ZERO WASTE DISCHARGE AND SUSTAINABLE DESIGN FOR HOTEL INDUSTRY

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Abstract- Currently the hotel industry is one of the largest waste producers and energy consumers throughout the world. Hotel industry if designed and well maintained can be self-sustainable. Energy consumption in hotel industry which is at a large scale comes from non-renewable sources of energy, which can be shifted to renewable sources of energy. Waste management in hotel industry can be of great advantage to achieve self-sustainability. Zero Waste is a philosophy that encourages the redesign of resource life cycles so that all products are reused. In this project we select Sairam Mahableshwar site to achieve all methodology. In this project author achieve to carry out Energy audit of hotel Sairam, Mahableshwar, to analyse and suggest improvements using renewable energy sources for Hotel Sairam, to analyse the Chemical and biological characteristics of discharge of hotel industry, to implement changes in waste management practices according to nature of waste & environmental conditions., To create a Zero waste discharge model for Sairam hotel campus, to analyse the negative impacts of hotel industry on environment. Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health. In zero waste concept we work on different mechanism like production of Bio Gas from hotel kitchen waste, sewage water treatment plan from kitchen waste water, Vermicomposting from hotel waste, wind energy from hotel waste, activated sludge from hotel waste, Photovoltaic cell energy from hotel waste.

Keyword: Kitchen Waste, Vermicomposting, Sewage Water, Bio Gas, Photovoltaic Cell, Zero Waste.

1. INTERODUCTION

Due to scarcity of petroleum and coal it threatens supply of fuel throughout the world also problem of their combustion lads to research in different corners to get access the new sources of energy, like renewable energy resources. Solar energy, wind energy, different thermal and hydro sources of energy, biogas are all renewable energy resources. But, biogas is distinct from other renewable energies because of its characteristics of using, controlling and collecting organic wastes and at the same time producing fertilizer and water for use in agricultural irrigation. Biogas does not have any geographical limitations nor does it require advanced technology for producing energy, also it is very simple to use and apply. Kitchen waste is organic material having the high calorific value and nutritive value to microbes, that's why efficiency of methane production can be increased by several orders of magnitude as said earlier.

1.1 BIO-GAS

BIOGAS is produced by bacteria through the bio-degradation of organic material under anaerobic conditions. Natural generation of biogas is an important part of bio-geochemical carbon cycle. It can be used both in rural and urban areas.

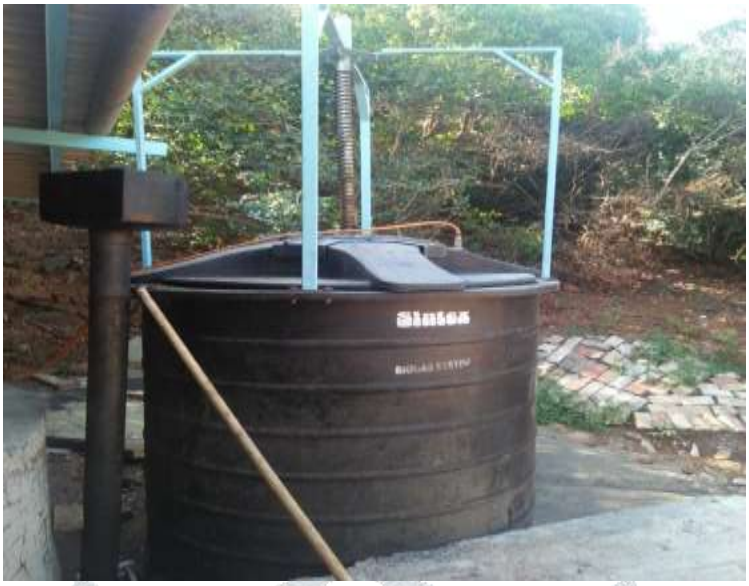

Figure1. Bio Gas Plant at Sairam Mahableshwar

Table1. Composite 567890=-n of biogas.

