  (d) Sewer Connection

- Approval from State Pollution Control Board for
  (a) Consent to Establish
  (b) Consent to Operate

- Approval from Petroleum and Explosives Safety Organization (PESO)
- HT /LT Supply approval from State power Corporation/ Board/ Company
- Provisional Fire Safety Certificate from Department of Fire Services
- Final Fire Safety Certificate from Department of Fire Services

Chapter-9: Other Intangible Benefits

9.1 Direct Benefits from the project

Apart from getting sales realized value of CBG and Bio fertilizer and carbon credits etc., following are the direct benefits which will be realized from the project.

9.1.1 Central Finance Assistance (CFA) under waste to energy programme on Energy from Urban, Industrial, Agricultural Wastes/ Residues and Municipal Solid Waste

9.1.1.1 Standard CFA pattern: Standard pattern of CFA for grant of 'In-principal Approval' to Waste to Energy projects under the programme is as follows:

S.No.	Type of project	Standard CFA rate @ installed capacity of the plant
1	Biogas	Rs 0.25 Cr per 12000 cum/day (maximum CFA of Rs. 5.0 Cr/project)
2	Bio CNG / Enriched Biogas/ Compressed Bio Gas	-Rs 4.0 Cr per 4800 kg/day (for Bio CNG generation from new biogas plant) -Rs 3.0 Cr per 4800 kg/day (for Bio CNG generation from existing Biogas plant#) -Maximum CFA of Rs. 10.0 Cr/project for both cases.
3	Power (based on Biogas)	-Rs 0.75 Cr/MW (for power generation from new biogas plant) -Rs 0.5 Cr /MW (for power generation from existing Biogas plant#) -Maximum CFA of Rs. 5.0 Cr/project for both cases.

#Note: In case Developer is setting up a new BioCNG/ Power plant based on Biogas already available or generated from already commissioned/operational/existing biogas plant or have already availed financial assistance from Government of India for Biogas plant, then CFA will be provided only for conversion of biogas to BioCNG (@Rs 3.0 Cr per 4800 kg/day) or biogas to power (Rs 0.5 Cr /MW), as mentioned in the table above.

9.1.1.2 Special CFA pattern:

i) Special Category States: In case the Waste to Energy plants is set up in Special Category States (NE Region, Sikkim, Himachal Pradesh, and Uttarakhand), Jammu & Kashmir, Ladakh, Lakshadweep and Andaman & Nicobar Islands, the eligible CFA would be 20% higher than Standard CFA pattern given in para 9.1.1.1 above.

ii) Biomethanation plants set up in registered Gaushala/Shelter: Biogas/Bio CNG/Power (biogas based) generation plants based on cattle dung as main feedstock set up by Gaushalas independently or through joint ventures/partnerships will be eligible for 20% higher CFA than

Standard CFA pattern given in para 9.1.1.1 above. These Gaushalas (Shelters) should be registered with the respective State Government.

9.1.2 Terms & Conditions

i) Developers shall share plant generation data with MNRE or any other agency designated by MNRE, except in the case of Biomass Gasifiers, through installation of SCADA System/remote monitoring system. (This is applicable for project proposals submitted after notification of this guideline).

ii) Expansion of Plants: Grant of CFA to plants which intend to add capacity to the existing plants shall also be considered. CFA for such plants will be considered only for the enhanced capacity by way of installation of new plant and machinery. Applications received for expansion projects will be processed as per guidelines existing at the time of submission of the application for expansion.

iii) Central financial assistance from any other Central Govt. Ministry should not be claimed for proposed plant for which application has been submitted to this Ministry.

iv) Waste to Energy (WtE) plants based on waste heat, waste plastics, waste tires or such other polymer waste shall not be eligible for CFA.

v) Biogas plants of size up to 250 kW capacity for power generation and up to 2500 m3/day for Biogas generation capacity are covered under Biogas Programme and shall not be eligible under this programme.

vi) Plants installed with new equipment/machinery only shall be eligible for CFA under this programme.

vii) Municipal Solid Waste (MSW)/Refused Derived Fuel (RDF) to power projects based thermal technologies (Incineration, Gasification, Pyrolysis etc.) are not supported under the Waste to Energy programme.