Component	**Concentration (by volume)**
Methane (CH4)	55-60 %
Carbon dioxide (CO2)	35-40 %
Water (H2O)	2-7 %
Hydrogen sulphide (H2S)	20-20,000 ppm (2%)
Ammonia (NH3)	0-0.05 %
Nitrogen (N)	0-2 %
Oxygen (O2)	0-2 %
Hydrogen (H)	0-1 %

1.1 VERMI COMPOSTING

Earthworms are one of the most important organisms among soil invertebrates owing to their beneficial effects on soil environment such as modification of soil physical properties and impact on decomposition of soil organic matter. They depend on soil for all of their activities hence they are called gabions. Earthworms are also known as rain worms, as they are seen in large numbers during rains, manure worms, as some varieties flourish well in manures. Earthworms play a significant eco-functional role in soil ecosystem by affecting physical, chemical and biological properties of the soil. Earthworms have dynamic potentials and can do wonderful jobs for man and biosphere. Vermicasting, also called vermicomposting, is the processing of organic wastes through earthworms. It is a natural, odorless, aerobic process, much different from traditional composting. Earthworms ingest waste then excrete casts – dark, odorless, nutrient- and organically rich, soil mud granules that make an excellent soil conditioner. Earthworm casts are a ready-to-use fertilizer that can be used at a higher rate of application than compost, since nutrients are released at rates that growing plants prefer. Vermicomposting used in potting soil mixes for **Sairam Mahableshwar** and as a top dressing for lawns. Vermicomposting also makes an excellent mulch and soil conditioner for home garden. Table 1 shows the chemical characteristic comparison between garden compost and vermicomposting.

Table3: Chemical characteristic of garden compost and vermicomposting

Parameter*	Garden compost	Vermicomposting
pH	7.80	6.80
EC (mmhos/cm)**	3.60	11.70
Total Kjeldahl nitrogen (%)***	0.80	1.94
Nitrate nitrogen (ppm)****	156.50	902.20
Phosphorus (%)	0.35	0.47
Potassium (%)	0.48	0.70
Calcium (%)	2.27	4.40
Sodium (%)	<.01	0.02
Magnesium (%)	0.57	0.46
Iron (ppm)	11690.00	7563.00
Zinc (ppm)	128.00	278.00
Manganese (ppm)	414.00	475.00
Copper (ppm)	17.00	27.00
Boron (ppm)	25.00	34.00
Aluminium (ppm)	7380.00	7012.00

Figure 2: Vermi Composting

1.3 PHOTOVOLTAIC CELLS

Power supply from the national grid is inefficient and unreliable, hence the need to provide alternative source of power, Electrical power supply from renewable sources is advantageous as the increasing Electrical demand is a scientific contribution to the peak demand on the grid. As individuals and companies generate their power through renewable energy, the stress on the grid is reduced. However, there is an ongoing interest in the possibility of making wider use of renewable energy, particularly in homes, offices and industries, for the purpose of lighting, heating and powering of appliances. In most rural and sub-urban regions in Nigeria, inhabitants do not have access to electricity supply. Where the Electrical energy is available, it is not reliable; hence inhabitants resort to other forms of energy such as wood, paraffin, and diesel generators, which pollute the environment and cause harm to man and plants.

Figure 3. Photovoltaic (Solar) Cells

India is endowed with abundant renewable energy resources, like biomass, wind, small and large scale hydro with potential for hydrogen fuel, geothermal and ocean energies. Except for the large scale hydropower generating station which serves as a major source of electricity, the current state of exploitation and utilization of renewable energy resources in the country is very low. The main constraint in the rapid development and diffusion of technology for the exploitation and utilization of renewable energy resources in the country is the absence of appropriate policy, regulatory and institutional framework to stimulate demand and attract investors. The comparative low quality of the systems developed and the high initial upfront also constitute barriers to the development of these systems.

1.4 WASTE WATER TREATMENT (SEWAGE)

Wastewater is water whose physical, chemical or biological properties have been changed as a result of the introduction of certain substances which render it unsafe for some purposes such as drinking. The day to day activities of man is mainly water dependent and therefore discharge 'waste' into water. Some of the substances include body wastes (faces and urine), hair shampoo, hair, food scraps, fat, laundry powder, fabric conditioners, toilet paper, chemicals, detergent, household cleaners, dirt, micro-organisms (germs) which can make people ill and damage the environment. It is known that much of water supplied ends up as wastewater which makes its treatment very important. Wastewater treatment is the process and technology that is used to remove most of the contaminants that are found in wastewater to ensure a sound environment and good public health. Wastewater Management therefore means handling wastewater to protect the environment to ensure public health, economic, social and political soundness.

1.5 WIND TURBINE ENERGY

The non-renewable fossil fuel is the primary source of energy relied by the hoteliers in India. This resource supplies electrical energy for most of the activities performed in hotels. The electricity is substantially used in hotel industry for providing a variety of facilities and services to meet the diverse requirements of customers. Significant amount of energy is consumed by catering; heating, ventilation and air conditioning (HVAC); housekeeping; lighting system; and office equipment (Hotel Energy Solutions, 2011, p.4). The cost of hotel operation is becoming high since there is an increased demand for electricity to provide modern guest comforts and services. The energy management in hotels is the practice of controlling the consumption of electricity required for the delivery of products and services to customers. The power utilization can be lowered by adapting strategies such as change of organizational practice with low or no cost; implementation of energy efficient technologies that require capital investment; and encouraging guest to consume low power in all their activities in hotel building towards supporting the efforts of hotel in minimizing their GHG emissions (**Sairam Mahableshwar**). The energy efficiency is able to elevate the level of service of the hotel by lowering its energy consumption and cost of operation. Small wind energy systems are based

on a rotor, a generator or alternator mounted on a frame, a tail (usually), a tower, wiring, and the electrical components: controllers, inverters, and/or batteries.

Figure 4.Wind Turbine Energy

A small wind electric system will work for you if:

- The hotel property has a good wind resource
- No large obstacles like buildings, trees or hills are near your hotel
- There is enough space
- The local zoning codes or covenants allow wind turbines
- Your hotel is comfortable with long-term investments

Renewable energy technology has a lower environmental impact than traditional energy sources. The renewable energy generation systems such as solar, wind, and hydropower can be installed to generate electricity at hotel buildings. This green and sustainable power reduces the energy bills and greenhouse gas emissions of the hotels. The solar photovoltaic (PV) panels generate clean electricity from the sunlight. This electricity is used up by the hotel electricity network through the electricity meter. The cost of a solar PV system varies depending on size, type of panels, installation type and equipment used.

1.6 OBJECTIVES

1. To carry out Energy audit of hotel Sairam, Mahableshwar
2. To analyse and suggest improvements using renewable energy sources for Hotel Sairam.
3. To analyse the Chemical and biological characteristics of discharge of hotel industry
4. To implement changes in waste management practices according to nature of waste & environmental conditions.
5. To create a Zero waste discharge model for Sairam hotel campus.
6. To analyse the negative impacts of hotel industry on environment.

2. LITERATURE SURVEY

Ankusha R. Gedekar et al. The tractor plant under study has been operational in the industrial area near Nagpur for the past three decades. Besides installation of production units this multinational unit has taken precaution to provide a well-designed industrial wastewater treatment plant (ETP). In addition to this ETP, this unit has provided a separate sewage treatment plant (STP). This study has been undertaken to assess the performance efficiency of a Sewage Treatment Plant (STP) of a Tractor making company located at MIDC, Hingna, Nagpur (Maharashtra).

B. Ahansazan et al. The Activated Sludge (AS) process was expanded as an intermittent to biological filters, and is particularly beneficial for large populations where land is at a premium.

More recent research however, has shown that the process can be acted in many different modes, manufacturing it a more flexible process than biological filtration. The number of waste water treatment plants has been maturing, and technical complexity has also been growing. In order to hold the connected rising costs of capital expenditure and operation within bounds, sagacious process technology solutions have to be found.