9.1.3 Procedure for Availing CFA

Submission of proposal:

i) The proposal for grant of "In-Principle" approval of CFA will be accepted through Bio URJA Portal (https://biourja.mnre.gov.in) before commissioning of the proposed plant [except for the projects mentioned in clause 9.1.3.1(iii)]. The last date for submitting the applications under these guidelines shall be 31.12.2025.

ii) Proposals submitted to the Ministry on or before 31.03.2021 under Waste to Energy Programme (notified vide letter no. 22/222/2016-17-WTE dated 30.07.2018 & 28.02.2020) but 'In principle' approvals could not be accorded thereafter as the programme was continued only for clearing committed liabilities: 'In-principle' approvals and subsequent release of CFA to such proposals, except Municipal Solid Waste (MSW)/Refused Derived Fuel (RDF) to power projects based thermal technologies, shall be governed by the relevant guidelines prevailing at the time of the receipt of the concerned proposals.

iii) Proposals received in the Ministry from 01.04.2021 till the issuance of these guidelines for Waste to Energy Programme: Eligible proposals falling under this category shall be governed by these guidelines. Waste to Energy projects which have been commissioned during afore mentioned period, shall also be considered as eligible for grant of CFA under this programme. The applications of such projects should be submitted within three months of date of notification of these guidelines.

iv) Incomplete proposal in any form and without requisite approvals/documents will be rejected. The rejection of the proposal will be intimated preferably within 60 days of submission of the proposal in the Bio URJA Portal. However, fresh proposal doing away with all shortcomings may be resubmitted before commissioning of the plant or 31.12.2025 whichever is earlier.

9.1.4 "In-Principle" Approval:

i) For projects with debt/loans from FIs/Banks: In case loan drawn by the developer of Waste to Energy plant is equal or more than from eligible CFA, the Implementation Agency shall receive the applications through Bio URJA portal, examine the applications and shall forward the

consolidated proposal to Ministry on bimonthly basis. The Ministry shall issue an "In-Principle" approval with the concurrence of IFD and approval of Secretary, MNRE. For projects with loan, Ministry/ implementing agency will go by the appraisal of the project by the lending bank/FI.

ii) For projects without debt/loan or projects wherein loan drawn by the developer of Waste to Energy plant is less than the eligible CFA, the Implementation Agency shall receive the applications through Bio URJA portal, examine the applications and thereafter the applications will be put up to Project Appraisal Committee (PAC). Only PAC recommended applications will be forwarded to Ministry in a consolidated manner on bimonthly basis. The Ministry shall issue an "In-Principle" approval with the concurrence of IFD and approval of Secretary, MNRE.

iii) The "In-Principle" approval will preferably be accorded to the proposals forwarded by IREDA preferably within 40 days of forwarding the proposal to Ministry.

9.1.5 Commissioning of the plant:

i) The time period for commissioning is 24 months for WTE plants and 12 months for Biomass Gasifiers from the date of "In-Principle" approval.

ii) After submission of application in the Bio URJA portal, if developers intend to commission the plant before "In-Principle" approval of CFA is accorded, prior intimation of commissioning the plant to IA is mandatory. However, accord of "In-Principle" approval for grant of CFA shall be subject to fulfilment of the eligibility conditions as mentioned in these guidelines.

iii) In case of delay for reasons not attributable to the developer, a suitable extension of time over the original period of commissioning may be granted by Secretary, MNRE provided an application is made by the developer, with supporting documents, 30 days before the original date of commissioning. If no such application is received by Implementing Agency and commissioning does not happen within the stipulated period (including the extended period), the "In-Principle" approval of CFA shall be treated as cancelled and no CFA shall be released.

9.1.6 Plant performance:

i) Inspection team will visit the plant for performance inspection based on request from the developer. The performance inspection of the plant will have to be carried out within 18 months

from the date of commissioning beyond which "In-Principle" approval will be cancelled except in those cases where reason(s) of delay in inspection is (are) beyond the control of Developer. For such cases, an extension of suitable period over the original performance inspection period can be granted by Secretary, MNRE provided an application is made by the developer, with supporting documents, before the completion of original inspection period of 18 months as given above.

ii) The developer may choose any one of the following agencies for inspection of the plant: - (a) Concerned State Nodal Agencies for Renewable Energy (SNAs); or (b) Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE); or (c) Biogas Technology Development Centre (BTDC).

iii) Performance testing of the plant would inter-alia imply the following: -

a) **Waste to Energy Plants:** The condition of successful commissioning of the Waste to Energy plants would imply operation of the plants for at least 3 consecutive months, including continuous operation for at least 72 hours at an average of 80% of the rated capacity of the plant. In case of biomethanation plants (Biogas, Bio CNG, Power based on biogas), continuous operation of the plant implies continuous operation of digester (raw biogas generation) for 72 hours. Based on the performance of the project for at least three consecutive months, following graded structure for release of CFA based on average PLF over a period of at least three months shall be applicable: -

Average PLF achieved during minimum 3 consecutive months	% of eligible CFA
≥80%	100
≥ 60% and < 80%	80
≥ 50% and < 60%	60
<50%	0

9.1.7 Disbursement of CFA

9.1.7.1 Disbursement after plant commissioning (Standard process): Applicable for all types of projects except Bio CNG plants under SATAT Initiative.

a) In case of Self-financed Projects or projects wherein loan drawn by the developer of Waste to Energy plant is less than the eligible CFA, the CFA shall be disbursed to

developer's bank account.

b) Bank financed: In case loan drawn by the developer of Waste to Energy plant is equal or more than from eligible CFA, CFA shall be disbursed to developer's loan account maintained in the lending FI/bank.

9.1.7.2 Advance disbursement during Construction Phase: Bio CNG plants which have signed Bio CNG (CBG) purchase agreement with Government Oil Marketing Companies (OMCs) under SATAT Programme of Ministry of Petroleum & Natural Gas and have also availed project loan of at least 50% of the total project cost from FI(s)/Bank(s) shall be eligible for advance disbursement of CFA during construction phase. The CFA will be released by the Ministry in two installments as below:

a) First installment of up to 50% of "In-Principle" approved CFA may be released during the construction phase to the lending FI(s)/Bank(s) subject to disbursement of at least 50% of loan amount by the FI/Bank. This may be treated as interest free loan until the release of second instalment of CFA. Documents required for availing advance disbursement of CFA during construction phase is given as below:

1) MNRE's "In-Principle" Approval letter.
2) Request letter for advance disbursement of CFA from lending Bank/FI.#
3) Loan disbursement letter indicating loan amount disbursed by lending bank/FI.
4) Furnishing of Bank Guarantee to the IA for an amount equal to the advance CFA for which the project is eligible. The bank guarantee should initially be valid for a period of four years from the date issue. Thereafter the project developer will have to extend the validity of the bank guarantee as required by the IA so as to cover the period permissible for successful performance testing, commissioning and release of CFA. The bank guarantee will be enchased if the project developer fails to adhere to the permissible timelines for successful commissioning & performance testing or submission of documents for release of CFA. The bank guarantee will be released along with the disbursement of CFA. #
5) Mandate form for payment transfer duly certified by FI/Bank for loan account.#
6) High resolution Photographs of the plant site showing progress of installation.
7) Consent to Establish (CTE) from State Pollution Control Board for the plant.
8) EIA clearance, if applicable.
9) Approval for storage & filling of Bio-CNG Plant from Petroleum and Explosives Safety Organization (PESO), Nagpur, if applicable.
10) Non-NPA certificate from the lending banks/FIs if loan availed.#
#Documents (marked with #) are also required to be submitted in original to Implementing Agency.