Dr. AksheyBhargava et al. Activated sludge is a sludge particles reduced in wastewater by the growth of organisms in aeration tanks. The term 'activated' comes from the fact that the particles teem with bacteria, fungi, and protozoa and is different from primary sludge in the sense that the sludge particles contain many living organisms that can feed on the incoming wastewater. Described simply, screened wastewater is mixed with varying amounts of recycled liquid containing a high proportion of organisms taken from a secondary clarifying tank, and it becomes a product called mixed liquor. It is to everyone's advantage for a community to be able to treat its wastewater in the most economical way.

Kinjal Patel et al. Fossil fuel are major source of fuel in world around which is in reduction stage now. Thus universe has moved toward renewable source of fuel and energy. Fossil fuel on burning emits out green gases and other air dispersible pollutants. If it can be utilized for better purposes it can reduce load to municipal solid waste management. This waste being organic in nature can be used for biogas production. This paper reviews the utilization of organic waste available for anaerobic digestion of waste and thus utilization of waste to energy. Any matter which can be decomposable by the action of microorganisms in a short period of time is called biodegradable. Mostly food waste; vegetable waste, bagasse, Garden waste are biodegradable.

S. Sharada et al. India is world's eleventh largest energy producer currently and accounts for nearly 2.4% of the world's total energy production .Due to scarcity of petroleum and coal it threatens supply of fuel throughout the world also problem of their combustion leads to research in the new sources of energy, like renewable energy resources. Solar energy, wind energy, different thermal, hydro sources of energy and biogas are all renewable energy resources. The problems can be met with a residual clean energy output in the form of biogas through a portable digester which can be installed from minimum resources. An original digester design is adopted in building a lab scale 20 L biogas plant.

K. M. Akkoli et al. The typical biogas is having the highest composition of Methane (50-70%) and remaining Carbon dioxide (30-50%), also small traces of some other gases, having the calorific value ranging from 21-24MJ/m3. The extraction of energy from the biomass wastes by its anaerobic degradation with the help of various technologies adopted and will be leading to the use of renewable energy systems effectively and efficiently.

Nikhil S. Mane et al. The solar energy is a promising type of renewable energy, in which energy from solar radiation is converted into useful means. There are two types of the solar energy, first one is solar thermal energy in which heat from solar energy is collected and used for various applications and second one is Photovoltaic energy in which light is converted into electricity. PV cells are sophisticated energy production device which converts light into electricity. Current design of PV cell has a solid construction and it has five layers of Back electrode, P type electron, N type electron, anti-reflection coating and front electron.

Cynthia E.L. Latunussa et al. Photovoltaic (PV) is one of the renewable technologies that has been gaining importance globally in the last decade. The International Energy Agency (IEA) estimates a total installed power of PV of around 136.5 GW at the end of 2015 Lifecycle impacts of photovoltaic (PV) plants have been largely explored in several studies. However, the end-of-life phase has been generally excluded or neglected from these analyses, mainly because of the low amount of panels that reached the disposal yet and the lack of data about their end of life. It is expected that the disposal of PV panels will become a relevant environmental issue in the next decades.

Kiran Ranabhat et al. This is the time of nanotechnology. But today there is nothing more important than energy, since the lack of energy means a significant obstacle to the present civilization, i.e. not enough food, warm shelter and connection to the Internet, including the consumption of nanotechnology products. Methods of conversion of solar energy into electricity, working principles and materials used for various types of photovoltaic technology, as well as the global solar market, present cost of solar energy and roadmap of solar energy is presented in this paper.

3. RESEARCH METHODOLOGY

A. Bio Gas-

3.1 Bio Gas Collection of waste materials

The types of kitchen wastes collected from **Sairam Mahableshwar** are the mixture of rice, potatoes, cabbages, spinaches, meats, chilies, and deals which contains mostly carbohydrates, proteins and lipids. Experimental studies carried out on a batch digestion reactor on food wastes at the temperature of 37℃ and retention time for 28 days. It is found that the methane gas produced are 0.28, 0.29, 0.47 and 0.48 liters per gram for fresh cabbages, boiled rice, mixed food wastes and cooked meats respectively. Therefore it is understandable that the mixed kitchen food wastes can produce substantial amount of a biogas but not individual food items

3.2 Production Process for Bio Gas

A typical biogas system consists of the following components:

(1) Manure collection
(2) Anaerobic digester
(3) Effluent storage
(4) Gas handling
(5) Gas use.

Biogas is a renewable form of energy. Methanogens (methane producing bacteria) are last link in a chain of microorganisms which degrade organic material and returns product of decomposition to the environment.

3.3 Principles for Production of Biogas

Organic substances exist in wide variety from living beings to dead organisms. Organic matters are composed of Carbon (C), combined with elements such as Hydrogen (H), Oxygen (O), Nitrogen (N), Sulphur (S) to form variety of organic compounds such as carbohydrates, proteins & lipids. In nature MOs (microorganisms), through digestion process breaks the complex carbon into smaller substances.

There are 2 types of digestion process:

- Aerobic digestion.
- Anaerobic digestion.

The digestion process occurring in presence of Oxygenis called Aerobic digestionand produces mixtures of gases having carbon dioxide (CO_2), one of the main “green houses” responsible for global warming.

The digestion process occurring without (absence) oxygen is called anaerobic digestionwhich generates mixtures of gases. The gas produced which is mainly methane produces 5200-5800 KJ/m3 which when burned at normal room temperature and presents a viable environmentally friendly energy source to replace fossil fuels (non-renewable).

3.2.1 Anaerobic Digestion

It is also referred to as biomethanization, is a natural process that takes place in absence of air (oxygen). It involves biochemical decomposition of complex organic material by various biochemical processes with release of energy rich biogas and production of nutrious effluents. Biological Process (Microbiology) Anaerobic digestion is a process where bacteria breakdown organic matter, such as manure, in the absence of oxygen. The anaerobic digestion process generates biogas that is composed mostly of methane, which can be used as an energy source (e.g., heat or electricity generation). A wide range of micro-organisms are involved in the anaerobic process which has two main end products: biogas and dig estate. Dig estate is the decomposed substrate, rich in macro and micro nutrients and therefore suitable to be used as plant fertilizer.