(b) Second instalment of balance CFA shall be released after commissioning of the plant and submission of documents. Second installment will be settled as per standard process described under clause 4.3 to 4.6(i). The amount disbursed during construction phase will be adjusted during disbursement of second installment and any surplus amount in

lieu of under performance of the projects that could have been disbursed to developer shall be recovered from the Bank/FI.

9.1.7.3 The service charge to implementing agencies and inspection agencies shall be released at the time of release of CFA after commissioning and performance testing of the plant.

9.1.7.4 The above disbursements of CFA to eligible projects will be done by MNRE/Implementing Agency in accordance with procedure specified for release of funds by Ministry of Finance.

9.1.7.5 Project Monitoring Mechanism

Developers shall share plant generation data with MNRE or any other designated agency, except in the case of Biomass Gasifiers, through installation of SCADA System/remote monitoring system.

9.1.8 Other Direct Benefits

Other direct benefits from the plant can be as follows: -

- No fee charged for change of land Permission
- Permission for auto refilling station
- Custom duty concession
- Electricity duty exempted
- No royalty on water used for power generation
- Sale of Carbon Credits

9.2. Economic / Social / Environmental Benefits from the project

9.2.1 Reduction in dependence on energy imports and improved energy security

The potentially substantial production of Bio CNG contributes to natural gas supply which currently relies substantially on imports. The project would help to diversify sources of gas supply in the country thus improving energy security and helping in shielding against possible price instability or volatility in international energy markets.

9.2.2 Improved Nitrogen availability

Digestion of paddy straw and other organic materials typically increases availability of the

nitrogen in the slurry. It improves the value of the material as a fertilizer. This increases the availability of bio-fertilizer which can be beneficial particularly in organic farming where inorganic fertilizers are not used.

9.2.3 Reduction in soil and water pollution and better waste management

The project will be benefitting the society by reducing soil and water pollution through better waste management. The project will provide opportunity to divert organic wastes away from traditional management methods, such as landfill and composting, and improve the management of slurries. It can also reduce odour from slurry spreading as the concentration of odour in the air is significantly lower when digested, instead of untreated slurry.

9.2.4 Reduction in carbon emissions and pollution

CBG plants create a socio-environmental impact by reducing carbon footprint, conserving fossil fuels, and providing a sustainable business opportunity. Biogas is a renewable, as well as a clean, source of energy. Gas generated through bio digestion is non-polluting. It reduces greenhouse emissions. No combustion takes place in the process, meaning there is zero emission of greenhouse gasses to the atmosphere; therefore, using gas from waste as a form of energy is actually a great way to combat global warming. Biogas plants significantly curb the greenhouse effect by lowering methane emissions by capturing this harmful gas and using it as fuel. So the plant will support to national commitments in achieving climate change goals

9.2.5 Boost to entrepreneurship, rural economy, and employment

The project will boost the entrepreneurship as certain subsidiary activities like aggregator, balers will be performed by local level entrepreneurs and farmers. The project will boost rural economy of the country and will also be helpful in generation of direct and indirect employment in the region

9.2.6 Supports National Policy on Biofuels – 2018

The project supports National Policy on Biofuels – 2018 introduced by Ministry of Petroleum and Natural Gas to promote clean energy through advance bio-fuels including CBG in the country. Government of India has not only made certain provisions but also provided 'Viability Gap Funding' (VGF) and other incentives to further promote the sector,

9.2.7 Supports Sustainable Alternative Towards Affordable Transportation (SATAT) Programme of Government of India

The project also supports Sustainable Alternative Towards Affordable Transportation (SATAT) Programme of Government of India. Ministry of petroleum and Natural Gas and Ministry of Skill Development and Entrepreneurship introduced SATAT program in October 2018 which aimed at providing a developmental effort that would benefit vehicle users as well as farmers and entrepreneurs. The programme aims to establish 5,000 CBG plants in the country in a phased manner, with 250 plants by 2020, 1,000 plants by 2022 and 5,000 plants by 2025. These plants are expected to produce 15 MMT of CBG per annum, which is about 40% of the CNG consumption of 44 MMT per annum in India as of Sep 2018. This will attract investment to the tune of INR 1.7 lakh crore and expected to generate direct employment or 75,000 people and produce 50 MMT of bio-manure for crops.