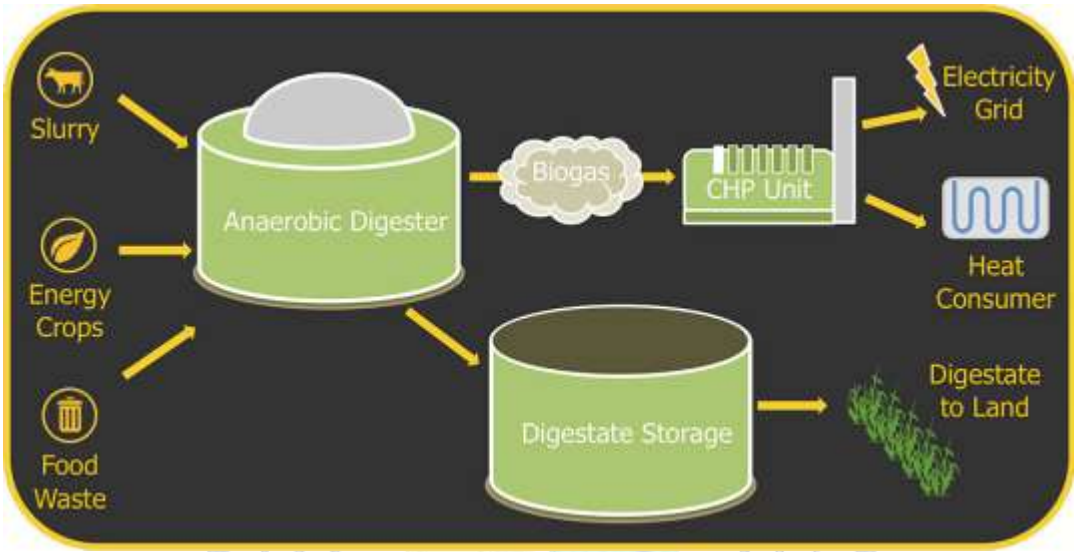

Figure 6: Anaerobic digestion

1. Hydrolysis

2. Acidification

3. Methanogens

B. Photovoltaic Cells

3.4 Photovoltaic Cells production

3.4.1 PV Systems

Photovoltaic systems vary in complexity and depend basically on the total load demand and the availability of sunlight. The estimation here is based on hybrid principles rather than stand-alone. The major components in this system are; PV array, charge controller, inverter, battery bank, utility feeder and installation accessories.

C. Vermicomposting

3.5 Vermicomposting Using Earthworm

A. Collection of Material

The moisture content of the medium was maintained at about 50%.-70% and the Kitchen waste was procured from the Hotel **Sairam Mahabaleshwar** . The kitchen waste was shredded before using by means of a kitchen waste shredder.

B. Collection of Earthworms

Earthworms (Eudriluseugeniae) were procured from vermicomposting center, located in Pune at **Sai Lab**. For the present study, separate vermibed was made using Twenty days (20 days) old kitchen waste with dung for mass culture of Eudriluseugeniae. The culture was constantly monitored throughout the period of study with time by time with Spraying of water. Mature worms for experimental purpose were taken from this stock culture.

C. Experimental Setup

Two sets of experiments were conducted in the present study.

D. Pre-Decomposition Experiment

A ceramic tank of 45x30x15 cm measurement was filled with a mixture (5 kg) of dung and kitchen waste , it was daily sprinkled with water so that it gets decomposed. Also this waste was turned up and down for proper aeration and decomposition. This experiment continued for 15 days.

E. Composting Experiment

In this study plastic container was filled with the pre-decomposed mixture of cow dung and kitchen waste 25 adult, mature, worms were taken from the stock culture and were uniformly released on the top of the containers of all the three experimental containers. The experiments were conducted inside the vermicomposting shade located in **Sai lab Pune**. The containers were covered by mesh garden cloth and were observed daily in order to check the various parameters necessary for the survival and reproduction of earthworms. This whole setup was maintained for 60 days till the finely granular vermicomposting was prepared. During the composting process the material was analyzed for different physic-chemical attributes such as pH, total Nitrogen, available Phosphorus, exchangeable Potassium, as per the methods suggested by other workers as well as for earthworm number, cocoon production and weight loss of organic substrate. During the course of investigation, the samples were examined at periodic intervals after 30 and 60 days of vermicomposting.

D. Sewage Treatment at Sairam Mahableshwar

3.6 Treatment Technologies Used For Sewage Treatment

Table6: Technologies used in Delhi STPs

Sr.No.	Technology	No. of STPs
1.	Activated sludge process (ASP)	26
2.	Bio filters (BIO-FAR)	3
3.	Extended Aeration (EA)	2
4.	Moving Bed Biofilm Reactor (MBBR)	2
5.	Oxidation Pond (OP)	1
6.	Interchange Sequencing Batch Reactor (ISBR)	1

3.6.1 Activated Sludge Process (ASP)

Activated-sludge technique, a sewage-treatment process in which sludge, the amassed, microbe's rich deposits of settling tanks and basins, is seeded into the approaching wastewater and the blend agitated for a few hours (4-8

hours) within the sight of an adequate air supply. Suspended solids and numerous organic solids are adsorbed by the sludge, while organic matter is oxidized by the microorganisms. The measures of air and sludge utilized can be differed to control the level of treatment got. The sludge is then isolated out in a settling tank.