9.2.8 Supports Swachh Bharat Mission (SBM) of Government of India

The project also supports Swachh Bharat Mission (SBM) of Government of India and is in line with nation's mission of clean India. SBM was launched in 2014, with the aim of increasing cleanliness in urban and rural areas of India. One of the primary objectives of the mission is to improve solid and liquid waste management in both rural and urban areas and the introduction of modern and scientific methods for MSW management SBM has led to a pragmatic shift in the MSW management landscape of India. Under this mission, greater emphasis is given to the collection, segregation, and safe disposal of household garbage. SBM has led to a pragmatic shift in the MSW management landscape of India. Under this mission, greater emphasis is given to the collection, segregation, and safe disposal of household garbage.

9.2.9 Supports Smart City Mission of Government of India.

The Project also supports smart city mission launched by government of India through tackling the twin problems of scientific waste management and availability of cleaner fuel in the gas network in these Smart Cities, for transport, domestic and commercial purposes. Smart Cities Mission of Government of India has proposed the integration of 60 out of the 100 selected cities into the CGD network.

Chapter-10: Recommendations & Conclusions

Keeping in view supply of raw material, demand of the CBG in the country, financial parameters & viability, it is **highly recommended** to set up the 10.00 TPD CBG plant as raw material is sufficiently available. A conservative estimate of CBG price has been taken in to consideration for calculation of the financial viability, which means, the estimates are more positive than the mentioned above. So, it is **strongly recommended** for installation of 10.00 TPD CBG plant.

The following other strategies are also recommended with respect to project: -

Strategy for Technology augmentation / efficiency improvement in future

Improving the technology efficiency is a main factor to improve the sustainability of the plant with more likely competition of biomass considering the stringent rules and demand and supply factors. From biomass collection to product CBG & organic manure, latest technology needs to be updated to de-risk the input cost and other market conditions.

Strategy for Manpower management

a) As latest biogas technology is automated to maximum extent, minimal human intervention is needed during different process. Minimum no of manpower should be hired on roll and other task /activities can be outsourced form external agencies.
b) Technicians can be hired from local ITI and polytechnic colleges as well as similar industries.
c) One week induction training should be arranged for all technical staff and skilled labour. They may be arranged plant visit to similar plant
d) Labour can also be hired on piece rate system instead of wage rate system, if possible
e) Biomass should be acquired from Biomass aggregator. The company should make agreement with them for supply of fixed quantity during the season. The company should not involve in hiring the aggregators.

Strategy for CBG Marketing

a) The presence of outlets of oil & gas marketing company's outlets in and around should be used for selling CBG. The best option is selling CBG at retail outlets of oil & gas

marketing companies. Separate CBG booths at the retail outlets will cater not only to the domestic customers but also to the industrial customers.

b) The biogas plant can plan to integrate compressed biogas supply with city gas distribution networks to boost supplies to domestic and retail users in existing and upcoming markets. They should tie up for the supply of CBG with the companies which have been authorized by Petroleum and natural gas regulatory board for establishment of CNG stations and distribution of PNG connections in the region.
c) The plant should tie-up with Industries for usage of CBG, which will boost the sales for usage of CBG in boilers as clean fuel rather than the fossil fuels.
d) The Plant should spread awareness among households, commercial establishments, and vehicle owners about direct & indirect benefits of using CBG/ BioCNG.

Based on the above description it is obvious that the proposed project is environment friendly, beneficial to society/nation and viable. Considering its wider ramification in the national context, it is always desirable to have many more such plants in future for the sake of India's energy security and emission reduction.

The promoters are keen for such environmentally benign technology having firm belief that such projects are going to be commercial venture in near future on expansion of market.

The project needs support from the Government and its agencies to achieve the national objectives as per "Swachh Bharat Mission".

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