Activated sludge plant involves:

1. Wastewater aeration in the presence of a microbial suspension,

2. Solid-liquid separation following aeration,

3. Discharge of clarified effluent,

4. Wasting of excess biomass, and

5. Return of remaining biomass to the aeration tank.

3.6.2 SEWAGE/WASTEWATER) TREATMENT STAGES-

1. Stage One: Screening

Screening is the first stage of the wastewater treatment process. Screening removes large objects like, diapers, nappies, sanitary items, cotton buds, face wipes and even broken bottles, bottle tops, plastics and rags that may block or damage equipment. Special equipment is also used to remove grit that gets washed into the sewer.

2. Stage Two: Primary Treatment

This involves the separation of organic solid matter (or human waste) from the wastewater. This is done by putting the wastewater into large settlement tanks for the solids to sink to the bottom of the tank. The settled solids are called 'sludge'. At the bottom of these circular tanks, large scrappers continuously scrape the floor of the tank and push the sludge towards the center where it is pumped away for further treatment. The rest of the water is then moved to the Secondary treatment.

3. Stage Three: Secondary Treatment

The water, at this stage, is put into large rectangular tanks. These are called aeration lanes. Air is pumped into the water to encourage bacteria to break down the tiny bits of sludge that escaped the sludge scrapping process.

4. Stage Four: Final Treatment

Next, the 'almost' treated wastewater is passed through a settlement tank. Here, more sludge is formed at the bottom of the tank from the settling of the bacterial action. Again, the sludge is scraped and collected for treatment. The water at this stage is almost free from harmful substances and chemicals. The water is allowed to flow over a wall where it is filtered through a bed of sand to remove any additional particles.

4. RESULT AND DISCUSSION

1. Bio Gas

Table7: Bio Gas Capacity

Parameters	Requirements
Waste required from **Sairam** Hotel	min 5 kg –max 10 kg per day
Water required	min 10 liters- max 20 liters per day
Plant size	6 feet height & 5 feet dia
Cooking hours	2.5 hrs per day
Gas	1.5 kg/day equal to LPG
Capacity	3000 L
Stove	double burner
Placement	only besides the house

2. Vermicomposting

Table8: Vermicomposting Capacity

Parameters	Requirements
Kitchen waste Required (Kg) from **Sairam** Hotel	5-10 kg per day
Total waste for composting (kg)	10*365 days =3650 for year
Earth worms required (kg)	1.7-2.0 kg
RCC Rings Required	6 Rings
Cost per Year- Cost of Ring and Bed Labour and other cost	 4000 per Year 2000 per year
Vermicomposting Production Per year	1875 kg-2000 kg
Returns per year Rs 9/kg	1875*9=Rs 16875

3. Sewage Water

Table9: Sewage Water Capacity

Parameters	**Requirements**
Feed Flow Rate (cubic-meter/day) from **Sairam** Hotel	50 m3/day or 34.722222 L/min
Impurities to be removed	pH, Oil and Grease, Color, Turbidity
Input	Kitchen waste from Sairam Hotel
Secondary Treatment Type	Moving Bed Bioreactor (MBBR), Fluidized Aerated Reactor, Dissolved Air Floatation, Activated Sludge, Sequential Batch reactor
Treatment Stages	Preliminary Treatment, Primary Treatment, Secondary Treatment, Disinfection, Tertiary Treatment
Treated Water Quality	Flushing
Approximate Power Consumption (in kW)	7 kw
Manufacturing Lead Time	45 days
Material of Construction	MSEP
Control Module	Control Module Available
Air Blower Power (kW)	1 kW
Air Blower Flow (L/min)	2000
Air Blower Count	2
Water Pump Power	1.5 kW, 1 kW
Equalisation Chamber Volume (Cubic-meter)	2mtr
Sludge Holding Chamber Volume (Cubic-meter)	1
Aeration Chamber Volume (Cubic-meter)	1000 mm
Clarifier Chamber Volume (Cubic-meter)	2000 mm
Disinfection Chamber Volume	1000 mm

(Cubic-meter)	
Installation Type	Prefabricated, Completes Civil work with Installation, Containerized Plug & Play
Hydraulic Retention time	5 hrs
Filtration System	yes
Tank Dimensions (mm)	1000 mm
Land Occupation	3000 x 4000 mm
Weight	4 ton
Number of flash mixers	2
Flash mixers flow rate	1m
Gate Thickness	4mm
Filtration Grade	50 micron
RO Membrane Thickness	63mm
Oxygen Requirement	yes
Pore size	0.1
Retention Time	5 hrs
Sewage Throughput	client scope
Reduction of Dry Matter	Filter Press
Biogas Production & Capture	yes
Toxic Gas Emission	yes
Size	60000 x 3000 mm
Automation Grade	Semi-Automatic, Automatic
Application	Hotel
Power Source	Electronic
Cooling Type	Water Cooled
Treatment Technique	YES
Voltage	440 v 3 phase
Water source	Kitchen Sewage Water residential
Inlet Water Quality	Kitchen sewage

4. Photovoltaic Cell

Table10: Photovoltaic Cell Capacity

Parameters	Requirements
Solar Package Range	1500Watts(1.5KW)
Appliances can run in **Sairam** Hotel	• Fan 5, Tube 2, CFL 4, TV 1 & PC • Fan2, Tube 2, CFL 4, TV 1, PC 1 & Mixie1
Solar Kits set	• 1.5 KW Solar Panel • 100AH/12V/C10 Battery * 6 • 2 Kva Solar Inverter • MPPT Charge Controller • Solar Panel Stands
Backup time	Up to 8 Hrs*
Power Saving / Month **	Up to 50%

5. Wind mill capacity - 1.5kva.

Table11: Wind Mill Capacity

Parameters	Requirements
Wind Mill Tower Height at **Sairam** Hotel	18 ft
Blade Material	Glass Fibre, Glass-Fibre Reinforced Resin (GFRRP), Carbon Fibre, Fibre Reinforced Resin (FRP)
Blade Length	2.2 ft
Rotor Diameter	2
Power	1.5 KW / 1.5 kva Power Factor 1
Blades Number	6
Efficiency	80
Max Speed	500
Start Up Wind Speed	2.5
Rated Wind Speed	14

Table12: Energy Audit Report at Sairam Mahabaleshwar

Sr. No	Energy Source	
1	Vermicomposting	1875 kg-2000 kg
2	Bio-Gas	1.5 kg/day
3	Wind Mill	1.5 kva
4	Photovoltaic Cell	1.5KW
5	Sewage Water	34.722222 L/min

CONCLUSION

From the consideration of all the above points we conclude that hotel industry is one of the largest waste producers and energy consumers throughout the world. Hotel industry if designed and well maintained can be self-sustainable. Energy consumption in hotel industry which is at a large scale comes from non-renewable sources of energy, which can be shifted to renewable sources of energy. Waste management in hotel industry can be of great advantage to achieve self-sustainability. Here we generate the Energy Audit report (Zero Waste) of **Sairam Hotel Mahableshwar** . Zero Waste is a philosophy that encourages the redesign of resource life cycles so that all products are reused. In this project we selected **Sairam Mahableshwar** site to achieve all methodology. In this project author achieve to carry out Energy audit of hotel Sairam, Mahableshwar, to analyse and suggest improvements using renewable energy sources for Hotel Sairam, to analyse the Chemical and biological characteristics of discharge of hotel industry, to implement changes in waste management practices according to nature of waste & environmental conditions. Here author give the suggestion to hotel industry there is no any lead expenses in Hotel Industry if you are using renewable energy sources. There is no any negative impact. To create a Zero waste discharge model for Sairam hotel campus, to analyse the negative impacts of hotel industry on environment. Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health. In zero waste concepts we work on different mechanism like production of Bio Gas from hotel kitchen waste, sewage water treatment plan from kitchen waste water, Vermicomposting from hotel waste, wind energy from hotel waste, activated sludge from hotel waste, Photovoltic cell energy from hotel waste.

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